Effect of different dietary of grape seed oil level on the growth performance and carcass characteristics in broiler chickens (*Gallus gallus domesticus*)

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Abstract

This study was conducted in the Animal Production Department, College of Agricultural Engineering Sciences, University of Baghdad for 35 days to evaluate the effect of adding different levels of grape seed oil to the broiler diets on the growth performance characteristics of the carcass. A total of 180 chicks one-day-old of commercial broilers Ross 308 were purchased. The birds were randomly distributed into four treatments and three replicates per treatment with 15 birds in each. The treatments were as follows: T1 control treatment (free of grape seed oil) and T2, T3 and T4 included the use of grape seed oil at rates of 0.25, 0.5 and 0.75%, respectively. The results showed a significant superiority ($P < 0.05$) for the treatment of grape seed oil supplementation for the treatment T3 in the body weight and cumulative weight gain at age 35, compared with the control treatment. While no significant differences were observed among the treatments of feed intake and feed conversion ratio. No significant differences were observed in the percentage of the yield and the relative weight of the birds. No significant differences were observed in the relative weights of the edible internal organs. In conclusion, the use of grape seed oil by 0.5% has improved broiler performance.

Keywords: broiler, grape seed oil, growth performance, carcass characteristic

Introduction

Most of researchers have recently focused on the use of plants, medical herbs and their essential oils in the diets of domestic birds as nutritional supplements. As they have the necessary properties to stimulate growth, enhance the body's immunity and the antimicrobial defenses, as well as stimulate the digestive system. The oils of these aromatic plants contain many different active compounds Such as hydrocarbons, phenols, ketones, esters and other active chemicals found in the oils of these aromatic

plants. These compounds have antimicrobial activity [1, 2]. Many researchers indicated that these oils have properties that make them an alternative to antibiotics because they have an important role in stimulating the bird growth and have a positive effect on the digestive system by the stimulation of juices and digestive enzymes such as amylase and ibex, improve liver function, act as antioxidants, and stimulate the immune system. Thus, improving the productive and physiological performance of birds [3, 4, 5].

Many essential oils have proved their role in improving the productive performance of poultry by possessing many effective compounds such as phenols including Carvacrol, Tymol gaiacol, flavonoids, zebenoids, coumarins, sativa, steroids and resins. One of these essential oils is grape seed oil. It is natural oil because it is produced from the grape seed, which is high in unsaturated fatty acids (85-90%) [6]. According to Lutterodt *et al* [7], these oils contain linoleic acid, which accounts for 66-75.3% of the total fatty acids, as well as Oleic acid and Stearonic acid, which have a role in metabolism, and these ratios vary with grape varieties [8]. Oleic acid contributes to an increase in the nutritional value of oil because it affects the stability of oxidation of oils [9]. Fatty acids play a vital role in the balance of oxidation, and regulation of inflammatory immunological responses [10].

Grape seed oil is an important source of omega 3 and 6 [11, 12]. Grape seed oil also contains a lot of organic compounds such as phenols, flavonoids and alkines [13]. The most significant are phenolic compounds, which have anti-oxidant, disease-prevention, anti-inflammatory, and germ-killing properties [14]. In addition, they also include flavonoids, carotenoids, phenolic acids, tannins and Stibenes [15]. Additionally, the Grape oil contains vitamin E in ratios ranging from 1 to 35 mg per 100 grams of oil [6, 16]. The high content of vitamin E is antioxidant as it protects cell membranes from oxidative damage from free cyclic compounds [17]. Because there is a trend to use alternative and organic compounds in poultry nutrition to substitute the usage of antibiotics, it seems to be important to focus on the local plants and feedstuffs to be incorporated in poultry diets. Therefore, the objective of the current study was to find out the effect of grape seed oil on the growth performance and carcass characteristics of broilers and to determine the best addition level.

Materials and methods

The study was conducted at the College of Agricultural Engineering Sciences, University of Baghdad for a period of 35 days, to show the effect of adding different levels of grape seed oil to the diets of meat broilers in order to study its effect on production performance and some of the carcass characteristics. The oil used in this study was produced by MANTOVA Company, Italy and exported to Iraq via the company of Emad- Baghdad, Shorja, which added to feed at levels of 0.25, 0.50, and 0.75%.

In this study, 180 chickens of the Ross308 commercial broiler chicken were used for the production of meat broilers in Abu-Ghraib and with an initial weight of 39.13 g. The chicks at one day old were randomly distributed to four treatments. Each

treatment included three replicates, each replicate contained 15 chicks. The chicks were raised on the floor in a hall containing rooms divided by wire mesh barriers 120 x 120 cm / room. During the research period, follow the lighting system for 23 hours of lighting with one hour of darkness. Water and feed system were freely provided *ad libitum* during the study. The chicks were fed on the starter diet at the age of 1-10 days, and grower diet from the age of 11 to 24 days, and finisher diet for 25-35 days of birds age (Table 1).

The body weight and feed consumption were recorded per week, the rate of increase in weight and food conversion ratio was accounted at the age of 35 days. Nine birds from each treatment were weighed individually and slaughtered. Then, the carcasses were cleaned, and weighed and the dressing percentage was calculated. Consequently, they were cut to their main and secondary parts and their weights were calculated based on the relative weight of the parts. Data analysis was carried out using statistical software (Statistical Analysis System (SAS) 9.4, SAS Institute, Cary, North Carolina, USA). The identification of differences was conducted by General Linear Model (GLM) procedure and differences between the treatments means were further carried out by Duncan's Multiple Range Test with a probability of 5% ($P < 0.05$).

Table (1): Composition and nutrient content of the diets (day 0–35)

Ingredients%	Starter diets (0-10) days				Grower diets (11-24) days				Finisher diets (25-35) days			
	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
Corn	47.7	47.7	47.7	47.7	61	61	61	61	63	63	63	63
Wheat	10	10	10	10	-	-	-	-	-	-	-	-
Soybean meal 48%	33	33	33	33	29.4	29.4	29.4	29.4	26.35	26.35	26.35	26.35
Protein concentrate 5% [1]	5	5	5	5	5	5	5	5	5	5	5	5
DCP 18% [2]	0.7	0.7	0.7	0.7	0.5	0.5	0.5	0.5	0.35	0.35	0.35	0.35
Limestone	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Corn oil	2	1.75	1.50	1.25	2.6	2.35	2.1	1.85	3.8	3.55	3.3	3.05
Grape seed oil	-	0.25	0.50	0.75	-	0.25	0.50	0.75	-	0.25	0.50	0.75
Salt	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
premix [3]	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total	100	100	100	100	100	100	100	100	100	100	100	100
Calculated nutrient level												
ME kcal/kg	3000.5	3000.5	3000.5	3000.5	3100.2	3100.2	3100.2	3100.2	3200.7	3200.7	3200.7	3200.7
Protein %	23	23	23	23	21.3	21.3	21.3	21.3	20	20	20	20
Calcium %	0.92	0.92	0.92	0.92	0.87	0.87	0.87	0.87	0.82	0.82	0.82	0.82
Avail p for poultry% [11]	0.47	0.47	0.47	0.47	0.43	0.43	0.43	0.43	0.40	0.40	0.40	0.40
Lysine %	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1

Methionine %	**0.50**	**0.50**	**0.50**	**0.50**	**0.49**	**0.49**	**0.49**	**0.49**	**0.47**	**0.47**	**0.47**	**0.47**
Cysteine %	**0.37**	**0.37**	**0.37**	**0.37**	**0.34**	**0.34**	**0.34**	**0.34**	**0.32**	**0.32**	**0.32**	**0.32**
Meth + Cysteine %	**0.87**	**0.87**	**0.87**	**0.87**	**0.79**	**0.79**	**0.79**	**0.79**	**0.74**	**0.74**	**0.74**	**0.74**

[1] Protein concentrates 5%: Al-wafi with 40% crude protein and fat 2.26%. [2] Dicalcium phosphate 18%. [3] Vitamin and Mineral premix provided per kilogram of diet: Vitamin A 11494 IU; vitamin D_3 1725 IU; vitamin E 40 IU; vitamin K3 2.29 mg; cobalamin 0.05 mg; thiamine 1.43 mg; riboflavin 3.44 mg; folic acid 0.56 mg; biotin 0.05 mg; pantothenic acid 6.46 mg; niacin 40.17 mg; pyridoxine 2.29 mg, Co 0.6 mg, Cu 20 mg, Fe 100 mg, I 2 mg, Mn 110 mg, Se 0.2 mg, Zn 100 mg.

Results and Discussion

Growth performance parameters:

Average living body weight:

Table (2) shows the effect of the addition of different levels of grape seed oil to the diets of broiler chicken in the live body weight. The results showed that there were significant differences (P <0.05) in living body weight between the treatments during the trial period, with no differences between the treatments of the addition of grape oil and the control treatment (T1) during the first week of the experiment, With significant significance at 7 days age (P <0.05) in the body weight of T4 (0.75% grape seed oil) compared with the T2 treatment (adding 0.25% grape seed oil) and the third treatment T3 (adding 0.5% grape seed oil). In the second week, the results did not show any significant differences between all treatments. A significant improvement was observed at 21 days (P <0.01) for the treatments (T1, T3, T4) in living body weight (977.33, 984.50, 975.50 g / birds), respectively, compared with the control treatment T2, which recorded a live body weight of 922.00 g / birds. While, a significant difference at the age of 28 days (P <0.01) was observed for the third treatment T3 Compared to the control treatment and the rest of the other addition treatments T2, T4. The ratio of live body weight of birds of the third treatment was 1623.15 g / bird and (1517.50, 1565.25, 1550.50 g / bird) for birds of the treatments (T1, T2, T4), respectively. At the age of 35 days, the third treatment of T3 was significantly higher (P <0.05) than the other treatments (T1, T2, T4), the mean body weight of T3 treatment was 2280.50 g / ha, compared with the treatments (T1, T2, T4), which recorded a mean live body weight (2217.07, 2200.00, 2211.50) respectively.

Table (2): Average body weight in broiler chickens fed different levels of grape seeds oil

Treatments[1]	Average body weight (g / bird)				
	Day 7	Day 14	Day 21	Day 28	Day 35
T1	165.00±0.55^{AB}	429.33±16.17	977.33±8.83^{A}	1517.50±3.98^{C}	2217.07±13.72^{B}
T2	163.50±0.87^{B}	436.75±5.05	922.00±7.51^{B}	1565.25±8.80^{B}	2200.00±19.05^{B}
T3	163.75±3.90^{B}	445.13±8.01	984.50±3.18^{A}	1623.15±16.25^{A}	2280.50±8.95^{A}
T4	171.25±3.32^{A}	424.00±12.70	975.50±3.75^{A}	1550.50±7.79^{B}	2211.50±25.11^{B}
Significance level	* 0.05	N.S	** 0.01	** 0.01	** 0.05

A, B, C (means±standard error) with different superscripts in the same column indicate significant difference ($p < 0.05$). [1] Dietary treatments: Negative control (T1) = basal diet, T2 = basal diet + grape seed oil 0.25% (v/w), T3 = basal diet + grape seed oil 0. 50% (v/w), T4 = basal diet + grape seed oil 0.75% (v/w).

Average weight gain

Table (3) shows the results of the addition of grape seed oil to the diet in the rate of weekly and total weight increase for meat breeds at the age of 7 and 14 days, which indicated, that no significant effect to add grape seed oil in the rate of increase of weight between all experimental treatments. While, at age of 21 days there were significant differences (P<0.01) for treatments (T1, T3, T4) compared to the second treatment T2. While at the age of 28 days a significant effect (P <0.01) was observed for T2 and T3, the rate of increase in the ratio of T2 (643.25) and T3 (638.65) compared to the first T1 and T4. At the age of 35 days, the results showed a significant effect (P <0.01) for the first two treatments T1 and the fourth T4 compared to the second treatment T2, which significantly exceeded these two treatments which recorded 699.57 and 661.00 g / bird, respectively in comparison with the treatment of T2 (634.75 g / bird), while T1 and T4 were not significantly different from T3. The results for the accumulative weight increase (1-35 days), indicated a significant difference (P <0.05) for the third treatment (T3) compared to the control treatment, as well as to other addition treatments (T2 and T4).

Table (3): Average weight gain in broiler chickens fed different levels of grape seeds oil.

Treatments[1]	Average weight gain (g / bird)					
	Day 7	Day 14	Day 21	Day 28	Day 35	CWG[2]
T1	125.87±0.55	264.33±15.67	548.00±11.03^{A}	540.17±4.89 ^{B}	699.57±13.25^{A}	2177.94±13.72^{B}
T2	124.37±0.87	273.25±5.92	485.25±2.45^{B}	643.25±1.30^{A}	634.75±27.86^{B}	2160.87±19.05^{B}
T3	124.62±3.90	281.38±11.91	539.38±4.84^{A}	638.65±102.03^{A}	657.35±25.20^{AB}	2241.37±8.95^{A}
T4	132.12±3.32	252.75±8.44	551.5±11.84^{A}	575.0±4.04^{B}	661.00±0.36^{A}	2172.37±7.07^{B}
Significance level	N.S	N.S	** 0.01	** 0.01	** 0.01	* 0.05

A, B, C (means±standard error) with different superscripts in the same column indicate significant difference ($P < 0.05$). [1] Dietary treatments: Negative control (T1) = basal diet, T2 = basal diet +

grape seed oil 0.25% (v/w), T3 = basal diet + grape seed oil 0. 50% (v/w), T4 = basal diet + grape seed oil 0.75% (v/w). [2] CWG = cumulative weight gain.

Feed Intake

The results for the rate of feed intake (Table 4) indicated that there is no significant difference in the rate of feed intake for all the treatments (1-5 weeks). In terms of cumulative feed intake, the result of statistical analysis showed no significant differences between all treatments.

Table (4): Average feed intake in broiler chickens fed different levels of grape seeds oil

Treatments[1]	Average feed intake (g / bird)					
	Day1- 7	Day8- 14	Day15- 21	Day22- 28	Day 29-35	Day 1-35
T1	131.15±0.81	390.72±14.43	643.92±6.96	988.33±8.80	1156.06±22.32	3310.17±51.12
T2	128.46±0.89	382.50±1.44	647.25±18.91	951.50±2.60	1106.50±53.98	3216.21±74.93
T3	129.66±1.35	385.75±2.45	651.25±13.13	988.25±14.00	1121.50±3.18	3276.41±0.24
T4	130.34±0.38	387.00±13.86	646.38±2.09	973.05±21.10	1127.83±1.25	3264.60±38.68
Significance level	N.S	N.S	N.S	N.S	N.S	N.S

N.S = the data (means±standard error) in the same column indicate no significant difference ($P < 0.05$). [1] Dietary treatments: Negative control (T1) = basal diet, T2 = basal diet + grape seed oil 0.25% (v/w), T3 = basal diet + grape seed oil 0. 50% (v/w), T4 = basal diet + grape seed oil 0.75% (v/w).

Feed conversion ratio

The effect of adding grape seed oil with different concentrations in the food conversion coefficient is shown in Table 5. The data indicated that there were significant differences ($P <0.05$) in the food conversion coefficient. It was observed no significant differences between the transactions at the age of 7 days, also, no significant differences between the treatments of the addition of grape seed oil compared to the control treatment T1 at age of 14 days. The results indicated that the fourth treatment T4 was significantly higher than ($P <0.05$) treatments T2 and T3, as the food conversion coefficient was recorded at 1.53 g / bird compared with T2 and T3, which recorded a food conversion coefficient of 1.40 and 1.38 g / bird respectively. While at the age of 21 days there was a significant deterioration in the food conversion coefficient for the second treatment T2, which was recorded 1.33 g / bird in comparison to treatments T1, T3 and T4 which was recorded (1.18, 1.21, 1.18 g / bird, respectively. At the age of 28 days, a significant improvement ($P <0.01$) was observed in the food

conversion coefficient for the treatments T2 T3, compared to the control treatments T1 as well as the T4 treatment. While at the age of 35 days, there were no significant differences between the different treatments, also with respect to the coefficient of cumulative food conversion coefficient throughout the duration of the experiment did not notice any significant differences between all treatments.

Table (5): Feed conversion ratio in broiler chickens fed different levels of grape seeds oil

Treatments[1]	FCR[2] (g / g)					
	Day 7	Day 14	Day 21	Day 28	Day 35	Day 1-35
T1	1.04±0.01	1.48±0.03 AB	1.18±0.03	1.83±0.03 A	1.65±0.06	1.52±0.03
T2	1.03±0.01	1.40±0.04 B	1.33±0.03	1.48±0.00 B	1.74±0.16	1.49±0.05
T3	1.04±0.04	1.38±0.05 B	1.21±0.04	1.55±0.05 B	1.71±0.06	1.46±0.01
T4	1.00±0.03	1.53±0.00 A	1.17±0.03	1.70±0.00 A	1.70±0.00	1.50±0.01
Significance level	N.S	* 0.05	* 0.05	** 0.01	N.S	N.S

A, B, C (means±standard error) with different superscripts in the same column indicate significant difference ($P < 0.05$). [1] Dietary treatments: Negative control (T1) = basal diet, T2 = basal diet + grape seed oil 0.25% (v/w), T3 = basal diet + grape seed oil 0. 50% (v/w), T4 = basal diet + grape seed oil 0.75% (v/w). [2] FCR = Feed conversion ratio.

Characteristics of carcass

The results of the effect of the addition of different concentrations of grape seed oil in refinement ration are presented in Table 6. No significant differences in the live weight of the birds, the weight of the cleaned carcass, and terms of the percentage of reflux. No significant differences were observed terms of the percentage of reflux between all treatments.

Table (6): Live body weight, carcass weight and dressing percentage in broiler chickens fed different levels of grape seeds oil

Treatments	live body weight (g)	Carcass weight (g)	Dressing percent-age
T1	2247.50±52.50	1717.50±52.50	76.41±0.55
T2	2195.00±55.00	1650.00±75.00	75.13±1.53
T3	2302.50±2.50	1757.50±52.50	75.35±2.33
T4	2265.00±45.00	1707.50±32.50	75.39±0.06
Significance level	N.S	N.S	N.S

N.S = the data (means±standard error) in the same column indicate no significant difference (P < 0.05). [1] Dietary treatments: Negative control (T1) = basal diet, T2 = basal diet + grape seed oil 0.25% (v/w), T3 = basal diet + grape seed oil 0. 50% (v/w), T4 = basal diet + grape seed oil 0.75% (v/w).

The relative weight of edible internal organs:

The results of the addition different concentration of grab seed oil on the relative weight of edible organs (Table 7), show no significant differences between all treatments compared with the control treatment T1.

Table (7): Relative weight of the edible internal organs in broiler chickens fed different levels of grape seeds oil

Internal organs relative weight %			
Treatments	Hart %	Liver %	Gizzard %
T1	0.52±0.05	2.35±0.18	1.51±0.09
T2	0.49±0.05	2.33±0.21	1.51±0.02
T3	0.39±0.03	2.12±0.05	1.71±0.16
T4	0.45±0.03	2.24±0.01	1.66±0.10
Significant level	N.S	N.S	N.S

N.S = the data (means±standard error) in the same column indicate no significant difference (P < 0.05). [1] Dietary treatments: Negative control (T1) = basal diet, T2 = basal diet + grape seed oil 0.25% (v/w), T3 = basal diet + grape seed oil 0. 50% (v/w), T4 = basal diet + grape seed oil 0.75% (v/w).

The relative weight of carcass parts:

Table (8) shows no significant differences in the relative weight of the chest, thighs and neck, while significant superiority (0.05 <P) in the back weight in treatment of T2, which recorded 21.17 g / bird compared to the control treatment T1, which recorded 18.33 g / bird while the T2 treatment did not show significant differences with T3 and T4 treatments. The weight of b wings was significantly higher (P <0.05) for T1 and T2 compare to treatment T3.

Table (8): Relative weight of the carcass parts in broiler chickens fed different levels of grape seeds oil

Carcass parts relative weight %					
Treatments	**Breast**	**Leg**	**Wing**	**Back**	**Neck**
T1	**35.66±0.07**	**28.98±0.45**	**18.33±0.31 B**	**10.04±0.13 A**	**6.25±0.25**
T2	**34.94±1.29**	**27.63±1.26**	**21.17±0.86 A**	**10.01±0.15 A**	**5.93±0.42**
T3	**36.52±1.33**	**28.18±0.56**	**19.50±0.44 AB**	**9.11±0.27 B**	**5.55±0.02**
T4	**36.47±0.84**	**27.94±0.07**	**19.61±0.51 AB**	**9.37±0.11 AB**	**6.15±0.18**
Significant level	**N.S**	**N.S**	*** 0.05**	*** 0.05**	**N.S**

A, B, C (means±standard error) with different superscripts in the same column indicate significant difference ($P < 0.05$). [1] Dietary treatments: Negative control (T1) = basal diet, T2 = basal diet + grape seed oil 0.25% (v/w), T3 = basal diet + grape seed oil 0. 50% (v/w), T4 = basal diet + grape seed oil 0.75% (v/w).

The results of the performance of production, especially the live body weight and the weight increase (Table 1 and 2), indicated that there was a significant improvement in the treatments mainly treatment T3, which includes the addition of grape seed oil by 0.5%, This significant improvement may be due to the role of aromatic oils, mainly grape seed oil, as it improves the taste of feed and stimulate the work of the digestive system by increasing secretions some enzymes such as trypsin, amylase, Lipase that improve digestibility of nutrients such as proteins, fats and complex carbohydrates and this in turn is positively reflected on bird performance [18 and 21]. This improvement may be attributed to the fact that grape seed oil is rich in active compounds such as phenols, flavonoids and alkenes [13]. It also contains vitamins that are soluble in fat, such as vitamin E [16]. As well as, it contains some unsaturated fatty acids that have an important role in the growth and build muscle cell tissues [19, 20, 22 and 23]. In addition, it plays a significant role in regulating the immune response and inflammatory as well as oxidative balance [10 and 21].

The results of adding different levels of grab seed oils indicated that, the use of grape seed oil by 0.5% has improved the weight of the live body and the accumulative weight gain of the broilers for 35 days, due to the effect of the components grape seed oil, by increasing secretions some enzymes such as trypsin, amylase, Lipase, that improve the digestibility of nutrients, such as proteins, fats and complex carbohydrates. Could be concluded that the addition of grape seed oil in the broiler diets at a level of 0.5% improved the growth performance.

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