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THE EFFECT OF DIFFERENT LEVELS OF OLIVE OIL IN RATION SUPPLEMENTATION ON SOME BIOCHEMICAL AND PRODUCTIVE TRAITS IN BROILERS

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ABSTRACT
This experiment was conducted to study the effect of dietary supplementation of different levels of olive oil on productive performance and some blood metabolites of broiler chicks. This experiment was done at the poultry farm of College of Veterinary Medicine University of Baghdad during period from 4/11/2016 to 13/12/2016 by using 200 chicks (Ross) and dispersed randomly to 4 treatment with 2 replicates for each treatment (25 chicks/ replicate) as a Control group (C) 0% of olive oil (basal diet), G1 group basal diet + 0.5% of olive oil, G2 group basal diet + 1% of olive oil and G3 group basal diet + 2% of olive oil. The result shows that olive oil improve the productive parameters such as the final live body weight of G3 (2850.00±41.27gm.) and total feed conversion ratio (1.38±0.07). In the biochemical parameters, the results showed significant decrease in blood cholesterol, triglyceride, Low density lipoprotein (LDL), Very low density lipoprotein (VLDL) and significant increasing in high density lipoprotein (HDL) for all treatments compared with control groups.

KEYWORDS: Broilers, Daily weight gain, LDL, HDL, VLDL.

INTRODUCTION

The poultry production especially broilers is one of the largest and fastest growing agro-based industries in the world and provides the opportunity of protein that needs for humans[1]. However, the opposing effect of consuming animal protein by humans with a high level of cholesterol can cause heart and arteries diseases. High energy diets have been shown to progress growth and feed efficiency[2, 3]. However, the effects of dietary fat content remain debatable, in previous research[4] has been determined that dietary fat supplementation induces an increase the growth rate and an amendment the meat quality .

Foglia *et al.* [5]showed that differences in fat deposition as a result of different nutritive oil levels may also be associated with the a similar metabolic differences between lean and fat chicken lines. Thus, the effect of different dietetic oil profiles on serum, very low density lipoprotein (VLDL), glucose, cholesterol and insulin were measured in effort to determine whether the changes observed in broilers fed on saturated fatty acids (SFA) or monounsaturated fatty acids (MUFA) rich diets, and those fed on polyunsaturated fatty acids (PUFA) rich diets are accompanied by changes in these metabolic parameters [6-8] reported that using vegetable oils and animal fats in broiler diets can have a positive effect on poultry production, they often present higher than expected biological value increasing dietary metabolizable energy (ME) which usually results in higher growth rates and enhanced feed efficiency. Olive oil with an abundant amount of monounsaturated fatty acids (MUFAs) is thought to not only contribute nutrients to the diets, but also to influence the fatty acids profiles in muscles and fat in monogastric animals[9,10]. The positive effects of olive oil are antioxidant property the main antioxidant of olive oil are phenolic compounds and carotenoids which are both hydrophilic and lipophilic in experimental studies[1]. The antioxidant capacity of olive oil has been a widely studied and known that after ingestion the phenolic compounds of olive oil such as oleuropein or hydroxytyrosol may display local antioxidants capacity in the gastrointestinal tract. Furthermore, after the absorption and metabolism of olive oil the antioxidants actives may display their effect at the cellular level[11]. Olive oil likewise increase birds immunity as dietary supplementation of either canola or olive oils with (2%) to broiler chick and increased the immune response to Newcastle disease (ND), final body weight (BW) and daily gain compared to control that not affecting triglycerides (TG), low density lipoprotein, very low density lipoproteins (VLDL) and saturated fatty acids when compared with the control[12]. Increased olive oil intake has found reducing the risk of developing rheumatoid arthritis and an autoimmune disease that characterized by inflammation and pain, particularly in the joints[13]. A clinical trial revealed that rheumatoid arthritis patients who supplemented their diets with olive oil and fish oil practiced better improvements in clinical measurements of the disease than did patients who supplemented with fish oil only[14].

MATERIALS & METHODS

Experimental design and diets

This experiment was carried out in the poultry farm of veterinary collage, Baghdad University. The experiment lasted for 42 days started from 4/11/2016 to 13/12/2016. We used 200 broiler chicks (Ross) one day old were

randomly divided to 4 experimental groups. Each group contained 2 replicates with 25 chicks each. The supplementation of olive oil divided as Control group 0% of olive oil (basal diet), G1 group basal diet + 0.5% of olive oil, G2 group basal diet + 1% of olive oil and G3 group basal diet + 2% of olive oil. The experimental diets were administered from 1 to 42 days, the starter diet was applied for 21 days of old as in the table (1), then finisher diet offered up to end of the experiment as in the table (2).

TABLE 1: Composition of experimental diets in starter periods of the experiment

Ingredient %	Control	G 1	G 2	G 3
Yellow Corn	54.5	53.5	53	50
Soybean meal	29	30	30	30
Wheat	5.5	5	4.5	6.0
Olive oil	0	0.5	1	2
Animal protein	8	8	8.5	9
Cacl2	0.7	0,7	0.7	0.7
Salt (NaCl)	0.3	0.3	0.3	0.3
Premix	2	2	2	2
Total	100	100	100	100

TABLE 2: Composition of experimental diets in finisher periods of the experiment

Ingredient %	Control	G 1	G 2	G 3
Yellow Corn	59	60	60	55
Soybean meal	27	27	27	25
Wheat	9	6.5	6	10
Olive oil	0	0.5	1	2
Animal protein	2	3	3	5
Calcium	0.7	0.7	0.7	0.7
Salt (NaCl)	0.3	0.3	0.3	0.3
Premix	2	2	2	2
Total	100	100	100	100

Productive parameters

The chicks were weighted individually on days 1, 7, 14, 21, 28, 35, and 42 per bin. The live body weights for each treatment were recorded.

Biochemical parameters

At day 42th of age, five birds from each group were slaughtered and collect the blood sample from bronchial vein in a test tube without anticoagulant. The serum was separated by centrifugation for 5 minutes at 3000 rpm and stored in a deep freezing (-20) until analysis, Using the serum to determine cholesterol, HDL, LDL, VLDL and triglycerides.

Statistical analysis

Statistical analysis of data was performed using SAS (Statistical Analysis System - version 9.1). One and Two way ANOVA and Least significant differences (LSD) post hoc test were performed to assess significant differences among means. $P < 0.05$ was considered statistically significant[15].

RESULTS & DISCUSSION

Live body weight and Body weight gain

During one day old results showed non-significant ($P>0.05$) differences in mean live body weights in one day and first week, but there was a significant ($P<0.05$) differences between treated groups from week two to the end of the experiment compared with the control group as showed in table (1).

TABLE 1: Effect of different levels of olive oil on weekly live body weights in grams at 42 days (Mean ± SE)

	Day one	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
C	F	F	E	D	C	B	A
0.0%	44.20 ±0.22	116.35 ±1.31	257.00 ±12.54	459.10 ±21.09	1010.00 ±23.22	1590.50 ±50.58	2139.75 ±63.18
OO	a	a	b	c	c	c	d
G1	G	F	E	D	C	B	A
0.5%	43.75 ±0.29	128.05 ±0.41	349.50 ±8.35	597.75 ±17.95	1159.00 ±27.01	1731.60 ±31.38	2375.10 ±47.58
OO	a	a	a	b	b	b	c
G2	G	F	E	D	C	B	A
1%	44.15 ±0.19	137.00 ±2.03	356.75 ±9.70	674.95 ±17.86	1181.90 ±20.40	1791.50 ±45.27	2549.50 ±50.06
OO	a	a	a	a	b	b	b
G3	G	F	E	D	C	B	A
2%	44.25 ±0.19	141.25 ±2.97	371.10 ±10.12	684.80 ±13.01	1295.75 ±31.78	1952.00 ±27.31	2850.00 ±41.27
OO	a	a	a	a	a	a	a
LSD	76.437						

C: Basal diet 0.0% olive oil (control) ; Olive Oil (OO)

Means with different small letters in the same column significantly different ($P<0.05$)

Means with different capital letters in the same row significantly different ($P<0.05$)

During the first and second weeks of the experimental there was a non-significant ($P>0.05$) difference in mean body weight gain between all treatments groups and the control group, but in the weeks three there is a significant

(P<0.05) differences within experimental groups and between groups. In week 4, 5, 6 the group G3 with 2% olive oil have a significant (P<0.05) differences compare with G1, G2 and control as showed in the table (2). Researchers estimate that 55- 66% of polyphenols from olive oil was absorbed after ingestion, primarily in the small intestine. Otherwise weight gain may be explained through the highest level of essential fatty acids unsaturated fatty acids and malabsorption of fatty acids in olive oil which can play a major role in reduces the rate of feed passage through the digestive system, which allows a better absorption of all nutrients present in the diet[16]. The result of this study is in agreement with[17] reported that the body weight gain BWG was improved by 6% olive oil *sediments*. In contrast with our results[18] observed a marked reduction in BWG.

TABLE 2: Effect of different levels of olive oil on body weight gain (daily gain) in grams at 42 days (mean ± SE)

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
C	C	B	B	A	A	A
0.0%	10.30 ±0.20	C20.09 ±1.84	28.87 ±3.45	78.70 ±5.10	77.89 ±9.32	78.46 ±9.92
OO	a	a	B	b	b	d
G1	C	B	B	AB	A	A
0.5%	12.04 ±0.09	31.63 ±1.19	35.46 ±2.65	80.17 ±4.39	81.80 ±5.93	91.92 ±7.93
OO	a	a	Ab	ab	ab	c
G2	C	B	B	A	A	A 1
1%	13.26 ±0.28	31.39 ±1.36	45.45 ±2.53	72.42 ±4.13	87.08 ±7.52	08.28 ±8.85
OO	a	a	A	b	ab	b
G3	D	C	C	B	B	A
2%	13.85 ±0.44	32.83 ±1.35	44.81 ±2.29	87.27 ±4.94	93.75 ±4.76	128.28 ±7.63
OO	a	a	Ba	a	a	a
LSD	14.129					

C: Basal diet 0.0% olive oil (control); Olive Oil (OO)
Means with different small letters in the same column significantly different (P<0.05)
Means with different capital letters in the same row significantly different (P<0.05)

Feed intake

The means of feed intake described in the table (3). During the first and second weeks of the experiment there was non-significant (P>0.05) differences between groups. The significant differences (P<0.05) began from the third week to the end of experimental, but groups G3 and G2 with2% and 1% olive oil have not any significant differences between them. Sudjana *et al.* [19] indicated that oleuropein in olive oil play a role in regulating the composition of the gastric flora by selectively reducing levels of *Campylobacter jejuni*, *Helicobacter pylori* and methicillin-resistant *Staphylococcus aureus* (MRSA). In contrast to these studies Zhang *et al.* [20] showed the inclusion of 5% olive oil in the diet decreased feed intake during the starter phase (d 0 to 21).

TABLE 3: Effect of different levels of olive oil on daily feed intake in gram at 42 days (mean ± SE)

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
C	E	D	C	B	B 108.46 ±12.00	A 151.43 ±15.31
0.0%	14.26 ±1.28	42.65 ±7.34	55.22 ±3.32	98.15 ±10.80	b	b
OO	a	a	b	b		
G1	E	D	C	B	B	A 184.76 ±27.45
0.5%	14.23 ±1.81	40.02 ±2.43	65.20 ±0.55	100.88 ±16.67	118.83 ±5.73	a
OO	a	a	ab	ab	ab	
G2	E	D	C	B	B	A 189.92 ±35.69
1%	17.26 ±0.23	44.16 ±0.81	68.27 ±3.39	111.69 ±3.61	120.47 ±4.87	a
OO	a	a	a	a	a	
G3	E	D	C	B	B	A
2%	15.26 ±1.55	49.75 ±1.01	70.34 ±5.14	114.91 ±5.45	123.67 ±4.63	195.58 ±15.34
OO	a	a	a	a	a	a
LSD	11.382					

C: Basal diet 0.0% olive oil (control); Olive Oil (OO)
Means with different small letters in the same column significantly different (P<0.05)
Means with different capital letters in the same row significantly different (P<0.05)

Feed conversion ratio (FCR)

The results of FCR are explained in the table (4) which showed a significant (P<0.05) differences in all weeks of the experiment between treated groups G3, G2 and G1 compared with control groups. The table (4) general described the improvement of the FCR with 2% olive oil from (1-42) days of the experiment, and we saw that total FCR became improved between the groups G3, G2 and G1compared with control group. Our results agreed with [21] indicated that oleuropein, which added to mixed feed with a dose of 400 ppm improves feed conversion ratio. In contrast to these studies Crespo and Esteve-Garcia[22]

found that olive oil at the rate of 6 and 10% had no effect on feed conversion ratio in broilers.

TABLE 4: Effect of different levels of olive oil on feed conversion ratio (FCR) at 42 days

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Total
C	C	A	A	C	C	A	B
0.0%	1.38±0.08	2.12±0.12	1.91±0.05	1.24±0.14	1.39±0.10	1.93±0.05	1.66±0.14
OO	a	a	a	b	ab	a	a
G1	D	D	B	D	C	A	C
0.5%	1.18±0.09	1.26±0.06	1.83±0.15	1.25±0.15	1.48±0.07	2.01±0.12	1.50±0.13
OO	b	c	a	b	a	a	b
G2	C	BC	BC	B	BC	A	B
1%	1.30±0.13	1.40±0.10	1.50±0.12	1.54±0.19	1.38±0.06	1.75±0.12	1.47±0.06
OO	b	bc	b	a	ab	b	b
G3	D	AB	A	C	C	AB	BC
2%	1.10±0.10	1.51±0.11	1.56±0.16	1.31±0.10	1.32±0.12	1.52±0.04	1.38±0.07
OO	b	b	b	ab	b	c	b
LSD	0.1434						

C: Basal diet 0.0% olive oil (control) ; Olive Oil (OO)
Means with different small letters in the same column significantly different (P<0.05)
Means with different capital letters in the same row significantly different (P<0.05)

Total Cholesterol, High density lipoproteins (HDL) and low density lipoproteins (LDL)

The table (5) is showed the improvement condition for the treated groups with olive oil in cholesterol level that showed significant (P<0.05) differences between treated groups compared with control group. HDL has a significant (P<0.05) differences in groups G3 and G2 compared with groups G1 and control. Also explained that LDL has a significant (P<0.05) differences between all treated groups compared with the control group. The olive oil contains Squalene that inhibits the enzyme Hydroxy methylglutaryl CoA reductase in the liver which helps cholesterol synthesis, thus reducing the concentration of cholesterol, the squalene compound also has the ability to remove free radicals that due to reducing of LDL-C oxidation and reduces concentration of cholesterol[23]. Our result agree with Feeding rats on diet containing olive oil significantly improved lipid profile as it reduced serum triglyceride, cholesterol and lipoproteins[24,25]. Olive oil contains 55-83% of oleic acid which plays a role in reducing low density lipoproteins (LDL)[26].

TABLE 5: Effect of different level of olive oil on HDL, LDL, Cholesterol of broiler chicks at 42 days (means ± SE)

	HDL mg/dl	LDL mg/dl	Cholesterol mg/dl
C 0.0% OO	74.69±0.89 b	66.99±10.87 a	152.79±5.87 a
G1 0.5% OO	78.75±2.08 ab	52.38±7.93 ab	139.58±1.06 b
G2 1% OO	80.21±1.16 a	49.57±8.89 b	137.94±2.49 b
G3 2% OO	82.23±1.59 a	47.22±4.73 b	136.63±1.80 b
LSD	5.0246	15.864	11.171

C: Basal diet 0.0% olive oil (control); Olive Oil (OO)
Means with different letters in the same column significantly different (P<0.05)

Triglycerides and VLDL

The results in table (6) described effect of the treatment in the triglycerides at 42 days of the experimental there was a significant (P<0.05) differences in triglycerides between all treated groups compared with control group so olive oil decrease the triglycerides level on treated groups. Results in table (6) described VLDL a significant (P<0.05) differences between treated groups and control group. The olive oil contains polyphenols which reduces Lipid peroxidation chain reactions that inhibition Triglyceride Lipase enzyme for responsible breakdown of triglycerides and thus causing increase in fat metabolism and high level in blood [22,27] in broilers demonstrated that unsaturated fatty acids may inhibit the activity of Δ9-desaturase enzyme that resulted in decrease of release of VLDL and triglycerides from the liver to the blood stream. Our finding are similar to some extent with previous reports showing that chicks fed with olive oil in rich diet had lower values of serum triglyceride[28].

TABLE 6: Effect of different levels of olive oil on Triglycerides (TG) and VLDL of broilers at 42 days (means ± SE)

	TG mg/dl	VLDL mg/dl
C 0.0% OO	55.55±0.02 a	11.11±1.80 a
G1 0.5% OO	42.29±6.24 b	8.45±1.16 ab
G2 1% OO	40.81±2.30 b	8.16±0.46 ab
G3 2% OO	35.93±1.15 b	7.18±1.37 b
LSD	12.767	3.6022

C: Basal diet 0.0% olive oil (control); Olive Oil (OO)
Means with different letters in the same column significantly different (P<0.05)

CONCLUSION

From the results of this study, it can be concluded that dietary olive oil supplementation have Improvement the feed conversion ratio and increase live body weight in G3 group with 2% olive oil. Also the using of olive oil improves some biochemical traits.

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