

## RESPONSE OF DUCK PERFORMANCE TO DIETS SUPPLEMENTED WITH OIL/FAT SOURCES

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### ABSTRACT

This experiment was conducted to study the response of Muscovy ducklings to dietary supplementation with various oil/fat sources and levels (3 and 6%) and iso-nitrogenous diets and the effect on growth performance, carcass traits, digestibility of nutrients and economical efficiency. A number of ninety one-day old Muscovy ducklings were used and were reared on floor and fed *ad-libitum* on starter diet for two weeks. Then, ducklings were divided equally into five groups of 18 each, and received the grower diets according to source (corn oil, dry fat) and level (3,6%) in addition to the control. The experiment lasted for 12 weeks.

The results indicated that body weight, weight gain were not statistically improved with oil/fat sources, whereas feed conversion was better by feeding corn oil containing diets. Ducks fed corn oil (CO3%) had surpassed all treatments and gave the highest live body weight, weight gain and feed conversion, while ducks fed dry fat (DF, 3%) gave the most inferior performance at the same age. Data of dressing, giblets, inedible parts and visceral fat percentages showed significant differences between the different treatments. The percentages of ether extract and crude protein of meat were affected by treatments. Dietary oil/fat sources improved significantly ether extract digestibility, while crude protein, crude fiber, organic matter and nitrogen free extract did not show any significant effect.

The economic evaluation showed that corn oil-containing diets gave better relative economical efficiency value than those of either dry fat or control diet.

**Keywords:** Ducks, performance, digestibility, carcass traits.

### INTRODUCTION

In many countries, meat type ducks become more popular farm birds as their growth and development occur much faster than that of chickens because it strongly influence the economic profits of production of poultry meat. Numerous studies on the use of supplemental oil/fat in broiler diets as a source of energy were reported and most of oil/fat sources in poultry diets are the common sources like vegetable oils and animal fats. Vegetable oil contains high levels of polyunsaturated fatty acids which inhibit lipogenesis (Tanaka *et al.*, 1983 and Donaldson, 1985), also, supplemental fat is an important component in broiler diets (Randal and David, 1985).

Many authors proved that using oil/fat as a source of energy in broiler diets can reduce feed intake, enhance the growth performance and improve efficiency of utilization (Sell and Owings, 1984; Mendes and Cury, 1986; Atteh *et al.*, 1989; Olomu and Baracas, 1989; Furuse *et al.*, 1992; Soto Salanove *et al.*, 1992 and Bartov and Bar-Zur, 1995). Feed conversions were significantly influenced by the type of fat supplement, and the best feed conversion was obtained with the vegetable oils (Alao and Bolnave,

1985). However, birds receiving poultry fat consumed more energy and were heavier and more efficient at 6 weeks of age, while digestibility nutrients were not altered (Golian and Maurice, 1992).

Other workers showed that the addition of oil/fat source may improve palatability of feed (Cherry, 1982), decreased rate of passage, improve digestion and intestinal absorption (Mateos *et al.*, 1982) and affect gastrointestinal transit time (Duke, 1989).

On the other hand, conflicting studies have been reported on the effect of dietary oil/fat on carcass characteristics. El-Husseiny *et al.* (1990), Valencia *et al.* (1993); Soudy (1997) and Abou-El-Wafa *et al.* (2000) found no significant differences on carcass quality due to oil/fat in chick diets, which disagree with those reported by Vila and Esteve-Garica (1996). Moreover, Sell *et al.* (1985) found an increase in carcass fat with supplementary dietary fat, whereas, Summer *et al.* (1985), Keren *et al.* (1990) and Dorgham (2001) did not find any significant effect.

Therefore this work was designed to study the response of Muscovy ducks to diets supplemented with various levels of different oil and fat sources and to investigate the effect on the performance, carcass traits and economical efficiency.

## MATERIALS AND METHODS

This work was carried out at the poultry farm, Faculty of Agriculture, Cairo University and the Department of Animal and Poultry Nutrition and Production, during the period from June to September 1998. A total of ninety one-day old Muscovy ducklings were wing banded and were brooded on a floor pen using wheat or rice straw as litter and electric heaters needed for brooding. All ducklings were fed starter diet (from 0 to 2 weeks, old) with 2932 Kcal ME/Kg and 22% CP; before receiving the experimental diets, and were kept under similar management system. Lighting program was provided about 23 hours daily. Feed and water were offered *ad-libitum* during the experimental period which lasted for 12 weeks of age.

During growing period (from 3 to 12 weeks old), ducklings were randomly divided into five treatment groups, with equally body weight of 18 birds each, and fed the following experimental diets:

- 1- Corn-soybean diet (Control)
- 2- Corn-soybean diet + 3% Corn oil (Low level, CL)
- 3- Corn soybean diet + 6% Corn oil (High level, CH)
- 4- Corn soybean diet + 3% Dry fat (Low level, DL)
- 5- Corn soybean diet + 6% Dry fat (Low level, DH)

The experimental diets were formulated to contain different levels of energy by supplementing different levels of oil/fat sources. The composition of the formulated diets is illustrated in Table (1). Diets were formulated to satisfy the nutrients needs as recommended by the N.R.C. (1994).

The birds were individually weighed as well as the consumed feed per pen of each treatment were determined biweekly and feed conversion values were calculated.

**Table (1): Composition and chemical analyses of the starter and grower diets**

Ingredients	Starter diet (0-2 wks)	Grower diets (3-12wks)				
		Control	CL	CH	FL	FH
Yellow corn	63.90	72.90	64.90	61.90	64.90	61.90
Soybean meal (44%)	25.00	16.00	16.00	16.00	16.00	16.00
Broiler concentrate <sup>1</sup>	10.00	10.00	10.00	10.00	10.00	10.00
Wheat bran	-	-	5.00	5.00	5.00	5.00
Corn oil	-	-	3.00	6.00	-	-
Dry fat*	-	-	-	-	3.00	6.00
Limestone	0.30	0.30	0.30	0.30	0.30	0.30
Vit+Min premix <sup>2</sup>	0.30	0.30	0.30	0.30	0.30	0.30
Table Salt	0.30	0.30	0.30	0.30	0.30	0.30
Lysine, Hcl	0.05	0.05	0.05	0.05	0.05	0.05
DL-Methionine	0.15	0.15	0.15	0.15	0.15	0.15
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Calculate values<sup>3</sup></b>						
Crude protein %	21.64	18.44	18.54	18.29	18.54	18.29
ME Kcal/Kg	2932	3033	3094	3258	3033	3114
Lysine %	1.22	1.02	1.03	1.02	1.03	1.02
Methionine %	0.42	0.55	0.54	0.53	0.54	0.53
Ca %	0.90	0.88	0.88	0.88	0.88	0.88
Available P,%	0.42	0.61	0.64	0.63	0.64	0.63
Price /Kg.(L.E.)	-	0.783	0.853	0.928	0.858	0.937
<b>Chemical composition<sup>4</sup></b>						
Moisture %	9.72	9.40	11.43	10.98	9.42	9.36
Crude protein %	22.82	18.67	19.32	19.86	19.40	20.06
Crude fiber %	3.50	3.80	3.45	3.98	3.65	3.91
Ether extract %	1.67	2.68	2.36	2.97	2.10	3.35
Ash %	7.37	5.98	5.39	6.10	5.35	6.32
NFE,%	54.92	59.47	58.05	56.11	60.08	57.00

- 1- Broiler concentrate contains: ME (Kcal/Kg) 2342, CP.52%, CF, 3% Ca.7%, available P. 3%, Lysine, 3.27% and methionine, 1.48%
  - 2- Supplied /Kg diet: Vit. A, 12000 IU; Vit D<sub>3</sub>, 2200, IU, Vit E, 10mg; Vit K<sub>3</sub> 2 mg; Vit B<sub>1</sub>, 1mg; Vit B<sub>2</sub> 4mg; vit B<sub>5</sub> 1.5mg; Vit.B<sub>12</sub> 10µg; Niacin, 20 mg; pantothenic acid, 10mg; folic acid, 1mg; Biotin, 50 µg; choline chloride, 500 mg; copper, 10mg; Iodine, 1mg; Manganese, 55mg; Zinc, 50mg; selenium, 0.1mg and iron, 30 mg.
  - 3- Calculated according to NRC (1994).
  - 4- Determined according to the methods of A.O.A.C (1990).
- \* Ultrakcal: is a mixture of vegetable oils and fatty acids designed to provide high energy source in poultry. It contains high levels of essential fatty acids to meet the linoleic acid requirements of broilers. IT stimulates feed intake, reduces the rate of food passage and subsequent improves digestion, increases Me value of the diet and reduces carcass fat deposition .

A digestibility trial was performed using 4 birds from each treatment at the end of the experiment to determine the digestion coefficient of nutrients of the experimental diets and faecal nitrogen was determined according to the procedure outlined by Jakobsen *et al.* (1960).

Moreover, at the termination of the experimental period (12 weeks of age), 4 birds from each treatment (2 males and 2 females) were randomly chosen and slaughtered to estimate carcass weight, giblets (liver, gizzard, heart), edible and non-edible parts in addition to visceral and fat pad. The percentages of the previous parameters were calculated in relation to the live body weight. Moreover, meat samples were taken from the carcasses for the chemical analysis.

Chemical analysis of tested oil/fat sources (Table 2) were estimated using Gas liquid chromatography apparatus analysis according to the method outlined also by A.O.A.C. (1990). The different diets, dried excreta and meat samples were analysed for their proximate analysis using methods outlined by A.O.A.C. (1990).

Data were statistically analysed according to Snedecor and Cochran (1981). The significant differences between means were assessed by using L.S.D. test according to Fisher (1960).

**Table (2): Fatty acid composition of the dietary oil/fat sources (%)**

F.A		Corn oil	Dry fat (Ultrakcal)
<b>Saturated</b>			
Myristic	C <sub>14</sub>	0.56	1.50
Palmitic	C <sub>16</sub>	13.67	20.98
Stearic	C <sub>18</sub>	3.49	5.46
<b>Un-saturated</b>			
Oleic	C <sub>18:1</sub>	29.74	38.50
Linoleic	C <sub>18:2</sub>	49.50	22.78
Linolenic	C <sub>18:3</sub>	-	1.0
Total Sat. F.A. (TS)		17.72	27.94
Total Unsat. F.A.(TUS).		79.24	62.28
TUS/TS		4.47	2.23

## RESULTS AND DISCUSSION

### Growth performance:

The results summarized in Tables 3 and 4 showed that ducks fed on corn oil diet at 3% level (CL) were heavier in live weight (LW) and body weight gain (BWG) than either those fed dry fat (DF) containing diets or control groups, at all studied ages. Analysis of variance showed a significant effect on BWG during the periods of (0-2, 3-12 wks), but was nearly similar among treatments during the whole periods (0-12wkds) with no significant difference. In this connection, similar results concerning different oil/fat sources were reported by Zataria and Sell (1990); El-Husseiny *et al.* (1990); Leeson and Atteh (1995); Nitsan *et al.* (1997); Zollitsch *et al.* (1997) and

Dvorin *et al.* (1998) who found that using vegetable oil and animal fat in poultry diets improved BWG.

On the other hand, ducks fed diets containing corn oil had significantly less feed intake compared to the other treatments. It was clearly noted that feed conversion ratio was significantly better with ducks fed diets contained CL. The finding confirm with previous results obtained by Alao and Balnave (1985); Brue and Latshaw (1985); Leeson and Atteh (1995) and Abou-El-Wafa *et al.* (2000).

**Table (3): Body weight (g) and weight gain (g) of ducklings at different age intervals .**

Age Wks	Treatment groups				
	Control	CL	CH	DL	DH
Body weight (g)					
Initial B.W	50.0±0.77	50±1.23	50±1.0	50±0.81	48±0.90
	a	ac	b	b	bc
2	349±10.50	331±8.73	303±9.67	301±8.99	304±11.99
4	1201±51.10	1157±38.89	1116±43.08	1137±39.40	1185±43.24
6	1926±73.08	1967±81.35	1971±85.99	1978±84.47	1927±80.45
8	2657±107.3	2706±115.0	2664±112.3	2653±120.4	2719±113.4
10	3085±162.1	3094±154.5	3008±150.5	2969±152.3	3025±149.4
12	3500±206.0	3567±189.0	3364±190.3	3294±182.6	3388±84.30
Weight gain (g)					
	a	ac	b	b	bc
0-2	298±10.48	283±8.70	254±9.11	251±8.63	256±12.03
2-4	852±44.90	825±35.0	812±35.8	836±35.1	881±35.4
	a	ab	b	ab	ab
4-6	725±49.8	810±47.6	855±46.6	841±51.3	742±44.7
	ab	ab	ab	a	b
6-8	731±54.0	739±44.2	693±35.2	675±41.9	793±39.90
8-10	428±63.0	389±52.0	344±44.8	317±39.2	306±44.8
	a	ab	ab	ab	b
10-12	415±52.6	472±44.5	356±45.8	325±44.7	363±37.8
0-12	3449±206.0	3518±188.7	3314±190.0	3245±189.0	3341±181.8

a, b, c.: Means in the same row with different superscripts are significantly different (P < 0.05).

**Table (4): Duck performance as affected by source and level of oil/fat supplementation during starter and grower period.**

Item	Treatment groups				
	Control	CL	CH	FL	FH
Body weight gain/bird (g)					
0-2 wks	a298±5.4 a	ac283±5.3 ac	b254±4.5 b	b251±5.3 b	b256±4.3 bc
3-12 wks	3151±8.1 a	A3235±7.51a	3060±6.8b	2994±5.7 b	b3085±8.9 b
0-12 wks	3449±11.8	3518±10.6	3314±9.5	3245±8.3	3341±9.1
Feed intake/bird (g)/day					
0-2 wks	34	64	67	76	71
3-12 wks	148	130	147	176	148
0-12 wks	129	120	134	160	136
Feed conversion/bird (9feed/g gain)					
0-2 wks	1.60	3.17	3.69	4.24	3.88
3-12 wks	3.28	2.82	3.37	4.12	3.37
0-12 wks	3.14	2.85	3.39	4.13	3.41

a,b,c, : Means in the same row with different superscripts are significantly different (P < 0.05).

## Yassein, S.A.

It is concluded that ducks fed low level of vegetable oil (CL) and high levels of dry fat (DH) showed better values of most growth performance parameters (Pinchasov and Nir, 1992; Klaus *et al.*, 1995; Roth-Maier and Kirchgessner, 1995; Vila and Esteve-Garcia, 1996 and Abou El-Wafa, *et al.* 2000). This improvement of growth performance of corn oil fed groups may be due to the lower digestibility of saturated fatty acids as compared to unsaturated fatty acids (Klaus *et al.*, 1995) or may be due to the reduction in rate of food passage Mateos *et al.*, (1982), or the presence of linoleic acid in corn oil which improve the growth rate (Pinchasov and Nir, 1992).

### Digestibility Coefficients:

No significant differences were found among treatments in digestion coefficient of crude protein (CP), crude fiber (CF), nitrogen free extract (NFE) or organic matter (OM) due to the effect of dietary oil/fat source (Table 5). However, ducks fed diets supplemented with CO had statistically higher digestibility coefficient of ether extract (EE) and surpassed those fed diets with DF source. The improvement may be due to the ability to absorb most of unsaturated fatty acids of corn oil than dry fat. Similar results were obtained by El-Husseiny and Ghazalah (1990), and Abou El-Wafa *et al.*, (2000). Furthermore, the digestion coefficient of OM decreased by using oil/fat sources. The results were generally in keeping with that proved by Ghoneim (1960). Also, the results of CF digestibility, agreed with those of Titus and Fritz (1971) who reported that the CF is slightly digested by poultry because the digestive enzymes have no action upon it and due to the lack of microorganisms which aid on CF digestion.

Table (5): Digestibility coefficients (%) of the experimental diets (mean  $\pm$  SE).

Treatment	OM	CP	EE	CF	NFE
Control	80.12 $\pm$ 2.18	88.91 $\pm$ 2.37	<sup>c</sup> 88.24 $\pm$ 1.45	25.33 $\pm$ 0.75	85.48 $\pm$ 2.47
Corn oil 3%	78.16 $\pm$ 4.47	89.98 $\pm$ 4.94	<sup>a</sup> 93.92 $\pm$ 0.84	24.89 $\pm$ 1.43	84.86 $\pm$ 3.27
Corn oil 6%	78.74 $\pm$ 4.62	88.22 $\pm$ 2.75	<sup>a</sup> 92.35 $\pm$ 0.67	24.53 $\pm$ 0.78	83.49 $\pm$ 1.77
Dry fat 3%	79.74 $\pm$ 4.62	86.67 $\pm$ 1.82	<sup>ab</sup> 91.04 $\pm$ 1.37	22.28 $\pm$ 1.51	85.27 $\pm$ 0.70
Dry fat 6%	77.37 $\pm$ 2.31	86.54 $\pm$ 1.34	<sup>ab</sup> 90.86 $\pm$ 2.16	23.91 $\pm$ 1.15	83.94 $\pm$ 2.69

a,b,c.: Means in the same column with different superscripts are significantly different (P < 0.05).

### Carcass traits and carcass composition :

The results presented in Table (6) showed that ducks given diets supplemented with either corn oil or dry fat at low (3%) or high (6%) level gave higher percentages of dressing and edible parts relative to body weight. The highest value was detected in the group fed low level of corn oil (CL) compared to the other treatments. Also, percentages of giblets to body weight were significantly lower for ducks fed oil/fat studied, whereas, edible parts were not significantly different. Similar results were obtained by Vila and

Esteve-Garcia (1996) and Soudy (1997). On the other hand, the percentage of pad fat decreased by adding either CO or DF to diets compared to the control. In this connection, Keren-Zvi *et al.* (1990); Valencia *et al.* (1993) and Nitsan *et al.*, (1997) found that vegetable oils supplementation decreases body fat in broiler chickens as previously reported by Donaldson, 1985. As expected, fat deposition percentages were higher for ducks fed dry fat than the other groups. Similar results were reported by Hurwitz *et al.* (1988) and Darryl and Sell (1994).

Data of carcass meat analysis in Table (6) showed that the percent of carcass protein content for ducks fed CL diet surpassed that of the DF diets. Moreover, ether extract increased and ash content decreased for ducks received CO or DF Supplemented diets. These results support those of Laurin *et al.* (1985) and Darryl and Sell (1994) who found that supplementing high level of fat to broiler diets increased the amount of carcass fat and reduced the percent of protein and ash.

**Table (6): Slaughter characteristics and carcass composition of Muscovy ducks fed diets supplemented with different oil/fat sources.**

Criteria	Treatment groups				
	Control	CL	CH	FL	FH
Live body weight (g)	3485	3638	3325	3385	3485
Carcass weight (g)	2235	2492	2187	2224	2289
Dressing %	b 64.13±1.80	a 68.49±0.53	ab 65.77±0.77	ab 65.70±0.66	ab 65.70±1.04
Giblets weight (g)	243	148	173	163	176
%	a 6.97±0.51	b 4.07±0.22	c 5.21±0.46	bc 4.82±0.21	bc 5.04±0.38
Edible parts (g)	2818	2991	2722	2720	2823
%	80.77±1.37	82.21±0.70	81.86±0.63	80.35±0.33	81.01±1.33
Inedible parts (g)	493	430	572	484	401
%	abc 14.15±1.34	ac 11.80±0.78	b 17.20±1.63	bc 14.31±0.39	c 11.50±0.84
Visceral fat (g)	72.10	39.65	45.89	33.17	73.91
%	a 2.07±0.42	b 1.09±0.26	ab 1.38±0.10	b 0.98±0.06	b 1.26±0.29
Fat Pad (g)	50.16	40.75	37.90	38.59	68.65
%	1.44±0.16	1.12±0.35	1.14±0.09	1.14±0.04	1.97±0.22
<b>Carcass composition % (on DM basis)</b>					
Moisture	73.23	74.00	74.14	74.45	73.50
Protein	25.12	25.93	21.88	23.20	22.51
Ether extract	1.31	1.65	2.14	2.45	2.80
Ash	1.34	1.23	1.31	1.29	1.27

a,b,c, : Means in the same row with different superscripts are significantly different (P < 0.05).

**Economical efficiency of the experimental treatments:**

Data for economical efficiency are shown in Table (7). In spite of the higher price of feed for the two oil/fat sources fed groups as compared to the control, the best economical efficiency (EE) was detected for ducks fed CC containing diets followed by ducks fed the control, while DF source had the lowest (EE). However, both feed cost/Kg gain and economical efficiency were worst for birds fed DF-containing diet, which may be due to their poor growth performance.

**Table (7): Economical efficiency of experimental treatments:**

Item	Experimental treatments				
	Control	CL	CH	DL	DH
Price of feed (L.E./Ton)	783	853	928	858	937
Final body weight (g)	3500	3567	3364	3294	3388
Body weight gain (g)	3449	3518	3314	3245	3341
Total feed intake (g)	10822	10024	11242	13398	11382
Total feed conversion	3.14	2.85	3.13	4.13	3.41
Chick price (L.E.)	4.25	4.25	3.39	4.25	4.25
Feed cost / bird (L.E.)	8.47	8.55	10.43	11.50	10.66
Vetrinary management/bird (L.E.)	0.50	0.50	0.50	0.50	0.50
Total cost/bird (L.E.)	13.22	13.30	14.39	16.25	15.41
Cost of feed/Kg gain (L.E.)	2.46	2.43	3.15	3.54	3.20
Total price /bird (L.E.)	29.75	30.32	28.59	28.00	28.80
Net revenue/bird (L.E.)	16.53	17.02	14.20	11.75	13.39
Economic efficiency (E.E.)	1.25	1.28	0.99	0.72	0.87
Relative economic efficiency %	100	102	79	58	70

- Feed cost/bird = price of Kg diet X total feed intake/bird.
- Total cost/bird = cost of feed/chick/Veterinary management.
- Cost of feed/Kg gain = Feed conversion X price of Kg diet.
- Price/bird = Total body weight X the price of each Kg live Wt = L.E 8.5.
- Net revenue/bird = Total price/bird at market age - Total cost of producing the bird.
- E.E. = Net revenue/ Total cost/bird.
- REE = Relative to the control group.

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**Yassein, S.A.**

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## استجابة الأداء الانتاجى للبط لعلائق مضاف اليها مصادر من الزيت أو الدهن سعد الدين احمد يس قسم تغذية وإنتاج الحيوان والدواجن - المركز القومى للبحوث - دقى - جيزة.

أجريت هذه التجربة بهدف دراسة استجابة البط المسكوفى لاضافة مصادر مختلفة من الزيت أو الدهن لعلائق متساوية فى الطاقة والبروتين وتأثير ذلك على كفاءة النمو وصفات الذبيحة ومعاملات هضم المركبات الغذائية فضلا عن التقييم الاقتصادى للعلائق المستخدمة فى التجربة. استخدم فى هذه الدراسة عدد ٩٠ كتكوت بط مسكوفى عمر يوم، غذيت على عليفة بادية لمدة اسبوعين، ثم قُسمت الكتاكيت إلى خمسة مجاميع تجريبية متساوية بكل منها ١٨ كتكوت وقد غذيت على علائق نامى تبعاً لنوع (زيت الذرة ، ودهن جاف) ومستوى (٦,٣%) من الزيت أو الدهن الجاف (الاسم التجارى Ultrakcal) بالاضافة للكنترول وقد استمرت التجربة لمدة ١٢ اسبوعاً.

أوضحت النتائج عدم وجود تحسن معنوى لكل من وزن الجسم والزيادة فى الوزن نتيجة اضافة الزيت أو الدهن الجاف، بينما تحسن معدل التحويل الغذائى باضافة زيت الذرة وخاصة مستوى ٣% الذى تفوق وأعطى أعلى كفاءة نمو بعكس الدهن الجاف ٣% الذى اعطى أدنى كفاءة. كان هناك تأثير معنوى للمعاملات المختلفة على صفات الذبيحة حيث سجلت المجاميع المغذاة على مصدر الزيت أو الدهن قيماً أعلى لنسبة النصافى وأقل لمحتوى دهن الأحشاء كذلك تأثرت نسبة البروتين والدهن للحم الذبيحة بين المعاملات.

كان هناك تحسن معنوى فى معامل هضم مستخلص الاثير بينما لم يكن هناك تأثير للمعاملات المختلفة على معامل هضم كل من البروتين والألياف والمستخلص الخالى من النتروجين. أوضحت النتائج تحسن الكفاءة الاقتصادية للبط المغذى على علائق مضاف لها زيت الذرة مقارنة بالمعاملات الأخرى ومجموعة الكنترول.