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DRY FATS AS ENERGY SOURCE IN BROILER DIETS

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ABSTRACT

This research work was carried out to study the effect of two dietary dry fat sources versus dietary vegetable oil (soybean oil) on the performance of broiler chicks. Two commercial sources of dry fat were used:

1-dry fat as hydrolyzed oils blend (DFOB).

2-dry fat calcium salt (DFCS).

One-day-old broiler chicks (Arbor Acres) were individually weighed, wing banded and randomly distributed into 3 equal treatments group each of 18 individual replicates. During the experimental period, which lasted for 49 days , chicks were fed the experimental diets which were formulated to satisfy the nutrient requirements of broiler chicks according to guide recommendations of "Arbor Acres" broiler, and were adjusted to be iso-nitrogenous and iso-caloric. The experimental diets were formulated in which the first one (T_1) was a diet containing soybean oil (SO) and served as a control. The other experimental diets contained either DFOB (T_2) or DFCS (T_3) as energy sources. Data on live body weight (LBW), feed intake and calculated feed conversion ratio (FCR) were recorded at the end of each period, while performance index (PI) and production number (PN) were calculated. Carcass characteristics and serum biochemical variables were taken at the end of experimental period (49 days of age).

Results obtained can be abstracted as follow:

- Control treatment (soybean oil) recorded the best values of LBW, FCR, PI and PN, during all experimental periods (starter, grower and finisher) compared to the other experimental treatments.
- Treatment 2 (DFOB) recorded the lowest values for performance traits.
- Neither carcass characteristics nor blood constituents were statistically affected by the experimental treatments.
- Fatty acids profile for the tested materials (SO, DFOB and DFCS) revealed that soybean oil (SO) contained the high unsaturated fatty acids (TU) and the lowest saturated fatty acids (TS) values, while DFOB product had the highest TS and the lowest TU values. The calculated AME reflected the fatty acids profile of the tested materials, where SO had the highest value of AME followed by DFCS product, then DFOB product.
- The simple calculations of economic efficiency confirmed the performance results obtained in this study, where treatment (SO) recorded the lowest feed cost / kg LBW and the best economic efficiency compared to T_3 (DFCS) and T_2 (DFOB), respectively.

It could be concluded according to the results of this particular work that:

-Oils are more valuable energy source in broiler diets than dry fat oils blend used in this study. The low performance of dietary dry fat oils blend could be attributed to the manufacturing process.

-Dry fat calcium salt used in this study needs more studies to specify the correct AME value suitable for use in broiler diets.

-The use of dry fat in poultry diets is a new concept that needs thorough studies before official registration, in Egypt.

INTRODUCTION

Fats and oils are important ingredients, which provide concentrated source of energy to achieve high-energy broiler diets. The value of various fats and oils in least-cost feed formulation is entirely dependent on their ME contents and the ME content of fats should be dependent on their digestibility and absorption *(Pesti et al., 2002)*.

The nutritive and AME values of fats and oils are influenced by the chemical nature of the fat or oil in question *(Renner and Hill, 1961; Young, 1961; Wiseman and Lesire, 1987 and Wiesman and Salvador, 1989)*. Studies have shown a reduction in the AME value of hydrolyzed fats when compared with the AME of the triglycerides from which they originated *(Wiseman and Salvador, 1991)*. For example, *Young (1961)* observed that AME values were generally higher for soybean oil, corn oil, lard and tallow than for their respective hydrolyzed products.

Oils of plant origin such as soybean oil contain high levels of unsaturated fatty acids, which are completely digested by fowl higher than animal fats such as lard, and tallow, as they contain higher proportions of saturated fatty acid *(Leeson and Atteh, 1995)*.

Dry fat, recently, appeared in the local market as an energy source in poultry diets. This product, which is in powder form has the previlage of being easier in mixing in the feed mill than the other forms of energy sources such as oil, tallow, poultry fat.... *etc*., which need to special equipment to mix with other ingredients.

Dry fat produced from the processing of hydrogenated oil / fat or their mixtures composed mainly of saturated fatty acids (SFA) which stearic (C18:0) being the most. Accordingly, it has low AME for poultry. However, the AME value of dry fat differs according to its composition of vegetable oils and fats *(Ramadan, 2005)*.

Some studies on dry fat (blended oils or fats) revealed lower performance compared with other energy sources such as soybean oil, rapeseed oil, sunflower oil... *etc. (Vilchez et al., 1987, Zollitsch et al., 1997, Aggoor et al., 2000 and Smith et al., 2003). While Pesti et al., (2002)* recorded no differences in live performance of broilers due to fat source (poultry greases, restaurant grease, animal / vegetable oil blend, palm oil, yellow grease and soybean oil).

Dry fat calcium salt (DFCS) is another product of dry fat defined as protected fat or rumen by-pass fat. This product is resulting from the soaponification of free fatty acids in palm oil with calcium, which is chemically bonded together to form a salt. Many studies supported the use of DFCS in dairy ration, while rare studies were found for poultry nutrition.

In last few years, many poultry producers started to use DFCS as an energy source in poultry diets and they had fluctuated results of growth performance.

This study aimed to evaluate broilers performance fed diets containing two products of dry fat: 1-dry fat oils blend (DFOB) and 2- dry fat calcium salt

(DFCS), which exist in local market, versus liquid source of dietary energy being soybean oil (SO).

MATREIALS AND METHODS

This experiment was carried out at the Poultry Research Farm, Poultry Production Dept., Fac. of Agriculture, Ain-Shams University, Cairo, Egypt, to compare the performance of broiler chicks fed diets containing vegetable oil versus dry fats as dietary energy sources. Two commercial sources of dry fat were used. They are:

1-dry fat as hydrolyzed oils blend (DFOB).

2-dry fat calcium salt (DFCS).

One-day-old broiler chicks (Arbor Acres) were individually weighed, wing banded and randomly distributed into 3 equal treatments each of 18 replicates. The average initial live body weight of assigned groups was nearly similar. Chicks were brooded and reared individually in separate wire cages in an open system house. Water and feed were offered *ad-libitum* and artificial light was provided 24 hours daily allover the experimental period, which lasted for 7 weeks. Chicks of all experimental treatments were kept under similar hygienic and environmental conditions and vaccinated against common disease.

During the experimental period, which lasted from 1 day old to 49 days of age, chicks were fed the experimental starter diets containing 23 % CP and 3100 Kcal ME/Kg feed, up to 21 days of age, then switched to a grower diet containing 20% CP and 3200 Kcal ME/Kg from 22 to 37 days of age, then a finisher diet which was fed during the finishing period (38-49 days of age) containing 18.5 % CP and 3200 Kcal ME/Kg feed. The experimental diet of the control treatment (T_1) contained soybean oil (SO) as energy source. The other experimental diets contained either DFOB (T_2) or DFCS (T_3) as energy sources. All diets were adjusted to be iso-nitrogenous and iso-caloric. The composition and calculated analysis of the experimental diets are shown in Table (1). All diets were formulated to satisfy nutrient requirements of broiler chicks according to recommendation of "Arbor Acres". Data on body weight, feed intake and calculated feed conversion ratio were recorded at the end of each period, while performance index (PI) and production number (PN) were calculated as follows:

$$PI = [LBW\ (kg) \ / \ FCR] \times 100.$$

$$PN = \frac{LBW\ (g) \times Livability\ (\%)}{Fattening\ period\ (days) \times FCR} \div 10$$

At the end of the experimental period, all the birds were starved for 12 hours then individually weighed prior to slaughter. Three random samples of experimental birds were taken from each treatment and slaughtered to determine the carcass characteristics. The carcass with neck, giblets (liver, empty gizzard and heart) and abdominal fat were separately weighed and expressed as percent of live body weight. The commercial carcass cuts (breast and thigh muscles) were estimated as a percentage of live body weight.

Blood samples were collected at the same time of slaughtering birds and blood serum was separated by centrifugation at 6000 r.p.m for 15 minutes. The obtained serum samples were decanted into plastic tubes, stoppered tightly and stored at-20 °C until biochemical determination were done. Determination of to cholesterol fractions, transaminases (ALT and AST), total protein, albumin, globulin and glucose which were colorimetrically determined using commercial kits, following the same steps as described by manufactures.

Fatty acids profile was determined by Principal Central Lab., Fac. of Agric., Cairo Univ. The A.O.A.C. (1990) method was applied for lipid extraction. Acid hydrolysis was carried out for DFCS before extraction. Fatty acids were separated according to the method of Vogel (1975).

Table (1): The composition and calculated analysis of the experimental diets.

Ingredients	Treatments								
	Starter (0-21 days)			Grower (22-37 days)			Finisher (38-49 days)		
	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3
Yellow corn	55.00	52.90	55.40	62.85	61.30	63.65	69.45	68.00	69.74
Soybean meal (44%)	29.00	29.40	28.90	21.70	21.17	21.00	15.90	16.16	15.90
Corn gluten meal	8.50	8.50	8.50	7.80	8.35	8.20	8.50	8.50	8.44
DL-methionine	0.11	0.11	0.11	0.10	0.10	0.10	0.08	0.09	0.08
L. lysine HCl	0.25	0.25	0.25	0.25	0.26	0.26	0.32	0.30	0.32
Mono Ca. phos.	1.60	1.60	1.60	1.58	1.60	1.60	1.45	1.43	1.43
Limestone	1.61	1.62	0.77	1.50	1.50	0.57	1.44	1.50	0.87
Na Cl	0.43	0.42	0.42	0.42	0.42	0.42	0.41	0.42	0.42
Vit. & Min Mixture*	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Soybean oil	3.20	-	-	3.50	-	-	2.15	-	-
Dry fat (DFM)	-	4.90	-	-	5.00	-	-	3.30	-
Dry fat (DFCS)	-	-	3.75	-	-	3.90	-	-	2.50
Total	100	100	100	100	100	100	100	100	100
Calculated analysis **									
Crude protein %	23.00	23.00	23.00	20.00	20.00	20.00	18.50	18.50	18.50
ME (k cal/kg diet)	3100	3100	3100	3200	3200	3200	3200	3200	3200
Calcium %	0.97	0.97	0.99	0.90	0.90	0.90	0.85	0.86	0.85
Av. phosphorus %	0.47	0.47	0.47	0.45	0.45	0.45	0.41	0.41	0.41
Methionine %	0.51	0.51	0.51	0.46	0.46	0.46	0.43	0.44	0.43
Met.+ cyst. %	0.92	0.92	0.92	0.82	0.83	0.83	0.77	0.79	0.77
Lysine %	1.20	1.21	1.20	1.02	1.02	1.02	0.94	0.94	0.94
Na %	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
EE %	5.70	7.30	5.60	5.96	7.66	6.07	5.11	6.20	5.09
CF %	3.35	3.33	3.35	3.00	2.94	2.98	2.75	2.74	2.76
Cost (L.E/kg)	1.492	1.508	1.494	1.420	1.430	1.419	1.344	1.351	1.343

***Each 3Kg contains: Vit.A 12 mIU ; Vit D_3 2.2 mIU ; Vit.E 10g ; Vit K 2g ; Vit B_1, 1g ; Vit.B_2, 5g ; Vit B_6, 1.5 g ; Vit B_{12}, 10mg ; Niacin 30g ; pantothenic acid 10g ; Folic acid 1g ; Biotin 50mg ; Choline 300g ; Iron 30g ; Iodine 1g ; Zinc 50g ; Manganese 60g ; Copper 4g ; Selenium 100 mg ; Cobalt 100 mg .**

**** According to Tables of NRC (1994).**

The method described by Farag *et al.* (1986) was applied for determining of fatty acids by GLC apparatus.

The total feed cost (L.E / bird) at the end of the experiment for each treatment, was calculated depending upon the local market prices of the ingredients used in formulating the experimental diets. Also, the total income (L.E / bird) was calculated depending upon the local market prices of 1 kg live body weight. Economic efficiency was determined by comparing the net revenue (L.E / bird) and the total feed cost, for each experimental treatment. It was calculated as follows:

$$\text{Economic efficiency} = \frac{\text{Net revenue (LE / bird)}}{\text{Total feed cost (LE / bird)}}$$

Data were statistically analyzed using the linear model (SX, 1992). A simple one-way classification analysis followed by least significant difference test (LSD) was used for testing the significance between means.

RESULTS AND DISCUSSION

The results of broiler's performance for the different experimental treatments are shown in Table (2). The effect of using dry fat products appeared at the end of the 1st experimental period (21 days of age). The dry fat oils bled (DFOB) and dry fat calcium salt (DFCS) recorded lower ($P < 0.05$) values of live body weight (LBW) than the control treatment (SO), where T_1 recorded 640 g/bird vs. 423 and 460 g/bird for T_2 and T_3, respectively. Feed consumption (g/bird) was lower for T_2 than T_1 and T_3. Statistical analysis showed significant difference ($P < 0.05$) between T_1 (SO) and T_2 (DFOB), while there was no significant difference ($P > 0.05$) between the two treatments of dry fat products (T_2 and T_3). Feed conversion ratio (FCR) results reflected the differences ($P < 0.05$) between the three experimental treatments indicating that T_2 was the worst (2.27) compared to T_1 (1.55) and T_3 (2.16).

At 37 days of age, control treatment (T_1) recorded the highest LBW and and the best FCR values followed by T_3 then T_2 with highly significant difference ($P < 0.01$) between them.

The same trend of LBW values was obtained at the end of the experimental period (49 days of age). Control treatment (T_1) recorded the highest value of LBW (2716 g/bird) followed by T_3 (2286 g/bird) then T_2 (2116 g/bird) with highly significant difference ($P < 0.01$) between them. Control treatment (SO) recorded 28.40% and 18.80% higher LBW than T_2 (DFOB) and T_3 (DFCS), respectively. Although the birds of T_1 consumed more feed than T_2 or T_3, it recorded the best FCR (2.02) than T_2 (2.37) or T_3 (2.31) with highly significant difference ($P < 0.01$) between T_1 and both T_2 and T_3 (Table 2).

Calculations of performance index (PI) and production number (PN) values revealed also that control treatment (T_1) recorded the best PI and PN values with highly significant difference ($P < 0.01$) with T_2 and T_3.

These results are in agreement with those reported by *El-Husseiny and Ghazalah (1989); Liarn and Yang (1992); Nistan et al. (1997), Abou El-Wafa et al. (2000) and Ramadan (2005)*. They reported that supplementing broilers diets with oils improved LBW and FCR. *Al-Athari and Watkins (1988) and Abou El-Wafa et al. (2000)* reported that hydrogenated oil resulted in poor growth and feed efficiency when compared to native oil. However, *Brown et al., (1993)* reported a lower AME value for hydrogenated soybean oil when compared to soybean oil in broiler chicks at 3 and 4 weeks of age. *Aggoor et al., (2000)* reported, also, that the poorest performance for growth and FCR, however, was achieved by dry fat (blended oils)-fed-groups. On the other hand, *Ramadan (2005)* studied the effect of different energy sources on broiler performance. The author observed that broiler chicks fed diets contain soybean oil had the best LBW and FCR, while the worst one was observed for those fed DFCS.

Table (2): The effect of dry fat on the performance of broiler chicks.

Items	Treatments			SEM*	P**
	T_1 (SO)	T_2 (DFOB)	T_3 (DFCS)		
Initial weight:	44.00	45.00	44.00	0.95	0.72
At 21 days of age:					
Live body weight (g/bird)	640.00 ^{a}	423.00 ^{b}	460.00 ^{b}	18.59	0.00
Body weight gain (g/bird)	596.00 ^{a}	378.00 ^{c}	416.00 ^{b}	18.06	0.00
Feed consumption (g/bird)	923.00 ^{a}	858.00 ^{b}	899.00 ^{ab}	28.08	0.08
Feed conversion ratio***	1.55 ^{c}	2.27 ^{a}	2.16 ^{b}	0.026	0.00
At 37 days of age:					
Live body weight (g/bird)	1724 ^{a}	1273 ^{c}	1396 ^{b}	35.77	0.00
Body weight gain (g/bird)	1680 ^{a}	1228 ^{c}	1352 ^{b}	35.25	0.00
Feed consumption (g/bird)	3320 ^{a}	2860 ^{c}	3043 ^{b}	68.40	0.00
Feed conversion ratio***	1.98 ^{c}	2.33 ^{a}	2.25 ^{b}	0.02	0.00
At 49 days of age:					
Live body weight (g/bird)	2716 ^{a}	2116 ^{c}	2286 ^{b}	55.03	0.00
Body weight gain (g/bird)	2672 ^{a}	2071 ^{c}	2242 ^{b}	54.63	0.00
Feed consumption (g/bird)	5388 ^{a}	4903 ^{b}	5171 ^{ab}	154.40	0.01
Feed conversion ratio***	2.02 ^{c}	2.37 ^{a}	2.31 ^{b}	0.02	0.00
Performance index (PI) %	134.50 ^{a}	89.30 ^{c}	98.96 ^{b}	7.41	0.00
Production Number (PN)	274.40 ^{a}	182.20 ^{c}	201.96 ^{b}	15.12	0.00

a, b .... means with different superscript(s)in the same row are significantly different ($P < 0.05$).
*** Standard error mean for comparison.**
****Probability.**
***** FCR= Feed consumption (g/bird) / Body weight gain (g/bird)**

Table (3) summarizes the results of carcass characteristics of experimental slaughtered birds sample. The treatment samples showed no differences in LBW, carcass weight (g/bird) and carcass % (dressing %) values ($P > 0.05$). No significant difference ($P > 0.05$) was also detected between treatments for liver weight (g/bird) or liver % of LBW. Same statistical results were obtained for gizzard %, heart %, giblets % or total edible parts %, of LBW.

Although the statistical difference between treatments for abdominal fat (g/bird) was not significant ($P > 0.05$), it recorded highly significant difference ($P < 0.01$) for abdominal fat % of LBW. Treatment (T_3) recorded the highest value (2.21%) comparing to T_1 and T_2 (Table 3). There were, no significant differences ($P > 0.05$) among treatments for breast %, thighs %, breast + thighs (g/bird) or breast + thighs % of LBW.

The results obtained for carcass characteristics are in agreement with those obtained by *Abou El-Wafa et al. (2000)* who found no significant effect on carcass characteristics due to fat source. While, *Aggoor et al. (2000)* found the inverse, as they reported higher ($P < 0.01$) values of carcass characteristics due to dietary supplemental oil than DFOB. Sanz *et al. (2000)* evaluated the effects of dietary fat type on fat metabolism and deposition in broiler chickens. They found that birds fed diets containing unsaturated fat resulted lower abdominal fat deposition than those fed diets containing saturated fat.

Table (3): Carcass characteristics of broiler chicks at 7 weeks of age as affected by the experimental diets.

Items	Treatments			SEM*	P**
	T_1 (SO)	T_2 (DFOB)	T_3 (DFCS)		
Live body weight (g/bird)	2731.6	2411.6	2306.3	155.6	0.08
Carcass weight (g/bird)	2171	1901.6	1821.3	124	0.07
Carcass %	79.45	78.84	79.02	0.86	0.77
Liver (g/bird)	47.33	46.00	42.67	2.04	0.14
Liver %	1.73	1.92	1.85	0.09	0.22
Gizzard (g/bird)	42 ^{a}	36.67 ^{ab}	33.67 ^{b}	2.29	0.03
Gizzard %	1.54	1.53	1.46	0.05	0.33
Heart (g/bird)	14.67 ^{a}	13.33 ^{ab}	11.67 ^{b}	0.94	0.05
Heart %	0.54	0.56	0.51	0.04	0.51
Giblets (g/bird)	104 ^{a}	96 ^{ab}	88 ^{b}	4.42	0.03
Giblets %	3.80	4.00	3.82	0.14	0.37
Total edible parts (g/bird)	2275	1998	1909	127.64	0.06
Total edible parts%	83.26	82.84	82.83	0.88	0.86
Abdominal fat (g/bird)	46.67	42.67	51	3.32	0.11
Abdominal fat %	1.71 ^{b}	1.77 ^{b}	2.21 ^{a}	0.06	0.00
Breast (g/bird)	493	437	422	32.16	0.15
Breast %	18.03	18.09	18.31	0.31	0.66
Thighs (g/bird)	449	388	381	25.65	0.07
Thighs %	16.42	16.10	16.54	0.27	0.30
Breast + Thighs (g/bird)	942	825	803	57.44	0.11
Breast + Thighs %	34.46	34.85	34.19	0.50	0.46

a, b .... means with different superscript(s)in the same row are significantly different ($P < 0.05$).

* Standard error mean for comparison.

**Probability.

No significant differences ($P > 0.05$) were detected between treatments for the results of blood constituents (Table 4). These results are in agreement with those found by *Aggoor et al. (2000)* who reported no effect of fat source on blood plasma constituents. *Abou El-Wafa et al. (2000)* reported, also, that no significant differences in plasma total cholesterol concentration were detected among different dietary treatments (fat sources).

Table (4): Blood constituents of broiler chicks at 7 weeks of age as affected by the experimental diets.

Variables	Treatments			SEM*	P**
	T_1 (SO)	T_2 (DFOB)	T_3 (DFCS)		
Total protein (g/dl)	2.60	2.70	2.60	0.44	0.97
Albumin (g/dl)	0.92	1	1.01	0.65	0.37
Globulin (g/dl)	1.35	1.37	1.59	0.15	0.28
A/G ratio	0.68	0.74	0.64	0.08	0.49
Total cholesterol (mg/dl)	102.33	119.67	113	10.76	0.34
Triglycerides (mg/dl)	61.67	56.83	54.67	8.46	0.71
HDL (mg/dl)	46.67	52.50	51.67	11.15	0.85
LDL (mg/dl)	43.33	55.87	50.40	4.05	0.06
Glucose (mg/dl)	213.33	223.67	221.33	9.46	0.55
ALT	16	27.7	17.7	5.41	0.14
AST	181.33	180	177.33	12.84	0.95

a, b .... means with different superscript(s)in the same row are significantly different (P < 0.05).
*** Standard error mean for comparison.**
****Probability.**

Fatty acids profile for the tested materials (SO, DFOB and DFCS) and their calculated AME content are presented in Table (5). It is observed that the fatty acids profile of the three tested energy sources varied markedly. Soybean oil (SO) contained high unsaturated fatty acids (TU) being 90% and low saturated fatty acids (TS) being 14.77%, while DFOB product had the highest TS (55.53%) and the lowest TU (40.62%). The calculated, AME (Table 5) reflected the fatty acids profile of the tested materials, where SO had the highest value of AME (8940 Kcal/kg) followed by DFCS product (7217 Kcal/Kg) then DFOB product (6513 Kcal/kg)

The results presented in Table (5) can explain the performance results summarized in Table (2). The efficiency of fat utilization is dependent on its fatty acids content *(Sibbald and Kramer, 1980). Young and Garrett (1963)* mentioned that an increase in the content of TU in relation to TS increases the absorption of TS. *Klaus et al. (1995)* demonstrated that source of fat had significant effect on broiler growth and suggested that saturated fats are less digestible for young chicks.

The superiority of using SO in this study may be due to its high content from linoleic and linolenic acids, which are known to be essential for the complete nutrition rather than high TU :TS ratio.

As for DFCS results (Tables 2 and 5), the calculated AME value (Table 5) did not differ to the recommended value of the producer. However, the obtained low performance of birds fed diets supplemented with DFCS may be attributed to the affect of soaponification process as a result of the connection between fatty acids and calcium content, which lead to lacking of fatty acids content of DFCS product *(Ramadan, 2005)*. The dissociation of this connection may be reduced in bird's gut, as pH degree of the proventriculus and gizzard ranged between 2.5 to 3.5. *Omar (1999)* reported that the connection between fatty acids and calcium in dry fat was highly soluble in pH 2 than that in pH 3 and this salability increased by the exposure time. Moreover, *Ramadan (2005)* concluded that the benefit of fatty acids content in DFCS restricted due to gastric pH of bird and smoothness of diet, consequently the time which diet overstay in the gizzard are insufficient to break down the connection bond of DFCS.

Table (5): Fatty acids profile of the different tested energy sources.

Items	Energy source		
	SO	DFOB	DFCS
Myristic acid (C14:0)	-	2.47	3.41
Margic acid (C17:0)	-	0.60	2.88
Palmetic acid (C16:0)	9.37	-	-
Stearic acid (C18:0)	5.40	53.46	30.42
TS	14.77	56.53	36.71
Palmitoleic acid (C16: 1)	-	24.57	20.54
Oleic acid (C18: 1)	22.25	15.71	33.37
Linoleic acid (C18: 2)	56.28	-	3.83
Linolenic acid (C18: 3)	11.51	0.34	0.07
TU	90.04	40.62	57.81
TU : TS [(1)]	6.10	0.72	1.57
TFFA [(2)]	0.07	2.31	10.96
AME [(3)]	8940	6513	7214

a, b .... means with different superscript(s)in the same row are significantly different ($P < 0.05$).

*** Standard error mean for comparison.**

****Probability.**

Although the calculated AME value of DFOB (Table 5) is slightly lower (6513 Kcal/kg) than the producer recommended AME value (7000 Kcal/kg) and the low level of free fatty acids (2.31%) comparing with that of DFCS (10.96%), birds fed diets containing DFOB gained lower body weight than that of DFCS. This result may be due to the higher level of total saturated fatty acids (TS) and lower level of total unsaturated fatty acids one (TU), therefore, TU :TS ratio for DFOB was lower (0.71) than that of DFCS (1.57) which negatively affected broiler growth. This conclusion is in agreement with suggestions reported by *Young and Garrett (1963); Sibbald and Kramer (1980) and Klaus et al. (1995)*. Moreover, it may be interesting to mention that the DFOB product used in this study had high level of ash content, thus it could be interpreted that this product is badly manufactured

The simple calculations of economic efficiency (Table 6) confirmed the performance results obtained in this study. Treatment (SO) recorded the lowest feed cost / kg LBW (2.79 L.E) and the best economic efficiency compared to T_3 and T_2, respectively.

It could be concluded according to the results of this particular work that:

-Oils are more valuable energy source in broiler diets than dry fat oils blend used in this study is bad manufactured product. The low performance of dietary dry fat oils blend could be attributed to the manufacturing process.

-Dry fat calcium salt used in this study needs more studies to specify the correct AME value suitable for use in broiler diets.

-The use of dry fat in poultry diets is a new concept that needs thorough studies before official registration, in Egypt.

Table (6): Effect of experimental treatments on economic efficiency at the end of the experimental period.

Treatments / Item	T_1 (SO)	T_2 (DFOB)	T_1 (DFCS)	SEM[1]	P[2]
Total feed cost (L.E/bird)	7.783 [a]	6.918 [c]	7.244 [b]	0.14	0.00
Final body weight (kg/bird)	2716 [a]	2116 [c]	2286 [b]	55.03	0.00
Feed cost/ 1 kg BW3 (L.E)	2.789 [c]	3.275 [a]	3.171 [a]	0.07	0.00
Total income (L.E / bird)	16.30 [a]	12.70 [c]	13.72 [b]	0.33	0.00
Net revenue (L.E / bird) 4	8.51 [a]	5.78 [c]	6.48 [b]	0.21	0.00
Economic Efficiency	1.09 [a]	0.83 [c]	0.89 [b]	0.02	0.00
Relative Economic Efficiency %	100 [a]	76 [c]	0.82 [b]	1.47	0.00

a, b ..... means with different superscript(s)in the same row are significantly different (P < 0.05).

(1) Standard error mean for comparison.

(2) Probability.

(3) Feed cost/ 1kg BW (L.E) = $\frac{\text{Feed cost (LE/bird)}}{\text{Kg. BW (0-49days)}}$

(4) Net revenue (LE / bird) = Total income (L.E / bird) -Total feed cost (LE / bird)

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الدهون الجافة كمصدر للطاقة في علائق دجاج اللحم

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أجريت تجربة لدراسة استخدام الدهون الجافة (زيوت مشبعة مخلوطة " DFOB") أو دهن جاف في صورة ملح كالسيوم "DFCS") مقابل زيت الصويا في علائق دجاج اللحم وتأثيرها على الأداء الإنتاجي. استخدم منتجان للدهون الجافة متوفرة في السوق المحلي. قسمت التجربة إلى ٣ معاملات بكل معاملة ١٨ مكرر من كتاكيت اللحم (أربور ايكرز) عمر يوم واستمرت التجربة لمدة ٤٩ يوم. تم تركيب العلائق التجريبية (٣ علائق لمراحل البادي، النامي والناهي) بحيث استخدم في المعاملة الأولى (المقارنة) زيت الصويا كمصدر للطاقة بينما استخدم الدهن الجاف من الزيوت المشبعة والمخلوطة (DFOB) في المعاملة (٢) ثم ملح الكالسيوم للدهن الجاف (DFCS) في المعاملة (٣). وقد كونت العلائق حسب الاحتياجات الغذائية المقررة للسلالة المستخدمة (أربور ايكرز).

<u>يمكن تلخيص نتائج الدراسة فيما يلي:</u>

- سجلت معاملة المقارنة والتي تحتوي على زيت الصويا–أعلى وزن جسم حي، أفضل معامل تحويل غذائي في جميع مراحل التجربة (بادي، نامي، ناهي). كما سجلت أفضل دليل أداء (PI) ، معامل كفاءة إنتاجية (PN) مقارنة بمعاملات الدهون الجافة.
- سجلت معاملة (٢) والتي تحتوي على الزيوت المشبعة المخلوطة في صورة دهن جاف (DFOB) – أسوأ نتائج للأداء الإنتاجي.
- لم يكن هناك تأثير للمعاملات على صفات الذبيحة ولا على محتويات الدم.
- احتوى الدهن الجاف للزيوت المشبعة المخلوطة (DFOB) على أعلى نسبة من الأحماض الدهنية المشبعة وأقل نسبة من تلك غير المشبعة، بينما احتوى زيت الصويا على أفضل نسبة من الزيوت غير المشبعة إلى المشبعة كما سجل أعلى قيمة للطاقة الممثلة المحسوبة.
- أوضحت الحسابات الاقتصادية أن استخدام زيت الصويا سجل أقل تكلفة تغذية / كجم وزن حي، أفضل كفاءة اقتصادية مقارنة بالدهون الجافة المستخدمة.

<u>يستنتج من هذه الدراسة أن :</u>

- الزيوت النباتية ذات قيمة عالية كمصدر للطاقة في علائق دجاج اللحم عن الدهن الجاف للزيوت المشبعة المخلوطة، والمستخدم في هذه الدراسة. والأداء الإنتاجى المنخفض للعلائق المحتوية على هذه الزيوت المشبعة المخلوطة قد يرجع إلى عملية التصنيع.
- ملح الكالسيوم للدهن الجاف المستخدم في هذه الدراسة كمصدر للطاقة في العلائق – يحتاج إلى دراسات أكثر لتحديد القيمة الفعلية للطاقة الممثلة لهذا المنتج والمناسبة للاستخدام في علائق الدواجن.
- استخدام الدهون الجافة كمصدر للطاقة في علائق الدواجن مفهوم جديد يحتاج إلى دراسات مستقبلية متخصصة قبل تسجيلها واستخدامها رسمياً- فى جمهورية مصر العربية.