

EFFECT OF DIFFERENT DIETARY FAT SOURCES ON PRODUCTIVE PERFORMANCE AND BREAST MEAT QUALITY IN JAPANESE QUAILS

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SUMMARY

This study was conducted to evaluate the effect of use various traditional oil sources (soybean oil (SO) or palm oil (PO)) and untraditional fat sources (short-chain fatty acids (FA) or distilled fatty acids (DFA)) in Japanese quail diets compared with control diets (without any fats source) on productive performance, slaughter and carcass traits, breast meat quality and blood parameters. Thus, each experiment investigated four fats by substituting them into a basal diet at the expense of the energy-yielding ingredients. At 7- day of age, 300 unsexed, Japanese quails were divided into 5 groups (60 quails each). Each group contained 3 replicates of 20 quails each. Five dietary treatments were distributed according to diets fed to quails consecutively during starter, grower and finisher phases. The experimental groups were: Basal diet without any fats (Control), Basal diet containing soybean oil as a fat sources (T1), palm oil (T2), fatty acids (T3) and distilled fatty acids (T4). The obtained result in this study revealed that 1 .There were no significant differences among all groups in live body weight (LBW) and body weight gain (BWG), feed consumption (FC) and Feed conversion ratio (FCR) values during starter, grower, finisher or overall periods, Except starter FC of (T2) group. 2 .Values of Energy conversion ratio (ECR), Protein conversion ratio (PCR), performance index (PI) and production efficiency factor (PEF) showed that all experimental groups are significantly similar to the control group. quails fed (T1) diet had better protein conversion ratio (PCR) but (T2) was the lowest values. 3 .Quails fed (T4) which fed Distillated fatty acids obtained the highest values on percentage of carcass, liver, heart, giblets and weight of edible parts. Otherwise, No significant differences among all experimental groups in weight of bursa and spleen. 4. Quails fed (T4) diet had the highest percentages of breast meat moisture and saturated fatty acid values. While quails fed control diets, had the highest water holding capacity (WHC) and unsaturated fatty acid values. 5 .No significant differences among all experimental groups in plasma total protein, albumin, globulin, total cholesterol, HDL, calcium or phosphorus, while plasma AST, ALT or LDL, was superior with quails fed (T4) diets. It could be recommended from this study to supplement 1,2 and 3% distillated fatty acids to quail diets in age up to 42 days for improve carcass characteristics and fatty acid profile of breast meat .

Keywords: *distillated fatty acids, soybean oil, palm oil, fatty acid, performance, quails.*

INTRODUCTION

The terms of oil or fat refer to triglycerides of several profiles of fatty acids. Fatty acids that are not bound to other organic components as glycerol are the so-called free fatty acids. The addition of vegetable oils to diet, besides supplying energy, improves the absorption of fat-soluble vitamins, diminishes the pulverulence, increases the palatability of the rations. Oils of plant origin, such as soybean oil or palm oil contain high levels of unsaturated fatty acids and are more completely digested by poultry (Leeson and Atteh 1995) and Azman *et al.*, 2004. Also, Atteh and Leeson (1985) showed significant increase in feed intake by saturated fatty acid supplementation. This was thought to be due to the fact that palmitic and stearic acids contributed very little energy to broiler diets. However, mixtures of saturated and unsaturated fatty acids, are fairly well utilized. By increasing fat sources to quail diets, the amount of feed intake decreased, and feed efficiency was improved (Jeffri *et al.*, 2010). Several studies had been conducted to increase the content of polyunsaturated fatty acid (PUFAs) in poultry meat by using dietary fat sources such as natural oil containing PUFAs (Kim *et al.*, 2007). On the other hand, the continuous increases in feed costs especially vegetable oils, locally produced or imported form a board as source of PUFAs for human, led to reach for other alternative feedstuffs or by products to be used as PUFAs source in poultry diets.

The supplementation of oil to diets leads to increase body weight gain in broilers (Newman *et al.*, 1998). On the other hand, Al Daraji *et al.*, (2010) observed that dietary fish oil at the inclusion level of 3% in quail diets recorded the best FCR followed by linseed oil while no significant effect on LBW and FI compared with the same level of sunflower oil and cotton seed oil. Whereas, there were no effects of dietary PUFAs enrichment on LBW and FI in broiler chicks (Moroufyan *et al.*, 2012). Furthermore, (Das *et al.*, 2014) indicated that supplementation of diets with different types of oil, soybean oil, palm oil and fish oil with either 2.5 or 3.0% didn't influence FCR of broilers up to 5 weeks of age.

The acidulated oil soapstock, also denominated as oil fatty acid, is a sub-product of the industry of vegetable oil. This sub-product is obtained through the alkaline neutralization of the raw oil, which produces a raw soap (a mixture of soaps, neutral oil, water, sterols, pigments, and other constituents). This unstable product is converted in acidulated soybean oil soapstock after a treatment of sulfuric acid in hot aqueous solution. Compared to soybean oil, acidulated soybean oil soapstock contains high levels of free fatty acids (50%), unsaponifiable matter, and oxidized fatty acids, besides being also rich in carotenoids (Pardio *et al.* (2001). The inclusion of acidulated soybean oil soapstock in rations for animals depends on the maintenance of a minimum of quality control, so that the product has surely not been adulterated by the inclusion of other low-quality oils (Wiseman *et al.*, 1984). Also, the use of refined soybean oil, raw soybean oil or acidulated soybean oil soapstock showed an increase on the levels of linoleic fatty acid on the carcass of quails fed with refined soybean oil and raw soybean oil in relation to the acidulated soybean oil (Crespo, 2002).

Therefore, this experiment was designed to study the effects of four types of dietary fat sources namely soy oil (rich in n-6 polyunsaturated fatty acid), palm oil (which contains more or less equal proportion of unsaturated and saturated fatty acids), fatty acids and distilled fatty acid (soapstock industry) on growth performance, carcass traits, breast meat quality, fatty acids (PUFAs) contain and blood parameters of Japanese quail (*Coturnix japonica*).

MATERIALS AND METHODS

Experimental chicks and Diets:

This study was conducted at Agricultural Experiments and Research Station at Shalakan, Poultry Production Experimental Unit, Faculty of Agriculture, Ain Shams University. The current study was composed of 300 unsexed one-days old, Japanese quails were randomly assigned to 5 treatments of 60 quails each in three replicates (20 quails per replicate) in the following treatments:

Basal diet without any fats (Control);

Diet containing 1, 2 or 3% soybean oil (SO) on starter, grower or finisher diets (T1); Diet containing 1, 2 or 3% palm oil (PO) on starter, grower or finisher diets (T2); Diet containing 1, 2 or 3% fatty acids (FA) on starter, grower or finisher diets (T3); Diet containing 1, 2 or 3% Distillated fatty acids (DFA) on Starter, Grower or Finisher diets (T4). Diets were formulated according to NRC (1994) and were offered in mash form (Table, 1).

All quails were reared under similar environmental, managerial and hygienic conditions. Feed and water were offered ad-libitum. At the end of the experimental period (42 days), feed intake (FI), Live body weight (LBW) and feed conversion ratio (FCR) were calculated for all the quails in the various dietary treatments. Growth performance: Live body weight (LBW) of each replicate was recorded, and average body weight gain (BWG) also was calculated by subtracting initial LBW of birds from final LBW. Average of feed consumption (FC) was calculated from difference between amount of feed provided for each replicate within treatments and residual quantity for same replicate .

Feed conversion ratio (FCR) in grams, energy conversion ratio (ECR) in Kcal or protein conversion ratio (PCR) in grams were calculated in different stages as the amount of feed consumed in a certain stage which is required to produce out one gram of weight gain in the same stage. Performance index (PI) was also determined according to North (1981), while production efficiency factor (PEF) was calculated according to Emmert (2000).

Slaughtering and carcass characteristics:

At the end of the experiment (42 days of age), 3 quails of each experimental treatment, around the average live body weight of each treatment, were slaughtered and eviscerated after 4-hour fasting, then carcass weight, giblets (liver, gizzard and heart) weight, bursa and spleen weight or ready-to-cook weight as percentages of live body weight were recorded. The initial processing included removal of the skin with feathers. This method was chosen to avoid the possible influence of temperature during carcass scalding on meat traits

Table (1). Feed ingredients and chemical analyses of experimental diets.

Ingredient	Dietary Treatment					
	7-21 days (Starter)		22-35 days (Grower)		36-42 days (Finisher)	
	Control	T. (s)	Control	T. (s)	Control	T. (s)
Yellow Corn	54.00	53.00	53.00	51.00	52.00	49.00
Soybean Meal (44%)	40.35	40.35	42.30	42.30	44.20	44.20
Fish meal (72%)	3.00	3.00	2.00	2.00	1.00	1.00
Fat sources*	0.00	1.00	0.00	2.00	0.00	3.00
Dl-Methionine	0.10	0.10	0.10	0.10	0.10	0.10
Di-Calcium Phosphate	0.85	0.85	1.00	1.00	1.10	1.10
Limestone	1.10	1.10	1.00	1.00	1.00	1.00
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Premix **	0.30	0.30	0.30	0.30	0.30	0.30
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00
Chemical Analysis						
Crude Protein %	24.07	24.02	24.08	23.98	24.07	23.94
ME Kcal/ Kg diet ***	2798	2805	2789	2888	2760	2910
Calcium %	0.80	0.80	0.78	0.78	0.78	0.78
Available P%	0.38	0.37	0.39	0.39	0.39	0.39
Lysine	1.45	1.49	1.49	1.49	1.49	1.49
Methionine & Cysteine	0.64	0.64	0.64	0.64	0.64	0.64

* Fat sources: control (0%) and T. (s) [SO (T1), PO (T2), FA (T3) and DFA (T4)]

** Each 3 Kg of the premix contains: Vitamins: A: 12000000 IU; Vit. D3 2000000 IU; E: 10000 mg; K3: 2000 mg; B1: 1000 mg; B2: 5000 mg; B6: 1500 mg; B12: 10 mg; Biotin: 50 mg; Choline chloride: 250000 mg; Pantothenic acid: 10000 mg; Nicotinic acid: 30000 mg; Folic acid: 1000 mg; Minerals: Mn: 60000 mg; Zn: 50000 mg; Fe: 30000 mg; Cu: 10000 mg; I: 1000 mg; Se: 100 mg and Co: 100 mg. *** ME: metabolizable energy.

Breast meat quality:

The two breast muscles: m. Pectoralis superficialis (MPS) and m. Pectoralis profundus (MPP) characterized with different morphology and post mortem carbohydrate catabolism were submitted to physicochemical analysis. The pH of MPS and MPP was determined at post slaughter min 30 and hour. A portable pH meter with a glass electrode preliminary calibrated in standard solutions with pH 4.0 and pH 7.0 was used. The electrode of the pH-meter was inserted at a depth about one cm into the muscle tissue. The WHC of meat was determined 24 hours after the slaughter by compression of muscle tissue sample over filter paper between two glass slides. The WHC was determined by the formula: $WHC = A/B \times 100$. where: WHC - water holding capacity of muscles %; A = weight of muscle samples before the compression, (g); B = weight of muscle samples after the (g). Note: Higher WHC values correspond to lower WHC of muscles. The otherwise, Fatty acid composition of meat was determined by fat extraction according to the method of Bligh and Dyer (2000) with methanol/chloroform mixture (2: 1), followed by thin-layer chromatography and fatty acid separation on a gas chromatograph (AOAC, 2002).

Blood plasma parameters:

Individual blood samples were collected in dry clean centrifuge tubes from the slaughtered quails and plasma was separated by centrifugation at 3000 (rpm) for 15 minutes and assigned for subsequent determination. Plasma samples were stored at (-20° C) in a deep freezer until the time of biochemical determinations. Values of Total protein, Albumin, Globulin, GOT, GPT, Total cholesterol, Total lipid,

Triglyceride, LDL, HDL, Calcium and Phosphorus plasma were estimated by using commercial diagnosing kits (Produced by bio-diagnostics company, Egypt).

Statistical procedures:

Pen means were the experimental unit for all obtained data. Data were subjected to one-way ANOVA analysis of variance General Linear Model (GLM) procedure of SAS software (2002) user's guide according to the following model: $Y_{ij} = \mu + T_i + e_{ij}$ Where; μ = overall mean, T_i = dietary treatment, e_{ij} = experimental error. Individual effects of dietary treatments were compared using Duncan (1955) multiple range tests at α level equal to 0.05 or 0.01.

RESULTS AND DISCUSSION

Fatty acids composition of the four types of fat sources.

Results of fatty acids composition of SO, PO, FA and DFA used in this experiment are represented in Table (2). The analysis indicated that saturated fatty acids were higher in (PO, 53.77%) than those found in (DFA, 19.61%), (SO, 17.72%) and (FA, 10.15%). Soybean oil was the highest in unsaturated fatty acids (75.67%), while PO was the lowest (27.36%) and DFA and FA in middle (66.82 or 49.50%) respectively.

Palmitic acid was relatively lower in SO (6.84%) and FA (6.03%) than DFA (16.68%) and PO (48.79%). While, linoleic acid was higher than in SO (40.75%) than DFA (31.44%), FA (25.82%) or PO (2.35%). It's noteworthy the high percentage of the unsaturated fatty acid especially in SO and DFA compared with FA and PO which is good for poultry health and adding soap industry residual oil in diets to practical growing local chicks' diets as a replacement of sunflower oil would have a positive effect on the cost of diets and the economic efficiency of growing chicks, without any adverse effect on production performance or carcass characteristics (Nematallah et al., 2017).

Table (2). Fatty acids composition of the four fat sources.

Fatty acid	Soybean oil (SO)	Palm oil (PO)	Fatty acid (FA)	Distilled Fatty Acid (DFA)
10: 0 Capric acid	0.330	0.450	0.144	0.790
14: 0 Myristic acid	0.154	0.030	0.025	0.048
16: 0 Palmitic acid	6.84	48.79	6.03	16.68
18: 0 Stearic acid	4.42	4.44	3.49	1.62
18: 1 Oleic acid	29.44	24.93	23.60	6.25
18: 2 Linoleic acid	40.75	2.35	25.82	31.44
18: 3 Linolenic acid	5.25	-	-	28.65
Saturated fatty acid	17.722	53.77	10.15	19.61
Unsaturated fatty acid	75.67	27.36	49.50	66.82
UNSFAs/SFAs*	4.27	0.51	4.88	3.41
Unknown fatty acid	6.55	18.92	40.34	13.57
Characteristics				
Moisture	2.59	3.44	11.23	13.85
Peroxide value	70.74	23.33	35.75	189
free fatty acids	2.79	5.48	59.77	87.81
Iodine value	30.18	21.90	25.85	20.55
Density	0.92	0.88	0.95	0.87

* UNSFA/SFA unsaturated fatty acids/ saturated fatty acid

Growth performance

The effects of dietary soybean oil, palm oil, free fatty acid and distilled fatty acid supplementation on quail's performance are presented in Table (3) that showed initial body weight of birds was similar within all groups.

When comparing birds of different groups, it is clear that no adverse effects were observed on LBW, BWG, FC or FCR when using 1-2-3% soybean oil, palm oil, fatty acids and Distillated fatty acids in starter, grower and finisher diets. It is clear that, chicks fed (T2) diet had better ECR and PCR values during overall period, while, chicks fed other dietary treatments had worse values, and those fed (T4) diet recorded values similar to those of control group. On the other hand, the best values of production efficiency factor (PEF) was recorded for quails fed T1 diet (192), while the worst recorded for quail fed T2 diet (166) and showed significant difference.

Data of productive performance are commonly, in agreement with the results of Wiseman (1991) who stated that AME of fats linearly decreased with increasing free fatty acid FFA content, and the decrease was more pronounced with the younger birds. This rate of reduction appeared to be influenced by degree of saturation of the fat, but only with younger birds.

Table (3). Effect of different dietary treatments on productive performance.

Treatment	Control	T1	T2	T3	T4	Sig.
Initial LBW 7 days (g)	23.87	23.97	24.25	23.80	23.53	NS
Final LBW 42 days (g)	187.00	188.67	178.67	183.00	185.33	NS
Body weight gain	163.13	164.70	154.42	159.20	161.80	NS
Feed Consumption	627.00	625.67	643.00	643.00	624.67	NS
Feed conversion ratio (overall)	3.86	3.80	4.16	4.04	3.86	NS
Energy conversion ratio	11.00	10.83	11.86	11.51	11.00	NS
Protein conversion ratio	0.93	0.91	1.00	0.97	0.93	NS
Production Efficiency Factor	187 a	192 a	166 c	175 b	186 a	*
Performance Index %	4.84	4.97	4.29	4.53	4.80	NS

a, b, c means within the same row with different superscripts are significantly different.

*Sig. = Significance * ($P \leq 0.05$). NS = Non-Significant.*

The obtained results disagree with those reported by Abdel-hakim *et al.*, (2009) in growing Japanese quails who showed that fed diets containing sunflower oil gave the highest body weight gain compared with those fed diets with tallow as fat source. In the same order Abou El-wafa (2000) concluded that vegetable oils (soybean, corn or sunflower oils) improved growth rate and feed conversion ratio of broiler chicks compared to animal fats (camel fat or margarine). However, chicks fed either sunflower oil or extracted full fat soybean recorded the best feed conversion. In contrary to that, Ibrahim (2005) reported that using different dietary oils did not affect on weight gain, feed intake or feed conversion ratio in Silver Montazah growing chicks .

Carcass traits

Data representing in Table (4) showed the relationship between different dietary fat (SO, PO, FA, or DFA) and carcass characteristics of slaughtered Japanese quails at 42 days of age. The percentage of a carcass, giblets and total edible parts in relation to live body weight for Japanese quails fed DFA (T4) diets reflected significant differences than those fed control diets. While bursa and spleen weight (g) were almost the same when quails fed different dietary treatments.

In general, the best figures of carcass characteristics were seen when DFA (T4) was incorporated in diets and corresponding values in relation to body weight were (73.90, 5.23 or 76.55%) for carcass, giblets and total edible parts respectively. Similar observations were reported by Nematallah *et al.*, (2013) who found that birds fed DFA diet reflected the highest significant carcass and giblets (%) compared with other treatments (SFO or CSO). However, these results disagree with those Dorgham *et al.*, (2001), Assaf *et al.*, (2003) or Ibrahim (2005) whose reported that no significant effect on carcass characteristics due to cotton oil, palm oil, sunflower oil, fatty acids or distillated fatty acids supplemented in chick's diets. In regard to percentage of gizzard, quails fed (T4) obtained the highest insignificant data of relative weights percentages of carcass, Liver, heart, total giblets and Edible parts within all groups. The dietary groups had significant effect on percentage of gizzard value. T3 was slightly higher than T1, T2 and T4 but not significantly

different. In addition, data of relative weights Bursa or spleen present non-significant ($P>0.05$) differences among all five experimental treatments.

Table (4). Effects of dietary treatment on carcass treats at the end of experiment

Treatment	control	T1	T2	T3	T4	Sig.
Carcass weight (g)	131ab	141a	129b	132ab	146a	**
Carcass (%)	68.39b	72.19a	68.56b	69.44ab	73.90a	*
Giblet (%)	4.63b	4.69b	4.14b	5.07a	5.23a	*
Bursa (g)	0.88	0.98	0.95	0.83	0.85	NS
Spleen (g)	0.66	0.75	0.68	0.96	0.55	NS
Total Edible parts (g)	139.66b	149.85a	136.40b	141.28b	155.69a	*
Total Edible parts (%)	73.02b	76.88a	72.7b	74.51b	79.13a	*

a, b, means within the same row with different superscripts are significantly different.

*Sig. = Significance * ($P\leq 0.05$). ** ($P<0.01$) NS = Non-Significant.*

Breast meat quality

Data of physical properties ground pale Japanese quail breast meat and fatty acid profile of quail breast meat are presented in Table (5). These data showed that birds fed (T4) diet have recorded significantly ($P\leq 0.05$) highest values of quail breast meat moisture percentage when compared to other groups. The Water Holding Capacity (WHC): value was affected significantly by the dietary groups in which control had the higher WHC value when compared to other treatments. thus, quails fed control diets showed higher WHC when compared to other treatments .

The pH value in breast muscle of quails from T2 was significantly higher than pH values of quails in groups control, T3, and T4 (Table 5). The type of dietary vegetable oil and waste oil very presence, significantly affected the degree of saturation of carcass fat.

Quails fed the different diets continuously for 42 days of age showed very different fatty acid patterns in their tissues (Table 5).

Table (5). Effects of dietary treatment on breast meat quality.

Treatment	Control	T1	T2	T3	T4	Sig.
Skin %	1.58	1.57	1.05	1.70	1.15	NS
Breast Meat %	16.44b	22.31a	17.89b	18.75b	17.56b	*
Bone %	2.38	2.51	2.42	2.45	1.88	NS
Physical properties ground pale Japanese quail breast meat.						
Moisture %	28.77b	29.56ab	28.05b	28.22b	32.56a	**
WHC % *	50.52a	43.25b	42.22b	47.75a	48.88a	*
Plasticity	5.05	6.61	6.25	6.19	6.04	NS
pH	6.19	6.15	6.54	6.20	6.02	NS
Symbol Fatty acid profile of ground pale Japanese quail breast meat.						
10: 0 Capric acid	0.46a	0.04c	0.18b	0.15b	0.03c	*
14: 0 Myristic acid	0.19a	0.06b	0.08b	0.09b	0.12ab	*
16: 0 Palmitic acid	18.29	15.33	14.98	13.16	11.27	NS
18: 0 Stearic acid	5.44	5.05	4.69	4.86	7.28	NS
18: 1 Oleic acid	39.77a	33.38b	32.44b	38.82a	41.62a	*
18: 2 Linoleic acid	0.01b	0.01b	0.01b	0.05a	0.05a	*
18: 3 Linolenic acid	0.04b	0.04b	0.08b	0.07b	0.15a	*
Saturated fatty acid	17.58c	19.99bc	21.02b	22.56b	28.45a	**
Unsaturated fatty acid	55.50a	44.00b	43.00b	46.00b	37.50c	*
UNSFAs/SFAs **	3.16a	2.20b	2.05b	2.04b	1.32c	*

* WHC = Water holding capacity

** UNSFA/SFA unsaturated fatty acids/ saturated fatty acid

a, b Means within the same row with different superscripts are significantly different.

*Sig. = Significance * ($P\leq 0.05$). ** ($P<0.01$) NS = Non-Significant.*

The breast meat of quails fed the control diet contained the highest levels of Capric and Myristic acids and the lowest level of linoleic and Linolenic acid. Moreover, there was a significant effect of the using DFA on oleic, linoleic, linolenic acid which have higher values than control diets. Quails fed control diets have the highest unsaturated fatty acid than other treatments. On the other hands birds fed (T4) obtained the highest Saturated fatty acid values. Control diets gave higher in the ratio between unsaturated fatty acid to saturated fatty acid.

Breast meat fatty acid composition

Fatty acid compositions of quails' breast muscle produced from different dietary treatments are presented in Table (5). There were some differences in the percentages of Capric, Myristic, Oleic, Linoleic, and Linolenic acids among all treatments, and percentages of Palmitic and Stearic acids were similar to those of each treatment. Furthermore, there was a numeric increase in the percentages of Linoleic, and Linolenic acids by the addition of DFA or FFA.

In addition, on breast meat SFA was increased and USFA or USFA/SFA ratio were decreased when quails fed diets supplemented with DFA (T4). In contrast, Japanese quails that fed control diet gave the lowest SFA (17.58 vs. 28.45%) and the highest USFA (55.50 vs.37.50) or USFA/ SFA ratio (3.16 vs 1.32%) compared with those fed DFA (T4) respectively and the differences were significantly.

Quails breast meat quality is often evaluated in terms of color, pH, water-holding capacity, tenderness, and sensory acceptability because consumers prefer meat that is juicy, tender, and not too pale (Fletcher and Smith, 2006). In addition, diet directly affects the fatty acid composition of quail's breast meat because fatty acids from the feed are deposited in the muscle (Wood and Enser, 1997). Therefore, the saturation level of the triglycerides in the feed affects the saturation level of the fatty acids in the thigh meat and thus its oxidation potential and shelf-life (Suksombat *et al.*, 2007).

Blood parameters

The values of plasma total protein, albumin, globulin, GOT, GPT, total cholesterol, total lipid, triglyceride, LDL, HDL, calcium and phosphorus in Japanese quails at 42 days of age where presented in Table (6). Different fat sources supplementation (T1 or T4) increased insignificantly plasma total protein, albumin and decreased globulin compared with those fed control diets.

Table (6). Effects of dietary treatment on blood parameters

Treatment	Control	T1	T2	T3	T4	Sig.
Total protein (g/dl)	3.17	4.43	4.70	4.16	3.13	NS
Albumin (g/dl)	1.15	2.85	2.59	2.18	1.55	NS
Globulin (g/dl)	2.02	1.58	2.11	1.98	1.58	NS
GOT (U/L)	17.74 ^b	18.72 ^b	20.49 ^b	27.00 ^a	27.42 ^a	**
GPT (U/L)	50.07 ^c	61.27 ^{bc}	45.18 ^d	77.00 ^b	83.55 ^a	*
Total cholesterol (mg/dl)	138	124	100	132	108	NS
Total lipid (mg/dl)	306 ^b	340 ^b	391 ^b	633 ^a	524 ^a	*
Triglyceride (mg/dl)	415 ^a	455 ^a	248 ^b	255 ^b	354 ^{ab}	*
LDL (mg/dl)	128 ^b	105 ^b	124 ^b	114 ^b	155 ^a	*
HDL (mg/dl)	189	150	145	180	177	NS
Calcium (mg/dl)	46	57	58	50	52	NS
Phosphorus (mg/dl)	25	25	19	21	27	NS

*a, b, c Means within the same row with different superscripts are significantly different. Sig. = Significance * (P≤0.05). ** (P<0.01), NS = Non-Significant.*

Regarding concerning hepatic enzymes (GOT or GPT), significant differences were found due to the different fat sources lipid metabolites, the results indicate that total lipid, triglyceride and LDL were significant affected by different fat sources and total lipid (524 vs. 306) and LDL (155 vs. 128) were significant increased and triglyceride (354 vs. 415) insignificant reduced in response to dietary DFA when

compared to quails fed control diets. The total plasma cholesterol and HDL for quails fed different fat sources (T2 or T4) reflected insignificant lower differences than those fed control diets.

These results agree with those reported by Abou El-Wafa *et al.*, (2000) who found that no significant effect was observed on plasma total cholesterol concentration due to oils or fat, but disagree with those of Nematallah *et al.*, (2014) who stated that the levels of total lipids, HDL and total protein in plasma were significantly affected by oil and fat sources and levels. Plasma Ca and P concentration values showed that quails fed different dietary fat sources (T1 or T4) reflected insignificant higher in plasma and insignificant lower in plasma P differences than those fed control diets. The corresponding values were 46, 57, 58, 50 and 52 g/dl for plasma Ca and 25, 25, 19 and 21 27 g/dl for plasma P respectively. Liu *et al.*, (2003) reported that dietary lipids depending on the type and amount of ingested enhanced or improved bone growth and development and modulated bone minerals content and improved Ca or P utilization.

CONCLUSION

From the present results, it could be concluded that adding soap industry residual oil: FA or distilled fatty acids as untraditional fat sources to growing Japanese quails diets as a replacement of SO or PO oil, haven't any adverse effect on the production performance, immune organs and almost blood parameters. On the other hand, there have effect on breast meat contain of saturated and unsaturated fatty acids also on plasma LDL, GOT, GPT.

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تأثير مصادر مختلف من الدهون علي الاداء الانتاجي وجودة لحم الصدر في السمان الياباني

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يهدف هذا البحث الي مقارنة استخدام اربع مصادر مختلفة من الدهون مصادر الطاقة في علائق السمان الياباني مقارنة بعليقة قاعدية لا تحتوي علي دهون. تم استخدام 300 كتكوت من السمان الياباني عمر 7 ايام لمقارنة تأثير 4 قسمت 300 كتكوت هبرد عمر يوم إلى 5 معاملات (60 طائر/ معاملة) وأحتوت كل معاملة على 3 مكررات (20 طائر/ مكرر) وكانت المعاملات التجريبية كما يلي:

عليقة قاعدية (مقارنة) بدون اي مصدر دهون، عليقة قاعدية تحتوي علي زيت الصويا كمصدر دهون بنسبة 1 و 2 و 3 % في علائق البادي و النامي و الناهي علي الترتيب، عليقة قاعدية تحتوي علي زيت النخيل كمصدر دهون بنسبة 1 و 2 و 3 % في علائق البادي و النامي و الناهي علي الترتيب، عليقة قاعدية تحتوي علي احماض دهنية كمصدر دهون بنسبة 1 و 2 و 3 % في علائق البادي و النامي و الناهي علي الترتيب، عليقة قاعدية تحتوي علي احماض دهنية مقطرة كمصدر دهون بنسبة 1 و 2 و 3 % في علائق البادي و النامي و الناهي علي الترتيب.

وتتلخص أهم النتائج المتحصل عليها فيما يلي:

- لم يتأثر وزن الجسم الحي، وزن الجسم المكتسب، معدل إستهلاك الغذاء، معامل التحويل الغذائي معنويًا بأي من المعاملات التجريبية خلال الفترة التجريبية الكاملة (6-1 أسابيع).
- لم تتأثر معنويًا قيم معامل تحويل البروتين او الطاقة خلال الفترة التجريبية الكاملة.
- لم تتأثر قيم دليل الإنتاج معنويًا بينما تأثرت قيم معامل كفاءة الإنتاج معنويًا بالمعاملات الغذائية المختلفة حيث لم تختلف المعاملات (T1) و (T4) عن معاملة المقارنة.
- بالنسبة للذبيحة سجلت المجموعة (T4) اعلي وزن ونسبة مئوية
- سجلت الطيور المغذاة عليقة (T4) اعلي وزن ونسبة مئوية للذبيحة والحوايج و كذلك وزن ونسبة الاجزاء المأكولة
- كانت للطيور المغذاة علي عليقة بها زيت صويا (T1) الاعلي معنويًا في النسبة المئوية للحم الصدر مقارنة بباقي المعاملات بينما لم يحدث اختلاف معنوي بين المعاملات في النسبة المئوية للجلد او العظم في الصدر.
- سجلت الطيور المغذاة علي (T4) اعلي محتوى في رطوبة لحم الصدر مقارنة بباقي المعاملات بينما سجلت الطيور المغذاة علي عليقة المقارنة اعلي نسبة احتجاز ماء للحم الصدر وكانت الطيور المغذاة علي (T2) الاقل في نسبة الماء المحتجز في لحم الصدر.
- لم تظهر اي اختلافات معنوية بالنسبة لدرجة حموضة لحم الصدر وكذلك نسبة الليونة في لحم الصدر.
- اظهر تحليل الاحماض الدهنية في لحم الصدر اختلافات معنوية في مستوي حمض الكابريك و الميريستيك والاوليك واللينوليك واللينولينك حيث سجلت مجموعه المقارنة اعلي محتوى في حمض الكابريك والميريستيك والاحماض الدهنية الغير مشبعة، بينما سجلت الطيور المغذاة علي عليقة (T4) اعلي نسبة من حمض الاوليك واللينوليك واللينولينك وكذلك المحتوى من الاحماض الدهنية المشبعة.
- اظهرت النتائج ان تغذية السمان علي احماض دهنية او احماض دهنية مقطرت ادي الي ارتفاع ملحوظ في انزيمات الكبد والليبيدات الكلية وكذلك كوليسترول LDL .
- لم تظهر اختلافات معنوية في الكالسيوم او الفوسفور او البروتين الكلي او الاليومين او الجلوبيولين او الكوليسترول الكلي في بلازما الطيور المغذاة علي العلائق المختلفة.