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STUDIES ON DIFFERENT SOURCES OF LIPIDS AND THEIR FATTY ACIDS COMPOSITION IN JAPANESE QUAIL DIETS: 1- INFLUENCE OF SUNFLOWER OIL , COTTON SEED OIL, COCONUT OIL, AND TALLOW ON ACCUMULATION FATTY ACIDS IN BREAST AND THIGH, SOME BLOOD CONSTITUENTS AND QUALITY OF MEAT LIPIDS .

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ABSTRACT

This experiment was done to study the influence of adding sunflower oil , cotton seed oil, coconut oil and tallow on the performance of laying quails and fatty acids composition in the muscles of males and females. Also, total lipids, FFA%, acid value, peroxide value ,TBA and some blood constituents were also measured . One hundred and fifty laying quails were used in this experiment and divided to five treatments and fed on isoenrgetic & isoproteinic diet. The fifth group was fed on basal diet (control), while, the other four groups were supplemented with 1 % sunflower, cotton, coconut oil or tallow in the diet. The results indicated that ,live body weight and feed efficiency did not affected by supplementation of different sources of lipids . Birds performance decreased at 18 weeks than at 14 weeks. Liver weight increased in birds that fed tallow than other treatment, while heart weight at age 18 weeks decreased significantly in birds that fed cotton than other treatments. Cholesterol level decreased significantly ($P< 0.05$) in birds that fed sunflower & control than other treatments but PCV % did not changed by treatments. Total protein increased significantly ($P < 0.05$) in birds fed tallow. Increasing the amount of accumulated total lipids in males than females also increased fat ratio in breast than thigh muscles. Decreased FFA% , acid value and peroxide value in males than females in all treatments . FFA % , acid value , peroxide value and TBA value were higher in thigh than breast in almost lipids . Saturated / unsaturated ratio decreased in almost oils after supplementation these oils in the diet especially the birds that fed tallow. So, supplementation of vegetable oils especially sunflower oil decreased accumulation of fats in breast & thigh and modifies saturated to unsaturated fatty acids and the latter more healthy to consumers .

Keywords: Lipids – Laying quail – Body weight – Feed efficiency - Tallow – Sunflower oil – cotton seed oil - Coconut oil – breast – thigh – TBA – FFA % - Peroxide value - Blood constituents .

INTRODUCTION

Fats perform certain physiological functions within the body. They are used as an energy resereves , insulation against temperature extremes and to protect tissue membranes and vital organs . Feed fats are important and economic source of metabolizable energy and essential fatty acids, as well as they enhance the adsorption of fat soluble vitamins, promote palatability of diets and reduce dustiness of feed. Plant oils contain high levels of unsaturated fatty acids which well absorbed by fowl than animal fats which contain higher proportions of saturated fatty acids (Mossab, *et al* . 2000)

In poultry and other monogastric animals , the fatty acid composition of tissue lipids depends on the lipids in the diet . As no special problems are associated with feeding fat to poultry , the use of different vegetable oils allows the enrichment of poultry meat with polyunsaturated fatty acids. (Lopez – Ferrer, *et al* . , 1999). Saturated fatty acids can be synthesized endogenously from acetyl CoA units by carbohydrate feeding. Synthesis or fat however is reported to be relatively rare in people who consume more than 25 % of their energy as fat (Hellerstein, 1999). Polyunsaturated fats are essential for life and cannot be produced endogenously. Endogenous alteration of dietary saturated fatty acids can also occure through elongation . Lengthing the existing saturated fatty acids, two carbons at a time, creates new fatty acids , This generally occurs in the endoplasmic reticulum (Cinti , *et al* . , 1992). Milk and coconut fat are rich sources of medium – chain fatty acids . neither of these classes of fatty acids is generally stored in significant amounts in body lipids . Animal fat , butter , palm oil and peanuts are rich sources of long chain polyunsaturated fatty acids which are present in membranes of the retina , brain synapses and sperms .

Increasing polyunsaturated fatty acids content of poultry diets, eggs, meat, and other edible parts increase the degree of unsaturation and could actuate their potency to lipid oxidation, leading to the development of off – flavors and off – odors , loss of PUFA and lower consumer acceptability (Hulen , *et al* . 1989 ; Ajuyah , *et al* . 1991) .

Polyunsaturated vegetable oils are very susceptiple to oxidation , and can deteriorate rapidly in foods during storage (McGeachin, *et al* . 1992). Lipid oxidation can be assessed by measuring primary oxidation products , such as lipid hydroperoxides , which are formed in the early steps of lipid oxidation , or by measuring secondary oxidation products , which are products of decomposition of hydroperoxide.Usefulness of these parameters to follow up lipid oxidation in foods greately depends on their fatty acids composition and degree of oxidation (Grau, *et al* . 2000) .

Experimental data (Keys, *et al* . 1957; 1965) indicated that a diet high in saturated fatty acids is associated with high levels of serum total cholesterol which in turn, are related to a high incidence of cornary heart disease .

This study was conducted to determine the effects of dietary fat source on performance , fatty acid composition of breast and thigh muscles and lipid oxidation in japanese quail

MATERIALS AND METHODS

The current study was carried out in Poultry Physiology Experimental Laboratory of the Poultry Production Department , Faculty of Agriculture , AinShams , Univeristy.

For nine weeks a total 150 birds Japanese quail were reard in cages. They were divided into five expermintal groups, 30 quail in two replates of 15 chicks. All birds were fed on isonitrogenous (20 % CP) corn – soybean diets supplemented with 1 % sunflower oil , cotton seed oil, coconut oil and tallow or without fat (control). Live body weight and feed intake were recorded in grams and feed efficiency ratio was then calculated . Diets were formulated to meet the nutrient requirements of laying quails according to NRC (1994) as shown in Table 1.

Table (1):Composition and calculated analysis of the basal and experimental diets

Ingredients	Basal diet	experimental diet
Yellow corn	63.46	62.01
Soybean 48%	22.0	22.95
Corn gluten	6.5	6.0
Dicalcuim phosphate	1.5	1.5
Calcium carbonate	5.5	5.5
Fats	0.0	1.0
Permix*	0.4	0.4
Salt	0.32	0.32
Lysine 98%	0.22	0.22
DL- Methionine	0.1	0.1
Total	100	100
Calculated Composition		
Protein	20.06	20.21
ME	2904.5	2860
Crude fat	2.78	2.74
C.F	2.34	2.33
calcium	2.49	2.49
Av. phosphorus	0.39	0.39

Supplied per Kg of diet : vit. A.120000 IU; vit.D.2200Iu; vit. E. 10mg ; vit. K. 2 mg; vit. B1, 1mg; vit. B2, 6mg; vit. B6, 1.5mg; vit. B12, 10mg; nicotinic acid 30mg; folic acid 1mg; pantothenic acid 10mg; biotin 50mg; choline chloride 500mg; copper 10mg; iron 30mg; manganese 60mg; zinc 50mg; iodine 1mg; selenium 0.1mg and cobalt 0.1mg .

Slaughter traits :- At the end of the first and second stage , two birds of each replicate representing the average group weight were slaughtered , allowed to bled , defeathered , eviscerated and internal organs were separated . Heart , liver and reproductive weights were recorded . Intestine thickness was determined as the procedures described by Stutz , *et . al* . (1983) and calculated as small intestine weight (g) / small intestine length (cm) .

Chemical analyses and blood parameters :- Blood samples were collected in a heparinized centrifuge tubes and centerifuged immediately for 15 minutes to separate plasma that was dacanted and frozen at – 20 C° untill chemical analyses. Plasma was analysed for total protein according to Biuret method described by Henery (1964) , total lipids according to Knight , *et al* . (1972) and total cholesterol according to Watson (1960) . Hematocrit was made according to Hunsaker (1969) .

Lipid Analysis :- The method of Folch , *et al* . (1957) was used to extract the total lipids of meat samples using a mixture of chloroform and methanol (2 : 1 v / v) by the cold extraction system . In this method , 0.5 g of meat sample was treated with 100 ml of chloroform methanol (2 : 1 v /v) solvent mixture and homogenized for 3 minutes. The mixture was filtered, the residue was further rinsed with 50 ml of the extractant solvent mixture. The micelle were combined and the solvent was removed. The obtained lipids were dried and weighed .

Fatty acid analysis :-_ Total lipids of quail meat were extracted with a mixture of chloroform : methanol : water in the proportions 1: 2 : 0.8(v / v / v) according to the method of Bligh and Dyer (1959) . Fatty acid methyl ester (FAME) was prepared by using sulfuric acid in methanol as esterifying reagent (A. O. A. C., 1965). The FAME was analysed by using gas chromatography (G c Model : - Shimadzu 4cM (PFE) equipped with FID detector and glass column 2.5 x 3 mm. The calibration and identification of fatty acid peaks was carried out by comparison with retention times of known authentic standards . The fatty acid results are expressed as weight percentages .

Free fatty acids :-__ The free fatty acids (FFA) were determined and calculated (as % oleic acid) . An aliquot of 25 ml of chloroform extract were pipetted into a conical flask and mixed with 25 ml of neutral ethyl alcohol (95 %).The mixture was titrated with 0.1N sodium hydroxide using phenolphthalein as an indicator. The percentage of free fatty acids were calculated as oleic acid from the following equation :- % Free fatty acids (FFA) =- V*N*2.82 / W

Where : V = Volume of NaOH ; N = Normality of NaOH ; W = Weight of fat in 25 ml chloroform extract .

Peroxide Value :_- Peroxide value was determined and calculated as milliequivelant peroxide in kilogram fat . An aliquot of 25 ml chloroform extract were pipetted in conical flask , 37 ml of glacial acetic acid and 1 ml of saturated potasssium iodide were added , the mixture allowed to stand with occasional shaking for 1 min . Then 30 ml of distilled water was added and the mixture allowed to stand 5 min . in the dark , 1 ml of 1 % starch solution was added and the mixture was titrated with 0.01 N sodium thiosulphate .

The peroxide value was calculated as following : -

Peroxide value (milliequivalent per / kg) =V*N*100 / W

Where : V = Volume of sodium thiosulphate . ; N = Normality of sodium thiosulphate . W = Weight of fat in 25 ml extract .

Thiobarbituric acid (TBA) :- Thiobarbituric acid (TBA) value as an index of fat oxidation was determined directly on the sample as described by Grau , *et . al* . (2000) . Samples were homogenized with distilled water , transferred to distillation flask with distillate was collected and from which 5 ml was pipetted into a glass stoppered tube and mixed with 5ml TBA reagent (0.2884 gm / 100 ml glacial acetic acid 90 %) , the mixture was heated in boiling water bath for 35 minutes . After cooling to the ambient room temperature , the absorbance was measured at 538 mm using specterophotometer (JENWAY 6300) , TBA value was expressed as mg malonaldehyde / kg sample .

Statistical analyses : The data obtained were subjected to analysis of variance according to SPSS, (1997). Significant differences among individual means were analyzed by Duncan's multiple range test (Duncan,1955).

RESULTS AND DISCUSSION

The composition of fatty acids in lipid sources used in this expermints the monounsaturated and polyunsaturated increased in vegetable oils than in animal fat .

Also, the saturated / unsaturated ratio , increased in tallow than vegetable oils (Table 2). These results agree with , El – Wafa , *et al*. (2000) who showed that vegetable oils contained high amounts of unsaturated fatty acids and low amounts of saturated fatty acids , while the opposite was true for animal fats . Sunflower and cotton seeds oil contained high amounts of linoleic acid C18 :2 (32.4 and 33.65 %) compared to the other tested oils .

Table 2 :-The fatty acids composition of the Lipid sources

Fatty acids	Sunflower	Cotton seed	Coconut	Tallow
C12 : 0	ND	ND	0.72	ND
C14 : 0	0.37	0.77	5.7	2.06
C16 : 0	12.8	24.98	17.3	24.36
C16 : 1	1.47	1.29	14.65	2.76
C18 : 0	7.94	3.97	15.08	25.08
C18 : 1	32.72	22.93	28.57	38.58
C18 : 2	42.94	43.65	8.95	4.78
C18 : 3	0.64	2.4	1.63	1.84
C20 : 0	ND	ND	0.2	ND
C20 : 1	ND	ND	6.32	ND
C22 : 0	1.15	ND	0.89	0.55
Total saturated	22.23	29.71	39.88	52.05
Total unsaturated	77.77	70.29	60.12	47.95
Saturated / unsaturated %	28.58	42.27	66.33	108.55

Data are expressed as percentage of total fatty acids .
C12 : 0 = Lauric acid , C14 : 0 = Myristic acid , C16 : 0 = Palmatic acid , C16 : 1 = Palmitoleic acid , C18 : 0 = Stearic acid , C18 : 1 n – 9 = Oleic acid , C18 : 2 n – 6 = Linoleic acid , C18 : 3 n –3 = Linolenic acid , C20 : 0 = Arachidic acid , C20 : 1 = Eicosenoic acid and C22 : 0 = Behenic acid . ND : not detected .

with quails fed tallow comparing with other treatments. The source of lipids had no significant (P < 0.05) effects on feed efficiency up to 14 weeks of age . It mentioned that the control birds had the least value of feed efficiency among all groups which were nearly similar . Feed consumption tends to increase when quails were fed a diet containing coconut oil , and decreased with diet contained cotton seed oil . These differeences are not significant . The highest feed effecincy obtained with quails fed coconut oil followed by cotton seed oil compared with other treatment . These results are agreement with (El – Kaiaty , *et . al* . 2001 ; Attia , *et . al* . 2004 and RamaRao , *et . al* . 2002) who illustrated that adding oil decrease the rate of passage of digesta induced and increase in feed utilization .

Table 3: show that no significant effects of lipid sources on body weigt at 14 week but it tended cotton seed oil and tallow to slightly decrease body weight of quails . Feed consumption tend to decrease

Fatty acids	Sunflower	Cotton seed	Coconut	Tallow
C12 : 0	ND	ND	0.72	ND
C14 : 0	0.37	0.77	5.7	2.06
C16 : 0	12.8	24.98	17.3	24.36
C16 : 1	1.47	1.29	14.65	2.76
C18 : 0	7.94	3.97	15.08	25.08
C18 : 1	32.72	22.93	28.57	38.58
C18 : 2	42.94	43.65	8.95	4.78
C18 : 3	0.64	2.4	1.63	1.84
C20 : 0	ND	ND	0.2	ND
C20 : 1	ND	ND	6.32	ND
C22 : 0	1.15	ND	0.89	0.55
Total saturated	22.23	29.71	39.88	52.05
Total unsaturated	77.77	70.29	60.12	47.95
Saturated / unsaturated %	28.58	42.27	66.33	108.55

Wenchuan, *et al.* (1996) reported also that feed intake did not differ among treatment fed coconut oil , soybean oil or lard for geese .

El – Wafa, *et al* . (2000) showed that vegetable oils (soybean oil, Corn oils and sunflower oil) improved the growth rate and feed conversion of broiler chicks compared to animal fats camel fat and margarine, Ozdogan, *et al.* (2004) reported that the heaviest body weight was observed in the chicks fed sunflwer oil and tallow group consumed significantly more feed than the other group. Torki , *et al.* (2003) found no effects of oil sources with diet on body weight, gain and feed intake during starter and grower periods.The benficial effects of sunflower oil and soybean oil may have been due to the higher content of unsaturated fatty acids in these oils as the degree of unsaturation and level of inclusion influnce on growth and feed intake (Smith , *et al* . 1971) .

Table 3 : Effect of Lipid sources on the performance of laying quails at 14 weeks of age .

Lipids / Performance	Sunflower	Cotton seed	Coconut	Tallow	Control
Intial body weight (g)*	185.9	162.8	176.9	168.15	162.2
Final body weight (g) at 14 wk	171.7	162.9	169.8	163.7	170.2
Feed consumption (g / bird / d)	31.3	31.3	37.6	28.9	36.7
Feed effeciency ratio (g feed / g egg)	0.22	0.21	0.21	0.22	0.18

*At 10 weerks of age .

Table 4 : Effect of Lipid sources on the performance of laying quails at 18 weeks of age .

Performance \ Lipids	Sunflower	Cotton seed	Coconut	Tallow	Control
Intial body weight (g)*	171.7	162.9	169.8	163.7	170.2
Final body weight (g) at 18 wk	173.6	171.4	172.6	170.6	175.6
Feed consumption (g / bird / d)	40.6	34.0	51.7	42.1	40.6
Feed effeciency (g feed / g egg)	0.18^{c}	0.19^{b}	0.20^{a}	0.18^{c}	0.17^{d}

Means with the same letter within row are not significantly different .
*At 14 weeks of age .

From table 5 . It noticed that the relative weight of some organ quail fed different sources of fats at 14 and 18 weeks of age in the two sexes . At 14 weeks of age , sex affect the relative weight of some organs , but not significantly . Liver % was higher in quails that fed on tallow followed by sunflower which may be due to the tallow contains more saturated fat than unsaturated one . These rusults agree with Popoulis and Dotas (2000) who reported the addition of 7 % cotton seed oil or sunflower seed oil to the diet increased liver fat . Yingku , *et .al*. (1996) liver and abdominal fat weights of geese fed on the coconut oil and lard were higher than those in the soybean oil fed group . The reproductive organs weight (ovary + oviduct in females and testis in males) were higher in birds fed sunflower and coconut oils than other treatments and did not differ from control ($P < 0.05$) . These results may be due to increasing egg formation especially in this peroid .

Table 5: Relative weight of some organs of quail fed different lipids sources at 14 and 18 weeks of age in males and females .

Age (wk)			14 (wk)					18 (wk)	
Lipid sources	Sex	Heart %	Liver %	Reproductive organs weight (g)	Intistinal thickness (g /cm)	Heart %	Liver %	Reproductive organs weight (g)	Intistinal thickness (g /cm)
Sunflower	Male	0.909	1.3	2.76	0.128	0.94	1.82	2.69	0.064
	Female	0.756	5.365	6.99	0.072	0.78	3.09	8.75	0.062
	Overall	0.832	3.33	4.88	0.10^{a}	0.86^{b}	2.45	5.72^{b}	0.063
Cotton	Male	0.887	1.91	2.4	0.066	0.62	1.37	2.11	0.051
	Female	0.745	3.22	5.01	0.078	0.68	3.92	7.18	0.071
	Overall	0.816	2.565	3.715	0.073^{ab}	0.65^{a}	2.65	4.65^{ab}	0.061
Coconut	Male	1.038	2.4	2.92	0.042	0.89	1.31	2.74	0.075
	Female	0.774	3.495	6.23	0.061	0.75	3.63	6.19	0.62
	Overall	0.906	2.945	4.57	0.053^{b}	0.82^{b}	2.47	4.47^{ab}	0.069
Tallow	Male	0.889	1.96	2.41	0.058	0.85	1.09	3.16	0.047
	Female	0.745	4.98	5.64	0.066	0.81	4.65	4.1	0.071
	Overall	0.755	3.468	4.02	0.059^{ab}	0.83^{b}	2.87	3.63^{a}	0.058
Control	Male	0.887	1.65	2.29	0.074	0.85	1.33	2.7	0.053
	Female	0.937	3.325	6.88	0.073	0.72	2.59	7.08	0.074
	Overall	0.907	2.488	4.59	0.074^{ab}	0.79^{b}	1.96	4.89^{ab}	0.063

Means with the same letter within columns are not significantly different
Small intestine weight (g) / Small intestine length (cm) .

At 18 weeks of age , sex affect the relative weight of some organs especially in females because the females in general have more fat than males .Heart % decreased significantly in cotton oil treatment compared with other treatments . Also, liver % especially in tallow treatment than others . At this time reproductive organs weight of sunflower oil treatment was the highest observation than other . The intestinal thickness smallest in coconut treatment than other treatments but this difference was not significant in all treatments ,when compared with control . Intestinal thickness did not differ significantly in all treatment compared with control . The thickness of intestine wall is considered as a good indicator for the number of microbial populations in intestinal lumen . The presnce of undesirable bacteria may induce a chronic inflammation resulting in a thickning of the intestinal wall (Krinke and Janroz , 1996) . So , from this result it we can be concluded that the different lipids used this time did not make any bad effect on the intestinal lumen

Tables 6 , 7 , 8 , show the effect of different lipid source on fatty acid composition of breast and thigh muscles in males and females quail . The saturated / unsaturated ratio weredifferent in two sides , the first side is the effect of sex and the second side is the source of lipids . Females always have high ratio than males and this result is normally true except for birds that fed coconut oil where, females nearly equal to males ratio. About the source of lipids, saturated / unsaturated ratio decreased in breast muscle of birds that fed tallow and this indicates that saturated fatty acids can be modified to unsaturated one but this mechanism is not completely understood until now, and may be saturated elongated and desaturated to form monounsaturated and polyunsaturated .

Table 6 :- The fatty acid composition of breast muscle in male and female quails fed different diets at 14 weeks of age .

Fatty acids	Sunflower		Cotton seed		Coconut		Tallow		Control	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
C12 : 0	0.19	0.23	ND	0.16	ND	ND	ND	0.5	0.19	0.79
C14 : 0	0.97	1.17	1.01	1.06	0.99	1.12	1.1	1.39	1.01	1.19
C16 : 0	20.51	21.18	22.13	19.12	21.77	19.7	23.47	23.55	19.44	18.57
C16 : 1	11.41	7.0	13.11	5.52	8.07	6.81	12.26	8.33	12.45	7.55
C18 : 0	4.08	8.58	5.45	10.61	7.54	8.94	6.16	8.06	6.68	9.0
C18 : 1	41.42	32.46	35.58	31.19	38.61	37.98	34.91	40.46	36.17	34.26
C18 : 2	20.7	24.65	21.03	28.96	19.38	21.79	19.32	15.62	22.02	22.38
C18 : 3	0.73	0.95	0.92	1.17	1.18	1.57	0.37	0.99	0.86	1.29
C20 : 0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C20 : 1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C22 : 0	ND	3.79	0.77	2.23	2.46	2.1	2.05	1.12	1.18	4.97
Total saturated	25.74	34.94	29.36	33.17	32.76	31.85	32.78	34.61	28.5	34.52
Total unsaturated	74.26	65.06	70.64	66.83	67.24	68.15	67.22	65.39	71.5	65.48
Saturated / unsaturated ratio	34.66	53.7	41.56	49.63	48.72	46.74	48.77	52.93	39.86	52.27

Data are expressed as percentage of total fatty acids .
C12 : 0 = Lauric acid , C14 : 0 = Myristic acid , C16 : 0 = Palmatic acid , C16 : 1 = Palmitoleic acid , C18 : 0 = Stearic acid , C18 : 1 n – 9 = Oleic acid , C18 : 2 n – 6 = Linoleic acid , C18 : 3 n –3 = Linolenic acid , C20 : 0 = Arachidic acid , C20 : 1 = Eicosenoic acid and C22 : 0 = Behenic acid . ND : not detected .

When compare the fatty acids composition of breast muscle by that found in the different source of fats on diet we noted that saturated fatty acids were lower in breast muscle and mono and polyunsaturated increased especially in birds that fed tallow. These results agree with Cortinas, *et al* . (2004).; HuiMin , *et al* . (1998); Mieczkowska, *et al.* (1999) who showed that soybean oil supplementaion resulted in reduction of saturated fatty acids and increase the polyunsaturated fatty acid content in lipids of adipose and muscle tissues of chicken in comparison with tallow . Manilla , *et al* . (1999) reported that fatty acid profiles for the breast muscle and abdominal fat were altered by fat supplementation.The oil diets (plant seed and fish) increased total polyunsaturated fatty acid cocentration in both types of tissue. While beef tallow decreased total monounsaturated and saturated fatty acid concentrations they were higher in the chickens fed the beef tallow diet .

Table 7 :- The fatty acid composition of thigh muscle in male and female quails fed different diets at 14 weeks of age .

Fatty acids	Sunflower		Cotton seed		Coconut		Tallow		Control	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
C12 : 0	0.18	0.42	ND	0.21	ND	ND	ND	0.13	ND	0.77
C14 : 0	0.91	1.09	1.05	1.01	1.05	1.38	1.19	0.82	0.74	1.11
C16 : 0	19.92	17.6	22.05	20.03	21.61	19.44	22.11	19.22	19.2	18.8
C16 : 1	10.77	7.49	14.25	6.87	8.21	8.15	14.16	6.97	11.77	6.59
C18 : 0	5.83	11.51	4.41	11.22	7.49	11.2	6.72	7.06	4.71	9.87
C18 : 1	36.79	32.38	36.22	30.85	39.3	30.69	34.28	33.59	40.39	33.6
C18 : 2	23.68	24.79	20 16	26.0	18.73	24.63	19.31	28.68	20.77	23.22
C18 : 3	0.89	1.57	1.2	1.12	1.31	0.8	0.81	1.33	1.04	2.35
C20 : 0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C20 : 1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C22 : 0	1.02	3.14	0.67	2.69	2.29	3.7	1.42	2.2	1.38	3.59
Total saturated	27.87	33.76	28.18	35.16	32.45	35.73	31.45	29.42	26.03	34.14
Total unsaturated	72.13	66.24	71.82	64.84	67.55	64.27	68.55	70.58	73.97	65.86
Saturated / unsaturated ratio	38.64	50.97	39.24	54.23	48.04	55.59	45.88	41.68	35.19	51.84

Data are expressed as percentage of total fatty acids .
C12 : 0 = Lauric acid , C14 : 0 = Myristic acid , C16 : 0 = Palmatic acid , C16 : 1 = Palmitoleic acid , C18 : 0 = Stearic acid , C18 : 1 n – 9 = Oleic acid , C18 : 2 n – 6 = Linoleic acid , C18 : 3 n –3 = Linolenic acid , C20 : 0 = Arachidic acid , C20 : 1 = Eicosenoic acid and C22 : 0 = Behenic acid . ND : not detected .

Some authors have suggested that the lower fat deposition in broilers fed polyunsaturated fats compared with those fed saturated fats was , in part , explained by an increased rate of lipid catabolism and by a decrease of FA synthesis (Sanz , *et al* . 2000 , Cortinas , *et al* . 2004) reported that total FA content of breast muscle was less than 15 % of the total FA content . Increasing the PUFA content of the diet decreased total fatty acid of thigh 17 % but didn't affect FA content in breast meat. Monounsaturated FA (MUFA) and saturated fatty acid (SFA) content of thigh decreased linearly as the inclusion of dietary PUFA increased wherease the relationship between PUFA content of feed and thighs was exponential

Table 8 :- The fatty acids composition of breast and thigh muscle in (female and male) quails at 18 weeks of age .

Fatty acids	Sunflower		Cotton seed		Coconut		Tallow		Control	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
C12 : 0	0.32	0.47	0.38	0.38	0.23	0.45	0.54	0.84	0.22	0.22
C14 : 0	1.07	1.57	1.02	1.6	1.08	1.54	1.43	1.67	0.88	0.92
C16 : 0	16.09	16.91	21.33	19.55	20.53	17.62	19.2	17.17	22.58	19.65
C16 : 1	10.62	7.35	10.23	6.91	15.8	9.61	9.85	8.92	11.4	8.98
C18 : 0	6.01	5.6	5.8	7.21	7.11	5.2	3.78	5.57	4.11	6.34
C18 : 1	40.64	35.1	40.28	35.25	32.86	38.76	42.93	39.58	45.0	35.38
C18 : 2	22.67	30.09	18.01	26.29	20.31	24.26	18.8	21.74	14.72	26.92
C18 : 3	1.37	1.42	1.66	1.25	0.73	1.6	1.45	2.84	0.55	0.43
C20 : 0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C20 : 1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C22 : 0	1.21	1.47	1.28	1.56	1.35	0.96	2.01	1.67	0.55	1.16
Total saturated	24.7	26.04	29.82	30.3	30.3	25.77	26.96	26.92	28.33	28.28
Total unsaturated	75.3	73.96	70.18	69.7	69.7	74.23	73.04	73.08	71.67	71.72
Saturated / unsaturated	32.8	35.21	42.49	43.47	43.47	34.72	36.91	36.84	39.53	39.13

Data are expressed as percentage of total fattyacids .
C12 : 0 = Lauric acid , C14 : 0 = Myristic acid , C16 : 0 = Palmatic acid , C16 : 1 = Palmitoleic acid , C18 : 0 = Stearic acid , C18 : 1 n – 9 = Oleic acid , C18 : 2 n – 6 = Linoleic acid , C18 : 3 n –3 = Linolenic acid , C20 : 0 = Arachidic acid , C20 : 1 = Eicosenoic acid and C22 : 0 = Behenic acid . ND : not detected .

From the results in table (9) , it could be noted that crude lipid % of breast and thigh muscles in males and females was affected by feeding different sources of lipids. Crude lipids % was higher in breast of males fed sunflower, cotton seed, tallow and control comparing with coconut oil . Male breast gave higher peroxide values in diet containing sunflower, cotton seed oils, tallow and control group. The high peroxide value of female thigh compared with breast in sunflower oil, cottonseed oil, coconut oil and tallow treatments .

Freee fatty acids content (as % oleic acid) and acidity value % of japanese quail muscle (breast & thigh) for male and female were determined and the obtained results were presented in table (9, 10). From the tabulated results, it could be noted that generally male thigh showed high FFA and acidity value in birds fed sunflower oil , coconut oil tallow and control group. Also higher values were exerted by female breast in sunflower oil, cotton seed oil, and control group . These results agree with (Chan *et al.* 1986 and Faustman, *et al.* 1989)the increase in the unsaturated fatty acid content, however , lead to an increase in lipid oxidation in the meat. An increase in the degree of polyunsaturation of meat may enhance the development of organoleptic problems (Ajuyah , *et .al* . 1993 and Gonzalez – Esquerra and Leeson, 2000) and lead to an increased sucsptibility to lipid oxidation (Klaus, *et al* . 1995 , Grau , *et al* .2001 a, b)

Table 9:- Effect of dietary lipids on crude lipids FFA %, acid value , peroxide value and TBA value of Japanese quail muscle at 14 weeks of age .

Lipids	Sex	Part	Crude Lipid%	FFA %	Acid value	Peroxide value*	TBA value
Sunflower	Male	B	22.34	0.94	1.86	195.59	1.21
		T	14.16	1.40	2.79	14.71	1.62
	Female	B	2.20	6.80	13.52	84.75	1.31
		T	3.96	5.53	11.00	229.36	1.66
Cotton seed oil	Male	B	17.31	0.64	1.27	47.39	1.32
		T	11.78	0.64	1.26	40.85	1.61
	Female	B	1.27	5.53	11.00	136.05	1.27
		T	2.13	3.66	7.29	180.99	1.82
Coconut	Male	B	4.34	1.41	3.97	191.39	1.44
		T	6.76	1.91	5.35	228.76	1.40
	Female	B	4.98	2.92	8.20	46.67	0.73
		T	7.15	4.78	13.43	86.96	1.52
Tallow	Male	B	13.76	1.00	2.00	37.57	1.70
		T	11.94	2.18	4.33	21.69	1.01
	Female	B	5.87	2.34	4.66	113.41	0.89
		T	6.59	3.12	6.22	205.66	1.34
Control	Male	B	20.53	1.15	2.29	83.57	0.37
		T	8.47	1.81	3.61	33.61	1.10
	Female	B	3.14	5.58	11.11	137.7	0.67
		T	3.52	4.41	8.77	74.63	1.51

FFA : Free fatty acid , TBA : Thiobarbituric acid , expressed as mg malonaldehyde per kg sample , B : breast , T : thigh ,* Peroxide value as milliequavalent per kg sample .

Table 10 :- Effect of dietary oils on crude lipids FFA %, acid value , peroxide value and TBA value of Japanese quail muscle at18 weeks .

Lipids	Sex	Crude Lipid%	FFA %	Acid value	Peroxide value*	TBA value
Sunflower	Male	15.28	2.35	4.67	107.14	2.30
	Female	11.79	1.35	2.69	274.91	0.70
Cotton	Male	27.03	1.16	2.30	103.01	0.44
	Female	15.63	3.84	7.64	175.06	1.94
Coconut	Male	13.86	1.74	3.46	99.82	1.32
	Female	6.49	2.31	4.60	288.07	2.44
Tallow	Male	23.45	1.08	2.14	493.39	1.40
	Female	7.63	2.92	5.89	218.97	2.81
Control	Male	38.17	0.97	1.93	95.40	1.52
	Female	9.32	3.09	6.16	297.34	2.73

FFA : Free fatty acid , TBA : Thiobarbituric acid , expressed as mg malonaldehyde per kg sample *Peroxide value as milliequavalent per kg sample .

Morrissey, *et al.*(1997) reported that thigh muscle is inherently more susceptible to lipid oxidation than breast muscle because it has a greater phospholipid content . In addition , thigh muscle is more oxygenated, and has higher total lipid content and water soluble prooxidants, such as iron.The levels of polyunsaturated fatty acids were higher in birds fed the diet containing sunflower oil throughout the whole growing peroid. Several studies suggest that in both birds and mammals, polyunsaturated fatty acid (PUFA) inhibit lipid synthesis (Wilson, *et al.* 1986 , 1990 ; Blake and Clarke 1990; Ntambi, 1991; Sanz, *et al* . 2000) and increase fatty acid oxidation (Shimomura , *et al* . 1990; Madsen , *et al* . 1999 ; Sanz , *et al* . 2000; Cunnane and Anderson 1997; Russell , *et al* . 2003)

It has been reported that oxidative changes are much more extensive in the dark meat than white meat. This may possibly be due to the increased level of lipids , phospholipid content , and polyunsaturation in the dark meat (Lin, *et al* . 1988 ; Skalan, *et al* . 1983 ; Ajuyah, *et al* . 1993) .

The diets rich in PUFA enhance lipid oxidation (Shimomura, *et al* .1990; Madsen, *et al* . 1999; Sanz, *et al* . 2000; Cunnane and Anderson, 1997) and this oxidation is higher for PUFA than for saturated fatty acids (Leyton , *et. al* . 1987) .

Gray and Pearson (1987) , reported that oxidative changes in meat products were initiated in the phospholipid fraction of membranes. The susceptibility of membrane phospholipids to oxidation might be related to their high concentration of PUFA .

Source of fats supplementation on some plasma constituents of quails is shown in table 11. Hematocrit (PCV)used as indicator for the stress on the birds. Hematocrit is not affected by different sources of lipid that supplementedl in the diet so use these lipids and these differences were significantly different ($P < 0.05$) and these results are true because total protein , total lipids & cholesterol were indicators to different lipid sources that add to the diets but sunflower oil was lower than control in cholesterol level .These results inagreement with Mickey , *et al* . (2001) who found that dietary fat intake decreased serum level of cholesterol. So, all nuritionists recommended to use it for better human health .

Table 11 :- Some plasma constituents of quails fed different lipidsources .

Lipids	Cholesterol (mg / dl)	Total lipids (mg / dl)	Total Protein (g / dl)	Hematocrit PCV %
Sunflower	88.98^{b}	210.37	3.80^{b}	0.54
Cotton	102.48^{a}	210.02	4.69^{a}	0.57
Coconut	108.8^{a}	211.53	4.14^{ab}	0.53
Tallow	100.8^{a}	214.15	4.94^{a}	0.50
Control	91.2^{b}	209.95	4.43^{ab}	0.52

Means with the same letter within row are not significantly different .

Total lipids also were higher in birds that fed on tallow and this was normal because this type of fat contains more saturated fatty acids than unsaturated fats . It may be those lipoproteinlipase play a role in birds fed tallow with respect to those fed oils on the other hand , sunflower and cotton seed oils were nearly equal to control. In agreement with our results on total lipids, El – Husseiny, *et al* (2002) showed that the vegetable oils decreased significantly serum total lipids when compared with tallow . Total protein also was significantly different ($P < 0.05$) especially in birds that fed on tallow and coconut oil . This may be because tallow deposited more fats than other treatment and this may be due to their spare effect on reducing the degredation of plasma and tissue proteins in birds that fed other treatment and control than that fed sunflower oil (Grminger ,1986) .

CONCLUSION

In conclusion , the lower fat deposition observed in quails fed sunflower oil andThe fatty acid profile of quail meat can be considerably modified by changing the fatty acid composition of the diet . The use of sunflower in diets resulte in higher content of unsaturated fatty acids in breast meat which possible benefits to human health .

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دراسات على مصادر مختلفة من الدهون ومحتواها من الأحماض الدهنية في السمان الياباني

١- تأثير زيت دوار الشمس وزيت بذور القطن وزيت جوز الهند ودهن الأبقار على ترسب الدهون في الصدر و الفخذ وبعض مركبات الدم وجودة دهون اللحم

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أجريت هذه الدراسة بكلية الزراعة – جامعة عين شمس بغرض دراسة تأثير مصادر مختلفة من الزيوت(دوار الشمس ، بذرة القطن ، جوز الهند ، دهن الأبقار) على إنتاجية طيور السمان البياض وتركيب الأحماض الدهنية في لحم الصدروالفخذ بالذكور والإناث وكذلك تقدير بعض ثوابت الدهن ودرجة التزنخ . كذلك تم دراسة التأثير على بعض الأعضاء الداخلية ومكونات الدم .

استخدمت الدراسة عدد ١٥٠ سمانة بياضة قسمت على خمس معاملات وغذيت على عليقه متساوية في نسبة البروتين والطاقة ومتساوية في نسبة الزيوت ١% بينما غذيت المجموعة الخامسة على عليقه كنترول خالية من أي زيوت .

وقد أشارت النتائج إلى :-

وجد أن زيت جوز الهند يتميز بوجود حمض اللوريك و حمض الأرشيديك وحمض الأيكوسنويك مقارنة بباقي الزيوت المستخدمة والخالية منهما .

كانت أعلى نسبة للأحماض الغير مشبعة موجودة بدوار الشمس وكان أقلها في دهن الأبقار وكان العكس صحيحا في الأحماض المشبعة .

لم تتأثر كفاءة الغذاء بين المعاملات المختلفة . ولكن انخفضت الإنتاجية في الفترة الثانية (١٨ أسبوع) عن الفترة الأولى (١٤ أسبوع) وكذلك معدل الاستفادة من الغذاء .

انخفض ا لوزن النسبي للكبد في الفترة الثانية عن الفترة الأولى كما ارتفعت % لوزن الكبد للسمان المغذى على دهن الأبقار مقارنة بباقي المعاملات كما انخفض وزن الكبد في المعاملة الكنترول مقارنة بباقي المعاملات .

ارتفع وزن القلب في المعاملات الخاصة بجوز الهند والكنترول مقارنة بمعاملات دهن الأبقار . أما في الفترة الثانية فقد انخفض وزن القلب عند إضافة زيت القطن مقارنة بالمعاملات الأخرى .

ارتفعت كمية الدهون الكلية المترسبة في الذكور عن الإناث كما ارتفعت نسبة الدهون في الصدر عن الفخذ .

انخفضت كمية الأحماض الدهنية الحرة وقيمة الأحماض وقيمة البيروكسيد في الذكور عن الإناث مع كل الزيوت .

انخفضت قيمة الحموضة في الكنترول ، جوز الهند ، دهن الأبقار وفى الإناث عن الذكور في الفترة الأولى ولكن تغير هذا الوضع في الفترة الثانية كانت حيث أقل مع زيت عباد الشمس ،القطن وكانت الذكور أيضا أقل في قيمة الحموضة من الإناث .

كانت نسبة الأحماض الدهنية الحرة وقيمة الأحماض وقيمة البيروكسيد وقيمة الحموضة أعلى في عضلات الفخذ عن الصدر في أغلب الزيوت المختلفة .

انخفض الكوليسترول معنويا في دم الطيور التي غذيت على عباد الشمس والكنترول مقارنة بالطيور التي غذيت على علائق أخرى . بينما ارتفعت نسبة الليبدات الكلية في دم الطيور التي تغذت على دهن الأبقار. لم تتأثر نسبة المكونات الخلوية في الدم(الهيماتوكريت) بالمعاملات المختلفة .

من هذا يتضح أن عباد الشمس أعطى أفضل النتائج ويوصى باستخدامه عن باقي الزيوت الأخرى لأنه آمن بالنسبة للمستهلك .