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EFFECT OF DIFFERENT DIETARY SOURCES OF FAT ON BROILER CHICKENS
2-FAT QUALITY AND CARCASS YIELD

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ABSTRACT : This work was carried out to study the Effect of feeding diets containing different sources of fats to broiler chicks on carcass characters, fat quality and histology of the internal organs including liver, kidney, heart and spleen were investigated in the present study.

1- A total of 90 one day broiler chicks were randomly distributed into 6 experimental groups and fed a commercial broiler diet for 8 days and from 9 to 52 d of age isocaloric and isonitrogenous diets containing 7.02% of six different fat sources, dried fat, corn oil, frying oil, heated frying oil for 8.24 and 48 hours respectively.

2- The different dietary sources had no significant effect on carcass characteristic.

3- The fat quality studies revealed that significant changes in the chemical properties and acid composition of dietary fats due to source and heat treatment.

4- Susceptibility of tissues to lipid peroxidation was increased by feeding heated frying oil especially hepatic tissues.

5- Diets containing frying oil heated for long time increased susceptibility of meat to oxidation.

INTRODUCTION

Fats are frequently included in broiler diets to increase the energy density. The safety of thermally-abused fats and oils for human and animal consumption has been the subject of research over many years. The general consensus has been that consumption of thermally abused fats at realists levels is not harmful since the dietary intake of lipids oxidation products is likely to be low **(Artman, 1969)**. In recent years this suggestion has been criticized on the basis that in many earlier studies the pathological end points assessed were crude and fatty acid oxidation products and cholesterol oxides have implicated in mutagenesis and carcinogenesis and in the a etiology of coronary heart disease **(Aiddis & Warner, 1991). Narusrewicz et al. (1987)** observed a marked increase in plasma thiobarbituric acid reacting substances (TBARS) in human subject after the ingestion of thermally-oxidized soybean oil, while elevation in plasma after ingestion of fresh oil were minimal.

Many lipid oxidation products may be absorbed by humans and animals. For these reasons, there is need for further research into the effects of consumption foods containing high levels of lipid oxidation products. The purpose of the present study was to investigate the effects of feeding diets containing dried fat, corn oil, frying oil and heated frying oil for 8,24 and 48 hours respectively on carcass characters, fat quality, microstructure of some internal organs including liver, heart , kidney and spleen and economical evaluation.

MATERIALS AND METHODS

2-1 Chickens and Diets

One-day-old broiler chicks were placed in a room and fed on a commercial broiler diet until the start of the experiment. At 9 days of age, chicks were weighed and allotted into 6 groups, 15 birds each (for a total of 90 birds). Each group housed in individual cage and fed on one of six experimental isonitrogenous and isocalaric diets (Table 1). For the six chick-groups there kinds of fats were used; the commercially used dried fat, corn oil and the frying oil (korsal), assigned for the first three groups, while the korsal oil(blend oil) was heated for three different periods 8,24 and 48 hours and assigned for the last three groups respectively. The oils were considered to have an equal energy value and added each at fixed ratio of about 7% of the diet.

2-2 Oils and heat treatment

The dried fat used in the first group is composed of a mixture of different vegetable oils, while the frying oil is a blend of cottonseed, soybean and sunflower oils, the percentage of each is not advertised. The heat treatment was performed in the laboratory using a large frying pan and the heating was continuous and unbroken for 48 hours at about 180 ± 10C° taking the quota of each treatment at its respective time 8,24 and 48 hours, Samples of the different oils, raw or heated were taken for analysis.

2-3 Estimations.

2.3.1 Carcass yield

At the end of the experiment five birds were taken randomly from each group and slaughtered after 12 h fast for carcass yield measurements. The last includes the weight of slaughter. edible and oven carcass, edible organs and in special liver, heart and abdominal fat.

2.3.2 Fat quality

Samples of the dietary and carcass (thigh, liver and adipose tissue) fats were analyzed for the chemical properties

Table 1 Composition of the basal diet

Ingredients		%
Ground yellow corn		50.10
Soybean meal (solvent-extracted, 44% CP)		30.80
Broiler concentrate (52% CP)*		10.00
Oil**		7.02
Mineral-vitamin premix		1.00
Dicalcium phosphate		0.88
DL. methionine		0.10
Coccidiostat		0.10
Calculated energy and chemical components* **		
Crude protein	%	23
Metabolizable energy	kcal/kg	3200
Methionine	%	0.60
Lysine	%	1.62
Calcium	%	1.16
Available phosphorus	%	0.66

*Broiler concentrate contains CP, 51.98%; CF, 0.07%; EE, 6.76 %; calcium, 8.66%; available phosphorus, 3.66%; methionine, 1.79%; methionine + cystine, 2.4% lysine, 2.82%; salt, 2% and ME, 3083 kcal/ kg .

**The oils added were dried fat, corn oil, frying oil and heated frying oil at 8.24 and 48h, for the six groups respectively:

The six diets are orderly coded as DFD, COD, FOD, FOD_8, FOD_{24} and FOD_{48}.

***The chemical composition of the basal diet was calculated according to the **(NRC 1994)** tables

According to **AOAC (1975)**. For the carcass, the total lipids, triglycerides and cholesterol were determined according to **AOAC (1975)**. **Jacobs** and **van Demark (1960)**, and **Zlatkis et al. (1953)** respectively. The fatty acid composition of dietary fats was measured by GLC.

2.3.3 Histopathological studies.

The organs heart, liver and spleen of different chick groups were sampled to be histopathologically examined. The samples were fixed in formalin, The specimens cut at 5-7 microns and stained with hematoxylin & eosin

2.3.4 Financial cost

As broiler industry is based on monentary returns rather than maximal chick performance, economical efficiency was calculated as the ratio between cost of one unit of carcass and cost of fed consumed at slaughter. In determining the cost, the expenses were generally represented by the combined cost of feed and chick charges with no regard to the cost of litter, building and equipment charges, or any other miscellaneous ones, making these costs as a financial base of comparison rather than a real meat production cost.

2.3.5 Statistical analysis

The data were statistically analyzed according to **Armitage (1971)**.

RESULTS AND DISCUSSION

3.1- The chemical properties of dietary fats

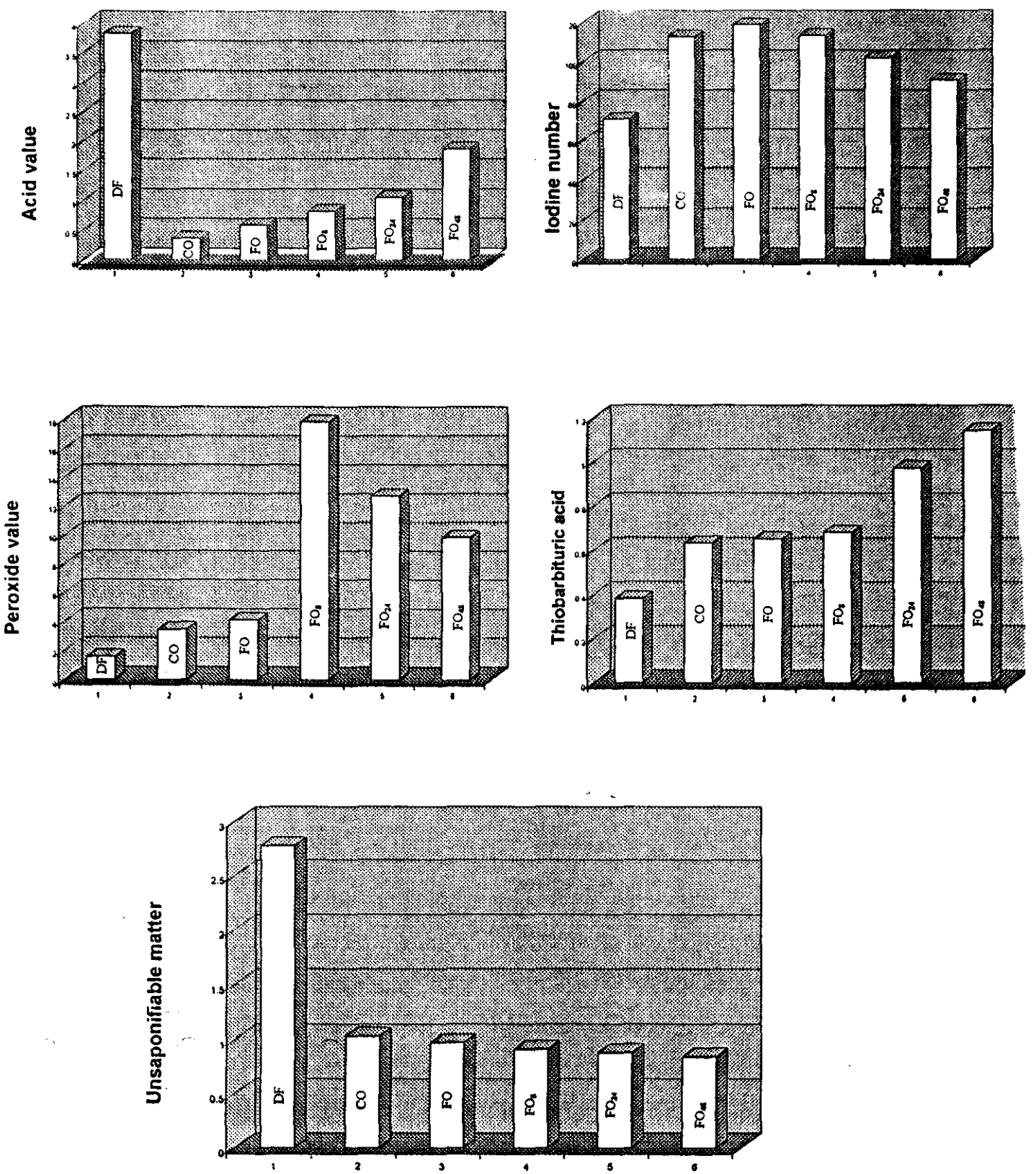
The properties of the fats used were determined using constants, some measuring the characteristics of its own as the acid value, iodine number, peroxide value, thiobarbituric acid value and unsaponifiable matter and others measuring the quality and the changes which may be affected by keeping conditions.

3.1.1- Acid value

The acid value results are presented in table (2). The obtained results showed that the dried fat had a significantly high value; more than 6 times the frying oil. It might be the kind of the fat blend or the processing factors in the dried fat which makes the difference. The acid value which measures the amount of the free fatty acids in the oil, matters nothing for the nutritional value but the quality.

Table (2): The chemical properties of the dietary fats

Items	Raw oils			Heated oils		
	DF	CO	FO	HFO_8	HFO_{24}	HFO_{48}
Acid value	f 3.82±0.11	a 0.36±0.03	b 0.59±0.04	c 0.82±0.02	d 1.05±0.08	c 1.86±0.03
Iodine number	a 70.80±0.94	d 112.37±0.35	e 118.37±0.44	d 113.01±0.32	c 101.88±0.96	b 90.67±0.62
Peroxide value	a 1.51±0.17	b 3.41±0.15	b 4.08±0.09	e 17.81±0.60	d 12.66±0.28	c 9.81±0.16
Thiobarbituric acid	a 0.38±0.015	b 0.63±0.015	b 0.65±0.026	e 0.68±0.018	d 0.97±0.009	c 1.14±0.061
Unsaponifiable matter	c 2.77±0.130	b 1.03±0.006	ab 0.97±0.006	ab 0.91±0.006	ab 0.88±0.009	A 0.84±0.009



(Fig. 1):The chemical properties of the dietary fats

Heat treatment increased the value to a degree varied according to the length of the heating time. As the time increased more fatty acids were liberated due to hydrolysis of the triglycerides. Hydrolysis was more extensive in the last 24 hours of heating.

3.1.2- Iodine Number

The iodine number is a more specific measure for the degree of unsaturation and the results in table (2) showed that 100g of corn oil and of frying one absorbed more grams of iodine (112.37 and 118.73 respectively) than that absorbed by the dried fat. It is the fatty acid composition in table (3) which confirms and shows 46.29% as total saturated fatty acids in the dried fat versus 12.50 & 22.50% in the corn oil and frying one respectively. Heating the frying oils up to 48 h oxidized the double bonds causing the $C_{18:2}$ & $C_{18:3}$ to decrease while $C_{18:1}$, $C_{16:1}$ and $C_{18:0}$, $C_{16:0}$, $C_{15:0}$ and $C_{14:0}$ increase making a total increase in the unsaturated fatty acids of 1.54, 3.04, 5.43 & 5.43 due to 8.24 and 48 h. heating and a total increase in the saturated of 1.88, 3.22 & 4.84 for the same periods of heating. The increase in $C_{15:0}$ and $C_{14:0}$ means that in this case it is not an oxidation but a breaking down of the carbon chains. Simillar findings were found **by waltking and Zmachinski (1970).**

3.1.3- Peroxide value

The value was found to be low in the dried fat (1.51) compared with that of corn (3.41) and frying oil (4.08). The difference in peroxide value may be attributed to the difference in unsaturated acid the oils contain. Heating increased the value in the first 8 h. then the peroxides formed in the induction period (stable peroxides) decomposed or reacted with other products of oxidation to produce the compounds responsible for the rancid flavor and odor. Simillar finding reported by **Fishwick and Swoboda (1977).**

3.1.4- Thiobarbituric acid

The dried fat scored the lowest Thiobarbituric acid while corn and frying oils scored the highest values. Heating increased the value of Thiobarbituric acid value and the value increased as the heating time increased in a significant relationship.

3.1.5- Unsaponifiable matter

the Unsaponifiable matter content of the investigated fats are presented in table (2). Heating decreased the amount of Unsaponifiable matter of frying oil and the value decreased as the time of heating time increased where it is significant ($p<0.05$) at 48 h heating time. The decrease in Unsaponifiable matter might resulted from the destruction of tocopherols and sterols under the heat experimental conditions **(Yuki and Shikaula 1976).**

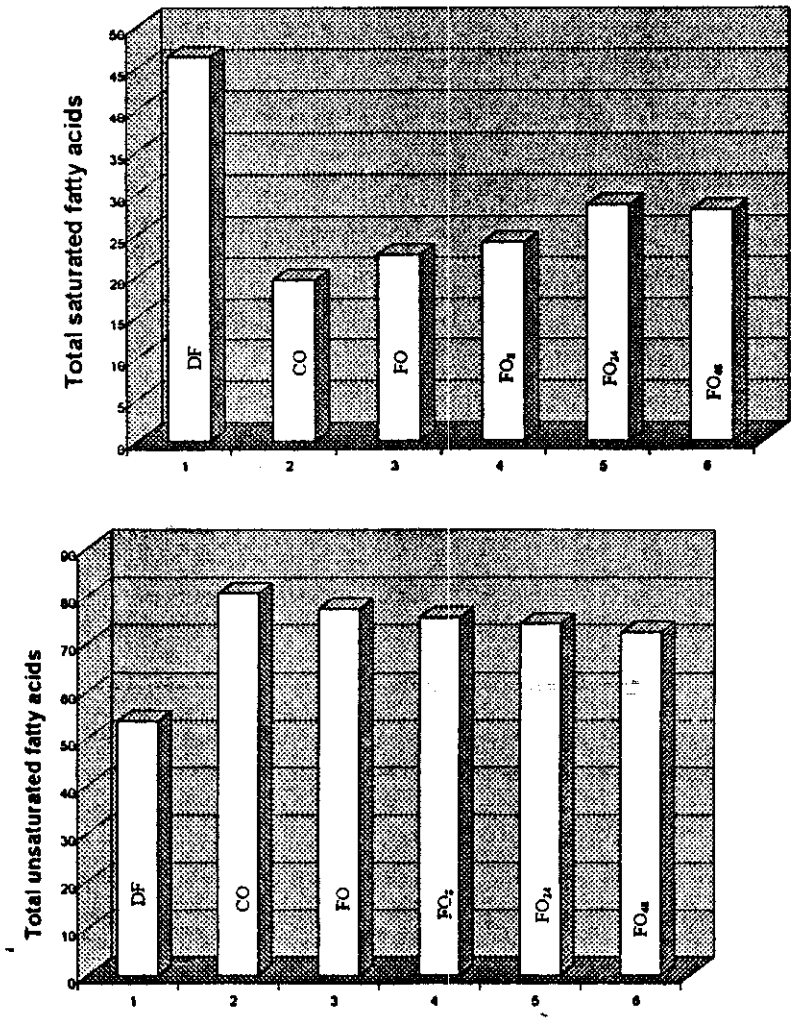
3.2- Fatty acid composition of dietary fat and oils

Fatty acid composition of dried fat, corn oil and heated or unheated

frying oil is presented in table (3). The obtained data revealed that the ratio between total unsaturated and saturated fatty acids (Tu/Ts) for corn oil and frying oil amounted (4.1:1) and (3.4:1) respectively. These values simply means that the unsaturated fatty acids of corn and frying oils are about 4 folds that of the unsaturated ones. Such values are higher than that values recommended for dried fat which in general low ratio of Tu / Ts (1.2:1). Oleic acid with one double bound resembles the highest amount of unsaturated fatty acids which is not an essential fatty acids and amounted to 35.07% in dried fat, while linoleic acid amounted only to 12.8% on the other hand linoleic ($C_{18:2}$) which is the major essential fatty acid of corn and frying oils to 49.9 and 46.74% respectively.

Table (3): Fatty acid composition of dietary fats and oils

Fatty acid %	Raw oils			Heated oils		
	DF	CO	FO	HFO_8	HFO_{24}	HFO_{48}
Myrstic acid $C_{14:0}$	d 1.70±0.06	a 0.46±0.03	b 0.79±0.009	bc 0.84±0.009	c 0.88±0.006	c 0.91±0.012
Pentadecanoic $C_{16:0}$	0.78±0.14	0.56±0.03	1.35±0.11	1.51±0.02	1.82±0.03	1.93±0.02
Palmitic acid $C_{16:0}$	e 28.3±0.53	a 16.40±0.42	a 17.2±0.199	b 18.2±0.17	c 19.11±0.11	d 21.07±0.50
Stearic acid $C_{18:0}$	d 14.57±0.38	a 2.08±0.099	b 2.65±0.04	bc 2,86±0.05	bc 3.07±0.04	c 3.34±0.09
Arachidic acid $C_{20:0}$	d 0.94±0.03	a 0.00	b 0.65±0.03	bc 0.68±0.02	bc 0.71±0.01	c 0.73±0.02
Total saturated fatty acids	46.29	19.50	22.55	24.09	28.59	27.98
Palmitoleic acid $C_{16:1}$	d 4.57±0.23	a 0.28±0.02	ab 0.51±0.01	b 0.69±0.003	c 1.24±0.03	c 1.27±0.04
Oleic acid $C_{18:1}$	e 35.07±0.57	c 29.05±1.06	a 26.62±0.27	b 27.41±0.24	c 29.41±0.099	d 33.02±0.04
Linoleic acid $C_{18:2}$	a 12.80±0.51	f 49.91±0.64	e 46.47±0.77	d 45.04±0.09	c 41.68±0.52	b 36.71±0.38
Linolenic acid $C_{18:3}$	a 1.15±0.03	ab 1.26±0.02	e 3.63±0.04	d 2.21±0.097	c 1.68±0.07	b 1.39±0.02
Total unsaturated fatty acids	53.59	80.50	77.23	75.35	74.01	72.39



(Fig. 2): Total saturated and unsaturated fatty acids of experimental fat.

The heating of frying oil leads to increase of total saturated fatty acids from 22.55 to 27.98 at zero and 48 h respectively and the unsaturated one decreased from 77.33 to 72.39%. Palmitic acid was increased by about 11% after heating for 24 h, similar results were obtained by **Farag and Taha (1991)**, they mentioned that the energy produced by the heating is sufficient to cause double bonds migration in both mono and diethenoid acids to β-Position followed by oxidative degradation of the B-position and producing an acid lower by two carbon atoms than the parent acid. There for fatty acids with C_{18} ($C_{18:1}$ and $C_{18:2}$) were converted to $C_{16:0}$ under heat treatments. Oleic acid was gradually increased from 26.62 to 33.02 by heating for 0 and 48 h. respectively. Linoleic acid was decreased by 21% after thermal treatment for 48h. These results are in agreement with those reported by **Artman and Smith (1972)**. However the decrease in the amount of Linoleic or Linolenic acid with prolonged heating might be interpreted as a result of oxidation. The high reactivity of methylene the methane group adjacent to unsaturated centers in linoleic acid is responsible for the fact such acids are highly acceptable to oxidation and this acid and its esters oxidize approximately ten times as rapidly as those of oleic acid which lack such group. Normal linoleic acid which contains two active methylene groups oxidize about twice as rapidly as linoleic acid **(Bailey's 1996)**.

3.3- Carcass quality

3.3.1- Carcass yield characteristics

The carcass yield characteristics of the different experimental broiler groups are presented in table (4). The results show no clear effect for the fat source on the different carcass traits and the percentage of the edible carcasses varied from 75.30 to 76.76%, a difference related to individual variations rather than fat source. The relative weights of the heart and visible fat follow the birds, weight more than the dietary fat. It is on the higher side in heavier birds and on the lower one in the dried fat group having the lightest weight.

Table (4) : Carcass characteristics of broiler chicks fed the experimental diets

Items	Unit	Raw oil groups			Heated oil groups		
		DFD	COD	FOD	$HFOD_{8}$	$HFOD_{24}$	$HFOD_{48}$
Live body weight	g	1868	2200	2552	2389	2312	2182
Slaughter weight	%	85.48±0.54	86.86±1.65	85.31±0.60	85.48±0.78	84.53±0.48	85.32±0.44
Edible carcass	%	76.24±0.76	76.31±1.91	76.35±0.54	76.76±0.76	75.30±0.64	75.63±0.53
Oven ready	%	71.59±0.80	71.47±1.81	71.71±0.76	72.21±0.67	72.21±0.81	70.95±0.50
Edible organs	%	4.64±0.05	4.84±0.15	4.65±0.29	4.55±0.18	4.80±0.12	4.68±0.09
Liver weight	%	2.53±0.06	2.39±0.16	2.38±0.14	2.22±0.11	2.36±0.08	2.37±0.05
Heart weight	%	0.48±0.04	0.48±0.03	0.60±0.12	0.57±0.11	0.54±0.07	5.54±0.06
Visible fat	%	1.06±0.35	1.46±0.31	1.65±0.15	1.52±0.13	1.74±0.30	1.46±0.32

3.4- Fat quality of the carcass

3.4.1- The chemical properties

The chemical properties of the carcass fat were measured in three representative sites the thigh, adipose tissue and liver are presented in table (5).

3.4.1.1 Acid value

In spite of wide variations in the acid values of the different fats added raw or heated (as low as 0.36 in corn oil and as high as 3.82 in the dried fat. They showed no clear effect on the acid value of the carcass fat in three nominated sites. From the obtained results the values were high in liver followed by thigh while the adipose tissue scored the lowest. The liver showed a value ranged from 2.87 to 3.23, the thigh 2 to 2.5 and the adipose tissue from 1.6 to 1.83 still it is noted that the dried fat effected the highest figures on the ranged sides. This means that the fat sources also have some effect but insignificantly felt.

3.4.1.2 The iodine number

The iodine number in the carcass fats, thigh, adipose and liver tissues. followed that of the dietary fat added. The chickens fed the dried fat attained numbers varied from 73.58 to 80.64 with the liver fat having the highest. This means that the quality and richness of the carcass fat in unsaturated fatty acids followed that of the dietary fat so closely. The heating of frying oil at $180 \pm 10C^{\circ}$ had significant effect on the iodine number of the oil and it is feeding showed a reduction in that of the carcass. These results are in agreement with those reported by **Bartov et al (1974).**

Table (5): The chemical properties of broiler fat of different experimental groups

Items	Raw oil groups			Heated oil groups		
	DFD	COD	FOD	$HFOD_8$	$HFOD_{24}$	$HFOD_{48}$
Thigh fats						
Acid value	2.5±0.31 a	2.07±0.17 e	2.2±0.06 d	2.1±0.12 d	2.03±0.15 c	2±0.15 b
Iodine number	74.42±1.02 a	107.2±1.11 d	109.57±0.84 b	106.97±1.42 bc	105.97±1.99 cd	103.13±0.89 d
Peroxide value	5.51±0.28 b	6.99±0.25 b	0.12±0.53 a	0.59±0.009 bc	0.61±0.012 c	0.62±0.015 c
Thiobarbituric acid	0.56±0.012	0.58±0.009	0.53±0.003	0.59±0.009	0.61±0.012	0.62±0.015
Adipose tissue fats						
Acid value	1.83±0.067 a	1.76±0.120 e	1.6±0.116 e	1.73±0.120 d	1.63±0.120 c	1.7±0.116 b
Iodine number	73.58±1.249 a	109.8±1.253 c	108.37±0.694 a	107.07±0.641 ab	106.52±2.190 b	103.44±0.768 d
Peroxide value	8.4±0.980 a	12.15±0.324 b	8.42±0.504 a	8.91±0.172 bc	10.21±0.413 d	14.36±0.385 d
Thiobarbituric acid	0.51±0.098	0.56±0.025	0.52±0.015	0.57±0.017	0.60±0.21	0.60±0.026
Liver fats						
Acid value	3.23±0.203 a	2.87±0.120 d	3.07±0.088 f	3±0.153 e	3.03±0.088 c	3.07±0.120 b
Iodine number	80.64±0.964 a	109.93±0.524 b	110.97±0.241 a	109.55±0.288 a	106.84±0.201 b	105.31±0.646 c
Peroxide value	8.58±0.349 a	13.05±0.403 ab	9.61±0.641 ab	9.98±0.332 ab	11.91±0.119 ab	16.63±0.784 b
Thiobarbituric acid	0.83±0.38	0.89±0.027	0.85±0.032	0.88±0.023	0.90±0.006	0.92±0.015

3.4.1.3- Peroxide value

The peroxide value may be used as and index of oxidative stability of meat lipids for measuring of primary products of lipid oxidation. The peroxide value of the carcass fat did not follow that of the dietary one to the degree that 17.81 in the dietary fat (FO H_8) showed a value of 6.25 less than that of the corn oil (3.41) which showed a value of 6.99. It seems that the bird body can cope with most of the ingested peroxides resulting in levels concentrated in the body fat. It was noted that the highest figures were recorded with corn oil and FOH_{48} in adipose and liver fats. The peroxide number in thigh, adipose tissue and liver indicate their susceptibility for oxidation. The decomposition of lipid hydroproxides involves a very complex set of reactions, volatile

breakdown products are formed. These breakdown products causing rancidity in foods. Lipid hydroperoxides can also condense into dimers and polymers, these high molecular weight materials can in turn oxidize and decompose into volatile breakdown products. The lipid hydroperoxides interact with proteins, membranes and biological components are of most concern to food chemists **(Bailey, 1984)**.

These reactions can affect vital cell functions by effecting damage to membranes, enzymes and proteins.

3.4.1.4- The thiobarbituric acid

The thiobarbituric acid numbers of the different treatments are presented in table (5). The results showed a significant elevation in TBA concentration in the thigh and adipose tissues of broilers fed diets containing 7.02% heated frying oils. This increment may be due to three factors: the first peroxidation of lipids rather than from absorption of malandialdehyde and other TBA-reactive substances from the gastrointestinal tract, secondly the lower concentration of tocopherol which is degraded by oxidation products in the intestinal lumen and the thirdly, the formation of unsaturated keto compounds in heated oils which may be absorbed and cause lipid peroxidation in vivo **(Sheehy et al., 1994)**.

Generally the feeding of diets containing thermally treated oils to broiler chicks may reduce storage stability of meat and meat products particularly those containing precooked or comminuted meat.

3.4.2- Total lipids, triglycerides and cholesterol in the thigh adipose tissue and liver

All obtained data in table (6) indicated that total lipids, triglycrides and cholesterol of thigh, adipose and liver tissues were not significantly affected by fat dietary treatments, indicating that an a role of fat sources and heat treated oils have no effect on carcass lipid fractions if used in poultry feed formulations.

Table (6): Total lipids, triglycerides and cholesterol in the thigh, adipose tissue and liver of different groups

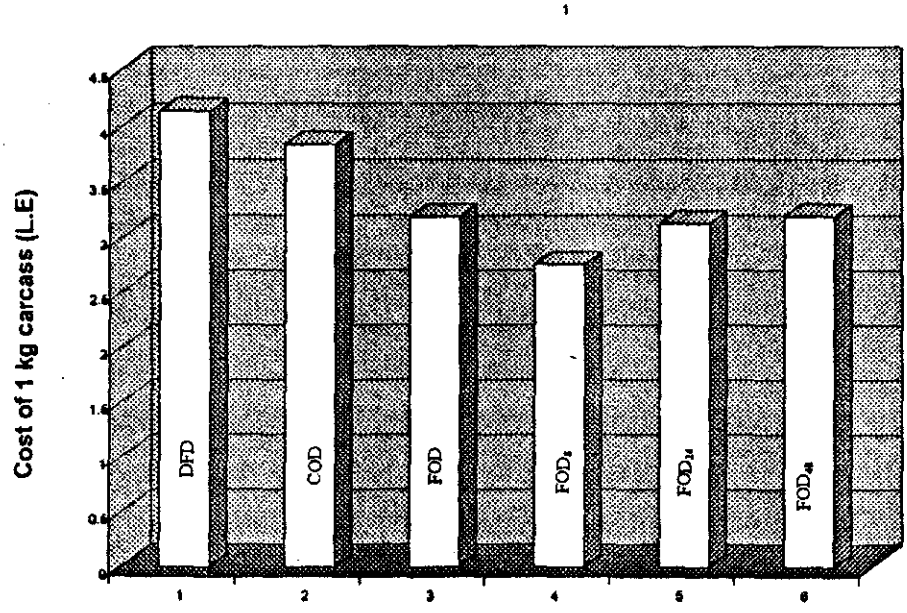
Items		Raw oil groups			Heated oil groups		
		DFD	COD	FOD	$HFOD_{8}$	$HFOD_{24}$	$HFOD_{48}$
Thigh							
Total lipid	g/100 g	10.96±1.93	849±1.44	10.73±0.91	10.47±0.53	9.18±0.89	6.64±0.85
Triglycerides	g/100 g	10.87±1.91	8.42±1.43	10.64±0.90	10.38±0.90	9.10±0.89	9.55±0.84
Cholesterol	Mg/100g	10.41±1.62	7.87±1.3	10.31±0.91	10.31±0.52	9.10±0.89	9.55±0.84
Adipose tissue							
Total lipids	g/100 g	71.09±2.33	69.72±1.98	73.53±0.63	72.50±1.21	72.56±2.88	76.82±2.92
Triglycerides	g/100 g	70.44±2.29	69.07±1.97	72.53±0.62	71.85±1.20	71.93±2.86	76.17±2.89
Cholesterol	Mg/100 g	72.60±2.29	67.11±2.11	72.06±0.99	72.70±0.076	73.15±2.45	78.60±3.28
Liver							
Total lipids	g/100 g	5.74±0.12	5.46±0.16	5.66±0.06	5.60±0.18	5.73±0.13	5.74±0.16
Triglycerides	g/100g	2.98±0.06	2.86±0.08	2.91±0.03	2.89±0.1	2.96±0.08	2.98±0.08
Cholesterol	Mg/100 g	356.83±4.61	309.19±4.61	336.93±5.21	341.75±10.93	349.28±8.73	419.04±27.97

3.5. Economical evaluation

From the economical point of view for broiler industry, nutrient requirements should be satisfied basing on monetary returns rather than maximum chick performance. The efficiency of each fat source as a diet ingredient meeting the energy requirement was estimated and presented in (table 7). It was found that during a 52 d-period the 8 h heated frying oil-diet was the most efficient in producing the most cheapest carcass. The length of heating period seemed to be effect. Generally the feeding of frying oil (raw or thermally heated) increase the maximum profit for meat production in broiler industry.

Table (7): Economical evaluation of different experimental diets

Items	DFD	COD	FOD	HFOD		
				$HFOD_8$	$HFOD_{24}$	$HFOD_{48}$
Cost of 1 kg feed intake (L.E)	1.1129	1.2182	1.1158	1.0076	1.0076	1.0076
Cost of feed intake at slaughter (L.E)	5.5223	6.0275	5.8331	4.7522	5.0979	4.9331
Cost of 1 kg carcass (L.E)	4.1294	3.8331	3.18	2.7547	3.1276	3.1865



(Fig. 3): Economical evaluation of different experimental diets

3.11 Histological examination of internal organs

3.11.1- Liver

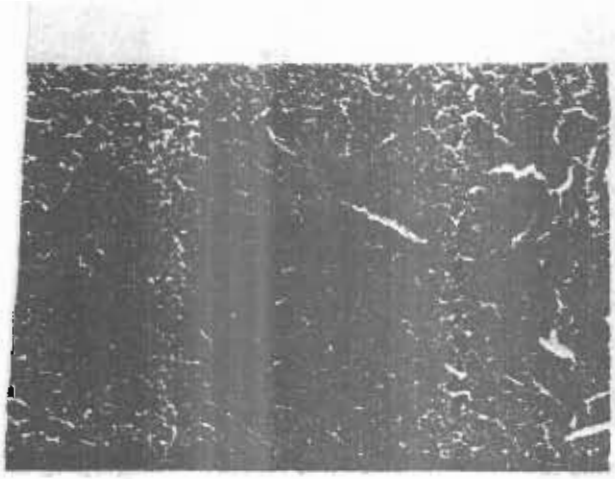
The Histological examination of liver is presented in photo(1-6)

The Histological examination of liver revealed a change in hepatic sinusoids and presence of mononuclear cells. The diets containing dried fat, corn oil and frying oil heated for 24 and 48 hr. showed severe dilatation in the hepatic sinusoids which engorged with blood since firstly the long heating of frying oil produce toxic products in the liver secondly many outers speculated that - tocopherol is degraded in the liver membrane by oxidation products resulting from oil heating and suggested that unsaturated keto compounds formed in heated oils such as 12-keto oleate may be absorbed and causes lipid peroxidation of liver cell membrane. The finding is supported by those of **Sollman et al. (1988)** who indicated that oxidized soybean oil reduced vitamin E concentration in plasma and in liver tissues by 40- 60%.

Histopathological finding of broiler chicks fed diets containing different oils

1- Liver

	Hepatic sinusoids	Mononuclear leucocytic cells
Dried fat	Severe dilatation Engorged with blood	Focal aggregations
Corn oil	Severe dilatation Engorged with blood	Heavy manner of aggregation
Frying oil	Mild dilatation	Few aggregations
Heated frying oil		
8 hrs	Dilatation	Focal aggregations
24 hr	Dilatations Engorged with blood	Aggregation in the portal
48 hr	Dilatation Engorged	Focal aggregations in the hepatic tissue



hoto 1: Liver of chickens fed diet containing dried fat (H & E x 160)

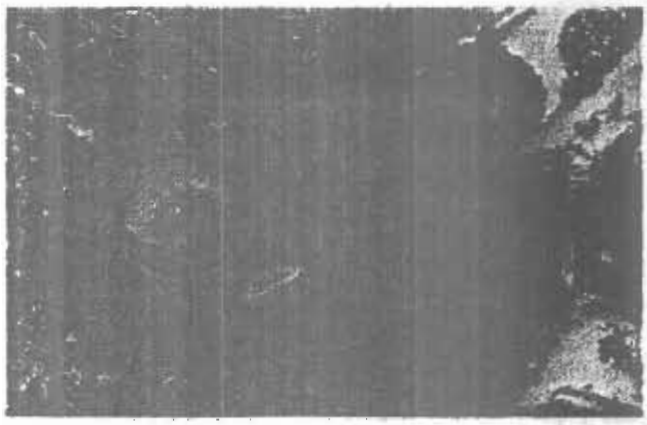


Photo 2: Liver of chickens fed diet containing corn oil (H & E x 160)

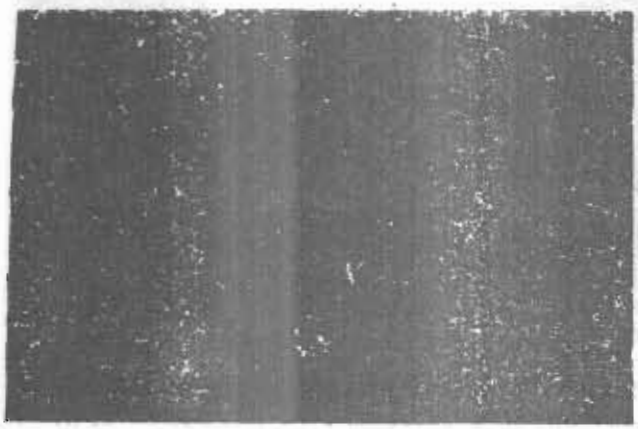


Photo 3: Liver of chickens fed diet containing frying oil (H & E x 160)

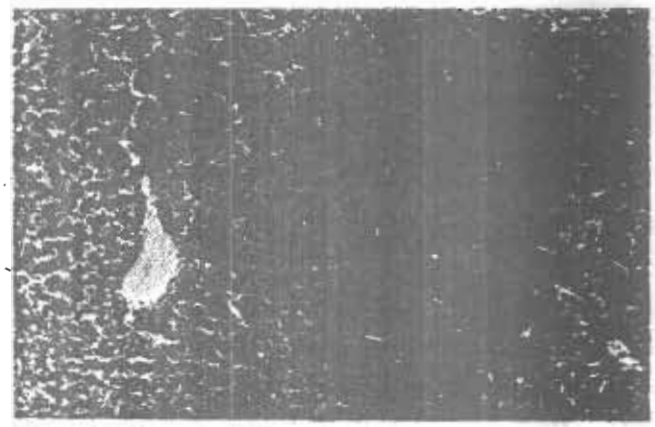


Photo 4: Liver of chickens fed diet containing frying oil heated for 8 hours. (H & E x 160)

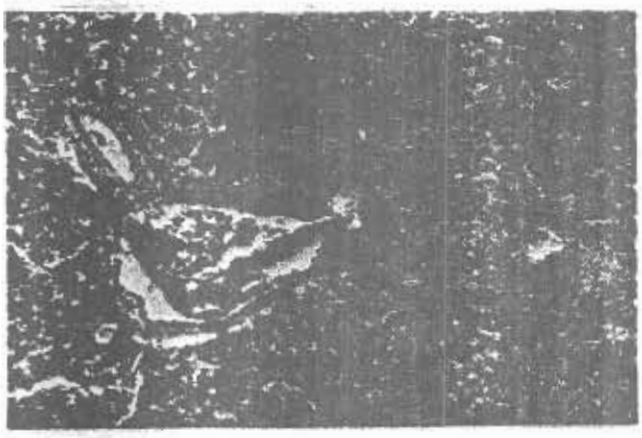


Photo 5: Liver of chickens fed diet containing frying oil heated for 24 hours (H & E x 160)

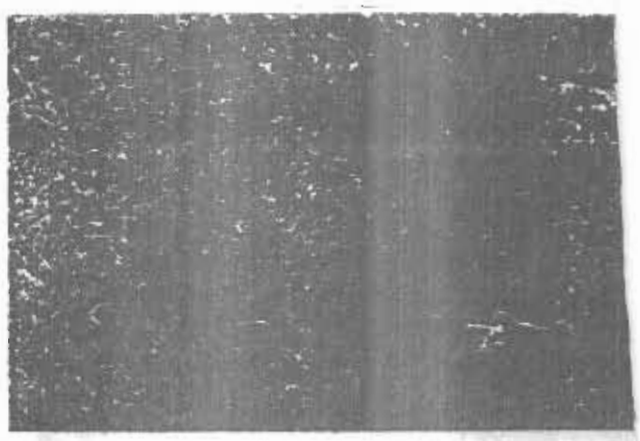


Photo 6: Liver of chickens fed diet containing frying oil heated for 48 hours (H & E x 160)

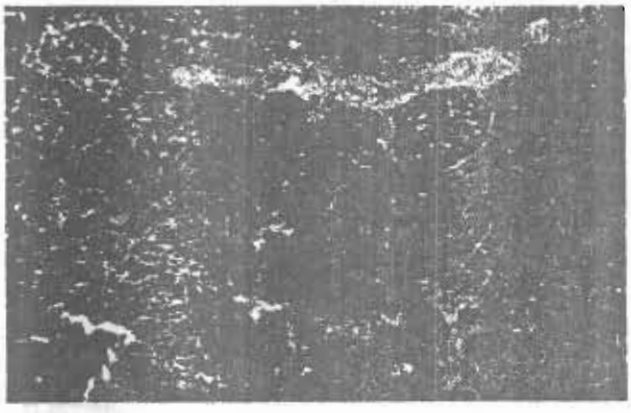


Photo 7: Spleen of chickens fed diet containing dried fat (H & E x 160)

Photo 8: Spleen of chickens fed diet containing corn oil (H & E x 160)

2- Spleen

The spleen of all different experimental groups were evaluated histopathologically. A summary of histopathologic analysis of spleen is shown in photo (7-12) where the results are reported as depletion of lymphocyte in the spleen of all broiler chicks fed diet containing 7.02% fat or oils. The depletion of lymphocyte may be due to aggregation of cells outside of the spleen in different organs e.g. liver. The heating of frying oil for 8,24 and 48 hrs did no produce other Histopathological changes when feeding for broiler chicks.

3- Heart

The Histopathological studies of heart is shown in photo (13-16). Where the results are reported in broiler chick. In the group fed diets containing frying oil for 48 hours, an abnormal response occurs which represented by hypertrophy in the myocardial muscle cells. This may be attributed to effect of toxic materials of frying oils for 48 h on the cell membranes of blood vessels outside the heart and causes more heart muscle function. (hypertrophy).

2- Heart and Spleen:

	Heart	Spleen
Dried fat	Mild myocardial hyperemia was detected	The splenic sinosoids were engorged with red blood cells
Corn oil	Slight dilatation in the myocardial capillaries was noticed	There was depletion in lymphocytes of the white pulps while focal aggregation of mononuclear leukocytes were noticed in the form of round circumscribed manner associated with thickening in the wall of the blood vessels.
Frying oil	Esinophils and mononuclear leucocytic cells were infiltrated the myocardial bundles in focal manner	Slight hyperemia all over the splenic red pulps while the white pulps showed severe depelation in the lymphoid cells.
Heated frying oil for 8 h	There was slight depression in the myocardial muscle bundles in association with hyperemic myocardial vessels.	Depletion in the lymphocytes of the white pulps was detected
Heated frying oil for 24 h	Fine granulate was observed in the sarcoplasm of the myocardial bundles	Depletion in the lymphoid cells.
Heated frying oil for 48 h.	The myocardial muscle cells showed hypertrophy	Lymphoid depletion was noticed in the white pulps.

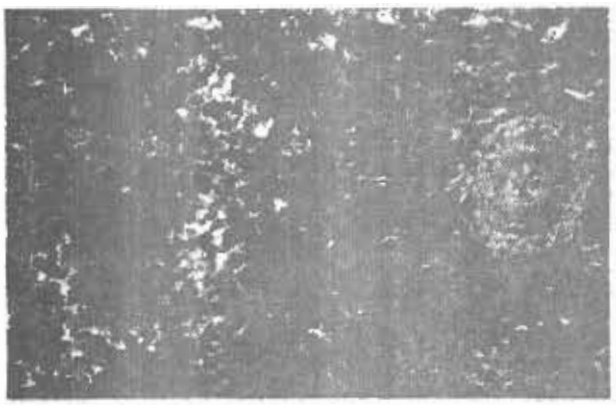


Photo 9: Spleen of chickens fed diet containing frying oil (H & E x 160)

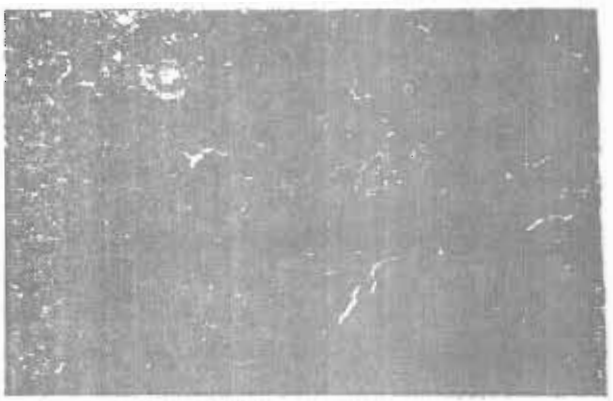


Photo 10: Spleen of chickens fed diet containing frying heated for 8 hours. (H & E x 160)

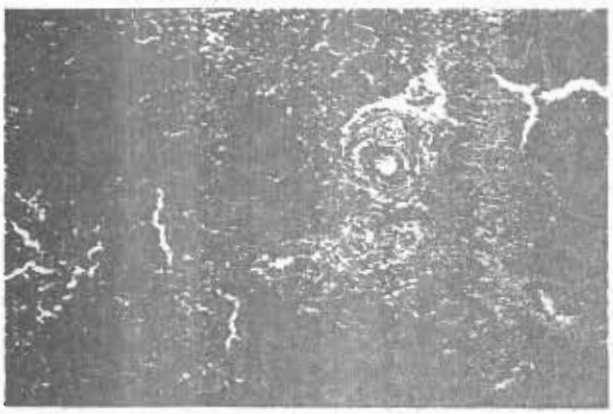


Photo 11: Spleen of chickens fed diet containing frying oil heated for 24 hours. (H & E x 160)

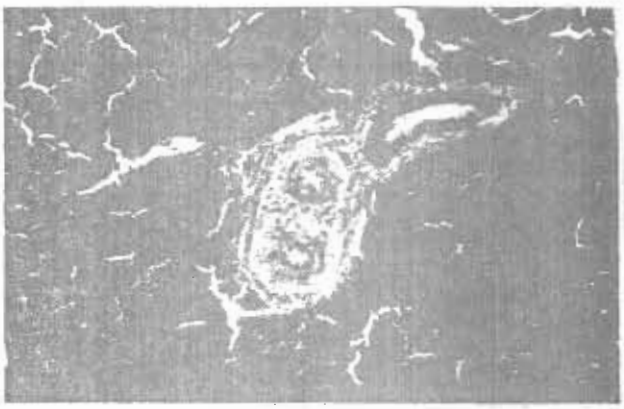


Photo 12: Spleen of chickens fed diet containing frying oi heated for 48 hours. (H & E x 160)

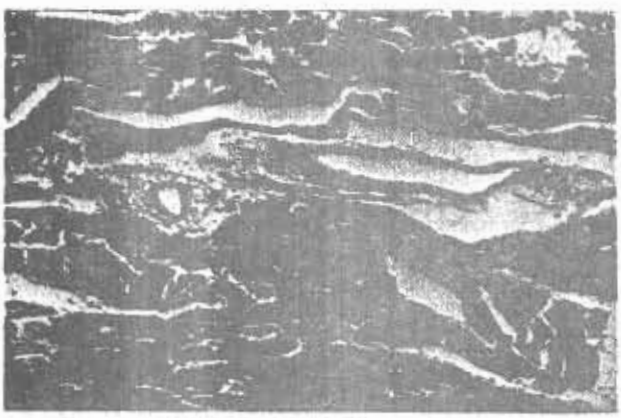


Photo 13 : heart of chickens fed diet containing dried fat (H & E x 160)

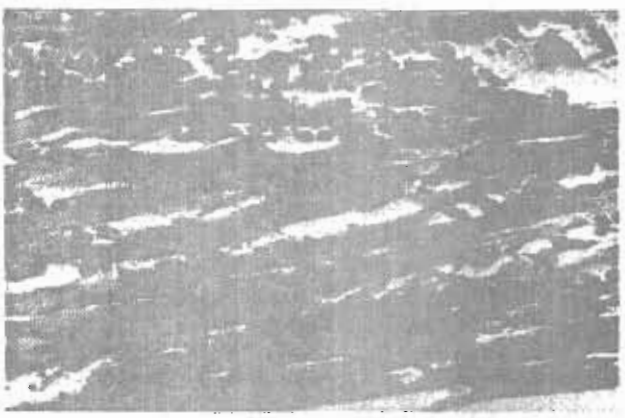


Photo 14 : heart of chickens fed diet containing frying oil (H & E x 160)

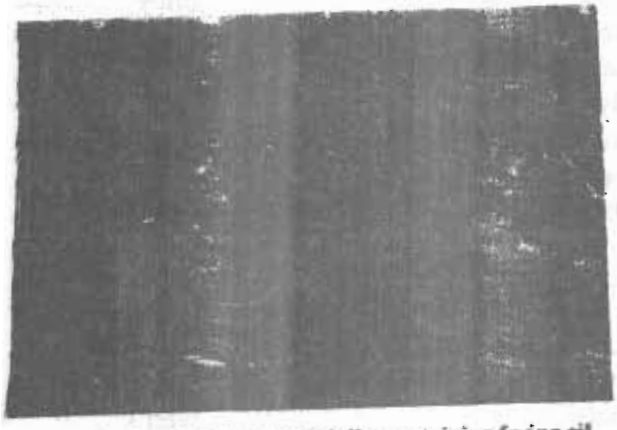


Photo 15 : heart of chickens fed diet containing frying oil heated for 8 hours. (H & E x 160)

Photo 16 : heart of chickens fed diet containing frying oil heated more than 8 hours. (H & E x 160)

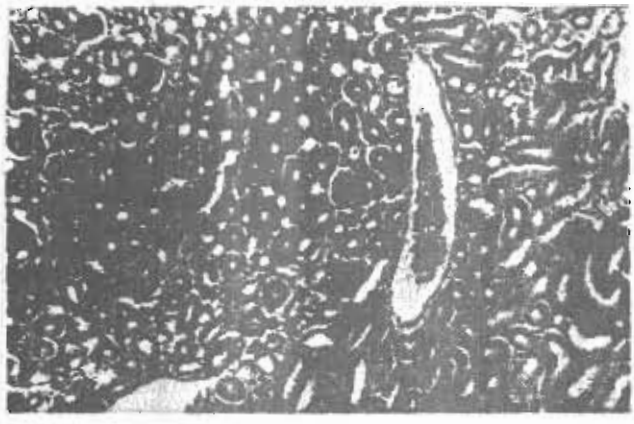


Photo 17 :kidney of chickens fed diet containing corn oil (H & E x 160)

Photo 18 :kidney of chickens fed diet containing frying oil (H & E x 160)

4- Kidney

The Histopathological examination of kindney is presented in photo(17,18). The examination revealed that hyperemia in dried fat and or infiltration of mononuclear leucocytic cells in corn oil. On other hand the heating of frying oil at 180±10c° for 8,24 and 48 h causes slight dilatation in capillaries (8h) and hyperemia of blood vessels (24 h). The gromeruli of chick kidney feds diet containing dried fat and heated oil for 48 h. showed hypertrophy and atrophy and this may be attributed to toxic materials present in the fat or oils due to thermal treatment.

3- Kidney

	Blood renals and lymphocyte	Gromeruli
Dried fat	Hyperemia of blood vessels	Some glomerular tufi showed proliferation with hypertrophy and other showed atrophy
Corn oil	Hyperemia in allover the blood vessels Mononuclear leucocytic inflammatory cells infiltration in focal manner.	
Frying oil	Focal aggregation of lymphocyte	Hypertrophy in the glomeruli
Heated frying oil for 8 hrs	Slight dilatation in capillaries	
Heated frying oil for 24 hr.	Hyperemia of blood vessels	
Heated frying oil for 48 hr.		Some of glomeruli were atrophied and others showed hypertrophied

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