J. Agric. Sci. Mansoura Univ., 27(10): 7127 - 7136, 2002

EFFECT OF FRESH AND HEATED CORN OIL FEEDING ON LIPID METABOLISM IN RATS

Taha, K.M.
Dept. of Agrc. Biochemistry, Fac. of Agric., Minufiya Univ.

ABSTRACT

The aim of this study was to examine the effect of feeding diets containing heated corn oil (HCO) for a long period (10 hours) on the total cholesterol (TC), triglycerides (TG) and the total phospholipids (PL) content and the fatty acids pattern in liver, aorta and plasma in a comparison with diets containing fresh corn oil (FCO) in rats. TC and TG content in the liver after one week HCO-feeding increased while PL decreased. TC, TG and PL content decreased in aorta and increased in plasma under the same period of HCO- feeding. After six weeks of HCO-Feeding TC increased acutely in liver and aorta tissues whereas they decreased in plasma. PL decreased in liver and plasma by 21.1% and 35.9% respectively and increased in aorta by 126.1% under the same conditions. TG decreased in liver and aorta tissue, while they increased in plasma. The unsaturated, saturated fatty acids (US/S) ratio and essential fatty acids (E.F.A.) specially linoleic acid decreased after one week and decreased more and more after six weeks of HCO-feeding, when they compared by FCO- feeding. So it can be concluded that feeding on long period heated oils led to harmful effect in experimental animals as hypercholesteremia and deficiency of essential fatty acids, which are necessary for many biological processes.

INTRODUCTION

Free radical – induced lipid peroxidation, has been proposed as an etiological factor in atherosclerosis (Henning and Chow 1988, Naito *et al.*, 1993) A direct correlation between lipid peroxidation in the aorta and the severity of atherslerotic lesions has been detected in humans (Piotrowski *et al.* 1990), and experimental animals (Loeper *et al.* 1984, Mowri. *et al.* 1986). Polyunsaturated fats have been widely used to lower serum cholesterol levels and thus to prevent the development of atherosclerosis. However, polyunsaturated fatty acids (PUFAs) are easily susceptible to peroxidation, and a high intake of dietary PUFAs might overwhelm the normal antioxidant defenses of the organism (Iritani *et al.* 1980, Nardini *et al.* 1993), and stimulates lipid peroxidation in liver, plasma, and aorta (Bulur *et al* 1995).

The biological study revealed that animals fed heated oil showed retardation of growth, poor efficiencies, rough, greasy mottled coats and shortened life span of experimental animals (EL-Shattory *et al.* 1991). Corcos Bendetti *et al.* (1990) indicated that heated unsaturated oil produces reduction in the ability of the antioxidative defence system and that vitamin E status is the earlist indicator of the oxidative effect regardless of age.

Shibayama (1992) reported that ingestion of heated and oxygenated corn oil induce hepatic injury, and that the development of hepatic injury may be related to liver cell membrane damage due to active oxygen radicals contained in heated and oxygenated corn oil. Howell *et al.* (1998) suggested that phytosterols are partially responsible for the differences in plasma

cholesterol levels and synthesis observed between polyunsaturated and mono unsaturated oils feeding in human. Gabriele (2000) concluded that high dietary conjugated linoleic acid (CLA) paralleled with controlled amounts of food exhibited alterations of phospholipid- specific fatty acids composition and phospholipid class distribution responses in rats.

The present investigation was undertaken to study the effect of long period heated oil feeding (corn oil) on the liver, aorta and plasma lipids content (phospholipids, triglycerides and cholesterol) and their fatty acids pattern when they compared with fresh oil feeding in rats.

MATERIALS AND METHODS

Refined corn oil free from additive anti-oxidants (about 4 Liter), was obtained from Cairo factory for oils and soaps production. About one half of this oil sample was heated at 170oC for 10 hours continuously then cooled to room temperature and stored in a dark place.

Animals: Male albino rats of three weeks old each weighing 60-70 gm were used in the experiment and classified into two main groups, each of 24 rats, and fed fresh diets (containing fresh or heated corn oil) daily. The animals had free access to food and water throughout the study. Each group was subclassified into two subgroups, the first was fed the diet for one week and the second for six weeks. The diet consisted of (g/100g):

Sucrose 20.0, corn starch 37.5, casein 20.0, cellulose 1.0 vitamin mixture 1.5, salt mixture 5.0 and diet oil 15.0 (Thomassen *et al.* 1979). After the feeding periods, rats were fasted overnight and sacirfied under ether anesthesia. Blood was taken by cardic puncture and serum was separated by centrifugation. Liver and aorta was removed, rinsed in ice-cold saline, blotted, wheighed, and stored at – 20oC until analysis of Lipids.

Lipids were extracted from serum and tissues by the method of Folch *et al.* (1957).

Total lipids were fractionated by thin layer chromatography (T.L.C.) according to Webster (1967). Serum, aorta and liver cholesterol were quantitated by the method of Searcy and Bergquist (1960), phospholipids were estimated by the method of Stewart (1980) and triglycerides by the method of Fletcher (1968). Fatty acids were methylated according to Morrison and Smith (1963), then analyzed by gas-liquid chromatography, Model GC H CM, Shinadzu as reported by Ali (1988).

RESULTS

Liver, aorta and plasma lipids :

It is obvious from the fatty acids (F.A.) composition of fresh and 10 hours heated corn oil (Table 1) that heating decreased the unsaturated F.A percentage specially polyunsaturated F.A.

Table (1) : Fatty acids pattern of Fresh and (10 hr) Heated Corn oil (expressed as percent of the Total F.A.)

F.A	Fresh Oil	Heated Oil
C14:0	0.45	1.43
C16:0	11.95	15.35
C16:1	0.47	0.45
C18:0	3.34	5.59
C18:1	29.27	28.55
C18:2	52.62	46.95
C18:3	1.18	0.85
C20:0	0.75	0.83
USFA	83.54	76.80
SFA	16.46	23.20
US/S	4.27	3.31
Unsaturation	138.52	125.45
E.F.A.	53.80	47.85

USF.A. = Unsaturated fatty acids
S.F.A. = Saturated fatty acids
E.F.A. = Essential fatty acids
US/S = The ratio of unsaturated fatty acids / saturated fatty acils.

In Table (2) liver total cholesteol (TC) and triglycerides (TG) increased by 12.5% and 28.8% respectively while total phospholipids (PL) decreased by 17.8% after one week heated corn oil feeding when it compared by fresh corn oil feeding which had the values of 1.76, 3.54 and 21.42 mg/gm wet tissue for TC, TG and PL respectively. After six weeks feeding by heated corn oil (HCO) only TC increased in a high percentage (47.3%) while both TG and PL decreased markedly (-8.4% and – 21.1% respectively) when compared with fresh corn oil (FCO) feeding (1.48, 8.97 and 27.81 mg/gm wet tissue respectively). Generally TC, TG and PL values in liver increased after six weeks feeding by both FCO and HCO while total cholestcrol in FCO feeding was decreased.

Table (2) : liver total cholesterol (TC), triglycerids (TG) and phospholipids (Pl) under the effect of fresh and (10 hr) heated corn oil for one and six weeks. (the values expressed as mg/gm wet tissue)

Time of Feeding	One week			Six weeks		
Lipid Fraction	Fresh oil	Heated oil	Change %	Fresh oil	Heated oil	Change %
TC	1.76	1.98	+12.5	1.48	2.18	+47.3
TG	2.54	5.46	+28.8	8.97	8.22	-8.4
PL	21.42	17.36	-17.8	27.81	21.93	-21.1

In aorta (Table 3) TC, TG and PL decreased by (64.3%, 35.5% and 22.2% respectively) after fed on HCO for one week in a comparison with

FCO feeding. In reverse TC, and PL increased by ratio of (29.1% and 126.1% respectively) after six weeks feeding by HCO whereas TG decreased by (8.9%) when it compared with FCO feeding. TC, TG and PL values decreased clearly after six weeks FCO feeding than one week but TC value increased, TG value had slight decrease and PL decreased markedly after six weeks HCO feeding when they compared by one week feeding.

Table (3): Aorta total cholesterol (TC), triglycerides (TG) and phospholipids (PL) under the effect of fresh and (10hr) heated corn oil for one and six weeks (the values expressed as mg/gm wet tissue).

Time of Feeding	One week			Six Weeks		
	Fresh oil	Heated oil	Change %	Fresh oil	Heated oil	Change %
TC	3.49	1.21	-64.3	2.61	3.37	+29.1
TG	50.28	32.45	-35.5	35.12	31.98	-8.9
PL	22.03	17.15	-22.2	5.32	12.03	+126.1

Table (4) showed that plasma TC, TG and PL increased by (38.9%, 43.5% and 29.3% respectively) in rats fed on HCO than those fed on FCO for one week which have the values of 0.18, 0.62 and 1.23 mg/ml plasma respectively.

After six weeks feeding by HCO, TC and PL decreased by (18.5% and 35.9% respectively) but TG increased by (47.6%) when they compared with FCO feeding. Generally, TG values in both FCO and HCO feeding decreased after six weeks than those of one week feeding, while TC and PL values increased after six weeks feeding by FCO and decreased when rats fed on HCO.

Table (4): Plasma Total cholesterol (TC), triglycerides (TG) and phospholipids (PL) under the effect of fresh and (10 hr) heated corn oil for one and six weeks (the values are expressed as mg/ml plasma).

Time of Feeding	One week			Six Weeks		
Lipid Fresh oil	Fresh Oil	Heated oil	Change %	Fresh oil	Heated Oil	Change %
TC	0.18	0.25	+38.9	0.27	0.22	-18.5
TG	0.62	0.89	+43.5	0.21	0.31	+47.6
PL	1.23	1.59	+29.3	1.53	0.98	-35.9

Fatty acids pattern of tissue lipids :

Under FCO and HCO feeding for one week the main fatty acids for liver (Table 5) were oleic (C18:1), Linoliec (C18:2), palmitic (C16:0) and stearic (C18:0). The percent of essential fatty acids (E.F.A.) in Liver cholesterol ester (CE), TG and PL were 29.93, 27.77 and 11.99% of total fatty acids respectively under FCO feeding and they were 24.35, 22.75 and

9.81%. of total fatty acids at the same manner under HCO feeding. In comparison with FCO feeding decreased the ratio of unsaturated / saturated fatty acids (US/S) markedly under feeding with HCO, where their values for CE, TG and PL were 2.26, 1.79, 1.39 respectively.

Table (5) : Fatty acids (F.A.) Pattern of Liver under the effect of one week feeding of fresh and (10 hr) heated corn oil (expressed as percent of the total F.A.).

F.A.	Fresh oil			Heated oil		
	CE	TG	PL	CE	TG	PL
C14:0	1.72	0.21	2.88	2.16	0.65	4.08
C16:0	19.39	19.93	20.41	22.91	22.43	23.24
C16:1	3.12	3.44	4.04	3.80	3.27	3.11
C18:0	3.80	8.78	11.15	4.62	12.79	14.55
C18:1	42.20	39.90	49.53	41.20	38.11	45.21
C18:2	27.50	27.10	10.59	22.53	22.28	8.77
C18:3	2.43	0.64	1.40	1.82	0.47	1.04
C20:0	0.84	-----	----	0.96	-----	-----
USFA	75.25	71.08	65.56	69.35	64.13	58.13
S.F.A.	24.75	28.92	34.44	30.65	35.87	41.87
US/S	3.04	2.46	1.90	2.26	1.79	1.39
Unsaturation	107.61	99.46	79.95	95.52	87.35	68.98
E.F.A.	29.93	27.74	11.99	24.35	22.75	9.81

USFA = unsaturated fatty acids .
SFA = Saturated fatty acids.
US/S = The ratio between unsaturated and saturated fatty acids.
E.F.A. = Essential fatty acids. CE = Cholesterol ester

Table (6): Fatty acids pattern of liver under the effect of six weeks feeding of fresh and (10 hr) heated corn oil. (expressed as percent of the total F.A.)

F.A.	Fresh oil			Heated oil		
	CE	TG	PL	CE	TG	PL
C14:0	0.81	0.36	2.97	2.54	1.14	6.45
C16:0	22.57	21.39	23.15	25.76	23.68	25.93
C16:1	6.12	1.69	3.66	5.79	1.62	3.05
C18:0	3.52	7.29	11.76	4.92	9.57	12.57
C18:1	30.20	45.79	46.25	37.41	43.10	43.54
C18:2	22.67	23.05	8.81	20.17	20.47	6.71
C18:3	4.03	0.43	3.40	2.18	0.32	1.75
C20:0	1.08	-----	----	1.23	------	-----
U.S.F.A.	72.02	70.96	62.12	65.55	65.61	55.05
S.F.A.	27.98	29.04	37.88	34.45	34.39	44.95
US/S	2.57	2.44	1.617	1.90	1.91	1.22
Unsaturation	102.75	94.87	77.73	90.08	86.92	65.25
E.F.A.	26.70	23.48	12.21	22.35	20.89	8.46

USFA = unsaturated fatty acids . SFA = Saturated fatty acids.
US/S = The ratio between unsaturated and saturated fatty acids.
E.F.A. = Essential fatty acids. CE = Cholesterol ester

Table (7) ; Fatty acids pattern of aorta under the effect of one week feeding of fresh and (10 hr) heated corn oil (expressed as percent of the total F.A.)

F.A	Fresh oil			Heated oil		
	Ce	TG	PL	CE	TG	PL
C14:0	1.53	1.42	3.43	6.85	3.89	8.87
C16:0	22.14	24.85	21.53	24.52	27.93	23.04
C16:1	10.60	2.43	3.45	8.78	2.06	2.63
C18:0	9.40	11.53	12.90	13.64	16.97	18.14
C18:1	45.44	29.93	43.36	38.29	25.57	35.16
C18:2	6.40	27.82	7.39	4.91	21.79	5.38
C18:3	1.26	0.73	2.12	0.82	0.53	1.29
C20:0	2.23	1.29	5.81	2.19	1.27	5.49
U.S.F.A.	63.7	60.91	56.32	52.8	49.94	44.46
S.F.A.	36.3	39.09	43.68	47.2	50.06	55.54
US/S	1.75	1.26	1.29	1.12	1.00	0.80
Unsaturation	72.62	90.29	67.95	59.35	72.78	50.42
E.F.A.	7.66	28.55	9.51	5.73	22.31	6.67

USFA = unsaturated fatty acids . SFA = Saturated fatty acids.
US/S = The ratio between unsaturated and saturated fatty acids.
E.F.A. = Essential fatty acids. CE = Cholesterol ester

Table (8): fatty acids pattern of aorta under the effect of six weeks feeding of fresh and (10 hr) heated corn oil (expresse as percent of total F.A.)

F.A.	Fresh oil			Heated oil		
	CE	TG	PL	CE	TG	PL
C14:0	3.13	2.32	4.10	6.65	5.69	10.84
C16:0	24.85	26.64	25.42	25.02	29.74	25.21
C16:1	11.85	6.68	2.56	11.22	5.80	1.95
C18:0	15.42	3.76	16.76	18.43	6.39	21.35
C18:1	36.31	34.15	36.26	32.07	29.95	28.85
C18:2	3.89	24.50	5.55	3.11	20.46	4.19
C18:3	1.87	1.02	2.51	1.09	0.87	1.47
C20:0	2.68	0.93	6.84	2.41	1.10	6.14
U.S.F.A.	53.92	66.35	46.88	47.49	57.06	36.46
S.F.A.	46.08	33.65	53.12	52.51	42.92	63.54
US/S	1.17	1.97	0.88	0.90	1.33	0.57
Unsaturation	61.55	92.89	57.44	52.78	79.28	43.59
E.F.A.	5.76	25.52	8.06	4.20	21.33	6.66

USFA = unsaturated fatty acids .
SFA = Saturated fatty acids.
US/S = The ratio between unsaturated and saturated fatty acids.
E.F.A. = Essential fatty acids. CE = Cholesterol ester

Table (9) : fatty acids Pattern of plasma under the effect of one week feeding of fresh and (10 hr) Heated corn oil. Expressed as percent of total (F.A.)

F.A.	Fresh oil			Heated oil		
	CE	TG	PL	CE	TG	PL
C14:0	----	0.82	1.89	0.68	1.79	3.16
C16:0	23.47	20.56	18.79	25.51	2592	20.15
C16:1	15.01	6.79	8.31	12.11	6.50	7.16
C18:0	12.80	4.15	6.45	16.25	5.99	9.17
C18:1	41.39	43.32	51.17	38.84	40.13	47.91
C18:2	6.59	23.77	6.42	6.06	19.18	5.14
C18:3	0.74	0.59	1.58	0.55	0.79	1.17
C20:0	------	------	5.39	--------	--------	6.14
U.S.F.A.	63.73	74.47	67.48	57.58	66.3	61.38
S.F.A.	36.27	25.53	32.52	42.42	33.7	38.62
US/S	1.75	2.92	2.08	1.36	1.97	1.59
Unsaturation	71.8	99.42	77.06	64.72	86.46	68.86
E.F.A.	7.33	24.26	8.0	6.61	19.67	6.31

USFA = unsaturated fatty acids .
SFA = Saturated fatty acids.
US/S = The ratio between unsaturated and saturated fatty acids.
E.F.A. = Essential fatty acids.
CE = Cholesterol ester

Table (10) : Fatty acids pattern of plasma under the effect of six weeks feeding of fresh and (10 hr) heated corn oil (expressed as percent of the total F.A.).

F.A.	Fresh oil			Heated oil		
	CE	TG	PL	CE	TG	PL
C14:0	0.57	1.01	3.10	1.34	2.74	8.32
C16:0	27.59	23.69	21.19	29.78	30.07	25.05
C16:1	20.08	7.58	6.72	17.28	6.52	5.23
C18:0	15.28	5.89	6.49	25.06	8.55	10.08
C18:1	31.59	40.33	46.93	23.40	35.30	38.32
C18:2	3.82	20.56	4.21	2.55	16.22	3.01
C18:3	1.07	0.94	2.47	0.59	0.60	1.46
C20:0	-------	-------	8.89	------	------	8.53
U.S.F.A.	56.56	69.41	60.33	48.82	58.64	48.02
S.F.A.	43.44	30.59	39.67	56.18	41.36	51.98
US/S	1.30	2.27	1.52	0.77	1.42	0.92
Unsaturation	62.52	91.85	69.48	45.55	76.06	53.95
E.F.A.	4.89	21.5	6.68	3.14	16.82	9.99

USFA = Unsaturated fatty acids . SFA = Saturated fatty acids.
US/S = The ratio between unsaturated and saturated fatty acids.
E.F.A. = Essential fatty acids. CE = Cholesterol ester

Chronic feeding for six weeks by either FCO or HCO (Table 6) produced no great change in fatty acids pattern of liver. However the percentage of C14:0 and C18:3 in CE and PL increased. US/S ratio and E.F.A. decreased slightly in both cases.

Fatty acids Pattern of aorta and plasma under FCO. and HCO. feeding for one and six weeks (Tables 7, 8, 9 & 10) indicated that the main fatty acids were C18:1, C16:0, C18:0, C18:2 and C16:1 in both CE and PL but in TG occupied C18:2 the order of C16:0. Lauric acid (C14:0) increased acutely under HCO feeding for one and six weeks specially in CE and PL in comparison with FCO feeding. US/S ratio and E.F.A. percentage had great decrease under HCO feeding if compared with FCO feeding. It can be observed that US/S ratio decreased markedly after six weeks under FCO and HCO feeding in EC and PL if compared with one week feeding but they increased in TG.

DISCUSSION

It was found that total cholesterol increased markedly in liver and aorta tissues specially after long period of HCO feeding but it decreased in plasma if compared with FCO feeding. Thus heating of corn oil led to decrease in linoliec acid percentage which inhibits cholesterol synthesis in liver. Cholesterols decreased in plasma as a result of its precipitation in aorta tissue. Studies in animals (Del Boccio *et al.* 1990 and Uysal *et al.* 1988), and humans (Yalcin *et al.* 1989) have shown that there is close relationship between lipid peroxidaion and hypercholesterimia.

HCO feeding caused decrease in TG of liver and aorta while the level increased in plasma indicating the decrease of lipid synthesis in tissues and increase in consumption of low density lipoprorteins (LDL) which carry TG from liver to the terminal tissues through blood plasma. The deficiency of linoleic acid and the increase of short chain fatty acids by corn oil heating may clarify the decrease of PL percentage after HCO feeding when they compared with FCO feeding.

Free radical induced lipid peroxidation (Henning and Chow 1988 and Naito *et al.* 1993). High intake of dietary polyunsaturated fatty acids (PUFAs) specially when they were heated for a long time might overwhelm the normal antioxidant defenses of the organism (Nardini *et al.* 1993 and Young and pathasaraty 1994). This may interpret the great decrease of US/S ratio and E.F.A percentage in Liver, aorta and plasma in animals fed with HCO compared with those fed on FCO.

REFERENCES

Ali, A.M.F. (1988). Sterol esters and normal hydrocarbons of some vegetable oils. Menofiya J. Agric. Res. 3:2063-2077.

Bulur, H.;G. Ozdemirler, O.Buge, G.Toker, M. Ozturk,and Mouysal (1995). High cholesterol diet supplemented with sunflower oil but not olive oil stimulates lipid peroxidation in plasma, liver and aorta of rats. J. Nutr. Biochem. 6:547-550.

Corcos Bendetti, P., M. Difelice; V. Gentili ; B. Tagliamonte and G. Tomassi (1990). Influence of dietary thermally oxidized soybean oil on oxidative status of different ages.

Del Boccio, G.; D. Lapenna ; E. Porreca ; A. Pennelli ; F. Savini ; P. Felicani and F.Cuccurullo (1990). Aortic antioxidant defense mechanisms: Time related in cholesterol fed rabbits. Atherosclerosis, 81, 127-135.

EL- Shattory, Y.; S-Hegazy; M.M. Soliman and S.M. Aly (1991). Heated Fats. Part 3: Biological effect of heating and tempering oils on fatty acid composition of liver, heart and serum lipids of rats. Nahrung; 35 (10): 1007-12.

Fletcher, M.J. (1968). A colorimetric method for estimating serum triglyeerides. Clin. Chem. Acta. 22, 303-307.

Folch, J.; M. Lee, andG.H. Sloane-Stanley (1957) A simple method for isolation and purification of total lipids from animal tissues. J. Biol. Chem. 226,497-507.

Gabriele. I.S. (2000). High dietary levels of a conjugated Linoliec acid mixture alter hepatic glycerophospholipid class profile and cholestrerol – carrying serum lipoproteiens of rats. J. Nutr. Biochem. 11:184-191.

Hennig, B. andC.K. Chow (1988). Lipid peroxidation and endothelial cell injury: Implications in athorosclerosis. Free Radical Biol. Med. 4, 99-106.

Howell, T.J.; D. E.Macdougall and P.J.H. Jones (1998). Phytosterols partially explain differences in cholesterol metabolism caused by corn or olive oil. Feeding. J. Lipid Res. 39:892-900.

Iritani, N.; E. Fukuda and Y. kitamura (1980). Effect of corn oil Feeding on lipid peroxidation in rats. J. Nutr. 110, 924-930.

Loeper, J., J. Emerit, J. Goy, L. Rozensztain, and M. Fragny (1984). Fatty acids peroxidation during experimental atheroma. Silicom action. Path. Biol. 32, 693-697.

Morrison, M.R. and M. Smith (1963). Preparation of fatty acid methyl esters and dimethyl acetyls from lipids with boron fluoride – methanol. J. Lipid Res. 5, 600-608.

Mowri, H, K. Chinen, S. Ohkuma and T. Takano (1986). Peroxides lipids isolated by HPLC from atherosclerotic aorta. Biochem. Int., 12, 347-352.

Naito, C., M. Kawamura, and Y. Yamamoto (1993). Lipid peroxides as intiating factor of atherosclerosis. Ann. N.Y. Acad Sci 676, 27-45.

Nardini, M; C.D. Saccini, M. Aquino, P.C. Benedetti and G. Tomassi (1993). Lipid peroxidation in liver microsomes of ats fed soybean, olive and coconut oil. J. Nutr. Biochem. 4, 39-44. Piotrowski, J.J., G.C. Hunter, C.D. Eskelson, M.A. Dubick, and V.M. Bernhard (1990). Evidence for lipid peroxidation in atherosclerosis. Life Sci, 46, 715-721.

Searcy, R.L. and L.M. Bergquist (1960). A new colour reaction for the quantification of serum cholesterol. Clin. Chim. Acta. 5, 192-199.

Shibayama, Y. (1992). Hepatotoxicity of heated and oxygenated corn oil. Exp. Toxicol Pathol., 44 (5) 255-8.

Stewart, J.C.M. (1980). Colorimetric estimation of phospholipids with ammonium ferrothicyanate. Anal. Biochem. 104, 10-14.

Thomassen, M.S.; E. Strom; E.N. Christiansen, and K.R. Norum (1979). Effect of marine oil and rapeseed oil on composition of fatty acids in lipoprotein triacylglycerols from rat blood plasma and liver perfusate. Lipids, 14, 58.

Uysal, M.; G.Kutalp and S. Seckin (1988) Effect of cholesterol feeding on plasma lipid peroxide, glutathione, glutathione peroxidase and glutathione transferase in the liver of rats. Int. J. Vit. Nutr. Res. 58, 339-342.

Webster, G.R. (1967): Incorporation of long chain fatty acids into phospholipids of respiring slices of rat cerebrum exp. Mol: pathol., 13,36

Yalcin, A.S.; N. Sabuncu, A. Kilinc, G. Gulcan., and K. Emerk (1989). Increased plasma and erthrocyt lipid peroxidation in hyperlipidemic individuals. Atherosclerosis 80, 169-170.

Young, S.G. and S.Pathasaraty (1994). Why are low-density lipoproteins atherogenic ? West J. Med. 160, 153-164.

تأثير التغذية بزيت الذرة الطازج والمعامل حرارياً على التمثيل الغذائي في الفئران

خالد مأمون طه

قسم الكيمياء الحيوية كلية الزراعة جامعة المنوفية

الهدف من هذا البحث هو دراسة تأثير التغذية على عليقة غذائية محتوية على زيت مسخن لمدة طويلة (١٠ ساعات) وقد وقع الاختيار على زيت الذرة لاحتوائه على الأحماض الدهنية عديدة الروابط الزوجية بنسبة كبيرة وبالتالي تأثره بالمعاملة الحرارية لفترة طويلة بشكل واضح على ليبيدات الكبد والأورطي وبلازما الدم مقارنة بالتغذية على زيت طازج.

و قد وجد أن :-

- ازدادت محتويات الكبد من الكولسترول الكلي والجلسريدات الثلاثية الكلية بنسبة مئوية بلغت ١٢,٥ ، ٢٨,٨% علي التوالى بينما نقصت محتوياته من الفوسفوليبدات بنسبة ١٧,٨% عند التغذية بالزيت المسخن لمدة أسبوع واحد.
- تحت نفس الظروف من التغذية والزمن نقص محتوى الأورطى من الكولسترول الكلي والجلسريدات الثلاثية الكلية والفوسفوليبدات بنسبة ٦٤,٣ ، ٣٥,٥ ، ٢٢,٢% علي التوالي بينما زادت محتويات البلازما من هذه المكونات بنسب ٣٨,٩ ، ٤٣,٥ ، ٢٩,٣% علي التوالي.
- بعد ٦ أسابيع من التغذية بزيت الذرة المسخن أرتفعت نسبة الكولسترول الكلي بشكل حاد في الكبد (٤٣,٧%) والأورطى (٢٩,٣%) بينما قلت في البلازما بنسبة (١٨,٥%) وانخفضت نسبة الجلسريدات الثلاثية في كل من الكبد والأورطى وزادت في البلازما بينما قلت نسبة الفوسفوليبدات في الكبد والبلازما وزادت في الأورطى بشكل حاد.
- بالنسبة لنموذج مكونات ليبيدات الكبد والأورطى والبلازما من الأحماض الدهنية فقد أدت التغذية بزيت الذرة المسخن إلي نقص نسبة الأحماض الغير مشبعة / الأحماض المشبعة وكذلك الأحماض الدهنية الضرورية خاصة حمض اللينوليك بدرجة واضحة بعد أسبوع واحد وانخفضت هذه النسبة بشكل أكثر حدة بعد التغذية بالزيت المسخن لمدة ٦ أسابيع وذلك عند مقارنتها بالتغذية علي زيت الذرة الطازج.
- من ذلك كله نستنتج أن هناك اتجاه عام لتجمع الكولسترول في نسيج الأورطى عنه في الكبد عند التغذية لمدة طويلة على الزيت المسخن وذلك راجع إلى انخفاض نسبة حمض اللينوليك والذى يثبط إلى حد كبير تكون الكولسترول، وكذلك انخفاض نسبة الجلسريدات الثلاثية في الكبد والأورطى وزيادتها في بلازما الدم راجع إلي انخفاض تصنيع الدهون في الأنسجة وزيادة سحب البروتينيات المنخفضة الكثافة والحاملة للجلسويدات الثلاثية من الكبد إلي الأنسجة الطرفية عن طريق بلازما الدم.
- من ذلك نستخلص أن استعمال الزيوت المسخنة لفترة طويلة في التغذية يؤدى إلى الكثير من الأضرار منها زيادة نسبة الكولسترول الذى يؤدى الى ضيق الشرايين وأمراض الذبحة وكذلك يؤدى إلى نقص نسبة الأحماض الدهنية الضرورية اللازمة لكثير من العمليات الحيوية بالجسم.