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NUTRITIONAL BIOASSAY OF HEATED SOYA BEAN AND PALM OILS AT DIFFERENT THERMAL TREATMENTS

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ABSTRACT

Soyabean oil and palm oil were submitted to heat treatment (170-180°C) as moderate heating for short-term (6 hrs.) and long-term (12 hrs.), as well as (220-230°C) as extra heating for 6 hrs. to evaluate these thermal effects on physical and chemical variables and fatty acids composition and compared to fresh oil ones & cotton seed oil as control. However, fried palm oil at 170-180°C for 6 hrs. had no observed changes in the all parameter of physicochemical properties and also saturated and/or unsaturated fatty acids content.

Nutritional assay of different heated soya bean and palm oils was carried out. Nine groups of adult Albino rats fed of individually diets contained 15% tested oil as follows: Cotton seed oil (control), fresh soya oil (F.S.O.), heated soya oil at <200°C for 6hrs. (H1.S.O.), - for 12 hrs (H2.S.O.), - at >200°C for 6 hrs. (H3.S.O.), fresh palm oil (F.P.O), heated palm oil at <200°C for 6hrs. (H1.P.O.), - for 12 hrs. (H2. P.O.) and - at >200°C for 6hrs. (H3.P.O.), respectively. The experimental feeding indicated that no significant differences in weight gain, food efficiency, liver weight and liver enzymes activity (ALT and AST) in rats group fed heated palm oil at>200°C for 6 hrs., as well as total lipids, total cholesterol and phospholipids in the serum of rats fed the same heated oil. Therefore, it can be concluded that palm oil was more stable against the moderate heating for short-term. The results indicated also that although, soya oil had high content of the essential fatty acid (Lenoleic acid), but it was less resistant against moderate or severe heating process than palm oil. However, the extra heating (220-230°C) and/or long-term (12 hrs.) for both soya and palm oils induced high thermoxidative processes and yield measurable products that decreased the nutritive value of such oils and made harmful effect in the liver functions for the experimental animals.

Keywords: fried oils, thermoxidation of oil, liver function, lipids profile, ALT (Alanine transaminase), AST (Aspartic aicd transaminase).

INTRODUCTION

Soyabean, palm and cotton seed oils are considered the principle source of oil in the diets of many Egyptians because its available sources, cheap prizes, good edible and taste (Warraki, *et al.*, 1979).

During preparing diets containing fats and oils are commonly exposed to extra heating such as frying, backing and roasting. Heating might be continuously or intermittently during reusing fats or oils. However, extra heating yield a measurable changes in the physical and chemical properties (Stevenson, *et al.*, 1984).

The chemical reactions which take place during frying process such as oxidation, hydrolysis, cyclisation, isomerization and polymerization were discussed by Arroyo, *et al.*, (1992); Chardingy, *et al.*, (1996) Sanchez, *et al.*, (1998) and Echarate, *et al.*, (2001). Other studies point out that as a consequence of production measurable compounds such as cyclic fatty

acids, monomers and dimers triglycerids can be presented toxicity (López-Varela, *et al.*, 1995). In addition, data reported by Garrido-Polonio, *et al.*, (1994) showed that the consumption of thermoxidized and polymerized oils by Wistar rats was followed by different degrees of liver tissues damage involving moderate to severe fibrotic degenarative areas containing eosinophilic binuclear hepatocytes.

In this study, it has been used palm and soya bean oils because palm oil is one of the riched natural source of ?-carotene (provitamin A) and it is cheaper than other oils, therefore palm oil is represented a cheap source of provitamin A (Manorama and Rukmini, 1991). Palm oil also increased food efficiency, nitrogen retention and digestibility coefficient (Hussein *et al.*, 1994). On the other used oil, soyabean oil is characterized by its high content of lenoleic acid (C18:2) and also its high ratio of unsaturated/saturated (U/S) ratio (Wiseman, *et al.*, 1991). Echarate, *et al.*, (2001) revealed that frying soya bean oil supplied more polyunsaturated fatty acids also increased total cholesterol contents with the increasing of heating process.

However, the aim of study is to state the different measurable effects of intermittent heated soya bean and palm oils comparing with cotton seed oil as control at less and/or more than 200°C for short-term (6 hrs) and long-term (12 hrs) on physicochemical variables, fatty acids composition, growth, food efficiency, liver weight, liver functions (ALT, AST) and lipids profile in the serum of Albino rats fed the previous oils.

MATERIALS AND METHODS

Samples of palm oil were obtained from Misr Gulf Oil Processing Co., Cairo, Egypt. Soya and cotton seed oils were obtained from a local market, El-Minia, Egypt in 2003. Intermittent heated palm and soya oils were subjected to fry 6 and 12 hrs (3 hrs/day) at 170-180°C (<200°C) and 220-230°C (>200°C) as the first, second and third and codded H1, H2 and H3, respectively.

Physicochemical properties and fatty acid composition:-

The acid value, iodine number, peroxide value, refractive index and saponification value were determined according to Official and Tentative Methods of American Oil Chemists, (1980). Fatty acids profile was conducted according to the method described by Farag, *et al.* (1981) and were applied for determination by Gas Liquid Chromatography (GLC).

Feeding experiments using adult Albino rats:-

Nutritional assay was carried out using adult Albino rats of weight approximately 100±5 g. They were divided into 9 groups of 5 rats each, and housed individually in stainless steel cages at 25°C for 30 days. The experimental diets consist of 15% casein, 15 % tested oil, 20% sucrose, 45% starch, 4% salt mixture and 1% vitamins mixture (Marcos, 1967). The seqence of these groups as the following: -

1- Control (cotton seed oil)
2- Fresh soya oil (F.S.O).

3- Heated soya oil at <200°Cfor 6 hrs (H1.S.O)
4- Heated soya oil at <200°C for 12 hrs (H2.S.O).
5- Heated soya oil at >200°C for 6 hrs. (H3.S.O).
6- Fresh palm oil (F.P.O).
7- Heated palm oil at <200°C for 6 hrs. (H1.P.O).
8- Heated palm oil at < 200°C for 12 hrs. (H2.P.O).
9- Heated palm oil at >200°C for 6 hrs. (H3.P.O).

All intermittently heated oils were carefully filtrated through glasswool before adding to the different diets.

However, food and water allowed ad Libtom, body weight changes and food consumed were recorded daily. At the end of the experimental period, rats were sacrificed and the liver was dissected out. Liver weight was recorded for the nine groups and blood samples from each tested group were collected to determine serum AST and ALT (Reitman and Frankel, 1957) where AST (Aspartic acid transaminase), ALT (Alanine transaminase). Lipids profile were measured as the following. Total lipids were conducted according to Folch and Stanley (1957), triglycerides by the method of Megran, *et al.*, (1997), total cholesterol was carried out according to the procedure of Allian, *et al.*, (1974) and phospholipids was determined according to Zilversmit and Davis (1950).

RESULTS AND DISCUSSION

Palm and soya bean oils became one of the most widely consumed edible oils and hence received attention in the domain of nutritional and biochemical studies. Effect of intermittent heating on the physicochemical variables are shown in Table (1). Data showed that acid value of fresh soya bean oil was higher than that recorded for fresh palm oil and cotton seed oil (control). The heating processes indicated also that acid values were gradually increased with the increasing of both time of frying and/or heating degree in the all tested oils. The rising in acid value by heating treatment could be explained through the breakdown of oil ester linkages (Stevenson, *et al.*, 1984). Data also indicated that iodine number was decreased by the intermittent heating for both soya and palm oils. This decreasing was due to the cleavage of unsaturated fatty acids into shorter chains (Warraki, *et al.*, 1979).

Peroxide values were markedly increased from 12.50 to 25.91; 27.75 and 35.16 for F.S.O; H1.S.O.; H2.S.O. and H3.S.O., respectively and also from 0.98 to 1.09; 2.87; and 4.05 for F.P.O; H1.P.O.; H2.P.O and H3.P.O, respectively. However, it is obvious that the increase of peroxide values by frying at more than 200°C for 6 hrs for both soya and palm oils were about 3 fold for soya bean oil and 4 fold palm oil than both fresh soya bean and palm oil respectively. The oxidation processes gave further degradation to form radicals of dimers, trimers, epoxides and hydrocarbons (Nawar, 1979). The progression of lipid peroxidation involved with positive relationship the decline of unsaturated fatty acids (Recknagel and Glende, 1973). Table (1) indicated also that the presence of no changes for the refractive index in all tested oils and control.

Saponification values were slightly changes among all heating treatments for each tested oil (Table 1).

However, from all results of Table (1) it can be observed that the minimum changes for acid values, iodine number, peroxide values and saponification values were occurred in the case of fried palm at less than 200°C for 6 hrs.

On the other hand, fatty acids composition is shown in Table (2). The results indicated that fresh soya oil was characterized by its high content of lenoleic acid (48.60%). Other investigations showed also that lenoleic acid was the major fatty acid in soya oil (Liu, *et al.*, 1995). While fresh palm oil was characterized by the presence of two major fatty acids. The first was palmetic acid (45.71%) and the second was oleic acid (39.90%). These results were supported with data reported by Hussein *et al.*, (1994). In addition, Table (2) and Fig. (1) showed also that U/S ratio of soya oil was the highest value followed by cotton seed oil (control) and palm oil, respectively.

Table (1): Physicochemical variables of the tested oils (g/100 g dry weight).

Treatmerit	Tested oil	Acid value	Iodine number	Peroxide value	Refractive index	Saponification value
1	Control	0.48	87.15	7.85	1.470	185.22
2	F.S.O.	11.42	92.05	12.50	1.465	168.11
3	H1.S.O	11.90	79.66	25.91	1.468	165.09
4	H2.S.O.	13.81	71.13	27.75	1.465	158.50
5	H3.S.O	15.63	67.91	35.16	1.473	160.04
6	F.P.O.	0.71	52.11	0.98	1.477	194.21
7	H1.P.O	0.97	49.06	1.09	1.471	192.70
8	H2.P.O.	1.35	30.91	2.87	1.469	194.05
9	H3.P.O	1.49	34.68	4.05	1.472	195.87

Table (2): Fatty acids content of dietary oils arranged to unsaturation.

Treatment	14:0	16:0	18:0	18:1	18:2	18:3	Saturated (s)	Unsaturated (U)	U/S ratio
1	0.31	18.32	17.35	24.53	39.67	-	35.98	64.20	1.78
2	-	11.05	12.37	18.26	48.60	8.33	23.42	75.19	3.21
3	-	10.98	9.55	18.03	44.35	8.71	20.53	71.09	3.46
4	-	11.02	6.09	17.54	43.39	8.83	17.11	69.76	4.08
5	-	10.95	6.33	16.91	44.01	9.07	17.28	69.99	4.05
6	1.20	45.71	4.55	39.90	9.22	-	51.46	49.12	0.95
7	1.12	45.03	3.62	39.94	8.99	-	49.77	48.93	0.98
8	1.11	44.10	3.21	39.77	8.82	-	48.42	48.59	1.003
9	1.14	44.25	2.33	40.35	8.51	-	47.72	48.86	1.024

In addition, the effect of intermittent frying at different times and degree on the composition of fatty acids for tested oils are also shown in Table (2). The results can be summarized as follows: -

1- The minimum changes were involved in the case of heated palm oil at less than 200°C for 6 hrs.
2- Stearic acid contents were decreased in the all heated oils.
3- Palmetic acids were slightly variation in the all heated oils.
4- The rate of decreasing lenoleic acid in soya bean oil was more than of palm one when compared with fresh soya bean and palm oil respectively.

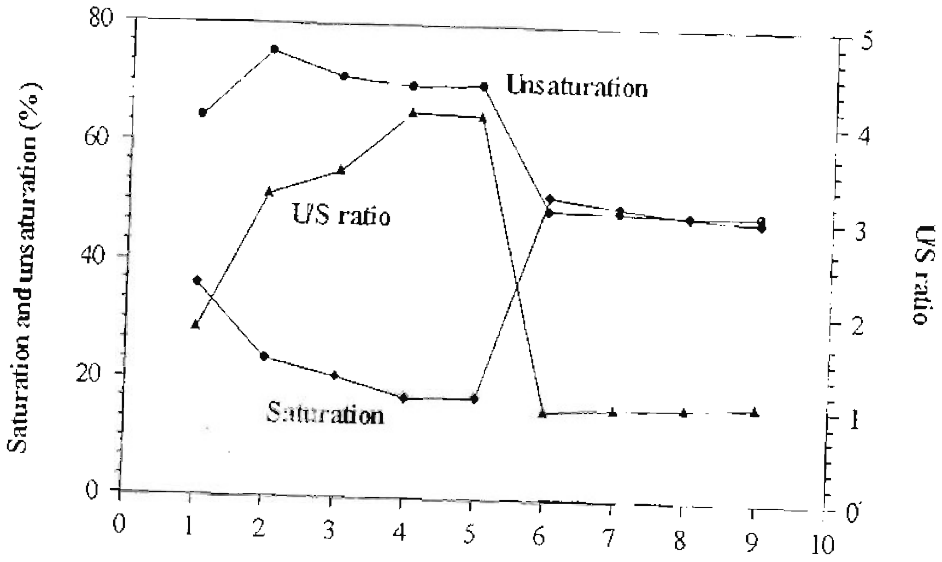

Fig. (1): Saturated (SFA) and unsaturated fatty acids (UFA) of fresh and heated oils.

Consequently, the unsaturated/saturated (U/S) ratios of heated soya oil were increased with the increasing of both time and degree of heating processes, while these U/S ratios in palm oil were slightly changes, (Fig. 1), this finding was supported with the idea of palm oil had high stability against thermal treatment at less than 200°C for 6 hours (Hussein, *et al.*, 1994). In addition, the decreasing of stearic acid or oleic acid by heating processes was due to that extra heating caused high oxidation for saturated or unsaturated fatty acids to yield hydrocarbons, cyclic fatty acids and short chain fatty acids (López-Varela, *et al.*, 1995).

On the other hand, nutritional assay of the different heated soya and palm oils were also discussed in Table (3). However, growth levels of rats fed the tested oils as reflected by body weight gain. The results showed that (B.W.G) in fresh soya oil was less than that recorded in control and fresh palm oil, respectively. Body weight gain in rats fed frying soya and palm oils showed significant decrease, this is due to the decrease in food intake. In contrast, food efficiency of rats fed fresh palm oil was identical with control and more than soya oil (0.314±0.01, 0.315±0.01 and 0.302±0.02) for groups fed control, palm and soya oils, respectively. Such results given are in agreement with those reported by Tony, *et al.*, (1991).

Table (3): Means of body weight gain, food efficiency, liver weight and liver enzymes activity of rats fed fresh and heated soya and palm oils.

Treatment	Initial B.W (g)	Final B.W. (g)	Daily gain (g)	Weight gain (g)	Food intake (g)	Fat intake (g)	Food efficiency	Liver weight (g)	Liver weight/100 g B.W	Liver enzymes	
										AST	ALT
1	100.2 ± 1.9	180.2^{a} ± 0.2	2.67^{a} ± 0.03	80.0^{a} ± 0.0	255.1^{a} ± 0.7	38.3^{a} ± 0.02	0.314^{a} ± 0.01	8.1^{a} ± 0.0	4.50^{a} ± 0.04	22.0^{a} ± 1.1	19.8^{b} ± 1.2
2	99.7 ± 2.1	175.6^{b} ± 1.7	2.53^{b} ± 0.06	75.9^{b} ± 0.03	251.2^{a} ± 0.5	37.7^{a} ± 0.035	0.302^{b} ± 0.02	8.3^{b} ± 0.0	4.80^{b} ± 0.25	17.2^{b} ± 1.3	17.9^{a} + 1.3
3	96.8 ± 1.6	169.9^{c} ± 1.9	2.44^{b} ± 0.1	73.1^{b} ± 0.11	252.2^{a} ± 0.1	38.0^{a} ± 0.22	0.288^{c} ± 0.0	8.4^{b} ± 0.01	4.94^{b} ± 0.017	17.5^{b} ± 1.0	18.9^{b} ± 1.1
4	98.5 ± 1.1	172.0^{c} ± 1.0	2.45^{c} ± 0.07	73.5^{b} ± 1.2	250.4^{b} ± 0.15	37.6b ± 0.0	0.294^{c} ± 0.0	8.6^{b} ± 0.03	5.00^{b} ± 0.19	18.1^{b} ± 0.9	18.5^{b} ± 1.5
5	101.0 ± 2.0	173.8^{b} ± 0.9	2.43^{c} ± 0.02	72.8^{c} ± 0.7	249.8^{b} ± 0.8	37.5^{b} ± 0.02	0.291^{c} ± 0.0	9.3^{c} ± 0.025	5.34^{c} ± 0.22	19.3^{c} ± 0.8	16.4^{b} ± 0.8
6	102.5 ± 2.2	181.9^{a} ± 2.3	2.65^{a} ± 0.35	79.4^{a} ± 0.74	252.5^{a} ± 0.7	37.9^{a} ± 0.02	0.315^{a} ± 0.01	7.8^{a} ± 0.02	4.30^{a} ± 0.08	23.2^{a} ± 1.4	16.8^{a} ± 0.7
7	99.2 ± 2.0	180.1^{a} ± 1.9	2.70^{a} ± 0.017	80.9^{a} ± 1.3	251.8^{a} ± 1.1	37.8^{a} ± 0.03	0.321^{a} ± 0.03	7.7^{a} ± 0.0	4.25^{a} ± 0.04	23.2^{a} ± 1.3	16.1^{a} ± 0.6
8	99.9 ± 1.5	177.3^{b} ± 1.6	2.58b ± 0.11	77.4^{b} ± 1.5	249.3^{b} ± 1.0	37.4^{b}± 0.035	0.309^{b} ± 0.05	8.5^{b} ± 0.01	4.80^{b} ± 0.035	24.1^{c} ± 0.9	17.8^{a} ± 1.02
9	101.1 ± 1.9	172.0^{c} ± 2.5	2.36^{c} ± 0.06	70.9^{c} ± 2.0	240.8^{c} ± 0.6	36.1^{c} ± 0.02	0.294^{c} ± 0.02	9.0^{c} ± 0.02	5.23^{c} ± 0.016	26.6^{c} ± 1.1	18.7^{b} ± 1.0

Mean values of five rats (2 months age) for the experimental periods of 30 days ± S.D. a,b and c indicate significant differences at p< 0.05.

Data are shown in Table (3) showed also that the heated oils at more than 200°C caused significant increase in liver weight. But in the case of groups fed fried soya or palm oils at less than 200°C for 6 hrs, there was no significant differences in liver weight. However, the increased liver weight that was observed in rats fed heated oils might indicate the hepotoxicity that occurred (Sinkeldam, *et al.*, 1983).

In addition, both of liver enzymes activity (AST and ALT) were significant increased with the increasing of time for 12 hrs (at less 200°C) and of temperature degree at more than 200°C (for 6 hrs), which was meaning that heating at less than 200°C for 6 hrs recorded no significant changes for both AST and ALT (Table 3). However, from previous data the changes of hepatorenal function were occurred in serum AST and ALT may be resulted in formation of free radicals in the oils that subjected to severe heating (long-time or more than 200°C) Nawar, (1979) and Recknagel (1983) illustrated that severe heating caused peroxidative breakdown of fatty acid chains and formation of free radical that attack the linkages of unsaturated fatty acids.

Lipids profile in serum rats fed different heated oils are shown in Table (4) and Fig. (2). The results showed that serum total lipids were 5.03±0.22, 4.92±0.25 and 5.16 ±0.41 g/dL for control, fresh soya and fresh palm oils, respectively. It is interest to notice that the rising of degree and/or time of heating induced an increasing of total lipids content, similar results are reported by Echarate, *et al.*, (2001) who revealed that frying soya and olive oils increased lipids contents 2-fold the comment of this finding is still understanding However, Table (4) and Fig. (2) showed also that serum triglycerides levels were not significant differences for each fresh and heated oil individually, while significant increasing was recorded for serum total cholesterol and serum phospholipids. The results of total cholesterol were 1.26±0.06; 1.31±0.07; 1.60±0.12 and 1.57±0.11 mmol/L for F.S.O.; H1.S.O; H2.S.O and H3.S.O, respectively, while F.P.O; H1.P.O.; H2.P.O and H3.P.O were 1.72±0.11; 1.89±0.03; 2.05±0.09 and 2.12±0.021 mmol/L respectively. On the other hand, serum phospholipids were ranged from (1.35±0.05 to 1.57±0.04 mmol/L) for fresh and several heated at less than 200°C soya oils, respectively. As well as, from (1.33±0.04 to 1.49±0.03 mmol/L) for fresh and several heated at less than 200°C palm oils, respectively.

Table (4): Lipids profile in serum rats fed fresh and different heated oils.

Treatment	Total lipids g/dL	Triglycerides mmol/L	Total cholesterol mmol/L	Phospholipids mmol/L
1	5.03±0.22^a	0.41±0.02^a	1.63±0.06^a	1.25±0.03^a
2	4.92±0.25^a	0.33±0.03^a	1.26±0.10^b	1.35±0.05^a
3	5.00±0.11^a	0.33±0.1^a	1.31±0.07^b	1.29±0.05^b
4	5.53±0.18^a	0.31±0.07^a	1.60±0.12^a	1.57±0.04^b
5	5.71±0.33^b	0.35±0.03^a	1.57±0.11^a	1.52±0.035^b
6	5.16±0.41^a	0.55±0.02^b	1.72±0.11^a	1.33±0.045^a
7	5.20±0.19^a	0.54±0.0^b	1.89±0.03^a	1.40±0.55^a
8	6.61±0.12^c	0.55±0.02^b	2.05±0.09^c	1.49±0.03^b
9	6.86±0.94^c	0.52±0.02^b	2.12±0.21^c	1.46±0.11^b

Mean values of five rats ±S.D. a, b and c indicate significant differences at p<0.05.

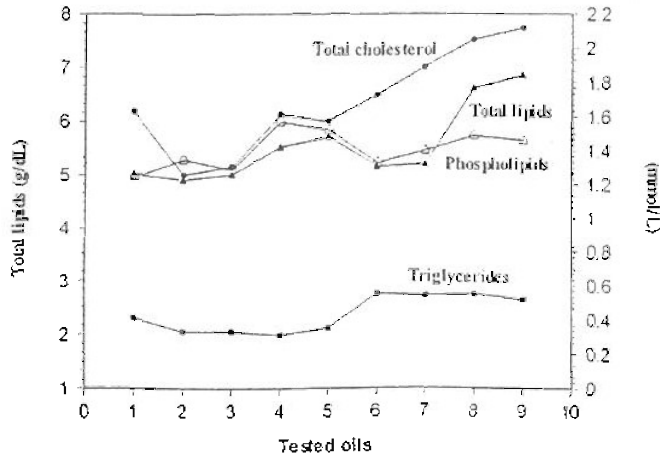

Fig. (2): Lipids profile in the serum rats fed fresh and heated oils.

However, the increasing rate of both total cholesterol or phospholipids by the same heating application at 170:180°C for different time 6 and 12 hours in the serum rats fed palm oils were less than that recorded for soya oils. Similar results are reported by Warraki *et al.*, (1979) in serum rats fed heated oils. They indicated that the presence of significant increase of total cholesterol in groups fed on continuously heated oil for 10 hrs, while slightly increasing of phospholipids was observed in serum groups fed intermittently heated oils.

In conclusion, fried palm oil at (170-180°C) for 6 hrs had no observed changes in the all parameters of physicochemical variables and fatty acids composition. In addition, it had not significant differences in B.W.G.; food efficiency, liver weight and liver functions (AST and ALT), as well as total lipids, total cholesterol and phospholipids in the serum of rats fed heated palm oil at the same conditions as mentioned previously. This meaning that palm oil was more stable against thermal effect at <200°C for 6 hrs.

However, although soya oil was considered more nutritive value than palm oil because its high content of the essential fatty acid lenoleic (C18:2) but it was less resistant than palm oil against thermal effects. Generally, the long-term heating for 12 hrs and/or extra heating at 220-230°C (<200°C) for 6 hrs caused high oxidation and peroxidation for both soya and palm oils and formed measurable products that reduced the nutritive values for these tested oils and badly effect in liver functions of the experimental animals.

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تقييم غذائى وبيولوجى لزيوت فول الصويا والنخيل المسخنة بمعـــاملات حراريـــة مختلفة

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أجرى فى هذا البحث معاملة حرارية لكل من زيت فول الصويا وزيت عباد الشمس على (١٧٠-١٨٠م) كتسخين متوسط لمدة قصيرة (٦ ساعات) وكذلك تسخين لمدة طويلة (١٢ ساعة) وأيضـــا تســـخين إضافى (٢٢٠-٢٣٠م) لمدة ٦ ساعات وذلك لتقييم تلك التـــأثيرات الحراريـــة علـــى الصفـــات الطبيعيـــة والكيماوية وتركيب الأحماض الدهنية ومقارنة تلك المعاملات بالزيوت الطازجة (زيـــت بـــذرة القطـــن – كنترول).

أكدت النتائج ان التسخين المتوسط على فترات متقطعة لم يسبب تغيرات محسوسة فى كل من رقم الحموضة والبيروكسيد واليودى والتصبن و كذلك تركيب الأحماض الدهنية المشبعة وغير المشـــبعة خاصـــة لزيت النخيل لهذه الدرجة مما يعطي انطباع بأن زيت النخيل أكثر مقاومة للتسخين من زيت فـــول الصويـــا أما التسخين الشديد فكانت هناك فروق واضحة وتغيرات محسوسة فى الصفات الطبيعية والكيميائية وكذلـــك تركيبها من الأحماض الدهنية.

وفى تجارب التغذية أعطت نتائج تغذية فئران التجارب على الزيـــوت المســـخنة المختـــبرة أن التسخين المتوسط لم يعطى فروق معنوية واضحة فى النمو ومعامل كفاءة الغذاء ووزن الكبد ووظائف الكبـــد (تقدير نشاط انزيمى الكبد اسبارتك والانين ترانس امينيز AST, ALT على التوالى) خصوصا زيت النخيـــل أما التسخين الشديد فقد أعطى فروق معنوية واضحة فى كل القياسات السابقة وأيضا زيادة وزن الكبد ونشـــاط انزيمى الكبد مما يوضح ان التسخين الشديد المذكور عالية يؤثر فى وظائف الكبد خاصـــة والصحـــة عامـــة لحيوانات التجارب المغذاة على الزيوت المسخنة بشدة (اكثر من ٢٠٠م لمدة ١٢ مـــاعة) كذلـــك أعطـــت تحاليلات سيرم الحيوانات المغذاة على الزيوت المسخنة تغيرات طفيفة فى محتوى الســـيرم (ليبيـــدات كليـــة ،كولسترول كلى ، فوسفوليبيدات) عند التسخين المتوسط (أقل من ٢٠٠ م ولمدة ٦ساعات فقط) خصوصـــا لزيت النخيل وكان التسخين الشديد عل كل من زيت النخيل أو الصويا أعطى فروق معنوية واضحة لتغـــير محتوى السيرم فى كل القياسات عدا التراى جلسرايد تغيراتها كانت غير معنوية.

من كل مما سبق يمكن التوصية بعدم زيادة مدة تسخين الزيوت السابقة عـــن ٦ ســـاعات وان لا تزيد درجة الحرارة عن ٢٠٠م ويفضل زيت النخيل على زيت الصويا فى التسخين لانه اكثر مقاومة علـــى الرغم من ان زيت فول الصويا ذو قيمة غذائية أعلى من زيت النخيل لاحتوائه على نسبة عالية من الحمـــض الدهنى لينولييك وهو من الأحماض الدهنية الأساسية.