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TRANS FATTY ACIDS IN A SELECTION OF FOODS AND OILS AVAILABLE IN RIYADH MARKETS

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ABSTRACT

The fatty acids compositions and the *trans* fatty acid contents of 3 different brands of vegetable oils used for cooking and frying, 4 different brands of margarines, 4 different brands of shortenings, and 7 different brands of biscuits and cookies obtained from local markets in Riyadh Saudi Arabia were determined by capillary GC methods. Frying oils from 3 different local restaurants and frying oils extracted from French fried potatoes obtained from 6 different international fast-food restaurants were also evaluated. Vegetable oils contained total saturated fatty acids in the range of 9.80-44.66% and were free of *trans* fatty acids. The contents of total saturated fatty acids and *trans* fatty acids were within the range of 23.90-52.36% and 0.57-15.37% in shortenings, 19.40-30.96% and 0.00-4.53% in margarines, and 28.86-69.94% and 0.00-23.12% in biscuits and cookies, respectively. Extracted oil from French fried potatoes of international fast-food restaurants contained large amounts of total *trans* fatty acids (3.79-27.34%) and total saturated fatty acids (26.03-41.95%). Used oil of frying oils from local restaurants and lab contained high contents of total saturated fatty acids and free of *trans* fatty acids. A comparison with available data from similar food items of different parts of the world indicated that Saudi Arabian products in the category studied have lower *trans* fatty acids except in some cookies and some French fried potatoes.

Key words: *biscuits and cookies,margarines, restaurants,shortenings trans fatty acids, vegetable oils.*

1. INTRODUCTION

Trans unsaturated fatty acids, also known as *trans* fats, occur when the isomeric configuration of the hydrogen carbon at a double bond position changes from the normal *cis* configuration to the *trans* configuration (Emken, 1984 and Nawar, 1996). *Trans* configuration results in straight molecules which like saturated fatty acids (SFA) pack together. When vegetable oils are partially hydrogenated to increase their melting point and stability, *trans* fatty acids are generated (Beare-Rogers, 1983 and Emken, 1984). Partially hydrogenated vegetable oils have been used extensively to replace tropical oils, beef tallow, and other animal fats in the world. *Trans* fatty acids are found in vegetable shortenings, some margarines, crackers, cookies and many other foods made with or fried in partially hydrogenated fats (Aro *et al.*, 1998). These products introduce range of *trans* fatty acids in the human diet.

Several indications had been published about adverse effects of *trans* fatty acids on human health. *Trans* fatty acids have been associated with an increased risk of cardiovascular disease (CVD) (Ascherio and Willett, 1997). *Trans* fatty acids have an adverse effect on the serum lipoprotein profile in that they raise the level of low density lipoproteins cholesterol (LDL-C) and decrease high density lipoproteins cholesterol (HDL-C) (Katan *et al.*, 1995, Khosla and Hayes, 1996 and Aro *et al.*, 1997,). The adverse effects of the *trans* fatty acids on the ratio of LDL cholesterol to HDL cholesterol are twice that of saturated fatty acids (Litin and Sacks, 1993). Some epidemiological studies have also found a positive association between levels of *trans* fatty acid intake and risk of cardiovascular disease (Mensink and Katan, 1990 and Hu *et al.*, 1997). *Trans* fatty acids also inhibit the biosynthesis of the essential fatty acids, which are important for tissue growth. In addition, high intake of *trans* fatty acids may have other health consequences. A study demonstrated an association of adipose store of *trans* fatty acids and risk of developing breast cancer in postmenopausal women (Holmes, 1999).

Due to these concerns, the Food and Agricultural Organization (FAO) and the World Health Organization (WHO) recommended that fats for human consumption contain less than 4% of the total fat as a *trans* and urged the food industry to reduce the presence of *trans* fats in their products (WHO/FAO, 1994).

The present study was performed to provide some preliminary data on *trans* fatty acid content of vegetable oils, shortenings, margarines, bakery products, and French fried potatoes from international fast-food restaurants available in Riyadh (Saudi Arabia) markets. The levels of *trans* fatty acids in food products available in Saudi market should be determined at a regular basis.

2. MATERIALS AND METHODS

Different brands of cooking and frying vegetable oils, margarines, shortenings and bakery products (biscuits and cookies) were purchased from local markets in Riyadh, Saudi Arabia. French fried potatoes (potato chips) were obtained from international fast-food restaurants in Riyadh, Saudi Arabia. Potato chips were also prepared (cubic 10X1.5 cm) and fried (150g sample /L palm cooking oil) in laboratory at 167^0C for 10 minutes. The palm cooking oil had been heated at 167^0C for 30, 50, and 70 minutes. All solvents and reagents used were of analytical grade.

Samples were prepared by combining random portions of each brand. Total lipids were extracted with chloroform: methanol (2:1 v/v) using Folch method (Folch *et al.*, 1957). Lipid content was expressed as percentage at wet base of the product.

Fatty acids were transformed into methyl ester according to the ISO procedure (ISO 5509, 1978). The oil or fat was boiled in methanolic sodium hydroxide solution and then with methanol and boron trifluoride. A nitrogen atmosphere was kept as long as possible during the whole procedure. The fatty acid methyl esters (FAMEs) were extracted with petroleum ether and were analyzed by gas chromatography (GC) (Shimadzu-GC017A, Kyoto, Japan) equipped with a flame ionization detector and integrator (Shimadzu C-R6A Chromatopac). The FAMEs were separated on a SP-2560 capillary column (100m X 0.25mm i.d. X 0.20μm film thickness of fused silica

(Supleco, Bellefonte, PA, USA; Cat No.2-4056). The fatty acids were identified by comparing their retention times with standards retention time, which included C18:1 n9t, C18:2 n6t (Sigma Chemical Co., St Louis, MO, USA). Each injection repeated three times and coefficient of variance of individual fatty acids was checked. The temperature for injection and detector were set at 250^0 and 260^0C, respectively. Initial temperature for the column was set at 180^0C for 3min to final temperature 220^0C at the rate of 2^0C/minute, with helium as a carrier gas at pressure of 19 psi with split ratio 70:1. The content of specific fatty acids in each of the product was expressed as percentage of total fatty acids.

2.1. Statistical analysis

All values of the various fatty acids are presented as mean ± SD of three replicates. Analysis of variance (ANOVA) was used to nalyzed fatty acids data from GC (SAS Institute, 1995). Differences in means among brands for each groups were evaluated by Duncan's Multiple Range Test procedure with the level of significance at $P<0.05$.

3. RESULTS AND DISCUSSION

The consumption of fat, oils and fried fast food has dramatically increased 200-400% during the last few years (Miladi, 1998). In Saudi Arabia, fat availability per capita per day increased from 32.3 g in 1969 to 70.1 g in 1994, more than two fold increment (FAO/AGROSTAT, 1996). The possible public health relevance of dietary *trans* fatty acids was emphasized by a study reporting that the level of *trans* fatty acids intake was directly associated with the increased risk of cardiovascular disease (Judd *et al.*, 1994 and Hu *et al.*, 1997).

The fatty acid composition of unused cooking and frying vegetable oils is shown in Table 1. The palm cooking oil was characterized by a higher ($P<0.05$) content of total saturated fatty acids and oleic acid compared to the sunflower and corn cooking oils. The palm cooking oil had also a lower ($P<0.05$) content of linoleic acid compared to the sunflower and corn cooking oils. All unused cooking and frying vegetable oils (palm, sunflower and corn oil) were virtually free of *trans* fatty acids , but contained a high content of saturated fatty

Table (1): The fatty acid (FA) composition (gFA/100g oil, mean ±SD)[w] in unused cooking and frying vegetable oils.

FA	Palm oil A	Palm oil B	Sunflower oil A	Sunflower oil B	Corn oil A	Corn oil B
C14:0	0.77 ± 0.17^{a}	0.85 ± 0.05^{a}	0.07 ± 0.01^{b}	0.06 ± 0.01^{b}	-[y]	-
C16:0	31.82 ± 5.76^{b}	39.09 ± 0.01^{a}	6.69 ± 0.15^{cd}	6.15 ± 0.01^{d}	10.99 ± 0.27^{c}	10.98 ± 0.10^{c}
C16:1, *cis*	0.75 ± 0.54^{ab}	0.17 ± 0.02^{b}	0.07 ± 0.01^{b}	0.06 ± 0.01^{b}	0.10 ± 0.01^{b}	1.23 ± 1.13^{a}
C18:0	4.62 ± 0.02^{a}	4.53 ± 0.25^{a}	4.01 ± 0.30^{ab}	3.54 ± 0.04^{b}	2.18 ± 0.07^{c}	1.29 ± 0.93^{d}
C18:1, *trans*	-	-	-	-	-	-
C18:1, *cis*	40.29 ± 2.88^{b}	43.57 ± 0.49^{a}	24.84 ± 0.08^{d}	28.06 ± 0.77^{c}	28.26 ± 0.45^{c}	28.37 ± 0.19^{c}
C18:2, *trans*	-	-	-	-	-	-
C18:2, *cis*	20.25 ± 8.85^{b}	9.57 ± 0.17^{c}	59.67 ± 1.12^{a}	58.63 ± 0.40^{a}	55.69 ± 0.12^{a}	55.64 ± 0.55^{a}
Total SFA	37.97 ± 5.41^{b}	44.66 ± 0.16^{a}	10.85 ± 0.17^{c}	9.80 ± 0.05^{c}	13.27 ± 0.34^{c}	13.51 ± 0.30^{c}
Total, *trans*	0.00	0.00	0.00	0.00	0.00	0.00
Others	1.34 ± 0.44^{b}	2.18 ± 0.47^{ab}	3.19 ± 0.05^{a}	3.55 ± 0.47^{a}	2.74 ± 0.94^{ab}	3.57 ± 1.52^{a}

[w] Means in the same row (a-d) with different letters are significantly different ($p<0.05$).

-[y] not detected

acids. Vegetable oils in the Saudi markets were virtually *trans* free. Aro *et al.*, (1998) found only minor amounts of *trans* fatty acids in the vegetable oils from European countries.

To see the effect of frying treatment on the generation of *trans* fatty acids, samples obtained from local restaurants and other vegetable oils were used for frying French fried potatoes (potato chips) in the lab for varying time. The contents of individual fatty acids in frying oils from local restaurants and lab frying are presented in Table 2. The frying oils from local restaurants and lab were free from *trans* fatty acids. The frying oils had a high level (37.80 – 48.65%) of total saturated fatty acids , mainly palmitic acid.

The relative amounts of the total *trans* fatty acids (C18:1 and C18:2), total saturated fatty acids, of the oil extracted from French fried potatoes obtained from six different international fast-food restaurants are provided in Table 3. The sums of the saturated myristic, palmitic, and stearic fatty acids were not significantly different ($P>0.05$) in all brands. Total *trans* fatty acid content in extracted oil of French fried potatoes (potato chips) from international fast-food restaurants varied considerably among brands (range 3.79 to 27.34%). The extracted oil of French fried potatoes from international fast-food restaurants A, C, and F contained higher ($P<0.05$) total *trans* fatty acids content than restaurants B, D, and E. The major *trans* fatty acids in all the extracted oils was C18:1. Five out of six international fast-food restaurants had a high amount (more than 4%) of total *trans* fatty acids –mainly elaidic acid. Ovesen *et al.* (1998) reported on the *trans* fatty acids in foods, among which frying fat from fast food restaurants. They found total *trans* fatty acid contents up to 21.9% and 16.6% in two fast-food restaurants frying fats. Aro *et al.* (1998) found that French fried potatoes from fast-food restaurants contained between 12 and 35% *trans* fatty acids.

The fatty acid profile of shortenings is given in Table 4. The total saturated fatty acids, mainly palmitic acid, were higher (52.36 $P<0.05$) in brand D compared with other brands. The total *trans* fatty acids in the shortenings of the Saudi markets ranged from 0.57 to 15.37%. The brand C had a higher ($P<0.05$) content of *trans* fatty acids followed by brand B, which both had more than 4% *trans* fatty acids. According to the label declarations, all the shortenings examined were

Table (2):The fatty acid composition (gFA/100g oil, mean ±SD) [w] in used frying oil.

FA	Local Restaurant A	Local Restaurant B	Local Restaurant C	(1)	Lab frying + (2)	(3)
C14:0	0.07±0.00[d]	0.92±0.02[a]	0.91±0.01[a]	0.44±0.17[c]	0.71±0.01[b]	0.86±0.01[a]
C16:0	34.31±0.85[d]	42.71±0.09[a]	42.33±0.28[a]	40.19±0.37[b]	39.07±0.33[c]	39.00±0.47[c]
C16:1, *cis*	0.26±0.18[a]	0.13±0.01[ab]	0.14±0.00[ab]	-	-	-
C18:0	3.15±0.01[c]	4.88±0.05[b]	4.69±0.23[b]	4.43±0.62[b]	5.76±0.03[a]	5.95±0.10[a]
C18:1, *trans*	-[y]	-	-	-	-	-
C18:1, *cis*	44.63±0.20[b]	40.70±0.14[d]	41.35±0.50[c]	46.00±0.47[a]	44.61±0.05[b]	44.96±0.06[b]
C18:2, *trans*	-	-	-	-	-	-
C18:2, *cis*	13.07±0.18[a]	8.81±0.03[b]	8.85±0.06[b]	8.61±0.04[b]	8.34±0.11[b]	9.30±2.16[b]
Total SFA	37.80±1.05[c]	48.65±0.06[a]	48.09±0.50[a]	45.07±0.41[b]	45.54±0.32[b]	45.81±0.37[b]
Total, *trans*	0.00	0.00	0.00	0.00	0.00	0.00
Others	2.02±1.79[a]	1.93±0.05[a]	2.11±0.34[a]	0.42±0.14[b]	0.97±0.32[b]	0.57±3.83[b]

[w] Means in the same row (a-d) with different letters are significantly different ($p<0.05$).

-[y] not detected

+1: Samples were fried for 10 min at 167°C in palm oil heated for 30 min.

2: Samples were fried for 10 min at 167°C in palm oil heated for 50 min.

3: Samples were fried for 10 min at 167°C in palm oil heated for 70 min.

Table (3):The fatty acid composition (gFA/100g, mean ±SD) [w] in extracted oil of French fried potatoes (potato chips) from some fast-food restaurants.

FA	Brand A	Brand B	Brand C	Brand D	Brand E	Brand F
C14:0	0.35 ± 0.03^{c}	0.65 ± 0.02^{b}	0.34 ± 0.00^{c}	-[y]	0.72 ± 0.03^{a}	-
C16:0	18.71 ± 0.12^{b}	30.77 ± 1.14^{b}	23.52 ± 0.91^{c}	15.24 ± 3.33^{e}	34.08 ± 1.30^{a}	19.41 ± 0.20^{b}
C16:1, *cis*	0.25 ± 0.06^{a}	-	-	-	0.14 ± 0.01^{b}	-
C18:0	15.06 ± 0.01^{a}	14.75 ± 3.46^{a}	15.21 ± 0.65^{a}	10.32 ± 6.82^{ab}	7.00 ± 0.08^{b}	12.47 ± 0.22^{a}
C18:1, *trans*	26.67 ± 0.07^{a}	4.17 ± 0.27^{c}	22.27 ± 0.17^{a}	9.29 ± 6.41^{b}	3.21 ± 0.65^{c}	22.96 ± 0.11^{a}
C18:1, *cis*	31.87 ± 0.14^{de}	39.90 ± 1.23^{a}	33.32 ± 2.29^{cd}	30.30 ± 1.73^{e}	35.36 ± 1.01^{bc}	37.77 ± 0.68^{ab}
C18:2, *trans*	0.67 ± 0.29^{a}	-	0.37 ± 0.13^{b}	-	0.57 ± 0.02^{ab}	-
C18:2, *cis*	3.39 ± 0.18^{b}	4.43 ± 3.37^{b}	3.01 ± 0.07^{b}	25.35 ± 2.49^{a}	14.65 ± 0.40^{ab}	2.84 ± 0.14^{b}
Total SFA	34.38 ± 0.08^{bc}	46.18 ± 0.62^{a}	39.08 ± 1.58^{abc}	25.56 ± 5.15^{d}	41.95 ± 1.42^{ab}	31.88 ± 0.42^{cd}
Total, *trans*	27.34 ± 0.22^{a}	4.17 ± 0.26^{c}	22.64 ± 0.04^{a}	9.29 ± 6.41^{b}	3.79 ± 0.63^{c}	22.96 ± 0.11^{a}
Others	2.64 ± 0.56^{a}	3.90 ± 3.05^{a}	1.86 ± 0.83^{a}	9.08 ± 8.05^{a}	2.65 ± 1.27^{a}	3.39 ± 2.23^{a}

[w] Means in the same row (a-d) with different letters are significantly different ($p<0.05$).

-[y] not detected

made from hydrogenated vegetable oils. These levels of *trans* fatty acids are similar with those in the Spanish shortenings (Alonso *et al.*, 2002), which have from 1.30 to 15.50%. However, shortenings marketed in Denmark had even low content of trans fatty acids (6.7-2.3%) (Ovesen *et al.*, 1998).

The fatty acid composition of the margarines is shown in Table 4. The total saturated fatty acids – mainly palmitic acid- was higher (30.96 $P<0.05$) in brand C and monounsaturated fatty acids –mainly oleic acid- was higher (35.92 $P<0.05$) in brand A compared with other brands. The total polyunsaturated fatty acids – chiefly linoleic acid- were higher (51.93 $P<0.05$) in brand D comparing with other brands. The total *trans* fatty acids in the margarines ranged from 0.00 to 4.53%. Only brand C had a high content (more than 4%) of *trans* fatty acids. Two brands of shortenings and one of margarine had a high content (more than 4%) of total *trans* fatty acids. All the margarines examined were made from hydrogenated vegetable oils, according to the label declarations. The total *trans* fatty acid values for margarines (0.00-4.53%) was low relative to margarine data for products of Australia (13.1%) (Mansour and Sinclair, 1993), Canada (23.6%) (Ratnayake *et al.*, 1998), the United States (22.6%) (Emken, 1995), and Greece (10%) (Kafatos *et al.*, 1994). However, margarines from Denmark (3.0%) (Ovesen *et al.*, 1996) and France (3.8%) (Bayard and Wolff, 1995) had total *trans* fatty acid levels similar to those found in margarines available in Saudi Arabia markets.

The fatty acid compositions in oil extracted from bakery products (biscuits and cookies) are presented in Table 5. The bakery products had total saturated fatty acids in the range of 28.86 to 69.94%, with brand A was the highest ($P<0.05$). The bakery products were found to have *trans* fatty acids in the range of 0.00 to 23.12%. Only brand G had large amounts of total *trans* fatty acids (23.12% $P<0.05$).

The *trans* content of bakery products (biscuits and cookies) can vary among bakery products. A study found that fat source in these biscuits was a combination of butter fat, palm oil, coconut and partially hydrogenated soybean oil (Ratnayake *et al.*, 1993 and 1998). The proportion of *trans* fatty acids studied in fourteen European countries in biscuits and cookies ranged from 1 to 28% (Van Erp-baart *et al.*, 1998), whereas in Argentina's cookies and crackers contained 18.15-31.8%

Table (4):The fatty acid composition (gFA/100g , mean ±SD) [w] in shortenings and margarines.

	Shortenings				Margarines			
FA	Brand A	Brand B	Brand C	Brand D	Brand A	Brand B	Brand C	Brand D
C14:0	0.58 ± 0.02^{b}	0.21 ± 0.02^{c}	0.20 ± 0.09^{c}	0.99 ± 0.04^{a}	1.65 ± 0.02^{a}	0.44 ± 0.04^{d}	0.55 ± 0.02^{c}	0.64 ± 0.04^{b}
C16:0	29.70 ± 0.19^{b}	14.63 ± 0.24^{c}	10.66 ± 0.82^{d}	46.42 ± 0.06^{a}	10.12 ± 0.38^{b}	13.48 ± 8.76^{b}	26.27 ± 0.14^{a}	10.44 ± 0.34^{b}
C16:1, *cis*	0.06 ± 0.04^{b}	0.12 ± 0.03^{ab}	0.06 ± 0.04^{b}	0.14 ± 0.01^{a}	-[y]	0.04 ± 0.03^{b}	0.10 ± 0.01^{a}	0.09 ± 0.02^{a}
C18:0	4.90 ± 0.32^{b}	14.43 ± 1.83^{a}	12.98 ± 0.93^{a}	4.81 ± 0.10^{b}	7.63 ± 0.23^{ab}	13.38 ± 9.09^{a}	4.03 ± 0.04^{b}	9.37 ± 0.06^{ab}
C18:1, *trans*	2.91 ± 0.24^{c}	8.81 ± 0.13^{b}	14.35 ± 2.31^{a}	0.43 ± 0.05^{d}	-	2.92 ± 0.16^{b}	4.41 ± 0.00^{a}	0.33 ± 0.23^{c}
C18:1, *cis*	28.98 ± 0.67^{bc}	24.53 ± 2.45^{c}	30.54 ± 4.84^{b}	36.46 ± 0.51^{a}	35.92 ± 0.03^{a}	29.49 ± 0.25^{c}	31.18 ± 0.30^{b}	23.11 ± 0.95^{d}
C18:2, *trans*	0.62 ± 0.47^{ab}	0.47 ± 0.07^{ab}	1.01 ± 0.28^{a}	0.14 ± 0.01^{b}	-	0.12 ± 0.01^{a}	0.11 ± 0.00^{a}	-
C18:2, *cis*	30.20 ± 0.31^{a}	25.80 ± 0.38^{b}	6.31 ± 0.43^{d}	8.92 ± 0.18^{c}	33.61 ± 0.65^{c}	36.00 ± 0.04^{b}	31.07 ± 0.04^{d}	51.93 ± 0.18^{a}
Total SFA	35.24 ± 0.50^{b}	29.39 ± 2.13^{c}	23.90 ± 1.71^{d}	52.36 ± 0.03^{a}	19.40 ± 0.64^{c}	27.35 ± 2.75^{b}	30.96 ± 0.15^{a}	20.55 ± 0.35^{c}
Total, *trans*	3.54 ± 0.71^{c}	9.28 ± 0.06^{b}	15.37 ± 2.59^{a}	0.57 ± 0.06^{d}	0.00	3.04 ± 0.17^{b}	4.53 ± 0.01^{a}	0.33 ± 0.23^{c}
Others	1.84 ± 0.02^{b}	9.72 ± 0.50^{b}	23.52 ± 9.22^{a}	1.32 ± 0.120^{b}	10.36 ± 2.08^{a}	1.91 ± 0.07^{b}	4.26 ± 2.48^{b}	4.08 ± 0.55^{b}

[w] Means in the same row (a-d) with different letters are significantly different ($p<0.05$).

-[y] not detected

Table (5):The fatty acid composition (gFA/100g mean ±SD) ^{w} in biscuits and cookies.

FA	Brand A	Brand B	Brand C	Brand D	Brand E	Brand F	Brand G
C14:0	0.59 ± 0.06^{c}	5.79 ± 0.51^{a}	0.94 ± 0.18^{c}	0.87 ± 0.03^{c}	2.11 ± 1.11^{b}	0.72 ± 0.06^{c}	0.69 ± 0.32^{c}
C16:0	43.68 ± 0.54^{a}	29.51 ± 0.54^{b}	38.07 ± 6.81^{ab}	39.05 ± 0.61^{ab}	27.55 ± 6.91^{b}	43.06 ± 0.41^{a}	8.01 ± 6.48^{c}
C16:1, *cis*	6.64 ± 1.19^{a}	0.37 ± 0.12^{b}	0.37 ± 0.12^{b}	$-^{y}$	0.45 ± 0.16^{b}	-	-
C18:0	19.02 ± 4.44^{a}	8.09 ± 0.72^{ab}	4.43 ± 1.18^{b}	5.27 ± 0.15^{b}	6.05 ± 3.18^{b}	5.63 ± 0.09^{b}	20.16 ± 8.80^{a}
C18:1, *trans*	0.79 ± 0.52^{b}	0.87 ± 0.13^{b}	-	-	0.79 ± 0.44^{b}	0.82 ± 0.16^{b}	22.15 ± 1.33^{a}
C18:1, *cis*	16.80 ± 6.53^{c}	21.87 ± 0.03^{bc}	30.39 ± 5.89^{bc}	41.38 ± 0.25^{ab}	54.46 ± 9.07^{a}	38.40 ± 0.33^{ab}	33.22 ± 0.72^{bc}
C18:2, *trans*	-	-	-	-	0.10 ± 0.04^{c}	0.39 ± 0.39^{b}	0.97 ± 0.04^{a}
C18:2, *cis*	8.83 ± 0.33^{bc}	6.22 ± 0.08^{de}	7.80 ± 1.80^{cd}	12.11 ± 0.13^{a}	4.98 ± 2.70^{e}	10.30 ± 0.17^{ab}	10.93 ± 0.26^{ab}
Total SFA	69.94 ± 6.73^{a}	43.76 ± 0.82^{bc}	43.81 ± 8.06^{bc}	45.21 ± 0.49^{bc}	36.17 ± 9.37^{bc}	49.41 ± 0.39^{b}	28.86 ± 4.64^{c}
Total, *trans*	0.79 ± 0.52^{bc}	0.87 ± 0.13^{bc}	0.00	0.00	0.72 ± 0.66^{bc}	1.22 ± 0.56^{b}	23.12 ± 1.28^{a}
Others	5.91 ± 4.73^{bc}	27.32 ± 1.63^{a}	18.00 ± 5.75^{ab}	1.63 ± 0.37^{c}	5.81 ± 4.81^{bc}	1.62 ± 0.83^{c}	1.89 ± 1.15^{c}

^{w} Means in the same row (a-d) with different letters are significantly different ($p<0.05$).

$-^{y}$ not detected

trans fatty acids (Tavella *et al.*, 2000). In this study the values of *trans* fatty acids ranged from 0.00 to 23.12% which is lower than that of European countries and Argentina and more than New Zealand which reported only 10% *trans* fatty acids (Lake *et al.*,1996).

CONCLUSION

The data obtained in this study indicated that there is a higher level of *trans* fatty acids in some of the selected food items sold in Saudi Arabia markets. Because of the health issue such as cardiovascular disease, breast cancer, and influence of the metabolism of essential fatty acids related to intake of *trans* fatty acid, therefore, it is essential that dietary fats and oils be analyzed regularly to ascertain the type and levels of *trans* fatty acids and other fatty acids. Food manufactures should be encouraged to reduce the levels of *trans* fatty acids arising from hydrogenation. They also should attempt to decrease the content of saturated fatty acids.

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الأحماض الدهنية من نوع ترانس في بعض الأطعمة والزيوت من أسواق مدينة الرياض

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ملخص

تم تقدير الأحماض الدهنية من نوع ترانس والأحماض الدهنية الأخرى بواسطة جهاز كروماتوجرافيا الغاز في ٣ منتجات من الزيوت النباتية المستخدمة في طهي وقلي الأطعمة. كما تم التقدير في ٤ منتجات من الزبد النباتي (المارجرين) و ٤ منتجات من السمن النباتي (الشورتننج) و ٧ منتجات من البسكويت. تم الحصول على المنتجات من أسواق مدينة الرياض – المملكة العربية السعودية.

تم أيضاً تقدير الأحماض الدهنية والأحماض الدهنية من نوع ترانس في الزيوت المستخلصة من أصابع البطاطس المقلية في بعض المطاعم المحلية (٣ مطاعم) وفي بعض المطاعم الدولية للوجبات السريعة (٦ مطاعم) وكانت النتائج كالتالي:

تحتوى الزيوت النباتية على ٩,٨٠-٤٤,٦٦% أحماض دهنية مشبعة وخالية من الأحماض الدهنية من نوع ترانس. يحتوى السمن النباتي على ٢٣,٩٠-٥٢,٣٦% أحماض دهنية مشبعة و ٠,٥٧-١٥,٣٧% أحماض دهنية من نوع ترانس. في حين أن الزبد النباتي يحتوى على ١٩,٤٠-٣٠,٩٦% أحماض دهنية مشبعة و ٠,٠٠-٤,٥٣% أحماض دهنية من نوع ترانس. أماالبسكويت فيحتوى على ٢٨,٨٦-٦٩,٩٤% أحماض دهنية مشبعة و ٠,٠٠-٢٣,١٢% أحماض دهنية من نوع ترانس.

تحتوى الزيوت المستخلصة من أصابع البطاطس المقلية في المطاعم الدولية للوجبات السريعة تحتوى على ٣,٧٩-٢٧,٣٤% أحماض دهنية من نوع ترانس و٢٦,٠٣-٤١,٩٥% أحماض دهنية مشبعة. أما الزيوت المستعملة في قلي أصابع البطاطس بالمطاعم المحلية والمعمل فتحتوى على نسبة عالية من الأحماض الدهنية المشبعة وخالية من الأحماض الدهنية من نوع ترانس. وجد بمقارنة النتائج المتحصل عليها أن الأطعمة المنتجة في السعودية (الزيوت النباتية والسمن النباتي والزبد النباتي) تحتوى على نسبة أقل من الأحماض الدهنية من نوع ترانس مقارنة مع مثيلاتها المنتجة في أنحاء مختلفة من العالم ماعدا بعض منتجات البسكويت وأصابع البطاطس المقلية بالمطاعم الدولية للوجبات السريعة فتحتوى على نسب عالية من الأحماض الدهنية من نوع ترانس.

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