Trans Fatty Acids in Adipose Tissue of French Women in Relation to Their Dietary Sources

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ABSTRACT: This study reports the fatty acid composition of subcutaneous adipose tissue in French women with special emphasis on the content of *trans* fatty acids originating from two main dietary sources, ruminant fats and partially hydrogenated vegetable oils (PHVO). Adipose tissue *trans* fatty acid levels from 71 women, recruited between 1997 and 1998, were determined using a combination of capillary gas chromatography and silver nitrate thin-layer chromatography. Results indicate that on average *cis* monounsaturates accounted for 47.9% of total fatty acids, saturates for 32.2%, and linoleic acid for 14.4%. *Cis* n-3 polyunsaturates represented only 0.7%. Total content of *trans* fatty acids was 2.32 ± 0.50%, consisting of *trans* 18:1 (1.97 ± 0.49%), *trans* 18:2 (0.28 ± 0.08%), and *trans* 16:1 (0.06 ± 0.03%). *Trans* 18:3 isomers were not detectable. The level of *trans* fatty acids found in adipose tissue of French women was lower than those reported for Canada, the United States, and Northern European countries but higher than that determined in Spain. Therefore, *trans* fatty acid consumption in France appears to be intermediate between that of the United States or North Europe and that of Spain. Based on the equation of Enig *et al.*, we estimated the mean daily *trans* 18:1 acid intake of French women at 1.9 g per person. The major *trans* 18:1 isomer in adipose tissue was Δ11*trans*, as in ruminant fats. Estimates of relative contribution of *trans* fatty acid intake were 55% from ruminant fats and 45% from PHVO. This pattern contrasts sharply with those established for Canada and the United States where PHVO is reported to be the major dietary source of *trans* fatty acids.

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At the beginning of the 1990s, epidemiological and clinical studies (1–8) suggested that dietary *trans* fatty acids might represent a risk for coronary heart disease. Clinical studies showed that *trans* fatty acids cause, in a dose-dependent manner (2), an increase of plasma low density lipoprotein cholesterol, and in some cases a decrease of plasma high density lipoprotein cholesterol (1–5,7). Occurrence of *trans* fatty acids in human tissues depends on their availability in the diet, because humans do not synthesize these fatty acid isomers. It is now well known that *trans* fatty acids are provided by three different dietary sources: the ruminant fats (milk and dairy products, beef, mutton, tallow) (9), the partially hydrogenated vegetable oils (PHVO) (some margarines, shortenings, baked goods, and chips) (10), and to a lesser extent, the refined vegetable oils (11). In France, the *trans* fatty acid content of most table margarines, both soft and hard, and low-fat spreads has decreased since 1995. At present, most of these products contain less than 1% total *trans* fatty acids (12) except for a few products which may contain up to 15% total *trans* fatty acids. In addition, products such as biscuits, crackers and French-fried potatoes that are marketed in France still contain 10–20% total *trans* fatty acids.

Estimates of *trans* fatty acids intake in France are 2.8 g/d capita from fat disappearance data (9) or 2.3 g from food consumption survey data (13). There are limitations in determining the *trans* fatty acids intake from nutrient databases, and therefore another approach should be considered. The *trans* fatty acid composition of adipose tissue is a reliable biochemical indicator of the consumption of "exogenous" fatty acids (14,15). The turnover rate of fatty acids in adipose tissue was shown to be approximately 3 yr (16), and therefore, its fatty acid composition would reflect dietary fats over that period.

The main objectives of this study were to determine the level of the different *trans* isomers (16:1*t*, 18:1*t*, 18:2*t*, and 18:3*t*) in adipose tissue of French adults, to assess their availability in the diet, and to determine their dietary origin (animal or processing) using the distribution of selected positional *trans* 18:1 isomers present in adipose tissue. In addition, the total fatty acid composition of adipose tissue of these French adults is reported, since such data are not available to date.

EXPERIMENTAL PROCEDURES

Subjects and sample collection. The study protocol was approved by the local ethical review committee, and informed consent was obtained from 71 participating women (age, 37 ± 10 yr; body mass index, 22 ± 3). They were recruited be-

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Abbreviations: FAME, fatty acid methyl ester; GC, gas chromatography; PHVO, partially hydrogenated vegetable oils; PUFA, polyunsaturated fatty acids; TLC, thin-layer chromatography.

tween 1997 and 1998. The selected participants were free of cancer and diabetes, and their lifestyles had not changed in the past 5 yr. Those who reported making major changes in their diet in the previous 5 yr were excluded. About 0.5–1 g abdominal subcutaneous adipose tissue was removed during abdominal surgery (hysterectomy, ovary cyst removal, etc.). The adipose tissue samples were immediately rinsed with an isotonic saline solution (0.9% NaCl) and then frozen and stored at –20°C until analyzed.

Sampling of foods containing PHVO. Fifteen brands of margarines and bakery products (biscuits, brioches, puff pastry, etc.) were purchased in local supermarkets in 1996 and 1997.

Lipid extraction. Thawed adipose tissue and food samples were ground in a mixture of chloroform/methanol (2:1, vol/vol). Total lipids were then extracted according to the method of Folch *et al.* (17). Solvents were evaporated to dryness under a stream of nitrogen. Lipids were taken up in an appropriate volume of chloroform/methanol (2:1, vol/vol) and stored in glass tubes at –20°C under nitrogen.

Fatty acid analysis. Fatty acid methyl esters (FAME) of total lipids were prepared using 14% boron trifluoride in methanol according to Morrison and Smith (18) and stored in hexane at –20°C under nitrogen. Analyses of total FAME were carried out on a gas chromatograph (Carlo Erba 5160, Milano, Italy) equipped with a flame-ionization detector and a split injector. A fused-silica capillary column (BPX 70, 60 m × 0.25 mm i.d., 0.25 μm film; SGE, France) was used with H_2 as a carrier gas (inlet pressure: 90 kPa). The split ratio was 1:70. The column temperature was programmed from 150 to 200°C at 1.5°C/min, then to 230°C at 2.5°C/min and held at 230°C until completion of the analysis (30 min). The injection port and the detector were maintained at 250°C. The gas chromatography (GC) peaks were integrated using an SP 4400 integrator (Spectra Physics, San Jose, CA). The different *trans* isomers of 18:2 and 18:3 were identified by comparing the GC retention times with authentic standards (Sigma, Saint Quentin Fallavier, France) or with well-characterized FAME mixtures prepared in our laboratory (11,19). In using these chromatographic conditions, all positional *trans* 18:1 isomers (6*t*-18:1 to 16*t*-18:1) could not be measured because of the overlap of five isomers (12*t*-18:1 to 16*t*-18:1) with *cis* 18:1 isomers. To measure the levels of all these isomers, the total *trans* 18:1 isomers were separated from *cis* 18:1 isomers by an additional step using $AgNO_3$ thin-layer chromatography (TLC) according to Wolff (19), with one minor modification. The developing solvent used for FAME separation was a mixture of hexane/diethylether (90:10, vol/vol). Analysis of the *trans* fraction was performed using a fused-silica capillary column (CP Sil 88, 100 m × 0.25 mm i.d., 0.20 μm film; Chrompack, Middelburg, The Netherlands) operated isothermally at 160°C, and using H_2 as the carrier gas (inlet pressure: 130 kPa) (19). Individual positional isomers of *trans* 18:1 were identified by comparison with synthetic isomers purchased from Sigma and with literature values (20). The total *trans* 18:1 content was calculated according to Ratnayake and Pelletier (21) by comparing the *trans* monoene fraction with the total FAME prior to $AgNO_3$ TLC fractionation. The *trans* 18:1 isomers, 6*t*-18:1 to 11*t*-18:1, well-separated on the total FAME chromatogram were therefore used as internal standard.

All the results are expressed as weight percentages of fatty acids using the factor (F'_t) described by Wolff *et al.* (22). This factor is linked to the theoretical response factor (F_t) by: $F'_t = F_t \times$ (fatty acid molecular weight/FAME molecular weight).

RESULTS

Fatty acid composition of abdominal adipose tissue. The detailed fatty acid compositions of women's adipose tissue (mean, standard deviation, and range) are presented in Table 1. *Cis* monounsaturated fatty acids accounted for about half (47.9% of total fatty acids), the major being oleic acid (9*c*-18:1) with 39.7%. The mean content of saturated fatty acids was 32.2%; palmitic acid (16:0) was the most prevalent with 22.2%. *Cis* n-6 polyunsaturated fatty acids (PUFA) ranged from 9.0 to 22.9% of total fatty acids (mean 15.3%), the main component being linoleic acid (9*c*,12*c*-18:2). *Cis* n-3 PUFA were present at very low levels (0.7% of total fatty acids).

The mean content of all *trans* fatty acids combined in adipose tissue in the 71 women examined was 2.32 ± 0.50% of total fatty acids, with a range of 1.41 to 3.96%. The *trans* fatty acids comprised isomers of 16:1, 18:1, and 18:2 acids (Table 2). The most prevalent *trans* isomers in adipose tissue were *trans* 18:1 acids, which were also the most abundant in foods. They represented 85% of the *trans* content and 1.97 ± 0.49% of adipose total fatty acids. There were several *trans*-18:1 isomers that ranged from Δ6 to Δ16. Accurate determination of the positional *trans* 18:1 isomers was obtained by a combination of $AgNO_3$-TLC and GC methods described above. The 18:1 isomers of the *trans* monounsaturated fatty acid band isolated from adipose tissue total FAME by $AgNO_3$-TLC were separated by GC into six individual FAME and two groups of FAME. The first group comprised 6*t*-, 7*t*-, and 8*t*-18:1, and the second the 13*t*- and 14*t*-18:1. Individual *trans* 18:1 isomers were 9*t*-, 10*t*-, 11*t*-, 12*t*-, 15*t*-, and 16*t*-18:1. Mean and range of their respective levels in all samples are shown in Table 2. The 11*t*-18:1 isomer was the most prevalent (0.65 ± 0.19%) in adipose total fatty acids. The only *trans* 16:1 fatty acid found in adipose tissue was 9*t*-16:1 which was well-separated from the iso and anteiso branched chain 17:0 fatty acids present in adipose tissue. The average content of 9*t*-16:1 was 0.06% of adipose tissue total fatty acids.

Total *trans* 18:2 isomer content was 0.28% of total fatty acids. The main 18:2 *trans* isomer was 9*c*,12*t*-18:2 at 0.13%, followed by 9*t*,12*c*-18:2 (0.06%). It is worth noticing that in our GC conditions, we could not exclude the possibility that the peak identified as the 9*t*,12*c*-18:2 also contained the 11*t*,15*c* isomer which has been found in bovine milk fat (23). The 9*t*,12*t*-18:2 was partially separated from 9*c*,13*t*-18:2. This isomer was identified in hydrogenated oils (21) and in bovine milk fat (23). Based on the partial overlap of these two

TABLE 1
Fatty Acid Composition of Total Lipids of Adipose Tissue from 71 Women (wt% total fatty acids)

Fatty acids[a]	Means ± SD	Range Min	Range Max
∑ SFA	32.23 ± 3.03	25.50	39.48
12:0	0.50 ± 0.22	ND[b]	0.97
14:0	3.43 ± 0.67	1.82	5.09
15:0	0.37 ± 0.09	0.20	0.73
16:0 iso	0.10 ± 0.03	ND	0.16
16:0	22.15 ± 1.80	17.51	26.01
17:0 iso	0.15 ± 0.06	ND	0.46
17:0	0.29 ± 0.06	0.18	0.47
18:0 iso	0.02 ± 0.06	ND	0.29
18:0	4.92 ± 1.20	2.43	7.79
20:0	0.23 ± 0.09	ND	0.47
22:0	0.04 ± 0.04	ND	0.17
24:0	0.01 ± 0.02	ND	0.06
∑ *cis*-MUFA	47.87 ± 3.00	40.39	57.52
14:1n-5	0.36 ± 0.14	0.08	0.76
16:1n-9	0.56 ± 0.13	0.4	1.44
16:1n-7	4.23 ± 1.08	2.00	7.09
17:1	0.27 ± 0.09	ND	0.45
18:1n-9	39.69 ± 2.55	32.28	49.75
18:1n-7	1.83 ± 0.48	ND	3.19
20:1n-9	0.7 ± 0.22	0.31	1.48
20:1n-7	0.18 ± 0.09	ND	0.4
22:1n-9	0.04 ± 0.03	ND	0.18
24:1n-9	0.00 ± 0.01	ND	0.03
∑ *cis* n-6 PUFA	15.34 ± 3.03	9.05	22.95
18:2n-6	14.35 ± 3.03	5.64	21.80
18:3n-6	0.05 ± 0.04	ND	0.15
20:2n-6	0.26 ± 0.09	0.1	0.55
20:3n-6	0.18 ± 0.08	0.08	0.55
20:4n-6	0.37 ± 0.42	0.15	3.72
22:4n-6	0.12 ± 0.08	ND	0.52
22:5n-6	0.01 ± 0.02	ND	0.09
∑ *cis* n-3 PUFA	0.74 ± 0.26	ND	1.4
18:3n-3	0.43 ± 0.17	ND	0.8
20:5n-3	0.03 ± 0.03	ND	0.12
22:5n-3	0.14 ± 0.07	ND	0.34
22:6n-3	0.14 ± 0.08	ND	0.43
Other *cis*-PUFA			
20:2n-9	0.17 ± 0.11	ND	0.71
20:3n-9	0.01 ± 0.03	ND	0.22
∑ TFA	2.32 ± 0.50	1.41	3.96

[a]SFA, saturated fatty acid; MUFA, monounsaturated fatty acid; PUFA, polyunsaturated fatty acid; TFA, *trans* fatty acid; ND, not detected (detection limit: 0.01%).

TABLE 2
***Trans* Fatty Acid Composition of Total Lipids of Adipose Tissue from 71 Women (wt% total fatty acids)**

Fatty acids	Means ± SD	Range Min	Range Max
∑ TFA	2.32 ± 0.50	1.41	3.96
9*t*-16:1	0.06 ± 0.03	0.01	0.21
∑ *trans* 18:1	1.97 ± 0.49	1.06	3.50
6*t* to 8*t*-18:1	0.09 ± 0.06	0.02	0.25
9*t*-18:1	0.27 ± 0.11	0.07	0.65
10*t*-18:1	0.29 ± 0.10	0.10	0.57
11*t*-18:1	0.65 ± 0.19	0.26	1.09
12*t*-18:1	0.24 ± 0.09	0.09	0.62
13*t* + 14*t*-18:1	0.27 ± 0.11	0.06	0.55
15*t*-18:1	0.07 ± 0.03	0.02	0.13
16*t*-18:1	0.09 ± 0.05	0.00	0.24
∑ *trans* 18:2	0.28 ± 0.08	0.16	0.52
9*t*,12*t* + 9*c*,13*t*-18:2	0.09 ± 0.04	0.03	0.19
9*c*,12*t*-18:2	0.13 ± 0.04	0.05	0.24
9*t*,12*c*-18:2[a]	0.06 ± 0.02	0.03	0.13
∑ *trans* 18:3	ND	ND	ND

[a]9*t*,12*c*-18:2; this peak might correspond to the sum of 9*t*,12*c* + 11*t*,15*c*. See Table 1 for abbreviations.

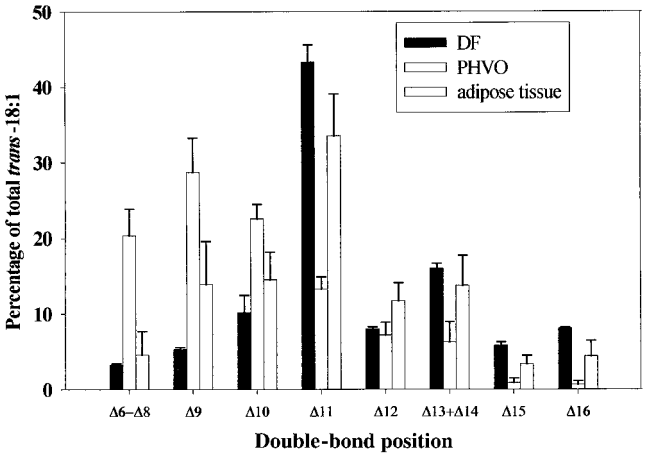

FIG. 1. Comparison of *trans* 18:1 positional isomer profiles in women's adipose tissue (n = 71), in dairy fat (DF; n = 10), and in partially hydrogenated vegetable oils (PHVO; n = 15). Positional isomers were analyzed using a combination of gas chromatography and silver nitrate thin-layer chromatography of fatty acid methyl esters. Values for each positional isomer are expressed as percentage of total positional isomers. Error bars represent standard deviation.

18:2 isomers, we estimated that 9*t*,12*t*-18:2, on average, represented about 20% of the complex peak (9*t*,12*t* plus 9*c*,13*t*), or 1% of the *trans* content and 0.02% of total fatty acids in adipose tissue. Therefore, 9*t*,12*t*-18:2 was the least common isomer of *trans*-18:2 found.

Profile of positional trans*-18:1 isomers in abdominal adipose tissue.* Figure 1 illustrates the mean distribution of positional *trans*-18:1 isomers in abdominal adipose tissue found in the 71 participating women; values were compared to those found in ruminant fats (average of 10 dairy products) and in PHVO (average of 15 selected *trans*-containing food products in France). The average distribution of *trans*-18:1 isomers in adipose tissue showed a greater similarity to ruminant fats than to PHVO *trans* fatty acids (Fig. 1). Vaccenic acid (11*t*-18:1) was the most prevalent both in adipose tissue fat (33% of total *trans* 18:1 acids) and in ruminant fats (43%).

DISCUSSION

Adipose tissue is regarded as a good reflection of long-term intake of fatty acids, some of which cannot be synthesized by humans, like linoleic, α-linolenic, and *trans* fatty acids

(15,24). Consequently, adipose tissue measurements may provide independent information on dietary habits. There are few data on the fatty acid composition of adipose tissue in European adults, and to our knowledge, none in France. Therefore, besides *trans* fatty acids, we report here the whole fatty acid composition of adipose tissue for 71 French women in 1997–1998. The content of *cis* PUFA (16%), consisting mainly of linoleic acid, was similar to that observed in 1985 in 59 Dutch women (17%) (24) or in 1986 in 76 U.S. males (16%) (25). However, it was lower than that reported in 1986 in 115 post-menopausal U.S. women (19.7%) (15) or in 1986 in 140 U.S. women (20.8%) (26). The contents of saturated (32.2%) and *cis* monounsaturated (47.9%) fatty acids found in this study were similar only to those reported in U.S. males (25). Because saturated and monounsaturated fatty acids are endogenously synthesized, their adipose content may not reflect their dietary intake.

Conversely, some studies have observed a correlation of *trans* fatty acid content between adipose tissue and the diet (14,15,27). The *trans* content in our French adipose tissue samples was 2.32% of total fatty acids, present as 16:1, 18:1, and 18:2 in all samples. On the other hand, *trans* fatty acids with 14 and 20–22 carbon atoms, and *trans* 18:3 isomers were below detection limits (0.01%) by GC. We noted that the 9*t*-16:1 level (0.06%), without contamination by branched-chain 17:0 fatty acids, was often lower than previously reported (15,25,27–29). The origin of this isomer is ruminant fats (30) and partially hydrogenated fish oils (31). Because *trans* 16:1 isomers sometimes have been associated with an increased risk of coronary artery disease (32), accurate chromatographic analysis is mandatory to avoid the overestimation due to closely coeluting branched-chain 17:0 fatty acids that are present. *Trans* polyunsaturates in adipose tissue of these French women contained less *trans* 18:2 acids (0.28%) than those observed in the American studies (0.9–1.3%). Data reported for Germany and the United Kingdom were similar to ours (0.34–0.59%) (29,33). These *trans* isomers were provided by PHVO (<2%) and by ruminant fats (about 1%). Differences of *trans* polyunsaturate adipose content between American and European populations reflect differences of their dietary fats. The *trans*-18:2 acids in decreasing order were: 9*c*,12*t* (0.13%) > 9*c*,13*t* (0.07%) > 9*t*,12*c* (0.06%) > 9*t*,12*t* (0.02%). *Trans* isomers of long-chain n-6 PUFA could be endogenously synthesized from mono-*trans*-18:2, and they are potential precursors of *trans* eicosanoid isomers (34). However, no *trans* isomers of long-chain n-6 PUFA were detected in adipose tissue. The di-*trans* isomer (9*t*,12*t*-18:2), which is known to alter the activity of Δ6-desaturase toward linoleic acid (9*c*,12*c*-18:2) (35), was found at <0.09%.

The bulk of *trans* fatty acids present in adipose tissue was *trans*-18:1 isomers. Their content ranged from 1.06 to 3.50% of total fatty acids of adipose tissue, with a mean value of 1.97%. These results are directly comparable to those determined in Canada (28), since the same combination $AgNO_3$-TLC and GC was used. *Trans*-18:1 content of adipose tissue from French women was lower than that of Canadians (4.8%), while the U.S. study (2.7 to 3.9%) was probably underestimated by omitting the 12*t*-18:1 to 16*t*-18:1 isomers (15,24–26). This suggests that *trans* fatty acid intake of these French women was lower than that of the Canadian and U.S. adults. The European data on *trans*-18:1 content of adipose tissue show that it varied from 0.43 to 2.43% among the eight countries participating in the Euramic Study (36). These values did not take into account the 12*t*-18:1 to 16*t*-18:1 isomers. As shown in Figure 1, these isomers constituted an average of 33% of total *trans*-18:1 isomers present in adipose tissue of the French women. Based on this estimate, we recalculated the published European data for comparison and observed that the *trans* content of French adipose tissue (1.97 ± 0.49%) was lower than those of North Europe countries (3.2–3.6%), but higher than that of Spain (0.6%). That would suggest that *trans*-18:1 acid intake in France was intermediate between countries of North and South Europe, which is in agreement with fat consumption data (9,37). Furthermore, our results on adipose tissue *trans*-18:1 acid content were similar to those obtained in France on *trans*-18:1 acid level in human milk (30,38), a biochemical indicator of *trans* fatty acid consumption of the previous day (39). Values of 1.8 ± 0.9% and 2.0 ± 0.6% (relative to total fatty acids) were found in milk of French women in 1995 by Combe *et al.* (38) in the Bordeaux region, and by Chardigny *et al.* (40) in the Dijon region, respectively.

The percentage value of *trans*-18:1 in adipose tissue of the 71 French women was applied to the equation of Enig *et al.* (14):

$$y = 0.97 + 0.44\,x \qquad [1]$$

which describes the relationship of *trans*-18:1 percentages between adipose tissue (y) and dietary fat (x). The estimated average of *trans*-18:1 in dietary fat was 2.27%, using this equation (Table 3). The mean total fat intake of our French women was 85 g/d/person, or 42% of energy based on dietary records (Boué, C., and Combe, N., unpublished data). We calculated that the consumption per capita of *trans*-18:1 acid might vary from 0.12 to 4.10 g/d, with an average value of 1.9 g/d (Table 3).

If we assume that there are no metabolic differences in turnover between the several positional *trans*-18:1 isomers in adipose tissue, then the respective proportions of these isomers in adipose tissue would depend on the availability in the diet. As shown in Figure 1, the pattern of *trans*-18:1 acids in adipose tissue was the result of contributions from both ruminant fats and PHVO. These results contrast widely with those reported by Chen *et al.* (28) for Canada and Ohlrogge *et al.* (41) for the United States. In these countries, the distributions of *trans*-18:1 isomers in adipose tissue were similar to those of dietary PHVO, indicating that they were the major dietary sources of *trans*-18:1 acids.

We assessed the relative contribution of both dietary origins to adipose storage of *trans*-18:1 isomers, using an equation proposed by Wolff (30) for human milk, which is based on the absence of 16*t*-18:1 in PHVO and its presence in ruminant fats. In Equations 2 and 3,

TABLE 3
Estimates of Human Consumption of Dietary *trans* Fatty Acids Based on Percentage of *trans* 18:1 in Adipose Tissue of 71 Women

		Range	
	Means	Min	Max
% *Trans* 18:1 in adipose tissue = *y* (wt% total fatty acids)	1.97	1.06	3.50
Equation of Enig *et al.* (Ref. 14)		$y = 0.97 + 0.44\,x$	
Estimate % *trans* 18:1 in women dietary fat = *x* (wt% total fatty acids)	2.27	0.33	5.34
Daily per capita total fat intake (g/d/person)	84.70	31.10	136.00
Estimate daily per capita intake of *trans* 18:1 (g/d/person)	1.93	0.12	4.10

$$8.1X + 0.5Y = Z \quad [2]$$

$$X + Y = 1 \quad [3]$$

X represents the intake of milk fat and *Y* the intake of margarines. *Z* is the percentage of 16*t*-18:1 relative to total *trans*-18:1 isomers in human milk. The author considered cow milk as the primary dominant source of ruminant fats for lactating French women and therefore used the value 8.1 as the mean proportion of the 16*t*-18:1 isomer in cow milk fat (30). However, this value was found to be 4.9% of the total *trans*-18:1 isomers in ruminant meat (30). Based on our dietary questionnaire, we found that ruminant fats were derived from 85% dairy products and 15% ruminant meat (Boué, C., and Combe, N., unpublished data). By using these values, the average percentage of 16*t*-18:1 in ruminant fats was 7.6%, which was applied to the above equations: $7.6X + 0.5Y = 4.4$ and $X + Y = 1$. *Z*, the mean 16*t*-18:1 proportion in adipose tissue, was 4.4% (Table 2). The relative contributions to *trans* fatty acid in the diet were estimated at 55% from ruminant fats and 45% from PHVO. These values were very similar to those deduced (58 and 42%, respectively) from the 16*t*-18:1 proportion in French human milk (30). These results suggest that lactating women consume little more dairy products than nonlactating women.

Ascherio *et al.* (42) recently reported clinical studies utilizing diets containing 3.3–10% of energy from *trans* fatty acids (elaidic acid: 9*t*-18:1). They showed that an increase of 2% in the intake of *trans* fatty acids raised the ratio of low density lipoprotein cholesterol to high density lipoprotein cholesterol by 0.1 unit when compared to a diet with isocaloric amounts of oleic acid. For the diet of the French women of our study, the percentage of energy from *trans*-18:1 acid was about 1%, with extreme values of 0.1 and 2.2% of total energy. These data were determined from the percentage of *trans*-18:1 acid in dietary fats (2.3%; range: 0.3–5.3%) and from total energy as fats (42%) in the diet of these subjects. The cholesterol levels of serum lipoproteins in these French women in relation to their total *trans* fatty acid intake and from either dietary source will be the subject of a further report.

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