AGENCE FRANÇAISE
DE SÉCURITÉ SANITAIRE
DES ALIMENTS

Maisons-Alfort, 20 February 2009

OPINION

of the French Agency for Food Safety regarding the estimation of *trans* fatty acid intake in the French population

THE DIRECTOR GENERAL

1. Summary of request

On July 16, 2007, the French Food Safety Agency (AFSSA) was directed by the Directorate General for food (DGAL) to provide scientific and technical support for the collection of data relating to the composition and consumption of fatty components.

2. Background information and work objectives

This request came in the context of a DGAL working group aimed at identifying the foundations and justifications of commitments that the industrial sectors propose or may propose for improvements regarding fats, in order to improve the quality of food ranges, as supported by the second national programme for nutrition and health (PNNS 2).

The request concerns the specific identification of information relating to the fatty composition of categories of food, intake of the different fatty components by the population, ordering of foods contributing to intake of the different fatty components, types of consumers according to different levels of consumption (age, gender, socio-economic group, etc.). The fatty acids specifically under consideration are total fats, saturated fatty acids (SFAs), *trans* fatty acids (*trans* FA) and the n-3 and n-6 polyunsaturated fatty acid families.

This opinion relates specifically to **the estimation of *trans* fatty acids intake in the French population**, based on a new food composition table and data from the INCA2 study.

In April 2005, AFSSA published a report on the health risks and benefits of *trans* fatty acids in food (AFSSA 2005a).
The key points of this report are as follows:

- adoption of a chemical definition of *trans* FAs;
- estimation of consumption levels of these FAs in the French population;
- examination of the effects of *trans* FAs on health, according to their nature and origin;
- drawing up recommendations in terms of maximum content in food and levels of food consumption;
- whether and how consumers should be informed of the presence of *trans* FAs in food.

In this report, the term *trans* FA is used to refer to all monounsaturated and polyunsaturated fatty acids containing at least one double bond in *trans* configuration.

According to the literature, *trans* FAs found in food derive from three main sources:

- ruminant biohydrogenation which causes the presence of *trans* FAs in milk and foods from ruminant animals (meat and dairy products);
- partial catalytic hydrogenation of oils or fats which is responsible for the presence of *trans* FAs in partially hydrogenated oils (margarines) and "shortenings" (mixtures of anhydrous fats used mainly for industrial purposes); this industrial process is used to reduce unsaturation;
- heat treatments (refining, deep frying, cooking, etc.), responsible for the formation of *trans* FAs in oils and fats. These treatments may be technological or domestic.

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With respect specifically to total *trans* FA intake, the data from the INCA1 study conducted in 1998-1999 showed the following results:

- average daily intakes of total *trans* FA were 3.0 g for boys, 2.7 g for girls, 3.4 g for men and 2.8 g for women. These intakes accounted for 3.2 to 3.5% of the energy intake from fats and between 1.2 and 1.4% of the total energy intake (TEI);
- for heavy consumers of *trans* FAs (95th percentile of the population), intakes in terms of quantity were approximately double, i.e. 5.8 g/day for boys, 4.7 g/day for girls, 5.8 g/day for men and 4.9 g/day for women. These intakes corresponded to 2.2%, 1.9%, 2.0% and 2.0% of the TEI for boys, men, girls and women respectively;
- the main food contributors were dairy products: they supplied 53% of the total *trans* FAs for adults and 45% for children; all of the products of animal origin provided around 62% for children and 67% for adults. Industrial bread products, industrial pastries and biscuits were in second position as food contributors: they supplied 18% of the total *trans* FAs for adults and almost 27% for children.

A review of the studies on the metabolism and the toxicity of *trans* FAs and those related to their impact on the immune response and on the risk factors for certain pathologies (obesity, metabolic syndrome, atherosclerosis, cancer) had been conducted. The data available showed that consumption of *trans* FAs above the threshold of 2% of the TEI leads to a significant increase in the risk of cardiovascular disease.
This value was considered in AFSSA's April 2005 report as a level of intake which should not be exceeded.

In order to reach intake levels compatible with this limit, AFSSA made the following recommendations:

- observing the public health objective aimed at reducing the consumption of SFAs, as consumption data have shown a positive correlation between SFA and total *trans* FA intake;
- reducing consumption of certain foods which contribute to the intake of *trans* FAs, in particular pastries, croissant-like pastries, industrial bread products, chocolate bars and biscuits;
- setting limits for *trans* FA content in different categories of products:
    - for the fats used in industry and by bakers ("shortenings") for making croissant-like pastries, pastries, biscuits, bread products and chocolate bars, this limit was set at 1 g/100 g of product in the form in which it is consumed;
    - for visible fats, this limit was set at 1% for table oils and margarines.

This opinion is based on scientific and technical work carried out by AFSSA's Scientific and methodological support unit for risk assessment (PASER). This was validated by the "Human nutrition" scientific panel which met on October 23, 2008 and January 29, 2009.

3. Methodology

3.1 Food composition data of *trans* FA: CIQUAL 2008 table

A table containing the total *trans* FA amount in foods was drawn up by the CIQUAL in 2008 from composition data provided by consumer associations, interprofessional bodies, members of the federation of commerce and industry, and food processing groups, including suppliers of catering products (Appendix 1). Some of these data came from the French Nutrition Institute (IFN).

Table 1 in Appendix 1 shows, for each food group in the INCA2 list, the number of foods with a *trans* FA amount above zero, zero or unknown at the end of the data collection period.
The data show that there remain a large number of foods for which the *trans* FA content is not known, in particular in the processed food groups such as "ready meals", "sandwiches", "condiments and sauces" and "pastries and cakes".

Hypotheses have been formulated in order to fill in the unknown values in an attempt to be exhaustive in the estimation of *trans* FA intake in the population for the INCA2 study (see paragraph 3.3).

3.2 Food consumption data: INCA2 2006-07 study

The food consumption data used to estimate *trans* FA intake come from the INCA2 study which was conducted in 2006-07 on 4079 individuals aged from 3 to 79 years and divided into 2 sub-samples: 1455 children aged 3-17 years and 2624 adults aged 18-79 years. The participants were selected from the 1999 national population census and databases covering new housing built between 1999 and 2004 according to a 3-stage sampling technique stratified on size of the urban area and region. The consumption of individuals was recorded using a 7-day open-ended food record, on which they noted the nature of the food and quantities consumed, estimated using a manual showing photographs of portions.

A weighting was allocated to each individual in the two samples (3-17 year-olds and 18-79 year-olds) in order to ensure their representativity on a national level. In addition, in order to guarantee the validity of the estimations, under-reporters were excluded from the analyses which therefore take into account 1444 children and teenagers and 1918 adults aged 18-79 with normal declaration levels.

The consumption data collected in 2006-2007 are consistent with the data for amounts of *trans* FA in food dating from 2007-2008.

3.3 Estimation of *trans* FA intake

Two scenarios were used to estimate *trans* FA intake:

- the first scenario corresponds to an estimation with no correction for unknown values;
- the second scenario includes a correction for unknown values.

Scenario 1 corresponds to the simulation methods used to estimate *trans* FA intake for the AFSSA report (AFSSA 2005a). The two scenarios were compared to verify the validity of the attribution of non-zero values for the unknown values.

For scenario 2, the composition data were consolidated taking the following into account for each food group:

- the fat content of each of the foods;
- the average "*trans* FA/total fat" ratio for all foods in the group for which the *trans* FA content is known.

The following formula was therefore chosen:

$$TFA_{ij} = FAT_{ij} \times TFA_{j} / FAT_{j}$$

Where: TFA_{ij} : estimated *trans* FA content in food i from group j
FAT_{ij} : fat content in food i from group j
TFA_{j} : average *trans* FA content for group j foods for which the content is known;
FAT_{j} : average fat content for group j foods for which the *trans* FA content is known.

For the three food groups "soups and broths", "eggs and egg derivatives", "shellfish and molluscs", an average content was estimated based on bibliographical data[1].

Tables 3 and 3b in Appendix 1 give the results for *trans* FA content for each food group respectively as follows:
- the 500 foods with a documented *trans* FA content;
- the 908 foods which are potential vectors of *trans* FA, with an actual or estimated *trans* FA content.

For certain foods, the *trans* FA content is highly variable and above-average values have been identified. The estimations made are therefore not maxima.

Finally, the estimation of *trans* FA intake was made by combining the consumption data from the INCA2 survey and the two *trans* fatty acid composition tables (average *trans* FA value) that had been drawn up.

4. Results

4.1 Energy and fat intake in the French population (Appendix 3)

Since *trans* FA intakes are expressed as gross values (grams per day) and also as a proportion of the total energy intake, the energy levels for adults and children by gender and age are here recalled.

The daily total energy intakes (TEI) for adults are around 2160 kcal per day with a significant difference between intakes for men (2500 kcal/day) and women (1860 kcal/day). Energy intake decreases with age for men while it remains fairly stable for women.
For children, there is also a significant difference in energy intake between boys (1900 kcal/day) and girls (1640 kcal/day). The level of energy intake increases with age for boys.

Levels of fat intake are also given for information purposes (Appendix 3).

4.2 Total *trans* FA intake in the French population

The results of estimations of total *trans* FAs in the French population are shown in the tables below for adults (Tables 1 and 6) and children (Tables 2 and 6).

[1] For "soups and broths", estimated *trans* FA content according to *Aro A, Amaral E, Kesteloot H, Rimestad A, Thamm M, van Poppel G (1998). Trans Fatty Acids in French Fries, Soups, and Snacks from 14 European Countries: The TRANSFAIR Study, Journal of Food Composition and Analysis, 11, 2, 170-7.*
For "eggs and egg derivatives", estimated *trans* FA content according to *Souci Fachmann Kraut: Die Zusammensetzung der Lebensmittel. Nährwert-Tabellen. H. Scherz, F. Senser, Medpharm, 6. Aufl. Stuttgart 2000, 1182 S.*
For "shellfish and molluscs", estimated *trans* FA content according to *Analysis of Greenshell™ mussels for trans fatty acid content. Crop & Food Research Analytical Report. November, 2005. Carlene McLean, Seafoods and Marine Extracts, New Zealand Institute for Crop & Food Research Limited.*

In scenario 1, the gross *trans* FA intake amounted to 1.8 g/day for adults, i.e. 0.75% of the TEI. The average daily *trans* FA intake is higher for men (2.0 g/day) than for women (1.6 g/day), but expressed as a proportion of the TEI it is virtually identical. Five percent of adults have a *trans* FA intake above 1.2% of the TEI. No difference is noted according to age brackets, either for men or women.

Trans FA intake for children is lower than for adults in absolute terms (1.5 g/day) but almost the same when expressed as a relative value (0.8% of the TEI). The gender difference was also present for children (boys [1.6 g/day] and girls [1.4 g/day]). The highest average intakes were found for young teenagers aged 11-14 years (1.7 g/day). The highest *trans* FA intake as a percentage of the TEI (0.83%) was found in the 3-10 age bracket.

In scenario 2, the average adult intake amounted to 2.3 g/day (i.e. approximately 1% of the TEI) and 3.9 g/day for the 95th percentile (i.e. 1.5% of the TEI). A difference between men and women was found in absolute terms, but not when adjusted as a proportion of the TEI. No difference was found for adults in different age brackets. Five percent of adults have a *trans* FA intake above 1.5% of the TEI and fewer than 0.1% have an intake above the 2% threshold.
For children, the average intake as a proportion of the TEI is 1%, which is similar to that of adults. Boys have a higher intake than girls, but it is identical when expressed as a proportion of the TEI. For boys, the highest intake was found in the 15-17 age bracket, with an average of 2.2 g/day and 3.7 g/day for the 95th percentile. For girls, young teenagers (11-14 years) have the highest intakes with an average of 1.9 g/day and 3.1 g/day for the 95th percentile. In total, 5% of children have an intake which is above 1.4% of the TEI and fewer than 0.1% have an intake above the maximum recommended limit of 2%.

To sum up, the *trans* FA intakes found in the case where hypotheses are formulated for the unknown values (scenario 2) are roughly 30% higher than those found if only the raw data supplied by professionals are taken into account (scenario 1). Thus the consolidation of composition data enables the risk of underestimating intakes to be put into perspective.
In addition, in both scenarios, the average intakes expressed as a proportion of the TEI and those of the 95th percentile are below the maximum intakes of 2% of the TEI set by AFSSA in 2005, both for adults and children.

4.3 Food groups contributing to the average total *trans* FA intake in the French population.

For the purposes of this opinion, *trans* FAs contained in dairy products (milk, cheese, butter, fresh dairy products) and in meat from ruminant animals are considered to be *trans* FAs of natural origin. In other words, these are *trans* FAs produced by ruminant biohydrogenation.
Trans FAs of technological origin are those contained in foods with hydrogenated vegetable fats (in particular certain cakes, pastries, pizzas and quiches, sweet and savoury biscuits and ready meals). They also include fats distributed in animal feed and found in animal products such as cured meats, poultry, game and farmed fish.

In scenario 2, it appears first of all that the proportion of *trans* FAs of natural origin (dairy products, butter and meat) is higher than that of *trans* FAs of technological origin for adults, i.e. 57.4% compared to 42.6% of total *trans* FAs. For children, the proportions of *trans* FAs from both sources are similar (50.7% compared to 49.3% of total *trans* FAs) (Table 3). With respect to scenario 1, the proportion of *trans* FAs of natural origin is higher, both for adults and children (Tables 3).

The main food groups contributing to the total *trans* FA intakes are more or less the same in both scenarios: cheeses, butter and meat (Tables 4, 5 and 7). The levels of consumption of these different food groups are shown in Appendix 2.
In scenario 2, cheeses are the first food group carrying *trans* FAs for adults, with 22% of the total intake, and the second largest for children, with 14% (Tables 4 and 5). Butter is in the leading position for children (14.4%) and in second position for adults (17%). Meats are in 4th position for adults (with 10.6%) and in third position for children (with 11%).

However, certain food groups such as ready meals, sandwiches and soups are higher up in the list of food groups for scenario 2 as a result of the hypotheses drawn up for unknown values (Table 7). Thus for adults, ready meals are in 3rd position with 11.2% of total *trans* FA intake in scenario 2 whilst they are in only 9th position with 1.9% for scenario 1.

To sum up, for both adults and children, in both scenarios, a dozen food groups contribute 90% of the total *trans* FA intake (Table 7).

Tables 1: *Trans* FA intake (g/day and % of TEI) for adults by gender and age

Scenario 1 (without correction for unknown *trans* FA content)

Gender	Age bracket	n	Intake in g/day				Intake as % of TEI			
			Mean	Standard deviation	Median	P95	Mean	Standard deviation	Median	P95
Men	18-34 years	143	2.06	1.05	1.94	3.67	0.72	0.30	0.69	1.09
	35-54 years	333	2.08	0.90	1.91	3.76	0.73	0.25	0.71	1.17
	55 and over	300	2.00	1.03	1.89	3.72	0.74	0.31	0.72	1.28
	Total Men	*776*	*2.04*	*0.98*	*1.91*	*3.72*	*0.73*	*0.28*	*0.71*	*1.20*
Women	18-34 years	299	1.58	0.71	1.50	2.90	0.77	0.27	0.76	1.26
	35-54 years	493	1.58	0.60	1.53	2.78	0.75	0.22	0.75	1.20
	55 and over	350	1.52	0.60	1.45	2.72	0.75	0.26	0.74	1.25
	Total Women	*1142*	*1.56*	*0.63*	*1.50*	*2.83*	*0.76*	*0.25*	*0.75*	*1.23*
Total adults		**1918**	**1.79**	**0.83**	**1.67**	**3.30**	**0.75**	**0.26**	**0.73**	**1.22**

Scenario 2 (with correction for unknown *trans* FA content)

Gender	Age bracket	n	Intake in g/day				Intake as % of TEI			
			Mean	Standard deviation	Median	P95	Mean	Standard deviation	Median	P95
Men	18-34 years	143	2.66	1.11	2.56	4.54	0.93	0.30	0.95	1.30
	35-54 years	333	2.67	0.96	2.50	4.54	0.94	0.26	0.94	1.40
	55 and over	300	2.56	1.15	2.40	4.52	0.96	0.33	0.94	1.48
	Total Men	*776*	*2.62*	*1.06*	*2.48*	*4.54*	*0.95*	*0.29*	*0.94*	*1.41*
Women	18-34 years	299	2.03	0.80	1.92	3.56	0.99	0.30	0.99	1.52
	35-54 years	493	2.03	0.66	1.95	3.38	0.97	0.23	0.95	1.42
	55 and over	350	2.02	0.66	1.93	3.23	1.00	0.26	0.99	1.51
	Total Women	*1142*	*2.03*	*0.70*	*1.93*	*3.34*	*0.99*	*0.26*	*0.97*	*1.47*
Total adults		**1918**	**2.31**	**0.91**	**2.17**	**3.90**	**0.97**	**0.28**	**0.96**	**1.46**

Tables 2: *Trans* FA intake (g/day and % of TEI) for children by gender and age

Scenario 1 (without correction for unknown *trans* FA content)

Gender	Age bracket	n	Intake in g/day				Intake as % of TEI			
			Mean	Standard deviation	Median	P95	Mean	Standard deviation	Median	P95
Boys	3-10 years	276	1.60	0.70	1.59	2.55	0.82	0.27	0.81	1.23
	11-14 years	209	1.72	0.58	1.69	2.84	0.75	0.21	0.75	1.07
	15-17 years	199	1.68	0.69	1.49	3.18	0.70	0.20	0.68	1.13
	Total boys	*684*	*1.64*	*0.66*	*1.60*	*2.67*	*0.78*	*0.24*	*0.78*	*1.17*
Girls	3-10 years	294	1.46	0.57	1.40	2.42	0.84	0.26	0.83	1.24
	11-14 years	241	1.45	0.53	1.38	2.54	0.74	0.21	0.73	1.22
	15-17 years	225	1.32	0.45	1.24	2.29	0.71	0.21	0.71	1.14
	Total girls	*760*	*1.42*	*0.53*	*1.37*	*2.42*	*0.79*	*0.24*	*0.78*	*1.21*
Total children		**1444**	**1.54**	**0.60**	**1.46**	**2.58**	**0.78**	**0.24**	**0.78**	**1.20**

Scenario 2 (with correction for unknown *trans* FA content)

Gender	Age bracket	n	Intake in g/day				Intake as % of TEI			
			Mean	Standard deviation	Median	P95	Mean	Standard deviation	Median	P95
Boys	3-10 years	276	1.92	0.77	1.90	2.89	0.99	0.27	0.98	1.38
	11-14 years	209	2.11	0.60	2.10	3.29	0.93	0.20	0.91	1.25
	15-17 years	199	2.15	0.74	2.00	3.69	0.91	0.22	0.87	1.35
	Total boys	*684*	*2.01*	*0.72*	*1.99*	*3.19*	*0.96*	*0.24*	*0.95*	*1.36*
Girls	3-10 years	294	1.77	0.60	1.70	2.77	1.02	0.26	0.99	1.46
	11-14 years	241	1.86	0.57	1.80	3.07	0.96	0.21	0.96	1.41
	15-17 years	225	1.71	0.51	1.63	2.80	0.93	0.22	0.90	1.38
	Total girls	*760*	*1.78*	*0.57*	*1.71*	*2.85*	*0.98*	*0.24*	*0.97*	*1.43*
Total children		**1444**	**1.90**	**0.66**	**1.84**	**3.03**	**0.97**	**0.24**	**0.96**	**1.38**

Tables 3: Breakdown of food groups which are sources of *trans* FA, by origin (natural or technological) for adults and children

Scenario 1 (without correction for unknown *trans* FA content)

	Proportion of *trans* FA intake (%)	
	ADULTS	**CHILDREN**
Food groups containing *trans* FAs of natural origin	72.2	61.2
Food groups containing *trans* FAs of technological origin	27.8	38.8
TOTAL	100	100

Scenario 2 (with correction for unknown *trans* FA content)

	Proportion of *trans* FA intake (%)	
	ADULTS	**CHILDREN**
Food groups containing *trans* FAs of natural origin	57.4	50.7
Food groups containing *trans* FAs of technological origin	42.6	49.3
TOTAL	100	100

Tables 4: Main food groups which are sources of *trans* FA, for adults [2]

Scenario 1 (without correction for unknown *trans* FA content)

Food group	Average *trans* FA intake (g/day)	*Trans* FA intake (%)	Total intake (%)
Cheeses	0.49	27.4	27.4
Butter	0.38	21.1	48.5
Meat	0.24	13.4	61.9
Fresh dairy products	0.15	8.5	70.4
Pastries and cakes	0.13	7.0	77.5
Croissant-like pastries	0.08	4.6	82.1
Pizzas, quiches and savoury pastries	0.06	3.5	85.6
Sweet and savoury biscuits and bars	0.04	2.2	87.7
Mixed dishes	0.03	1.9	89.6
Milk	0.03	1.8	91.4
Margarine	0.03	1.7	93.1
Bread and bread products	0.03	1.6	94.7
Entremets, cream desserts and jellified milks	0.02	1.2	96.0
Oil	0.02	0.8	96.8
TOTAL	**1.78**	**100.0**	

Scenario 2 (with correction for unknown *trans* FA content)

Food group	Average *trans* FA intake (g/day)	*Trans* FA intake (%)	Total intake (%)
Cheeses	0.51	22.08	22.1
Butter	0.38	16.62	38.7
Mixed dishes	0.26	11.24	49.9
Meat	0.25	10.63	60.6
Pastries and cakes	0.18	7.72	68.3
Fresh dairy products	0.15	6.64	74.9
Soups and broths	0.09	3.73	78.7
Croissant-like pastries	0.08	3.56	82.2
Pizzas, quiches and savoury pastries	0.07	2.99	85.2
Sweet and savoury biscuits and bars	0.04	1.69	86.9
Entremets, cream desserts and jellified milks	0.04	1.56	88.5
Milk	0.03	1.48	89.9
Sandwiches, snacks	0.03	1.48	91.4
Bread and bread products	0.03	1.43	92.8
Margarine	0.03	1.30	94.1
Cured meats	0.03	1.21	95.4
Oil	0.02	0.69	96.1
TOTAL	**2.31**		

[2] The food groups which do not contribute to the *trans* FA intakes are not shown in the table, nor are those with intakes less than 0.02 g/day. However, the total average intake includes all food groups. The food groups which are a source of *trans* FA of natural origin are shown in blue.

Tables 5: Main groups of food which are sources of *trans* FA, for children [3]

Scenario 1 (without correction for unknown *trans* FA content)

Food group	Average *trans* FA intake (g/day)	*Trans* FA intake (%)	Total intake (%)
Butter	0.27	17.7	17.7
Cheeses	0.25	16.6	34.3
Meat	0.20	13.1	47.3
Pastries and cakes	0.16	10.2	57.5
Fresh dairy products	0.14	9.3	66.9
Croissant-like pastries	0.12	7.6	74.5
Sweet and savoury biscuits and bars	0.08	4.9	79.4
Milk	0.07	4.5	83.9
Pizzas, quiches and savoury pastries	0.05	3.4	87.3
Mixed dishes	0.04	2.4	89.7
Entremets, cream desserts and jellified milks	0.03	1.8	91.5
Chocolate	0.02	1.5	93.0
Bread and bread products	0.02	1.4	94.4
Other hot drinks	0.02	1.4	95.9
Margarine	0.02	1.1	97.0
TOTAL	**1.52**	**100.0**	

Scenario 2 (with correction for unknown *trans* FA content)

Food group	Average *trans* FA intake (g/day)	*Trans* FA intake (%)	Total intake (%)
Butter	0.27	14.4	14.4
Cheeses	0.26	14.0	28.4
Meat	0.21	10.9	39.3
Mixed dishes	0.21	10.8	50.1
Pastries and cakes	0.19	10.1	60.2
Fresh dairy products	0.14	7.6	67.7
Croissant-like pastries	0.12	6.1	73.9
Sweet and savoury biscuits and bars	0.08	4.0	77.8
Milk	0.07	3.8	81.6
Pizzas, quiches and savoury pastries	0.06	3.0	84.7
Soups and broths	0.04	2.2	86.8
Entremets, cream desserts and jellified milks	0.04	2.2	89.0
Sandwiches, snacks	0.03	1.5	90.5
Bread and bread products	0.02	1.3	91.8
Chocolate	0.02	1.2	93.0
Cured meats	0.02	1.2	94.2
Other hot drinks	0.02	1.2	95.3
Margarine	0.02	0.9	96.2
TOTAL	**1.89**		

[3] The food groups which do not contribute to the *trans* FA intakes are not shown in the table, nor are those with intakes of less than 0.02 g/day. However, the total average intake includes all groups of foods. The food groups which are a source of trans FA of natural origin are shown in blue.

Table 6: *Trans* FA intakes for adults and children in the 2 scenarios

		SCENARIO 1 without correction of unknown values		SCENARIO 2 after correction of unknown values	
		Mean	95th percentile	Mean	95th percentile
ADULTS	as absolute value (g/day)	1.8	3.3	2.3	3.9
	% of TEI	0.7	1.2	1	1.5
CHILDREN	as absolute value (g/day)	1.5	2.6	1.9	3
	% of TEI	0.8	1.2	1	1.4

Table 7: Groups of foods which are sources of *trans* FAs for adults in the 2 scenarios[4]

	SCENARIO 1 without correction of unknown values		SCENARIO 2 with correction of unknown values	
Food group	Contribution to average total intake (%)	Group ranking	Contribution to average total intake (%)	Group ranking
Cheeses	27.4	1	22.1	1
Butter	21.1	2	16.6	2
Meat	13.4	3	10.6	4
Fresh dairy products	8.5	4	6.6	6
Pastries and cakes	7.0	5	7.7	5
Croissant-like pastries	4.6	6	3.6	8
Pizzas, quiches and savoury pastries	3.5	7	3.0	9
Sweet and savoury biscuits and bars	2.2	8	1.7	10
Mixed dishes	**1.9**	**9**	**11.2**	**3**
Milk	1.8	10	1.5	12
Margarine	1.7	11	1.3	15
Bread and bread products	1.6	12	1.4	14
Entremets, cream desserts and jellified milks	1.2	13	1.6	11
Oil	0.8	14	0.7	17
TOTAL	**100.0**		**98.9**	

[4] The food groups which do not contribute to the *trans* FA intakes are not shown in the table. However, the total average intake includes all groups of foods. The food groups which are a source of *trans* FA of natural origin are shown in blue. In scenario 2, "broths and soups", "sandwiches and snacks" and "cured meats" are in 7th, 13th and 16th positions respectively.

5. Interpretation of the results and discussion

Recent food consumption and *trans* FA content data have led to updated estimates for intake in the French population in 2008. The data taken from scenario 2 reduced the likelihood of underestimating *trans* FA intake, and were therefore the only data taken into consideration for interpretation.

On average, *trans* FA intake as a gross value is higher for adults (2.3 g/day) than for children (1.9 g/day). However, the average intake expressed as a percentage of TEI is similar for adults and children, at around 1%.
Trans FA intake is higher for men than for women and for boys than for girls. Little difference is noted for different ages of adults.
For adults, the food groups which are a source of natural *trans* fatty acids (meats and dairy products) make up the majority of the total *trans* FA intake and represent a larger proportion than the *trans* fatty acids from industrial origin. For children, intake is divided equally between the two origins – natural and industrially produced.

5.1 Changes in *trans* FA intake, estimated from 1998-1999 (INCA1) and 2006-2007 (INCA2) food consumptions

In 1998-1999 (INCA1), daily intake of total *trans* FAs accounted on average for 1.2 to 1.4% of TEI (depending on age and gender) and for 1.9 to 2.5% of TEI for the 95th percentile of the population. In 2006-2007 (INCA2), according to scenario 1, which corresponds to methods close to those used to estimate intakes in 1998-1999 (without correction for unknown values), average intake was about 0.8% of TEI and 1.2% of TEI for the 95th percentile. There has therefore been a reduction of around 40%.

However, the differences noted between the estimations of *trans* FA intake in 1998-1999 compared to 2006-2007 should be treated with caution. They do not necessarily reflect a drop of the same order in *trans* FA content in foods and they are difficult to analyse. Several elements must be taken into consideration:

- the consumption data used are not the same: INCA1 in 1998-1999 and INCA2 in 2006-2007; changes in consumption took place between the two surveys; so for example, the consumption of dairy products and meats decreased in adults;
- data collection regarding added fats was improved between the two surveys: collection of more precise and accurate information on added fats during cooking or serving being taken into account through answers to questions relating to eating habits;
- the composition data are not the same; a new composition table was drawn up using the data supplied by professionals from the industry and collected in 2008. A greater amount of data was used for this work than in 2005 (AFSSA 2005a).

5.2 Analysis of the limits of the study

In addition to ruminant biohydrogenation and partial catalytic hydrogenation of oils and fats, heat treatments of industrial and/or domestic origin (refining, deep frying, etc.) constitute another source of *trans* FAs in human food. However, current data show that heat treatments are negligible as an origin, given in particular the time/temperature combinations generally used (AFSSA 2005a; AFSSA 2005b; AFSSA 2005c; Hénon et al. 1997).
The hypothesis of a substantial impact of these *trans* FAs on total intake levels can therefore be discounted.

Secondly, AFSSA has not managed to take into account a number of parameters in this study, which may skew the estimation of *trans* FA intake, leading to over- or underestimation of *trans* FA intake:

- the high variability of *trans* FA content in certain foods

The *trans* FA contents taken into account in the estimation of intake are the average values for each food. The variability of content noted for certain foods could therefore not be taken into account. In certain cases, the maximum value may be very high compared to the mean value, i.e. 5 to 6 times the average content for certain sweet or savoury biscuits and even up to 15 times the average content for sliced loaves; taking into account the mean value is therefore a potential source of underestimation of *trans* FA intake. In addition, the lack of data makes it impossible to calculate a confidence interval.

- the particularities of institutional catering

The *trans* FA contents collected relate to ordinary foods eaten at home. These contents were applied to the consumption data for food consumed outside the home as well as for food consumed at home.
It is legitimate to raise the question of the contribution to total *trans* FA intake from certain specific foods in institutional catering (foods with particular formulas) given the different *trans* FA content (possibly higher) compared to those used in the estimation.

- the share of small-scale or "home-made" products

The *trans* FA contents collected relate to industrial products. It was not possible to take into account the distinction between, on the one hand, industrial and small-scale products and on the other hand, "home-made" products: for example the estimated content in the bibliography in the case of soups is for industrial soups but applied to all soups, including to the large proportion of soups that are "home-made".

- market segments

The market segment (discount, premium price, own brands, national brand) was often given in the composition data collected: 51% for national brands, 43% for own brands, 5% for premium prices and 1% for discount products. At a national level, the market share for "hard-discount" products is around 13% of the market share by value (TNS Worldpanel 2007). Thus, since discount and premium price products were under-represented in the data, it was not possible to conduct an in-depth analysis taking into account market segments.
Simulation scenarios enabling groups of individuals consuming exclusively major branded products, own or discount brands were not explored.

- market shares

The market shares for foods were not taken into account in the composition data compilation process for *trans* FAs given the disparate nature of the data and the low level of feedback for all products. When several products were assigned to a food from the INCA2 list, a simple arithmetic mean of the *trans* FA contents was calculated on the basis of available data without taking into account the respective market shares of these different products. However this limitation is a recurring one when carrying out simulation studies.

5.3 Analysis taking into account new epidemiological and clinical data

Although the natural (products derived from ruminants) or industrially produced (partially hydrogenated vegetable oils) origin of a *trans* FA cannot be validly used as a basis for a regulatory definition of *trans* FAs (AFSSA 2005a), it now appears that, given the existence of new data, this notion should be taken into account in the field of public health. The sole criterion which consists of the chemical definition, proposed by AFSSA in 2005, is no longer sufficient and the data published since 2005 (biological effects, health effects, in particular the risk of cardiovascular disease) should be included in order for the recommendations to be improved.

On an epidemiological level, several case studies and ecological studies have shown a positive association between high total *trans* FA intake and the risk of coronary heart disease or cardiovascular death (Willett et al. 1993; Ascherio et al. 1996; Hu et al. 1997; Oomen et al. 2001; Pietinen et al. 1997; Ascherio et al. 1994). In the studies where it was not possible to distinguish natural and industrially produced *trans* FAs, it has been shown that the increase in cardiovascular risk is linked to high industrially produced *trans* FA intake, when they account for

over 1.5% of total energy intake (Willett et al. 1993, Ascherio et al. 1994, Pietinen et al. 1997). With respect to natural *trans* FAs at the levels at which they may be consumed, according to certain studies, in western populations (up to 1.5% of TEI[5]) (Mozaffarian et al. 2006, Willett et al. 2006), no association with coronary risk has been found. Recently, a prospective study from a Danish cohort showed that in 3700 men and women monitored for 18 years, the ruminant *trans* FA intakes are not associated with the risk of occurrence of coronary diseases; intake, in particular for men, may reach an average of 1.1% of TEI (2.8-4.9 g/day) in the highest quintile (Jacobsen et al. 2008).

The effects of industrially produced (IP) *trans* FAs on blood biomarkers for cardiovascular risk have been relatively well examined. It is now accepted that the consumption of IP *trans* FAs with an intake of over 2% of TEI increases cardiovascular risk through an increase in LDL cholesterol and a decrease in HDL cholesterol (Lock et al. 2005).
With respect to the effects of ruminant *trans* FAs, a Canadian intervention study recently showed that intakes of approximately 1.5% of TEI had no effect on the blood biomarkers for cardiovascular risk (Motard-Bélanger et al. 2008). In addition, the data from the Transfact study show that ruminant *trans* FAs do not alter HDL cholesterol, even at higher intake levels than for those related to spontaneous food intake (Chardigny et al. 2008).

In conclusion, natural *trans* FAs at the levels at which they may be consumed in food (1.5% maximum of TEI) do not alter the fat biomarkers for cardiovascular risk and are not associated with an increase in this risk in epidemiological studies. However, observation and cohort epidemiological studies have found an increased risk of cardiovascular events associated with the consumption of high levels of total *trans* fatty acids and IP *trans* fatty acids (over 2% of TEI and over 1.5% of TEI respectively).

Taking into consideration estimated *trans* FA intake in the French population, we can advance the following conclusions:

- average ruminant *trans* FA intakes are around 0.6% of total energy intake for adults and 0.5% for children; intake for the 95th percentile is 0.9% and 0.7% respectively for adults and children. These values are thus well below the levels of *trans* FA intakes identified as not presenting cardiovascular risk (Jacobsen et al. 2008);
- average intake of IP *trans* FAs is around 0.4% of total energy intake for adults and 0.5% for children; the intakes for the 95th percentiles are 0.6% and 0.7% respectively.

In conclusion, AFSSA considers that:

- the average estimated *trans* FA intake and that for the 95th percentile in the French population (1-1.5% of total energy intake [TEI]) is below the threshold of 2% of TEI set in 2005, irrespective of age and gender, both for children and adults;
- although the simulation methods differ, these estimated levels of intake may be considered as being lower than those observed in 2005;
- it is necessary to continue improving the food composition table for *trans* FAs taking the contribution of types of foods into account more exhaustively, in particular premium price, discount, institutional catering, small-scale produce, etc. which are not sufficiently known at the present time, in order to have a better appraisal of the variability of *trans* FA content of foods and therefore their intake levels;
- taking into account total *trans* FAs must now include identifying whether they are of natural or IP origin;
- with respect to natural *trans* FAs, their levels of consumption by the French population (0.5-0.9% of TEI) remain below those identified as not presenting cardiovascular risk, i.e. 1.5% of TEI;
- the presence of IP *trans* FAs in foods is of only technological and functional benefit; AFSSA therefore encourages efforts to reduce the use of these *trans* FAs, both in human food and animal feed, in order to reduce the risk of exposure. Alternatives to the use of *trans* FAs for their technical and functional properties must be planned.

[5] This level of *trans* FA intake can only be reached with a daily consumption of over 1 litre of milk, 100 g of camembert cheese and 50 g of butter.

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Key words

Natural trans fatty acids, artificial trans fatty acids, content, intakes, INCA2

APPENDICES

APPENDIX 1: Constitution of a food composition table for total *trans* fatty acids, 2008 data

1. Data collection

A food composition table for total *trans* FAs was drawn up in 2008 by the CIQUAL from data collected from the following sources:

- consumer associations (…);
- interprofessional bodies through the French Nutrition Institute (IFN);
- members of the Federation of Commerce and Distribution (FCD) through this federation;
- suppliers of a major French distributor and member of the FCD;
- the Federation of industrial bakers, cake and pastry companies (FEBPB), the National fats federation (FNCG) and the Centre of information on meat (CIV);
- major food processing or catering groups.

The data was collected between March and July 2008 and related to the composition of foods during the period 2007-2008.

Data relating to 885 different food products were received, corresponding to a total of 965 *trans* FA contents.

2. Matching food products with INCA2 foods

The compilation of raw data by the CIQUAL, consisting of a collation and consolidation of existing data, led to the 885 products being aligned with 500 foods in the INCA2 reference list. Up to 44 products were matched with a given food (e.g. sliced bread).

2.1 Names which were too imprecise

In certain cases, the names of products supplied were too vague to enable the food to be unambiguously identified. When Internet searches or queries to the bodies supplying the data did not enable the matter to be put beyond doubt, the products were not taken into account for updating the composition table.

2.2 Raw meats and meat products compared to cooked meats and meat products

In the absence of data relating to yields on cooking and any retention factors applicable to *trans* fatty acids, contents in raw products were extrapolated to the same products in ready-to-eat form.

3. Quality of data received

In general the data received were scantily documented in the following areas:

- with respect to the product: date of production, market segment (discount, premium price, own brand or national brand)
- the method of analysis: nature of the method, date of analysis, number of analyses, laboratory accreditation, quality control in the laboratory
- the method of calculating the following: recipe, source of data, taking account of the manufacturing process.

Thus, for the first appraisal of data collected at the beginning of June 2008, the average quality index was 42 (index between 0 and 100), with high variability between families of foods (average index 31 for pizzas, quiches and savoury pastries, compared to an average index of 63 for fresh dairy produce).

3.1 Levels which were too imprecise

Current analytical methods enable levels of the order of 0.001 g of *trans* fatty acids for 100 g of product to be quantified (this limit can nonetheless vary, depending on food matrices). However, some cases (particularly margarines) recorded contents of "less than 1 g/100 g"; this level is well above the quantification limit. In addition, in its report published in 2005, AFSSA indicated this threshold of 1% of total *trans* fatty acids as the maximum acceptable content in margarines. It would appear therefore that the analytical method (or calculation) chosen did not lead to a sufficiently precise level. The decision was therefore taken to approximate values such as "less than x g/100 g" to values "equal to x g/100 g" to avoid wrongly underestimating these values.

3.2 The case of aberrant values

Certain aberrant values were received. One example is that of pizzas (containing cheese) indicated as having zero *trans* fatty acid content, despite such products containing at least the *trans* fatty acids in their ingredients, including the cheese.
In such situations, either the values supplied were not taken into account, or whenever possible, approximations corresponding to *trans* fatty acid contents in similar foods were taken into consideration.

4. Compilation of "raw" values

The compilation of raw data was carried out in two stages:

1) the selection of relevant "raw" values and their aggregation to find a single average value for each INCA2 food (accompanied by a minimum and maximum content where applicable);
2) consolidation, i.e. filling in missing values.

4.1 Assessment of *trans* FA contents in the INCA2 list (Table 1)

The INCA2 study list includes 1342 codified foods in 43 groups. Among these foods:

- 434 foods are considered not to be sources of *trans* FAs; their content is therefore zero. Details of 22 of these foods were supplied by professionals themselves. These foods as a whole can be divided into 3 categories:
  - 187 foods corresponding to 8 complete groups: "waters", "coffee", "alcoholic beverages", "fruits", "pureed and cooked fruits", "foodstuffs intended for special diets", "dried vegetables" and "rice and durum or cracked wheat";
  - 148 foods representing a large proportion of the two groups: "vegetables (not including potatoes)" and "soft drinks";
  - and finally 99 foods in 15 food groups such as "breakfast cereals", "pasta", "milk", "fresh dairy produce", "oil", "chocolate", "sugar and sugar derivatives", "entremets, cream desserts, etc." Examples include UHT skimmed milk, fat-free plain yoghurt and virgin olive oil.
- 908 foods are considered to be potential sources of *trans* FAs
  - 500 foods have an average *trans* FA content (values supplied by professionals). These foods fall into 32 of the 43 groups in the list. When several products were matched with a single food in the INCA2 list, minimum and maximum values were proposed, in addition to the average value.

- 408 foods (falling into 30 groups) had no reported *trans* FA content and were therefore considered to be foods with unknown values. They account for slightly less than 45% of foods which are potential sources.

Table 1: Number of foods with a positive, zero or unknown *trans* fatty acid content in each group of the INCA2 study list

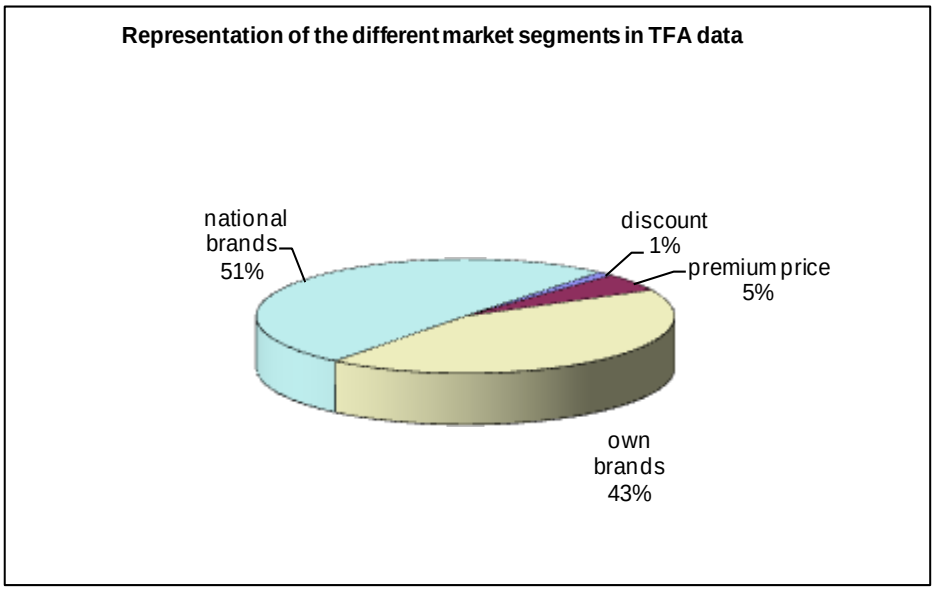
No.	Food groups	Total number of foods in the group	Number of foods with *trans* FA content >0	Number of foods with *trans* FA content =0	Number of foods with unknown *trans* FA content
1	Bread and dried bread products	25	21		4
2	Breakfast cereals	24	19	3	2
3	Pasta	5	2	2	1
4	**Rice and durum or cracked wheat**	**5**		**5**	
5	Other cereals	4	1	2	1
6	Pastries	12	12		
7	Sweet and savoury biscuits and bars	34	34		
8	Cakes	46	32		14
9	Milk	21	10	3	8
10	Fresh dairy produce	61	49	7	5
11	Cheeses	105	95	1	9
12	Eggs and egg derivatives	13			13
13	Butter	15	15		
14	Oil	31	27	3	1
15	Margarine	27	27		
16	Other fats	6	1		5
17	Meat	35	33		2
18	Poultry and game	23	6		17
19	Offal	17	9		8
20	Cured meats	55	13		42
21	Fish	76	2		74
22	Shellfish and molluscs	20			20
23	Vegetables (not including potatoes)	100	1	92	7
24	Potatoes and related species	12	5	4	3
25	**Dried vegetables**	**11**		**11**	
26	**Fruits**	**43**		**43**	
27	Dried fruits and nuts	25	1	14	10
28	Ice creams and frozen desserts	11	1	1	9
29	Chocolate	16	15	1	
30	Sugar and sugar derivatives	23	5	17	1
31	**Waters**	**56**		**56**	
32	Soft drinks	60	1	56	3
33	**Alcoholic beverages**	**38**		**38**	
34	**Coffee**	**7**		**7**	
35	Other hot drinks	11	5	5	1
36	Pizzas, quiches and savoury pastries	21	18		3
37	*Sandwiches, snacks*	29	2		27
38	Soups and broths	19			19
39	Ready meals	78	18		60
41	Entremets, cream desserts and jellified milks	32	19	2	11
42	**Pureed and cooked fruits**	**11**		**11**	
43	Condiments and sauces	63	1	34	28
44	**Foodstuffs intended for special diets**	**16**		**16**	
	TOTAL	**1342**	**500**	**434**	**408**

4.2 Taking account of market share

In the absence of exhaustive information in the dossiers supplied (completed for only 210 out of 885 foodstuffs), it was not possible to take market share into account in the raw data compilation process.
In addition, the data was received in diverse formats: sometimes annual tonnages were given, sometimes market share as a percentage. Furthermore, these market shares were usually supplied for markets which were not comparable with the INCA2 reference list. For example, a market share could be given as a percentage of the wholemeal sliced bread market or of the sweet biscuits market, whereas the INCA2 list includes all sliced breads in the same item, or on the contrary subdivides the sweet biscuit market into 22 different foods.
In addition it would not have been possible to use data from panels such as Secodip to weight *trans* fatty acid contents in foods according to the market share of products, because the data from a large number of files had been anonymised (brand names deleted) by the IFN at the request of the operators.

4.3 Taking account of market segments

Market segments (discount, premium price, own brand, national brand) were usually given in the dossiers received.
The pie chart below shows the breakdown of the different market segments for the *trans* fatty acid contents collected.



In fact, for national consumption, hard discount accounts for around 13% of market share in terms of value (TNS Worldpanel 2007 data).
The breakdown of market segment for the data collected is therefore not representative of the French market. This under-representation of data relating to discount and premium price products meant that it was not possible to process data segment by segment.
To conclude, when the "raw" values were compiled, averages were calculated for each INCA2 food, irrespective of market segment.

4.4 Consolidation of unknown values

Unknown total *trans* fatty acid contents were consolidated at the end of the aggregation stage:

- either by extrapolation from a similar food taking into account its fat content, if applicable;

Example 1: full milk yoghurt TFA content extrapolated from that of sweetened full milk yoghurt

Example 2: 60-65% fat processed cheese TFA content extrapolated from that of 25% processed cheese taking into account the difference in fat content

- or by using the content for the same food if it was in the AFSSA 2005 report.

To conclude, some 70% of the 569 foods in the INCA2 reference list identified by the Ciqual as being potential sources of *trans* fatty acids have a *trans* fatty acid content (393 contents) and 176 values are still unknown.

NB: for certain INCA2 foods, there are several methods of consumption (food eaten on its own/added when serving/added when cooking). For these foods, a value was attributed only to the food itself.

4.5 Variability of total fatty acid contents

For certain foods, a high degree of variability in *trans* fatty acid contents was noted (see Table 2). In the 2008 version of the food composition table for *trans* fatty acids, the minimum and maximum values were given, where applicable.

Table 2 – Variability of *trans* fatty acid contents for some foods

FOOD CODE	FOOD NAME	mean (g/100 g)	min	max	SD	N
7200	sliced bread	0.1389	0.0029	2.13	0.396	44
24231	chocolate sandwich biscuit e.g. Prince or BN	0.5318	0.0128	2.75	0.8657	43
24049	shortbread biscuit e.g. Galette du Mont Saint Michel	0.8345	0.1	1.62	0.45	22
38400	corn puff snack without peanuts	0.0595	0	0.67	0.1406	22
24000	non-specified biscuit	0.9179	0.06	5.2	1.2813	19
24036	non-specified chocolate biscuit	0.5919	0.09	2	0.5168	16
31070	fruit and nut dark chocolate (almond hazelnut raisin praline) bar	0.3817	0.1	0.6	0.1468	16
31060	jelly sweets	0	0	0	0	14
24037	biscuit filled with fruit paste e.g. Figolu fig biscuits	0.1986	0.01	1.1	0.285	14
16632	60% low fat	0.6429	0.35	1.1	0.2221	14
31000	chocolate biscuit bar e.g. Kit-Kat, Lion or Twix	0.3143	0.1	0.7	0.2161	14
24038	chocolate biscuit e.g. Pépito or Mikado Lu	0.5193	0.1	2	0.6483	14
31040	40% minimum cocoa dark chocolate cooking or snack bar	0.284	0	0.5248	0.1839	12
7730	baker's flaky chocolate pastry	0.7173	0.39	1.2	0.2369	11
4004	Salted potato crisps	0.0744	0	0.2	0.0732	11
38106	potato puff snack e.g. Chipster Lu	0.1508	0	0.69	0.2051	11
24684	cookie	0.5755	0.1	1.05	0.395	11
32016	chocolate or chocolate and hazel nut filled cereals with added vitamins and minerals eg. Kellogg's Frosties Grr or Smacks Choco Trésor	0,09	0	0,16	0,0424	10
7740	pre-packed industrial brioche	0.45	0.1	0.9	0.3078	10
24630	madeleine	0.5144	0.08	1	0.4619	9
32001	sweet non-filled chocolate cereals with added vitamins and minerals	0.0564	0	0.2	0.0719	8
677	dark chocolate bar filled with praline	0.3209	0.1	0.71	0.2145	8
31035	iced chocolate bar e.g. Mars, Twix, Snickers	0.2763	0.2	0.31	0.0393	8
23032	chocolate brownie	0.4803	0.14	1	0.3429	8
18101	sweetened drinking chocolate powder	0.0625	0	0.2	0.0744	8
31003	all types of sweets other than jelly	0.025	0	0.1	0.0346	8
38401	cheese filled or topped cracker type snack e.g. Monaco Lu	0.3786	0.2	0.5	0.122	7
24310	wafer sandwich biscuits other than fruit (chocolate, vanilla, hazelnut, etc.)	0.3906	0.054	1.22	0.5143	7
31004	milk chocolate bar or Kinder Maxi type bar	0.2824	0	0.6	0.1915	7
24686	genoa sponge cake filled with orange and topped with chocolate e.g. Pim's	1.4443	0.03	2	0.9492	7
92510	other pastries	0.5571	0.2	0.8	0.2299	7
32023	cereals with fruit and added vitamins and minerals e.g. Nestle Fitness & Fruits	0,0173	0	0,1	0,0369	7

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Table 3 – Review of *trans* FA contents by food group for the 500 non-zero values

No.	Food groups	Number of foods with *trans* FA content >0	Mean	Standard deviation	Min	Max
1	Bread and dried bread products	21	0.14	0.46	0.01	2.13
2	Breakfast cereals	19	0.04	0.03	0.00	0.16
3	Pasta	2	0.58	0.05	0.54	0.62
5	Other cereals	1	0.14		0.14	0.14
6	Pastries	12	0.69	0.29	0.45	1.33
7	Sweet and savoury biscuits and bars	34	0.31	0.28	0.01	1.21
8	Cakes	32	0.43	0.38	0.01	1.44
9	Milk	10	0.05	0.02	0.03	0.08
10	Fresh dairy produce	49	0.46	0.53	0.05	2.08
11	Cheeses	95	1.42	0.67	0.08	3.66
13	Butter	15	2.85	0.87	1.12	3.84
14	Oil	27	0.47	0.17	0.13	0.76
15	Margarine	27	0.66	0.12	0.42	0.81
16	Other fats	1	1.00		1.00	1.00
17	Meat	33	0.57	0.47	0.01	1.80
18	Poultry and game	6	0.04	0.01	0.03	0.04
19	Offal	9	0.17	0.19	0.01	0.49
20	Cured meats	13	0.05	0.07	0.01	0.20
21	Fish	2	0.08	0.00	0.08	0.08
23	Vegetables (not including potatoes)	1	0.20		0.20	0.20
24	Potatoes and related species	5	0.08	0.07	0.01	0.20
26	Fruits	1	0.01		0.01	0.01
28	Ice creams and frozen desserts	1	0.28		0.28	0.28
29	Chocolate	15	0.27	0.09	0.11	0.38
30	Sugar and sugar derivatives	5	0.13	0.11	0.03	0.28
31	Waters	1	0.02		0.02	0.02
35	Other hot drinks	5	0.10	0.07	0.00	0.17
36	Pizzas, quiches and savoury pastries	18	0.48	0.42	0.08	1.47
37	Sandwiches, snacks	2	0.22	0.15	0.11	0.33
39	Ready meals	18	0.47	0.61	0.04	2.05
41	Entremets, cream desserts and jellified milks	19	0.14	0.14	0.01	0.66
43	Condiments and sauces	1	0.07		0.07	0.07
	TOTAL all groups	**500**	**0.64**	**0.74**	**0.00**	**3.84**

Table 3 – Review of *trans* FA contents by food group for the 908 non-zero values (actual or estimated)

No.	Food groups	Number of foods with *trans* FA content >0	Mean	Standard Deviation	Min	Max
1	Bread and dried bread products	25	0.16	0.42	0.01	2.13
2	Breakfast cereals	21	0.04	0.03	0.00	0.16
3	Pasta	3	0.40	0.31	0.04	0.62
4	Other cereals	2	0.09	0.07	0.05	0.14
6	Pastries	12	0.69	0.29	0.45	1.33
7	Sweet and savoury biscuits and bars	34	0.31	0.28	0.01	1.21
8	Cakes	46	0.41	0.33	0.01	1.44
9	Milk	18	0.12	0.17	0.03	0.58
10	Fresh dairy produce	54	0.43	0.52	0.01	2.08
11	Cheeses	104	1.41	0.66	0.08	3.66
12	Eggs and egg derivatives	13	0.02	0.00	0.02	0.02
13	Butter	15	2.85	0.87	1.12	3.84
14	Oil	28	0.47	0.17	0.13	0.76
15	Margarine	27	0.66	0.12	0.42	0.81
16	Other fats	6	0.92	0.20	0.50	1.00
17	Meat	35	0.57	0.46	0.01	1.80
18	Poultry and game	23	0.04	0.02	0.01	0.09
19	Offal	17	0.15	0.14	0.01	0.49
20	Cured meats	55	0.10	0.05	0.01	0.22
21	Fish	76	0.05	0.06	0.00	0.33
22	Shellfish and molluscs	20	0.01	0.00	0.01	0.01
23	Vegetables (not including potatoes)	8	0.10	0.06	0.02	0.20
24	Potatoes and related species	8	0.06	0.06	0.01	0.20
27	Dried fruits and nuts	11	0.01	0.00	0.00	0.01
28	Ice creams and frozen desserts	10	0.15	0.07	0.05	0.28
29	Chocolate	15	0.27	0.09	0.11	0.38
30	Sugar and sugar derivatives	6	0.13	0.09	0.03	0.28
32	Soft drinks	4	0.06	0.10	0.00	0.21
35	Other hot drinks	6	0.09	0.06	0.00	0.17
36	Pizzas, quiches and savoury pastries	21	0.48	0.39	0.08	1.47
37	Sandwiches, snacks	29	0.21	0.07	0.09	0.35
38	Soups and broths	19	0.10	0.00	0.10	0.10
39	Ready meals	78	0.47	0.38	0.02	2.05
41	Entremets, cream desserts and jellified milks	30	0.14	0.13	0.01	0.66
43	Condiments and sauces	29	0.04	0.05	0.00	0.16
	TOTAL of all groups	**908**	**0.44**	**0.62**	**0.00**	**3.84**

APPENDIX 2: Average daily consumption (mean and standard deviation, g/day) for adults and children for the main groups of foods which are sources of *trans FAs*

Food groups	ADULTS		CHILDREN	
	Mean	SD	Mean	SD
Bread and dried bread products	115.0	81.4	55.8	51.6
Pastries	11.8	20.1	17.8	23.0
Sweet and savoury biscuits and bars	9.0	18.2	16.4	21.6
Cakes	37.5	39.2	37.4	36.6
Milk	85.7	143.1	177.2	152.2
Fresh dairy produce	81.9	82.0	76.0	65.7
Cheeses	33.4	28.8	18.8	18.1
Butter	11.0	11.6	7.7	7.2
Oil	10.7	10.2	6.8	7.5
Margarine	4.4	8.1	2.5	4.7
Meat	49.7	37.5	38.1	28.8
Cured meats	34.3	28.8	25.1	22.1
Chocolate	5.7	12.1	11.8	15.1
Other hot drinks	129.5	238.5	23.5	60.3
Pizzas, quiches and savoury pastries	23.2	34.8	20.2	27.0
Sandwiches and snacks	16.5	34.0	14.0	24.7
Soups and broths	86.1	126.3	41.0	66.1
Ready meals	69.1	66.3	58.4	50.5
Entremets, cream desserts and jellified milks	25.2	40.6	29.7	36.9

APPENDIX 3: Estimated calorie and fat intake in the INCA2 study

Table 1: Total energy intake (kcal/day) for adults by gender and age

Gender	Age bracket	n	Mean	Standard deviation	Median	95th P
Men	18-34 years	143	2590.3	743.7	2519.8	3752.9
	35-54 years	333	2543.6	522.5	2449.8	3516.7
	55 and over	300	2414.9	587.7	2369.0	3460.9
	Total Men	*776*	*2499.9*	*598.3*	*2424.0*	*3563.3*
Women	18-34 years	299	1846.1	455.8	1808.4	2591.0
	35-54 years	493	1885.7	420.4	1864.7	2661.5
	55 and over	350	1823.6	407.6	1765.2	2516.5
	Total Women	*1142*	*1854.6*	*426.5*	*1830.2*	*2608.8*
Total adults		**1918**	**2161.6**	**596.4**	**2109.7**	**3202.9**

Table 2: Total energy intake (kcal/day) for children by gender and age

Gender	Age bracket	n	Mean	Standard deviation	Median	95th P
Boys	3-10 years	276	1740.4	519.8	1729.0	2499.3
	11-14 years	209	2058.6	411.5	2018.7	2867.7
	15-17 years	199	2166.2	569.7	2068.8	3474.7
	Total boys	*684*	*1904.0*	*540.3*	*1850.9*	*2853.2*
Girls	3-10 years	294	1565.4	384.3	1514.0	2186.2
	11-14 years	241	1748.8	401.8	1752.9	2466.4
	15-17 years	225	1687.5	416.9	1657.8	2492.5
	Total girls	*760*	*1641.2*	*406.6*	*1608.3*	*2363.7*
Total children		**1444**	**1776.7**	**492.3**	**1737.0**	**2686.8**

Table 3: Fat intake (g/day) for adults by gender and age

Gender	Age bracket	n	Mean	Standard deviation	Median	95th P	EFSA %
Men	18-34 years	143	103.7	30.3	103.5	146.9	37.5
	35-54 years	333	102.2	25.9	98.6	147.8	38.5
	55 and over	300	96.3	28.4	91.7	140.5	39
	Total Men	*776*	*100.0*	*27.9*	*98.2*	*146.5*	*38.5*
Women	18-34 years	299	80.0	23.0	78.6	124.8	39.7
	35-54 years	493	80.4	20.9	78.8	120.8	39.2
	55 and over	350	78.0	19.6	76.9	110.5	39.8
	Total Women	*1142*	*79.5*	*21.1*	*78.1*	*120.0*	*39.6*
Total adults		**1918**	**89.3**	**26.1**	**86.6**	**136.6**	**39.1**

Table 4: Fat intake (g/day) for children by gender and age

Gender	Age bracket	n	Mean	Standard deviation	Median	95th P	EFSA %
Boys	3-10 years	276	74.2	24.9	74.5	112.3	38.5
	11-14 years	209	84.8	20.7	83.9	128.8	37.0
	15-17 years	199	89.8	25.1	89.4	139.8	37.7
	Total boys	*684*	*79.9*	*24.7*	*78.2*	*123.2*	*38*
Girls	3-10 years	294	67.3	19.4	64.6	100.8	38.7
	11-14 years	241	72.8	18.6	73.8	111.4	37.7
	15-17 years	225	68.2	15.6	67.6	103.5	37.1
	Total girls	*760*	*69.0*	*18.2*	*67.0*	*104.0*	*38.1*
Total children		**1444**	**74.6**	**22.2**	**73.4**	**114.1**	**38**