



# *Trans-fatty acids in Portuguese food products*



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# Abstract

This document contains the results from a survey on the *trans*-fatty acid content in foods sold in Portugal. It explores the food categories known to be the main source of industrial *trans*-fatty acids, based on similar international surveys, detailing individual data for a total of 268 food samples. It also explores the main food categories responsible for the presence of *trans*-fatty acids in the Portuguese diet, as well as the main determinants of their presence.

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## Abbreviations

EU	European Union
FDA	Food and Drug Administration
GRAS	generally recognized as safe
ISO	International Organization for Standards
TFA	<i>trans</i> -fatty acid

Additional abbreviations, used specifically to present data in illustrations

A	animal fat
B	butter
BRA	Brazil
H	hydrogenated fat
M	margarine
n/d	not detected
n/s	not specified
O	vegetable oil
O/V	vegetable oil and vegetable fats
PH	partially hydrogenated fat
PT	Portugal
SD	standard deviation
U	unknown
UAE	United Arab Emirates
USA	United States of America
V	vegetable fat

# Executive summary

There is consistent evidence of adverse health effects from industrial *trans*-fatty acids (TFAs). Several measures to limit TFA intake have already been taken in various countries, but limited information is available in several countries on the actual TFA content in foods. In order to ensure accurate data on intake of TFAs, and to implement adequate measures to reduce their consumption, each country should have an estimate of the TFA content in the overall diet.

The objective of this report is to provide updated data on the TFA content in Portuguese foods. It therefore details the results of 268 samples (acquired and analysed between October and December 2013), chosen based on a previous desk review to identify the food groups of higher concern in terms of their TFA content. The TFAs were quantified by gas chromatography after fat extraction. Potential unconformities were also estimated, taking as a basis a maximum limit of 2% TFAs in the fat.

Only 17% of the samples analysed had a TFA content superior to 2% in the fat and, similarly, only 16% had more than 0.5g per recommended dose. No unconformities were detected in the fat spreads group, potato chips and french fries, bakery and breakfast cereals, instant soups and sauces, chocolate snacks and desserts, and microwave popcorn. However, the fast-food group contained some samples slightly surpassing 2% TFAs in the fat, but this was associated with the presence of high amounts of cheese. The pastry group contained an average of 2.0% TFA in the fat, with a maximum of 8.5%, representing 30.0% of potential unconformities. Similarly, the biscuits, wafers and cookies group presented an average of 3.5% TFAs in the fat, with values ranging from 0.2% to 30.0%. These latter data are biased by a small group of samples from Brazil (n=6), all with TFA amounts superior to 20% in the fat; these were properly labelled (as mandatory in that country). If these samples are left aside, the mean TFA amount in the biscuits, wafers and cookies group are reduced to 1.0%, reaching a maximum of 9.1% in the fat, which reduces the unconformities to 5%.

In terms of the labelled fat type, only 5% (n=15) of the samples indicated the presence of partially hydrogenated fat. From these, just over 25% (n=4) contained TFA amounts superior to 2%. Hydrogenated fat was more commonly mentioned (22%; n=58), with about 17% (n=10) of the samples surpassing 2% TFAs in the fat. A significant proportion of the samples were unlabelled (32%).

Despite not being of high concern, the elevated prevalence of TFAs in the pastry group (a highly available low-price food product in Portugal, sold unlabelled) requires measures to reduce the TFA amounts in the industrial fats used in their preparation.

## 1. Background

TFAs are unsaturated fatty acids with at least one double bond in the *trans* geometric configuration. They are mainly formed by industrial hydrogenation of vegetable oils, a widespread strategy to increase the oxidative stability of vegetable oils and produce solid fats. The TFA content of industrially hydrogenated fats is dependent on diverse parameters of the technological process, and can reach up to 60% in the fat. The TFA content of beef and dairy products, of natural origin, ranges from 2% to 5% in the fat (1).

There is consistent evidence of adverse health effects from industrial TFA intake, particularly in terms of blood lipoprotein profiles and coronary heart disease, and no reports are available of any beneficial impact on human well-being (2). Several approaches have been implemented to reduce their presence in processed food products, from specific limitations placed on the content of industrialized TFAs to mandatory labelling, including recommendations for voluntary reduction by the industry (3). After years of intense discussion, the Food and Drug Administration (FDA) determined that partially hydrogenated oils are no longer generally recognized as safe (GRAS) and should be eliminated by 2018 (4), opening the door for a more widespread removal of TFAs from foods.

WHO's European Food and Nutrition Action Plan 2015–2020 focuses on the reduction of diet-related noncommunicable diseases, and includes a priority intervention on the elimination of TFAs (5). Ingestion of TFAs (including those of natural origin) should be limited to <1% of the daily energy intake. The recent Vienna Declaration, in the context of Health 2020, strengthens the general commitment of all Member States to take decisive action regarding healthier food, including a reduction of products with high TFA content, and to implement common approaches to promote product reformulation (6). Simultaneously, European Union (EU) Regulation No. 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers determined that by 13 December 2014 a report on the presence of *trans*-fats in foods and in the overall diet of the EU population should be released (7). Based on accurate data from each Member State, EU-wide measures are expected to be implemented.

In Portugal, only recommendations for voluntary reduction have been implemented. However, while the TRANSFAIR study positioned Portugal among the countries with the lowest TFA contents in their foods (8), the 2005 survey implemented by Stender et al. (9) presented a worse view, with up to 43% TFAs in the fat of selected foods. Indeed, national data on table margarines (n=40) sold in Portugal in 1991 (10) (and a decade later (11)) showed an effective presence of TFAs in margarine lipids (0.4–14.2% in 1991; and 0.2–8.9% in 2001). More recently (2006 (12)), a survey on cookies and biscuits sold in Portugal (n=100) revealed a TFA range from 0.2% to 41.1% in the fat (with an average of 2.8%), without significant differences when re-analysed in 2012 (0.11–27.4%) (13). No updated data were found relating to other food categories.

Given that only limited information is available on the TFA content of Portuguese foods, and the essential nature of this information for an accurate estimation of population exposure to TFAs, the objective of the present work is to provide accurate and updated data on the TFA content of food products sold in Portugal.

## 2. Materials and methods

### 2.1 Search strategy

In the absence of a representative national nutrition survey, a preliminary desk review was performed to identify the food categories containing higher amounts of TFAs of industrial origin, based on scientific articles and reports from various countries (mostly from Europe, the United States and Brazil). The following food categories were selected:

- fat spreads
- potato chips/french fries
- bread/breakfast cereals
- bouillon cubes and instant soups
- chocolate snacks and instant pre-mixed desserts
- popcorn
- cookies and biscuits
- pastry
- fast food.

### 2.2 Sample acquisition and categorization

Most products originated from six chain supermarkets (represented all over Portugal), but samples sold by small and privately owned shops were also included for locally manufactured products. For products manufactured locally (that is, not mass produced), in particular pastry, samples from a range of geographical areas were analysed.

Based on the selected categories, and after manual label inspection, a total of 268 samples were purchased (during October to December 2013). With few exceptions, samples were selected among those indicating the presence of partially hydrogenated fat or hydrogenated fat in the ingredients list (indexed as PH and H, respectively, in the data recording). Some samples with limited information in the ingredients list, or indicating margarine as an ingredient, were also included.

Samples were coded with four digits, by purchase order (1000 to 1268), and classified based on label information. A detailed inspection of the label was carried out, recording fat types and amounts (when specified), coding for hydrogenated fat, partially hydrogenated fat, vegetable fat, vegetable oil, and butter (recorded as H, PH, V, O and B, respectively). The manufacturing origin of the sample (when indicated) was also recorded. The food dose recommended by the manufacturer was taken into account, and applied to unlabelled products within the same category. For unlabelled individual food products (pastry, fast-food menus, etc.), the entire product was used as the individual dose.

For easier interpretation and discussion of the results, the sample type within each category was simplified. The pastry group, for instance, which included croissants and other traditional products, was only divided into puff and non-puff pastry. Under the cookies and biscuits category, no distinction was made between filled and covered items, as both contained the same type of ingredients. All pre-fried french fries were acquired in restaurants after frying, therefore including both the fat from the manufacturer and from the frying medium used at the restaurant, both of unknown origin and composition. For the fast-food menus, the potato chips were analysed separately from the hamburgers or nuggets, and the results were detailed individually and as a complete menu. A more comprehensive description of the composition of all samples is presented in Annex 6.

## 2.3 Sample preparation

When the recommended dose was not specified by the manufacturer, each sample was carefully weighed to obtain the unit/dose mass. After reduction to a homogeneous mass in a domestic food processor, a representative sample portion was refrigerated (4°C) and analysed within two or three days. Most samples were analysed as acquired, except for microwave popcorn and frozen puff sheets, which were prepared according to the manufacturer instructions, prior to analysis.

## 2.4 Trans-fat analysis

The fat fraction was extracted from the food with organic solvents, and a portion used for separation by gas chromatography, after conversion to fatty acid methyl esters.

The TFA total mass was calculated on the basis of internal standard triundecanoin glyceride, added before lipid extraction. Fat was extracted with a ternary mixture of cyclohexane, 2-propanol and aqueous sodium chloride (NaCl) solution, using the method initially described by Smedes (14), enabling a fast and clean separation of the lipid phase, widely used by the working group (13,15).

The lipids were converted to their methyl ester by cold alkaline derivatization, following an international standard (16) (International Organization for Standards (ISO) standard number 12966-2:2011). Chromatographic separation was achieved on a FAME column (50m x 0.25mm x 0.2µm; as defined by J&W Scientific, United States), with helium as the carrier gas at 17 PSI, and a temperature gradient from 140°C to 200°C, adjusted for adequate separation in a total of 40 minutes. The injection port was at 260°C, with a 1:100 split ratio, and the detector was at 270°C. All the parameters were in accordance with ISO standard number 15304:2002 (17).

The fatty acids were identified by comparison with commercial standards from Supelco (Sigma, United States), and from Matreya (United States). A total of 52 fatty acids with 8 to 24 carbon atoms were quantified, including 11 *trans* isomers: C16:1t (n=1), C18:1t (n=4), C18:2t (n=3), and 18:3t (n=3).

Based on the recommendations of the aforementioned ISO standard (17) and the purpose of this study (total TFA content), the TFA amount was reported as the sum of all TFA methyl esters with a double bond, expressed as a mass fraction of all fatty acid methyl esters. Additionally, and based on the internal standard amount, an estimation of the total fatty acids was made, used as an approximation of the total fat amount. Therefore, the TFA relative percentage was also estimated on a sample basis of 100g, and per recommended dose.

# 3. Results and discussion

## 3.1 Fat spreads

Knowing that margarines are potentially the main source of industrial TFAs, mostly as ingredients in processed food products, a survey of margarines was carried out. Samples were divided into margarines for domestic use (n=11), and industrial ones (n=5). This group also included chocolate-based spreads (n=5), known to contain a high proportion of added oils and fats. Despite the reduced consumption of peanut butter in Portugal, one sample (imported) declared the presence hydrogenated fat in the ingredients list, and was therefore included in the study.

The results of the margarine study are detailed in Table 3.1, ordered according to increasing TFA content in the fat. Both domestic and industrial margarines presented low amounts of TFAs, without surpassing 2% in the fat or 0.5g per dose, based on the amounts recommended by the manufacturers. The same was observed for chocolate spreads and peanut butter.

Butter, from dairy cream, was taken as a reference for the amount of TFAs from natural origins (n=5). The samples analysed showed TFA amounts within those described in the literature for this product. Despite all samples being superior to 2% in the fat (2.07%–3.58%), as expected, the amounts ingested per recommended dose (10g) are low.

## 3.2 Potato chips and french fries

A total of 18 samples of pre-packed potato chips were analysed. All samples were labelled as being prepared with vegetable fat, therefore with a low probability of containing TFAs (if correctly labelled). However, potato chips being a potential source of TFAs in several countries, an extensive survey was carried out, including both branded and unbranded samples, with diverse presentations and prices. Simultaneously, french fries acquired in diverse fast-food restaurants (all frozen and pre-fried) were also analysed (n=7). These samples included both the fat from the industrial pre-frying process and the fat absorbed during the frying process in the restaurants. No information was available on the fat type or labelling.



**Table 3.1. TFA content in fat spreads, including margarines, chocolate spreads and peanut butter**

Type	Sample code	TFAs			Fat type*	Label, % fat	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose				
<b>Domestic margarines</b>	I 200	0.26	0.16	0.02	O/V	Spread, 60	EU	10
	I 197	0.33	0.18	0.02	O/V	Spread, 55	EU	10
	I 196	0.41	0.24	0.02	O/V	Cooking, 66	PT	10
	I 199	0.45	0.30	0.03	O/V; H	Cookin , 74	EU	10
	I 198	0.47	0.25	0.03	O/V	Spread, 50	PT	10
	I 253	0.64	0.40	0.04	O/V	Spread, 55	EU	10
	I 191	0.65	0.47	0.05	O/V	Spread, 70	PT	10
	I 207	0.77	0.50	0.05	O/V	Cooking, 59	EU	10
	I 201	1.20	0.68	0.07	O/V	Cooking, 59	PT	10
	I 254	1.43	0.86	0.09	O/V; H	Spread, 55	EU	10
	I 252	1.93	1.37	0.14	O/V; H	Cooking, 60	EU	10
<b>Industrial margarines</b>	I 225	0.57	0.50	0.05	O/V; PH	Cooking, n/s	PT	10
	I 222	0.59	0.38	0.04	O/V	Cooking, 59	PT	10
	I 223	0.59	0.36	0.04	O/V	Cooking, 59	PT	10
	I 226	0.84	0.78	0.08	O/V; PH	Cooking, 80	PT	10
	I 224	2.16	1.57	0.16	O/V; PH	Cooking, n/s	EU	10
<b>Chocolate spread</b>	I 195	0.14	0.07	0.01	O/V	44	EU	20
	I 193	0.38	0.15	0.03	O/V	36	EU	20
	I 026	0.45	0.16	0.03	O; H	32	EU	20
	I 194	0.59	0.23	0.05	O; V	36	EU	20
	I 015	0.86	0.32	0.14	O/V; H	32	EU	20
<b>Peanut butter</b>	I 077	0.25	0.13	0.03	O; H	n/s	USA	20
<b>Mean</b>		0.73	0.46	0.06				
<b>Maximum</b>		2.06	1.57	0.16				
<b>Minimum</b>		0.14	0.07	0.01				
<b>SD*</b>		0.52	0.39	0.04				

\* See the list of abbreviations on page iv.

As shown in Table 3.2, the amount of TFAs in the fat for the potato chips and french fries was consistently low (average 0.6%, reaching a maximum of 1.3%). Therefore, the amounts per recommended dose were below 0.1%, allowing the conclusion that this is not a problematic food category in the Portuguese market, in terms of TFAs.

### 3.3 Bakery and breakfast cereals

These products are not characterized by a high amount of fat, but rather by a high frequency of consumption by a loyal customer base – they are popular brands with a strong market share and are therefore important contributors to TFA intake for particular individuals.

This category included sliced bread (n=4) and breakfast cereals (n=3). Only one sample of sliced bread indicated the presence of partially hydrogenated fat, with the remaining three samples acquired for control. Only three brands of breakfast cereal indicated the presence of hydrogenated or partially hydrogenated fats, across a wide selection of labels analysed. The results are detailed in Table 3.3.

The amount of TFAs in the extracted fat varied from 0.4% to 1.0% (average 0.7%), leading to the conclusion that this category of food is also of no concern in Portugal in terms of TFA ingestion.

**Table 3.2. TFA content in potato chips and french fries**

Type	Sample code	TFAs			Fat type*	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose			
<b>Potato chips (packet)</b>	I 152	0.17	0.06	0.02	V	EU	30
	I 160	0.43	0.15	0.04	V	EU	25
	I 161	0.46	0.16	0.05	V	EU	30
	I 151	0.54	0.17	0.04	V	EU	25
	I 157	0.57	0.24	0.06	V	EU	25
	I 154	0.58	0.21	0.05	V	EU	25
	I 150	0.60	0.20	0.05	V	EU	25
	I 153	0.60	0.21	0.05	V	EU	25
	I 156	0.62	0.18	0.05	V	EU	25
	I 158	0.65	0.22	0.06	V	EU	25
	I 159	0.65	0.24	0.10	V	EU	40
	I 205	0.68	0.27	0.07	V	EU	25
	I 155	0.71	0.24	0.06	V	EU	25
	I 100	0.77	0.29	0.07	V	PT	25
	I 203	0.81	0.21	0.05	V	EU	25
	I 206	0.85	0.36	0.09	V	PT	25
I 204	0.95	0.32	0.10	V	EU	30	
I 202	1.26	0.38	0.10	V	PT	25	
<b>Pre-fried (restaurants)</b>	I 164	0.36	0.05	0.03	U	PT	70
	I 162	0.37	0.06	0.05	U	PT	90
	I 231	0.42	0.06	0.05	U	PT	90
	I 163	0.53	0.08	0.08	U	PT	90
	I 165	0.60	0.09	0.09	U	PT	100
	I 166	0.67	0.07	0.12	U	PT	165
	I 259	0.71	0.08	0.10	U	PT	120
<b>Mean</b>		0.62	0.18	0.06			
<b>Maximum</b>		1.26	0.38	0.12			
<b>Minimum</b>		0.17	0.05	0.02			
<b>SD*</b>		0.22	0.10	0.02			

\* See the list of abbreviations on page iv.

### 3.4 Soups and sauces (dry or cubes)

This category includes traditional bouillon cubes (n=5) and instant soup powders (n=5). The labels of several fat-based seasonings – including mayonnaise and diverse sauces – were inspected but none indicated the presence of partially hydrogenated or hydrogenated fats in the ingredients list. Only vegetable oils and fats were consistently mentioned.

Three bouillon samples indicated the presence of hydrogenated fat, while two indicated vegetable fat (acquired for control purposes). Among the instant soups, again only one indicated the presence of hydrogenated fat and the remaining four were analysed as control samples. The results are detailed in Table 3.4.

One bouillon cube had 1.9% TFAs in the fat (with hydrogenated fat as the single fat source), but no other sample had over 0.7% TFA content. The amounts per dose were also of no concern. Among the soups, and contrary to what might be expected, the sample containing hydrogenated fat presented the lowest amount of TFAs; however, all samples had low TFA content in the fat, and per dose.

**Table 3.3. TFA content in bread and breakfast cereals**

Type	Sample code	TFAs			Fat type*	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose			
<b>Sliced bread</b>	I 251	0.40	0.04	0.02	V	EU	50
	I 241	0.70	0.02	0.01	V	PT	45
	I 064	0.91	0.02	0.01	V	PT	45
	I 065	1.02	0.03	0.01	PH	PT	50
<b>Breakfast cereals</b>	I 076	0.41	0.07	0.02	O;H	EU	30
	I 239	0.53	0.01	0.00	PH	EU	30
	I 240	0.97	0.02	0.01	PH	EU	30
<b>Mean</b>		0.71	0.03	0.01			
<b>Maximum</b>		1.02	0.07	0.02			
<b>Minimum</b>		0.40	0.01	0.00			
<b>SD*</b>		0.26	0.02	0.01			

\* See the list of abbreviations on page iv.

**Table 3.4. TFA content in bouillon cubes and instant soups**

Type	Sample code	TFAs			Fat type*	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose			
<b>Bouillon cubes</b>	I 244	0.60	0.13	0.01	V;H	EU	10.0
	I 243	0.63	0.12	0.01	V	EU	4.4
	I 053	0.64	0.40	0.04	H;V	EU	10.0
	I 242	0.73	0.12	0.01	V	EU	4.4
	I 052	1.93	1.37	0.14	H	EU	11.0
<b>Soup</b>	I 249	0.34	0.02	0.00	H	EU	20.0
	I 245	0.45	0.04	0.03	V	EU	20.0
	I 248	0.47	0.18	0.05	V	EU	30.0
	I 246	0.53	0.03	0.00	V	EU	15.0
	I 247	0.77	0.10	0.01	V	EU	15.0
<b>Mean</b>		0.71	0.25	0.03			
<b>Maximum</b>		1.93	1.37	0.14			
<b>Minimum</b>		0.34	0.02	0.00			
<b>SD*</b>		0.45	0.41	0.04			

\* See the list of abbreviations on page iv.

### 3.5 Chocolate snacks and desserts

All samples from the chocolate snack (n=4) and dessert (n=6) categories included hydrogenated fat in the ingredients listed on the labels. The latter group included solid mixtures for preparation of chocolate mousse and Chantilly cream. In the chocolate mousse pre-mixes, the dose was estimated according to preparation with water, not milk. The results are detailed in Table 3.5.

The amounts of TFAs quantified were near 2% in two samples, with 3% in a third one, and only one sample contained 0.5g per dose. Indeed, these products are expected to be preserved for a long time at ambient temperature, requiring the use of solid fats that are highly resistant to oxidation, which are historically available by means of hydrogenation. While in other food categories, vegetable

fats are clearly being used more, in the chocolate snacks and desserts group, the products all still contain hydrogenated fat. Despite not being the focus of this report, it is also worth mentioning that these samples contained higher amounts of saturated fat, ranging from 80% to 90%.

### 3.6 Popcorn

Microwave popcorns have been internationally recognized as a potential source of TFAs. However, none of the samples analysed indicated the presence of hydrogenated fat in the ingredients list. Three samples were acquired for control purposes and all contained TFA amounts below 0.8% (Table 3.6). On the other hand, one sample of classic ready-to-eat popcorn, indicating the presence of hydrogenated fat (# I 250 – palm kernel hydrogenated fat) was analysed, revealing higher TFA amounts (1.5%). Nevertheless, the amount of fat was generally reduced, thus the amounts per dose were all very low.

**Table 3.5. TFA content in chocolate snacks and instant pre-mixed desserts**

Type	Sample code	TFAs			Fat type*	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose			
<b>Chocolate snacks</b>	I 135	0.26	0.07	0.04	V	EU	58
	I 086	0.53	0.19	0.07	PH	EU	40
	I 059	0.55	0.27	0.11	PH	EU	40
	I 080	2.00	0.75	0.50	H	PT	30
<b>Desserts</b>	I 221	0.06	0.01	0.00	H	PT	30
	I 054	0.13	0.04	0.02	H	PT	25
	I 055	0.24	0.02	0.01	H	PT	25
	I 056	0.32	0.02	0.01	H	PT	25
	I 057	1.91	0.25	0.18	H	EU	25
	I 058	3.05	0.78	0.23	H	EU	25
<b>Mean</b>		0.90	0.24	0.12			
<b>Maximum</b>		3.05	0.78	0.50			
<b>Minimum</b>		0.06	0.01	0.00			
<b>SD*</b>		0.87	0.38	0.13			

\* See the list of abbreviations on page iv.

**Table 3.6. TFA content in popcorn**

Type	Sample code	TFAs			Fat type*	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose			
<b>Butter</b>	I 051	0.50	0.08	0.02	V	EU	30
	I 013	0.66	0.09	0.03	V	EU	30
	I 094	0.79	0.13	0.03	V	EU	25
	I 250	1.54	0.12	0.04	H	EU	30
<b>Mean</b>		0.87	0.23	0.11			
<b>Maximum</b>		1.54	0.78	0.50			
<b>Minimum</b>		0.50	0.01	0.00			
<b>SD*</b>		0.46	0.27	0.15			

\* See the list of abbreviations on page iv.

### 3.7 Biscuits, wafers and cookies

One of the food categories identified as a potentially important source of TFAs was cookies and biscuits, with high consumption levels in the Portuguese diet. An intensive survey was carried out of the ingredients lists of hundreds of samples, culminating in the detailed analysis of 53 samples. Among these, 21 contained only vegetable fats, but the reduced information provided on the label, along with the known elevated consumption levels among the Portuguese, and the similarities with other samples that contained hydrogenated or partially hydrogenated fats, resulted in their inclusion in the analysis.

**Table 3.7. TFA content in cookies and biscuits**

Type	Sample code	TFAs			Fat type*	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose			
Plain	I 083	0.21	0.03	0.01	V	EU	35
	I 087	0.26	0.05	0.02	A; O/V	PT	40
	I 030	0.34	0.07	0.02	V	PT	30
	I 029	0.44	0.08	0.03	M	PT	40
	I 050	0.49	0.09	0.03	V	PT	40
	I 016	0.51	0.02	0.01	O/V; H	PT	40
	I 014	0.53	0.09	0.03	V	EU	40
	I 028	0.56	0.12	0.03	O/V	EU	30
	I 088	0.63	0.02	0.01	M	PT	40
	I 093	0.72	0.12	0.02	V	EU	15
I 069	0.89	0.14	0.07	V	PT	45	
Covered/filled	I 078	0.25	0.06	0.01	V	EU	52
	I 021	0.28	0.09	0.02	H	EU	20
	I 068	0.33	0.10	0.04	V	ES	40
	I 032	0.35	0.06	0.02	H;V	PT	32
	I 009	0.47	0.13	0.02	H	EU	18.8
	I 073	0.52	0.13	0.06	H; O/V	PT	45
	I 023	0.65	0.11	0.03	H	UAE	30
	I 134	0.68	0.20	0.20	V	EU	100
	I 092	0.71	0.18	0.12	V	EU	66
	I 074	0.77	0.21	0.09	V	EU	44
	I 020	0.98	0.19	0.10	H;V	PT	55
	I 234	1.00	0.24	0.03	V; H	PT	44
	I 079	1.03	0.32	0.12	V; H	PT	38
	I 018	1.03	0.28	0.08	H	PT	30
	I 049	1.13	0.30	0.13	H;V	PT	45
	I 071	1.18	0.36	0.14	H;V	EU	37.5
I 033	1.52	0.21	0.09	H; O	EU	45	
I 012	<b>3.61</b>	0.89	0.30	M	PT	35	
I 025	<b>20.7</b>	3.63	<b>1.09</b>	H	BRA	30	

**Table 3.7.** *Continued*

Type	Sample code	TFAs			Fat type*	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose			
<b>Covered/filled</b>	I 024	<b>25.1</b>	3.76	<b>1.13</b>	H	BRA	30
	I 019	<b>25.3</b>	3.69	<b>1.11</b>	H	BRA	30
	I 022	<b>30.3</b>	5.31	<b>1.59</b>	H	BRA	30
	I 034	<b>37.6</b>	7.51	<b>2.25</b>	H	BRA	30
<b>Wafer</b>	I 041	0.24	0.06	0.03	H	EU	40
	I 043	0.30	0.08	0.03	H;V	EU	40
	I 090	0.32	0.09	0.02	H	EU	25
	I 044	0.39	0.10	0.03	H; O	EU	26
	I 046	0.48	0.14	0.06	V	PT	40
	I 047	0.57	0.19	0.03	V	PT	40
	I 081	0.59	0.23	0.07	B;V	EU	18
	I 075	0.65	0.21	0.06	H; B	EU	30
	I 045	1.00	0.31	0.12	V	EU	40
	I 040	1.11	0.25	0.05	B; H	EU	20
	I 017	1.56	0.41	0.18	O; H	EU	45
	I 082	<b>9.18</b>	3.30	<b>0.99</b>	V; H; O	EU	30
I 042	<b>22.9</b>	5.25	<b>1.58</b>	V	BRA	30	
<b>Puff</b>	I 039	0.32	0.10	0.03	O/V	PT	30
	I 122	0.48	0.18	0.03	H; O/V	PT	15
	I 072	0.65	0.19	0.07	V; H; O	EU	35
	I 048	0.70	0.26	0.08	PH	EU	32
	I 038	0.73	0.19	0.09	O/V; H	PT	45
	I 085	7.84	3.01	1.20	PH	PT	40
<b>Mean</b>		3.98	0.82	0.26			
<b>Maximum</b>		37.6	7.51	2.25			
<b>Minimum</b>		0.21	0.02	0.01			
<b>SD*</b>		8.66	1.64	0.50			

Samples presenting more than 2% TFA in the fat or 0.5g/dose are shown in bold.

\* See the list of abbreviations on Page iv.

For ease of discussion, samples were grouped into four types: simple (n=11), covered/filled (n=23), wafers (n=13), and puff-based (n=6). The results are detailed in Table 3.7, ordered by their increasing TFA content within each subcategory, with the samples presenting more than 2% TFAs in the fat or 0.5g per dose highlighted in bold.

The cookies classified as simple or plain had a comparatively lower fat content than all the remaining groups in this category. The lipid proportion was mainly composed of margarine, made from oils and fats in diverse proportions (recorded as O/V in the data). No labels mentioned the use of hydrogenated or partially hydrogenated fats. Indeed, the maximum amount of TFAs in the lipid proportion was 0.9%, which is an acceptable level in terms of the use of refined fats. Consequently, the TFAs per dose varied from 0.01g to 0.07g per dose.

The higher absolute amounts of TFAs were found in the cookies with cream (filling and/or topping), with 26% of samples containing more than 2% TFAs in the fat. When looking for the fat type used, 70% of the filled/topped cookie group were prepared with hydrogenated fat and none indicated the presence of partially hydrogenated fat. Interestingly, one sample indicating vegetable fat in the contents had a TFA content of 3.6%, which is indicative of mislabelling. The remaining positive samples (n=5) had values ranging from 20.1% to 37.6%, the highest amounts found among all the samples presented in this report. These were all samples from Brazil, displaying accurate information on the nutritional label (mandatory in that country) and giving a clear indication of the TFAs per dose. This was consistent with the results from the analysis, which found the TFA content to be higher than 1g of TFAs per recommended dose of 30g.

The wafers category fared slightly better in terms of TFA content, with only two samples presenting elevated amounts of TFAs; however, 60% of the wafers were prepared with hydrogenated fats. Again, the worst case was an isolated sample from Brazil, containing 22.9% TFA content in the fat. The other positive sample was from an international brand, made in the EU, with 9% TFAs in the fat. These were the only two samples containing TFA levels above 0.5 g in the recommended dose (1.0 g and 1.6g, respectively). In the puff-based cookies, two samples indicated the presence of partially hydrogenated fats, but among these, only one was of high concern, with 7% TFAs in the fat and therefore 1.2g per dose.

Although it is not the objective of the present report, one cannot ignore the generally elevated amounts of saturated fats in these products, particularly in the wafers food category, varying from 52% to 96% (66% on average, when reported as the sum of saturated fat plus TFAs).

### 3.8 Pastry

Portugal has a high number of commercial shops selling fresh pastry, frequently produced in-house. These include croissants, doughnuts, waffles, chocolate-filled sweet bread, chocolate cakes, cupcakes and a huge amount of traditional (frequently puff-based) pastry, known to contain high amounts of saturated fat. The variability of fat sources and amounts are therefore predictably high, based on the assumption that the fat suppliers are diverse.

In order to have a clearer understanding of the TFA content in pastry, and given that these samples are usually sold unlabelled, samples were acquired from local shops in a variety of geographical areas. A total of 36 samples sold in supermarkets were also included. The results are divided into non-puff pastry (Table 3.8) and puff pastry (Table 3.9).

A total of 26% of the non-puff pastry samples were prepared with fats containing more than 2% TFAs (Table 3.8). Based on the pastry weight (highly variable), the TFAs per dose surpassed 0.5g in 19% of the samples. In the puff pastry category, 30% of the samples were prepared with fats containing more than 2% TFAs, and 29% contained more than 0.5g per dose, reaching a maximum of 4.13g per dose.

Also included in this category were four samples of frozen pastry sheets available for domestic use, two of which indicated the presence of hydrogenated or partially hydrogenated fats, along with one as a control sample. Only the sample with partially hydrogenated fat contained high amounts of TFAs (around 2%).

In terms of geographical origin of the samples, the reduced number of items in particular regions prevents a consistent differentiation (Table 3.10). However, apparently higher amounts were found in the samples from the north of Portugal, when compared those from central Portugal and the south of the country.

### 3.9 Fast-food

Some of the most significant fast-food chains in Portugal (and worldwide) were included, being of general concern in terms of *trans*-fat content in their foods. The fried potatoes were analysed separately, enabling a distinction to be made between the source of TFAs, when present (as discussed in Subsection 3.2). Table 3.11 details the results for the meat- and fish-based products (nuggets, pizza and hamburgers), and the menus that were included in the analysis, with the recommended potato dose.

The only three samples surpassing 2% TFAs in the fat contained a significant amount of cheese, consistent with the presence of TFAs from ruminant fat. Therefore, these amounts are probably mostly from natural origin. Similarly, and despite the low amount of TFAs in the fried potatoes (see Subsection 3.2), most TFAs in the menus are likely to be from the cheese content.

**Table 3.8. TFA content in non-puff pastry**

Type	Sample code	TFAs			Fat type*	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose			
<b>Non-puff</b>	I 091	0.07	0.01	n/d	H	EU	15
	I 004	0.24	0.02	0.01	V;H	PT	60
	I 187	0.46	0.16	0.18	U	PT	115
	I 010	0.50	0.08	0.04	V;H	PT	45
	I 006	0.54	0.17	0.06	V;H	EU	40
	I 066	0.55	0.14	0.08	O/V	EU	60
	I 037	0.57	0.14	0.07	V	EU	50
	I 031	0.59	0.18	0.03	V/O	EU	15
	I 219	0.60	0.06	0.05	U	PT	90
	I 220	0.66	0.13	0.05	V	PT	45
	I 063	0.68	0.22	0.10	V;O	EU	45
	I 089	0.75	0.16	0.07	O	EU	45
	I 035	0.81	0.17	0.09	V	EU	50
	I 061	0.94	0.27	0.12	V;H	EU	50
	I 011	0.94	0.20	0.09	V;H;B	EU	45
	I 008	0.96	0.21	0.08	H;V	PT	40
	I 007	1.10	0.25	0.10	H;V	PT	40
	I 005	1.18	0.22	0.09	V;H	PT	40
	I 097	1.23	0.30	0.14	V/O	EU	45
	I 179	1.79	0.48	0.31	U	PT	65
	I 003	1.98	0.64	0.20	H;B	EU	30
	I 060	<b>2.48</b>	0.54	0.21	B;H	EU	40
	I 172	<b>2.63</b>	0.55	<b>0.55</b>	U	PT	115
	I 173	<b>3.49</b>	0.81	<b>0.93</b>	U	PT	85
	I 000	<b>3.61</b>	0.51	0.39	PH	PT	80
	I 185	<b>4.47</b>	1.43	<b>0.71</b>	V;PH	EU	50
I 070	<b>5.75</b>	1.13	<b>0.51</b>	V	PT	45	
I 189	<b>7.72</b>	2.51	<b>1.26</b>	U	PT	50	
I 001	<b>8.07</b>	0.93	<b>1.02</b>	PH;H	PT	110	
<b>Mean</b>		1.90	0.44	0.26			
<b>Maximum</b>		8.07	2.51	1.26			
<b>Minimum</b>		0.07	0.01	n/d			
<b>SD*</b>		2.14	0.53	0.33			

Samples presenting more than 2% TFA in the fat or 0.5g/dose are shown in bold.

\* See the list of abbreviations on Page iv.



**Table 3.9. TFA content in puff pastry**

Type	Sample code	TFAs			Fat type*	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose			
Puff	I 104	0.28	0.10	0.08	V	EU	80
	I 002	0.31	0.08	0.04	PH	PT	55
	I 124	0.35	0.11	0.10	V; O; PH	PT	50
	I 149	0.44	0.12	0.11	U	PT	95
	I 182	0.46	0.15	0.10	U	PT	65
	I 132	0.46	0.15	0.18	U	PT	80
	I 186	0.46	0.10	0.08	V	EU	80
	I 127	0.47	0.08	0.11	U	PT	65
	I 103	0.47	0.18	0.10	PH	PT	50
	I 118	0.48	0.08	0.06	U	PT	75
	I 123	0.48	0.18	0.03	PH	PT	90
	I 142	0.49	0.17	0.16	U	PT	95
	I 120	0.49	0.05	0.05	U	PT	90
	I 101	0.49	0.10	0.12	U	PT	120
	I 143	0.49	0.11	0.05	U	PT	50
	I 109	0.50	0.12	0.12	U	PT	100
	I 112	0.56	0.19	0.17	U	PT	90
	I 140	0.57	0.16	0.14	U	PT	90
	I 147	0.59	0.17	0.15	U	PT	90
	I 214	0.61	0.13	0.14	U	PT	110
	I 108	0.60	0.18	0.13	U	PT	75
	I 144	0.62	0.16	0.18	M	PT	115
	I 102	0.63	0.13	0.16	U	PT	120
	I 115	0.65	0.20	0.15	U	PT	75
	I 062	0.65	0.17	0.10	V; O; B	EU	57
	I 141	0.66	0.23	0.22	U	PT	100
	I 098	0.66	0.27	0.42	PH; H	PT	160
	I 175	0.66	0.17	0.10	U	PT	60
	I 125	0.67	0.15	0.07	U	PT	60
	I 230	0.67	0.15	0.20	U	PT	130
	I 180	0.68	0.17	0.19	U	PT	110
	I 233	0.68	0.14	0.23	U	PT	165
	I 111	0.68	0.19	0.17	U	PT	90
	I 208	0.70	0.28	0.28	U	PT	100
I 181	0.70	0.18	0.26	U	PT	145	
I 238	0.72	0.17	0.25	U	PT	150	
I 218	0.74	0.14	0.24	U	PT	170	

**Table 3.9.** *Continued*

Type	Sample code	TFAs			Fat type*	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose			
<b>Puff</b>	I 217	0.78	0.20	0.22	U	PT	110
	I 105	0.79	0.20	0.10	U	EU	50
	I 067	0.80	0.19	0.09	V/O	EU	45
	I 099	0.80	0.22	0.10	V;H	EU	45
	I 096	0.81	0.29	0.12	V	EU	40
	I 126	0.82	0.20	0.12	U	PT	140
	I 210	0.83	0.27	0.31	U	PT	115
	I 107	0.83	0.28	0.22	U	PT	80
	I 113	0.84	0.21	0.13	U	PT	65
	I 110	0.85	0.22	0.32	U	PT	145
	I 232	0.86	0.22	0.12	U	PT	55
	I 212	0.88	0.30	0.39	U	PT	135
	I 114	0.89	0.33	0.38	U	PT	115
	I 237	0.90	0.20	0.25	U	PT	130
	I 229	0.95	0.26	0.21	U	PT	80
	I 176	0.97	0.17	0.19	U	PT	110
	I 130	1.00	0.31	0.17	U	PT	90
	I 174	1.02	0.15	0.30	U	PT	195
	I 177	1.02	0.19	0.16	U	PT	85
	I 036	1.26	0.21	0.17	V;H	EU	80
	I 131	1.39	0.08	0.07	U	PT	120
	I 228	1.46	0.24	0.29	U	PT	120
	I 178	1.73	0.47	0.40	U	PT	85
	I 129	1.81	0.22	0.13	U	PT	55
	I 119	1.93	0.51	<b>0.56</b>	U	PT	110
	I 148	1.97	0.46	<b>0.70</b>	U	PT	150
	I 216	<b>2.32</b>	0.54	<b>0.81</b>	U	PT	150
	I 106	<b>2.41</b>	0.53	0.35	U	PT	65
	I 211	<b>2.43</b>	0.67	<b>0.80</b>	U	PT	120
	I 171	<b>2.63</b>	0.55	<b>0.55</b>	U	PT	100
	I 190	<b>2.65</b>	0.66	<b>0.50</b>	U	PT	75
	I 121	<b>2.66</b>	0.98	<b>1.17</b>	U	PT	120
	I 128	<b>2.99</b>	0.62	0.40	U	PT	60
I 116	<b>3.13</b>	0.82	<b>0.82</b>	U	PT	100	
I 215	<b>3.38</b>	1.27	<b>1.59</b>	U	PT	125	
I 227	<b>3.52</b>	0.52	<b>0.67</b>	U	PT	130	
I 213	<b>3.57</b>	1.34	<b>1.21</b>	U	PT	95	

**Table 3.9.** *Continued*

Type	Sample code	TFAs			Fat type*	Origin*	Dose (g)
		% (in fat)	g/100g	g/dose			
	I 139	<b>4.21</b>	1.82	<b>1.37</b>	U	PT	75
	I 145	<b>5.70</b>	0.80	<b>0.56</b>	U	PT	70
	I 133	<b>5.71</b>	0.65	<b>0.53</b>	U	PT	65
	I 146	<b>5.81</b>	1.64	<b>2.14</b>	U	PT	130
	I 117	<b>6.03</b>	1.98	<b>2.08</b>	U	PT	105
	I 236	<b>6.40</b>	1.98	<b>1.78</b>	U	PT	90
	I 235	<b>6.46</b>	1.61	<b>2.90</b>	U	PT	180
	I 136	<b>6.73</b>	1.79	<b>1.16</b>	U	PT	120
	I 138	<b>6.90</b>	1.91	<b>2.87</b>	U	PT	150
	I 137	<b>7.11</b>	2.29	<b>4.13</b>	U	PT	180
	I 209	<b>7.41</b>	2.17	<b>3.03</b>	U	PT	140
	I 188	<b>7.87</b>	2.11	<b>2.42</b>	U	PT	115
	I 184	<b>7.90</b>	1.64	<b>1.40</b>	U	PT	85
	I 183	<b>8.47</b>	2.11	<b>1.48</b>	U	PT	70
<b>Frozen puff sheets</b>	I 084	0.41	0.13	0.05	V/O	EU	40
	I 095	0.62	0.24	0.09	H	PT	40
	I 192	<b>2.09</b>	0.88	0.35	V;PH	PT	40
	I 001	<b>8.07</b>	0.93	<b>1.02</b>	PH;H	PT	110
<b>Mean</b>		2.01	0.52	0.54			
<b>Maximum</b>		8.47	2.29	4.13			
<b>Minimum</b>		0.28	0.05	0.03			
<b>SD*</b>		2.27	0.61	0.77			

Samples presenting more than 2% TFA in the fat or 0.5g/dose are shown in bold.

\* See the list of abbreviations on Page iv.

**Table 3.10. Geographical origin of the pastry samples**

Location	District	No. of samples	Average TFA % (in fat)
<b>North</b>	Viseu	3	<b>5.61</b>
	Braga	6	<b>4.41</b>
	Bragança	5	<b>3.83</b>
	Porto	41	<b>2.78</b>
	Aveiro	10	1.11
	Viana do Castelo	1	0.70
<b>Centre</b>	Lisboa	9	1.70
	Setúbal	2	0.77
	Coimbra	2	0.56
<b>South</b>	Faro	2	1.28
<b>National</b>	(Supermarkets)	36	1.30

**Table 3.11. TFA content in fast-food menus**

Type	Sample code	TFAs			Fat type*	Description	Origin	Dose (g)
		% (in fat)	g/100g	g/dose				
<b>Fast food</b>	I 170	0.38	0.06	0.01	U	fish nuggets	EU	25
	I 167	0.38	0.06	0.04	U	chicken nuggets	EU	70
	I 169	0.48	0.09	0.03	U	chicken nuggets	EU	30
	I 168	0.54	0.10	0.10	U	chicken nuggets	EU	100
	I 261	0.61	0.08	0.10	U	chicken nuggets	EU	125
	I 260	<b>2.41</b>	0.23	<b>0.28</b>	U	pizza (cheese + ham)	EU	240
	I 262	<b>2.42</b>	0.33	<b>0.98</b>	U	hamburger (cheese)	EU	300
	I 263	<b>3.07</b>	0.40	<b>0.67</b>	U	hamburger (cheese)	EU	170
	I 264	0.46	0.07	0.12	U	chicken nuggets + chips	EU	160
	I 265	0.46	0.08	0.14	U	chicken nuggets + chips	EU	170
	I 266	0.66	0.08	0.20	U	chicken nuggets + chips	EU	370
	I 267	1.69	0.22	0.72	U	cheeseburger + chips	EU	350
	I 268	1.39	0.19	1.06	U	hamburger + chips	EU	500
<b>Mean</b>		1.15	0.15	0.34				
<b>Maximum</b>		3.07	0.40	1.06				
<b>Minimum</b>		0.38	0.06	0.01				
<b>SD</b>		0.95	0.11	0.38				

Samples presenting more than 2% TFA in the fat or 0.2g/dose are shown in bold.

\* See the list of abbreviations on Page iv.

## 4. Conclusions

Based on the 268 samples analysed, it is evident that TFAs are present in Portuguese food products, but the situation is only of major concern in two particular cases: in the pastry and cookies categories. Pastry products – particularly those produced locally rather than industrially – had an elevated prevalence of samples containing more than 2% TFAs in the fat and higher amounts per portion. This observation was consistently found all over the Portuguese territory, and might be associated with an elevated prevalence of regular consumers. Imported cookies and biscuits are also of some concern (particularly those from Brazil), available mainly in low-cost shops, which could increase the consumption frequency of TFAs in certain low-income population groups. These products in particular contained very high amounts of TFAs, ranging from 20.7% to 37.6% – comparatively higher than the worst EU sample from among the 268 analysed (which contained 9.1% TFAs).

The low levels of TFAs found in industrial and domestic margarines was not consistent with the situation observed in the pastry category. It can therefore be assumed that the fats used in the preparation of these products are probably imported and not directly available to consumers. In order to confirm this observation, the TFA content of industrial margarines used in the production of local pastry products should be analysed.

Finally, reference should be made to the fact that most of the labels inspected already have a clear indication of the vegetable fat content, in accordance with Regulation No. 1169/2011 (7). Hydrogenated fat is more prevalent than partially hydrogenated fat. The mean TFA amounts were lower (1.1%) in the products containing hydrogenated fat, as expected, but 17% of the samples surpassed 2% TFAs. The samples containing partially hydrogenated fat contained 2.5% TFAs on average, with 36% surpassing 2% TFAs in the fat. Still, mislabelling can also be a significant concern, because a variety of the samples analysed without hydrogenated or partially hydrogenated fats contained more than 1% TFAs in the fat.

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# 6. Annex

**Table 6.1. Details of the samples analysed**

Sample code	Food type	Origin*	Fat type*	TFA % (in fat)	Total fat (g/100g)	Dose (g)	TFAs (g/dose)
I 000	Pastry	PT	PH	3.61	14.10	80	0.39
I 001	Pastry	PT	PH;H	8.07	11.54	110	1.02
I 002	Pastry	PT	PH	0.31	25.19	55	0.04
I 003	Pastry	EU	H;B	1.98	32.43	30	0.20
I 004	Pastry	PT	V;H	0.24	8.50	60	0.01
I 005	Pastry	PT	V;H	1.18	18.76	40	0.09
I 006	Pastry	EU	V;H	0.54	30.74	40	0.06
I 007	Pastry	PT	H;V	1.10	22.24	40	0.10
I 008	Pastry	PT	H;V	0.96	21.47	40	0.08
I 009	Cookies and biscuits	EU	H	0.47	27.20	19	0.02
I 010	Pastry	PT	V;H	0.50	16.52	45	0.04
I 011	Pastry	EU	V;H;B	0.94	21.47	45	0.09
I 012	Cookies and biscuits	PT	M	3.25	24.74	35	0.27
I 013	Popcorn	EU	V	0.66	13.62	30	0.03
I 014	Cookies and biscuits	EU	V	0.53	16.46	40	0.03
I 015	Chocolate spreads	EU	O/V;H	0.86	37.28	20	0.14
I 016	Cookies and biscuits	PT	O/V;H	0.51	3.85	40	0.01
I 017	Cookies and biscuits	EU	O;H	1.56	26.11	45	0.18
I 018	Cookies and biscuits	PT	H	0.83	26.82	30	0.07
I 019	Cookies and biscuits	BRA	H	21.40	14.57	30	0.93
I 020	Cookies and biscuits	EU	H;V	0.94	19.54	55	0.10
I 021	Cookies and biscuits	EU	H	0.22	31.42	20	0.01
I 022	Cookies and biscuits	BRA	H	23.93	17.51	30	1.26
I 023	Cookies and biscuits	UAE	H	0.65	17.59	30	0.03
I 024	Cookies and biscuits	BRA	H	20.06	15.02	30	0.90
I 025	Cookies and biscuits	BRA	H	14.88	17.55	30	0.78
I 026	Chocolate spreads	EU	O;H	0.45	34.69	20	0.03
I 028	Cookies and biscuits	EU	O/V	0.56	20.51	30	0.03
I 029	Cookies and biscuits	PT	M	0.44	18.40	40	0.03
I 030	Cookies and biscuits	PT	V	0.34	20.83	30	0.02
I 031	Pastry	EU	V/O	0.59	29.80	15	0.03
I 032	Cookies and biscuits	PT	H;V	0.35	18.42	32	0.02
I 033	Cookies and biscuits	PT	H;V	1.38	14.82	45	0.08
I 034	Cookies and biscuits	BRA	H	30.14	19.96	30	1.80
I 035	Pastry	EU	V	0.81	21.51	50	0.09
I 036	Pastry	EU	O/V;H	1.26	16.62	80	0.17
I 037	Pastry	EU	V	0.57	24.43	50	0.07
I 038	Cookies and biscuits	PT	O/V;H	0.73	26.65	45	0.09
I 039	Cookies and biscuits	PT	O/V	0.32	31.76	30	0.03
I 040	Cookies and biscuits	EU	B;H	1.11	22.07	20	0.05
I 041	Cookies and biscuits	EU	H	0.24	27.29	40	0.03
I 042	Cookies and biscuits	BRA	V	22.91	22.92	30	1.58
I 043	Cookies and biscuits	EU	H;V	0.30	25.48	40	0.03
I 044	Cookies and biscuits	EU	H;V	0.39	25.89	26	0.03
I 045	Cookies and biscuits	EU	V	1.00	31.12	40	0.12
I 046	Cookies and biscuits	PT	V	0.65	32.93	30	0.06
I 047	Cookies and biscuits	PT	V	0.48	29.84	40	0.06

Sample code	Food type	Origin*	Fat type*	TFA % (in fat)	Total fat (g/100g)	Dose (g)	TFAs (g/dose)
I 048	Cookies and biscuits	EU	PH	0.70	37.55	32	0.08
I 049	Cookies and biscuits	EU	H;V	1.13	26.68	45	0.13
I 050	Cookies and biscuits	PT	V	0.49	17.65	40	0.03
I 051	Popcorn	EU	V	0.50	16.43	30	0.02
I 052	Bouillon	EU	H	2.79	30.27	11	0.09
I 053	Bouillon	EU	H;V	0.73	26.38	10	0.02
I 054	Chocolate mousse	PT	H	0.13	26.85	25	0.02
I 055	Chocolate mousse	PT	H	0.24	14.30	25	0.01
I 056	Chocolate mousse	PT	H	0.32	5.91	25	0.01
I 057	Chocolate mousse	EU	H	1.91	13.10	25	0.18
I 058	Chantilly	EU	H	3.05	25.50	30	0.23
I 059	Chocolate snacks	EU	PH	0.55	49.97	40	0.11
I 060	Pastry	EU	B;H	2.48	21.60	40	0.21
I 061	Pastry	EU	V;H	0.94	28.32	50	0.12
I 062	Pastry	EU	V;O;B	0.65	26.77	57	0.10
I 063	Pastry	EU	V;O	0.68	32.47	45	0.10
I 064	Bread	PT	V	0.91	1.83	45	0.01
I 065	Bread	PT	PH	1.02	2.47	50	0.01
I 066	Pastry	EU	O/V	0.55	24.70	60	0.08
I 067	Pastry	EU	V/O	0.80	24.36	45	0.09
I 068	Cookies and biscuits	EU	V	0.33	31.64	40	0.04
I 069	Cookies and biscuits	PT	V	0.89	16.15	45	0.07
I 070	Pastry	PT	V	5.75	19.56	45	0.51
I 071	Cookies and biscuits	EU	H;V	1.16	30.77	38	0.13
I 072	Cookies and biscuits	EU	V;H;O	0.65	38.82	35	0.07
I 073	Cookies and biscuits	PT	H;O/V	0.41	25.75	45	0.04
I 074	Cookies and biscuits	EU	V	0.77	27.32	44	0.09
I 075	Cookies and biscuits	EU	H;B	0.59	39.33	30	0.07
I 076	Breakfast cereals	EU	O;H	0.41	15.85	30	0.02
I 077	Chocolate spreads	USA	H	0.25	52.27	20	0.03
I 078	Cookies and biscuits	EU	V	0.25	22.54	52	0.01
I 079	Cookies and biscuits	PT	V;H	0.86	30.77	38	0.10
I 081	Cookies and biscuits	EU	B;V	0.57	33.35	18	0.03
I 082	Cookies and biscuits	EU	V;H	9.18	35.95	30	0.99
I 083	Cookies and biscuits	EU	V	0.21	14.01	35	0.01
I 084	Pastry	EU	V/O	0.41	31.38	38	0.05
I 085	Cookies and biscuits	PT	PH	7.84	38.35	40	1.20
I 086	Chocolate snacks	BRA	V	0.53	35.62	40	0.07
I 087	Cookies and biscuits	PT	A;V;O	0.26	19.24	40	0.02
I 088	Cookies and biscuits	PT	M	0.63	3.80	40	0.01
I 089	Pastry	EU	O	0.75	20.91	45	0.07
I 090	Cookies and biscuits	EU	H	0.32	29.58	25	0.02
I 091	Pastry	EU	H	0.07	9.85	15	0.00
I 092	Cookies and biscuits	EU	V	0.71	25.46	66	0.12
I 093	Cookies and biscuits	EU	V	0.72	16.88	15	0.02
I 094	Popcorn	EU	V	0.79	15.91	25	0.03
I 095	Pastry	PT	H	0.62	38.21	40	0.09
I 096	Pastry	EU	V	0.81	35.56	40	0.12
I 097	Pastry	EU	V;O	1.23	24.61	45	0.14
I 098	Pastry	PT	V/O;H;PH	0.66	40.35	160	0.42
I 099	Pastry	EU	V;H	0.80	27.54	45	0.10
I 100	Potato chips	PT	V	0.77	37.23	25	0.07



Sample code	Food type	Origin*	Fat type*	TFA % (in fat)	Total fat (g/100g)	Dose (g)	TFAs (g/dose)
I 101	Pastry	PT	U	0.49	20.32	120	0.12
I 102	Pastry	PT	U	0.63	21.25	120	0.16
I 103	Pastry	PT	PH	0.47	38.70	50	0.10
I 104	Pastry	EU	V/O	0.28	35.96	80	0.08
I 105	Pastry	EU	U	0.79	25.27	50	0.10
I 106	Pastry	PT	U	2.41	22.12	65	0.35
I 107	Pastry	PT	U	0.83	33.64	80	0.22
I 108	Pastry	PT	U	0.60	30.88	75	0.13
I 109	Pastry	PT	U	0.50	23.99	100	0.12
I 110	Pastry	PT	U	0.85	26.21	145	0.32
I 111	Pastry	PT	U	0.68	27.60	90	0.17
I 112	Pastry	PT	U	0.56	33.48	90	0.17
I 113	Pastry	PT	U	0.84	24.81	65	0.13
I 114	Pastry	PT	U	0.89	37.71	115	0.38
I 115	Pastry	PT	U	0.65	31.04	75	0.15
I 116	Pastry	PT	U	3.13	26.37	100	0.82
I 117	Pastry	PT	U	6.03	32.86	105	2.08
I 118	Pastry	PT	U	0.48	16.16	75	0.06
I 119	Pastry	PT	U	1.93	26.60	110	0.56
I 120	Pastry	PT	U	0.49	10.23	90	0.05
I 121	Pastry	PT	U	2.66	36.78	120	1.17
I 122	Cookies and biscuits	PT	H; O/V	0.48	37.69	15	0.03
I 123	Pastry	PT	PH	0.35	32.52	90	0.10
I 124	Pastry	PT	V/O; PH	0.67	21.98	50	0.07
I 125	Pastry	PT	U	0.82	23.91	60	0.12
I 126	Pastry	PT	U	0.47	16.16	140	0.11
I 127	Pastry	PT	U	2.99	20.60	65	0.40
I 128	Pastry	PT	U	1.81	12.33	60	0.13
I 129	Pastry	PT	U	1.00	30.72	55	0.17
I 130	Pastry	PT	U	1.39	5.48	90	0.07
I 131	Pastry	PT	U	0.46	33.31	120	0.18
I 132	Pastry	PT	U	5.71	11.38	80	0.53
I 134	Cookies and biscuits	EU	V	0.50	29.19	100	0.14
I 135	Chocolate snacks	EU	V	0.26	26.13	58	0.04
I 136	Pastry	PT	U	6.47	28.35	120	2.20
I 137	Pastry	PT	U	7.11	32.27	180	4.13
I 138	Pastry	PT	U	6.90	27.71	150	2.87
I 139	Pastry	PT	U	4.21	43.23	75	1.37
I 140	Pastry	PT	U	0.57	27.52	90	0.14
I 141	Pastry	PT	U	0.66	34.61	100	0.22
I 142	Pastry	PT	U	0.49	34.41	95	0.16
I 143	Pastry	PT	U	0.49	21.78	50	0.05
I 144	Pastry	EU	M	0.62	25.52	115	0.18
I 145	Pastry	PT	U	5.70	14.10	70	0.56
I 146	Pastry	PT	U	5.81	28.27	130	2.14
I 147	Pastry	PT	U	0.59	28.82	90	0.15
I 148	Pastry	PT	U	1.97	23.60	150	0.70
I 149	Pastry	PT	U	0.44	27.79	95	0.11
I 150	Potato chips	EU	V	0.60	33.04	25	0.05
I 151	Potato chips	EU	V	0.54	32.06	25	0.04
I 152	Potato chips	EU	V	0.17	38.13	30	0.02
I 153	Potato chips	EU	V	0.60	35.03	25	0.05

Sample code	Food type	Origin*	Fat type*	TFA % (in fat)	Total fat (g/100g)	Dose (g)	TFAs (g/dose)
I 154	Potato chips	EU	V	0.58	36.89	25	0.05
I 155	Potato chips	EU	V	0.71	33.75	25	0.06
I 156	Potato chips	EU	V	0.62	29.92	25	0.05
I 157	Potato chips	EU	V	0.57	42.02	25	0.06
I 158	Potato chips	EU	V	0.65	34.05	25	0.06
I 159	Potato chips	EU	V	0.65	36.89	40	0.10
I 160	Potato chips	EU	V	0.43	35.31	25	0.04
I 161	Potato chips	EU	V	0.46	33.54	30	0.05
I 162	French fries	PT	U	0.37	16.12	0	0.05
I 163	French fries	PT	U	0.53	16.01	90	0.08
I 164	French fries	PT	U	0.36	13.55	70	0.03
I 165	French fries	PT	U	0.60	14.88	100	0.09
I 166	French fries	PT	U	0.67	10.50	165	0.12
I 167	French fries	PT	U	0.38	14.75	70	0.04
I 168	French fries	PT	U	0.54	18.88	100	0.10
I 169	French fries	EU	U	0.48	18.67	30	0.03
I 170	French fries	EU	U	0.38	15.10	25	0.01
I 171	Pastry	PT	U	2.63	20.88	100	0.55
I 172	Pastry	PT	U	3.49	23.12	115	0.93
I 173	Pastry	PT	U	0.72	18.51	85	0.11
I 174	Pastry	PT	U	1.02	15.09	195	0.30
I 175	Pastry	PT	U	0.66	25.43	60	0.10
I 176	Pastry	PT	U	0.97	17.58	110	0.19
I 177	Pastry	PT	U	1.02	18.50	85	0.16
I 178	Pastry	PT	U	1.73	27.00	85	0.40
I 179	Pastry	PT	U	1.79	27.03	65	0.31
I 180	Pastry	PT	U	0.68	25.69	110	0.19
I 181	Pastry	PT	U	0.70	25.85	145	0.26
I 182	Pastry	PT	U	0.46	33.29	65	0.10
I 183	Pastry	PT	U	8.47	24.92	70	1.48
I 184	Pastry	PT	U	7.90	20.78	85	1.40
I 185	Pastry	EU	V; PH	4.47	31.92	50	0.71
I 187	Pastry	PT	U	0.46	34.55	115	0.18
I 188	Pastry	PT	U	7.87	26.77	115	2.42
I 189	Pastry	PT	U	7.72	32.54	50	1.26
I 190	Pastry	PT	U	2.65	25.02	75	0.50
I 191	Margarine	PT	O/V	0.65	71.82	10	0.05
I 192	Pastry	PT	V; PH; O	2.09	41.88	200	1.75
I 193	Chocolate spreads	EU	O/V	0.38	38.05	20	0.03
I 194	Chocolate spreads	EU	O/V	0.59	39.48	20	0.05
I 195	Chocolate spreads	EU	O/V	0.14	46.10	20	0.01
I 196	Margarine	PT	O/V	0.41	58.92	10	0.02
I 197	Margarine	EU	O/V	0.33	53.38	10	0.02
I 198	Margarine	PT	O/V	0.47	54.11	10	0.03
I 199	Margarine	EU	O; H	0.45	65.30	10	0.03
I 200	Margarine	EU	O/V	0.26	63.66	10	0.02
I 201	Margarine	PT	O/V	1.20	56.79	10	0.07
I 202	Potato chips	PT	V	1.26	30.26	25	0.10
I 203	Potato chips	EU	V	0.81	25.92	25	0.05
I 204	Potato chips	EU	V	0.95	33.67	30	0.10
I 205	Potato chips	EU	V	0.68	40.10	25	0.07
I 206	Potato chips	PT	V	0.85	42.43	25	0.09

Sample code	Food type	Origin*	Fat type*	TFA % (in fat)	Total fat (g/100g)	Dose (g)	TFAs (g/dose)
I 207	Margarine	EU	O/V	0.77	65.15	10	0.05
I 208	Pastry	PT	U	0.70	40.74	100	0.28
I 209	Pastry	PT	U	7.41	29.24	140	3.03
I 210	Pastry	PT	U	0.83	32.79	115	0.31
I 211	Pastry	PT	U	2.43	27.48	120	0.80
I 212	Pastry	PT	U	0.88	34.09	135	0.39
I 231	French fries	PT	U	0.42	13.85	90	0.05
I 232	Pastry	PT	U	0.86	25.43	55	0.12
I 233	Pastry	PT	U	0.68	20.51	165	0.23
I 234	Cookies and biscuits	PT	V;H	0.91	23.75	44	0.02
I 235	Pastry	PT	U	6.46	24.95	180	2.90
I 236	Pastry	PT	U	6.40	30.90	90	1.78
I 237	Pastry	PT	U	0.90	21.76	130	0.25
I 238	Pastry	PT	U	0.72	23.50	150	0.25
I 239	Breakfast cereals	EU	PH	0.53	2.16	30	0.00
I 240	Breakfast cereals	EU	PH	0.97	2.10	30	0.01
I 241	Bread	PT	V	0.70	2.40	45	0.01
I 242	Bouillon	EU	V	0.73	17.03	4	0.01
I 243	Bouillon	EU	V	0.63	19.47	4	0.01
I 244	Bouillon	EU	V;H	0.60	22.09	10	0.01
I 245	Soup	EU	V	0.45	8.39	20	0.03
I 246	Soup	EU	V	0.53	5.68	15	0.00
I 247	Soup	EU	V	0.77	12.59	15	0.01
I 248	Soup	EU	V	0.47	38.90	30	0.05
I 249	Soup	EU	H	0.34	6.71	20	0.00
I 250	Popcorn	EU	H	1.54	8.05	30	0.04
I 251	Bread	EU	V	0.40	10.66	50	0.02
I 252	Margarine	EU	O/V;H	1.93	71.15	10	0.14
I 253	Margarine	EU	O/V	0.64	62.38	10	0.04
I 254	Margarine	EU	O/V;H	1.43	60.01	10	0.09
I 255	Butter	EU	B	2.67	75.15	10	0.20
I 256	Butter	EU	B	3.37	39.23	10	0.13
I 258	Butter	EU	B	2.07	55.16	10	0.11
I 259	French fries	PT	U	0.71	11.60	120	0.10
I 260	Fast food	PT	U	2.41	9.71	240	0.28
I 261	Fast food	PT	U	0.61	13.54	250	0.10
I 262	Fast food	PT	U	2.42	13.52	410	0.98
I 263	Fast food	PT	U	3.07	12.88	260	0.67
I 264	Fast food	PT	U	0.46	15.46	160	0.12
I 265	Fast food	PT	U	0.46	16.69	170	0.14
I 266	Fast food	PT	U	0.66	12.91	370	0.20
I 267	Fast food	PT	U	1.69	13.13	350	0.72
I 268	Fast food	PT	U	1.39	13.96	500	1.06

\* See the list of abbreviations on Page iv.

The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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