# LEVEL OF *TRANS* FATTY ACIDS IN THE NEW ZEALAND FOOD SUPPLY

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# LEVEL OF *TRANS* FATTY ACIDS IN THE NEW ZEALAND FOOD SUPPLY

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**CONTENTS**

## LIST OF TABLES



## LIST OF FIGURES

**SUMMARY**

This project has conducted a survey of selected New Zealand foods to determine moisture and fat content, and fatty acid profiles. The principal objective was to provide data on *trans* fatty acid content to support decisions regarding labelling.

Samples were chosen on the basis of several criteria:

- Information about major fat sources in the New Zealand diet was reviewed;
- Samples containing solely animal fats with naturally occurring *trans* fatty acids were excluded;
- Samples taken for a concurrent survey of *trans* fatty acids in foods in New South Wales were reviewed;
- Recent surveys of margarines, table spreads, and deep frying fats in New Zealand meant that these samples were excluded; and,
- Samples for which the New Zealand Food Composition Database already contained information were also excluded.

This meant that the focus of the survey was on baked goods, pastry, pies, biscuits, cakes, snackfoods and a few table spreads for which data were not available. The actual samples were:

- Biscuits and cakes (12 samples)
- Table spreads (6 samples)
- Fast food (1 sample – french fries)
- Chocolate (4 samples)
- Snack bars (6 samples)
- Pies and pastry (10 samples)
- Popcorn (2 samples)
- Chips/crisps (2 samples)
- Partially cooked chips/wedges (3 samples)
- Shortening (1 sample)

The *trans* fatty acid content of these samples was generally low (<5% or <5 g *trans* fats per 100 g total fatty acids). Slightly higher values were observed for generic table spreads (6-7%). The absence of samples with higher *trans* fatty acid content in the fat component suggests that partially hydrogenated fats are not widely used by the food manufacturing and bakery industries in New Zealand, and the *trans* fatty acid content of many products comprises the naturally occurring levels in animal fats. Exceptions are imported products (one biscuit and both popcorn samples) whose fat component included approximately 10% and 47% *trans* fatty acids respectively.

Although this survey represents only a small proportion of the many products available, the results for snack bars, table spreads, and butter/plant oil blends suggest that the *trans* fatty acid content of these categories of products has declined since previous surveys in 1995 and 1998.

# 1 INTRODUCTION

In a proposal concerning health claims for foods in Australia and New Zealand, Food Standards Australia New Zealand (FSANZ) discussed "high level health claims" concerning diet-disease relationships (FSANZ, 2005). In this document, released for public comment, FSANZ reported:

> "FSANZ considers there is convincing evidence of a relationship between reduction in dietary intake of saturated and *trans* unsaturated fatty acids and reduction in blood level of LDL-cholesterol.
>
> On the basis of the two above relationships for LDL-cholesterol, FSANZ provides approval for claims made on the basis of saturated fatty acids and LDL-cholesterol, or saturated fatty acids and *trans* unsaturated fatty acids and LDL-cholesterol. However, claims in relation to *trans* unsaturated fatty acids alone and LDL-cholesterol have not been approved. This is because it is not clear whether the effect of *trans* fatty acids on LDL-cholesterol is biologically meaningful at low levels of intake, which is likely to be the case in Australia and New Zealand."

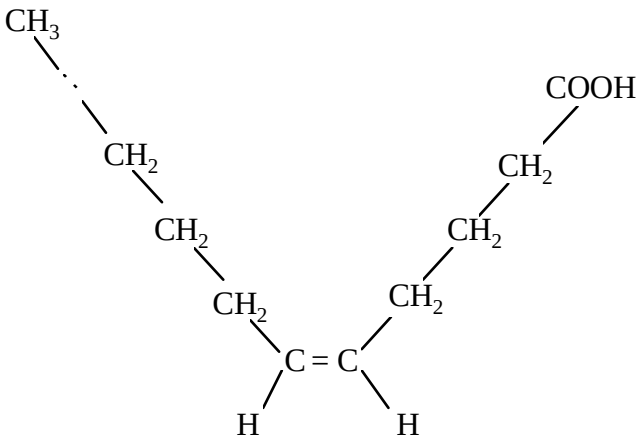
A review of the relationship between saturated and *trans* unsaturated fatty acids and LDL-cholesterol and coronary heart disease found that the association between *trans* fatty acids and LDL cholesterol was "convincing, while the relationship with coronary heart disease was "probable" rather than "convincing" (Booker and Mann, 2005). This review also noted the paucity of reliable estimates of population intakes of *trans* fatty acids in Australasia, although an estimate published in 1996 was not reviewed (Lake and Thomson, 1996).

In January 2006 an amended regulation on food labelling from the US Food and Drug Administration (FDA) came into force. This required that *trans* fatty acids be declared in the nutrition information panel of conventional foods and dietary supplements. Such labelling may be possible in the future for foods in New Zealand.

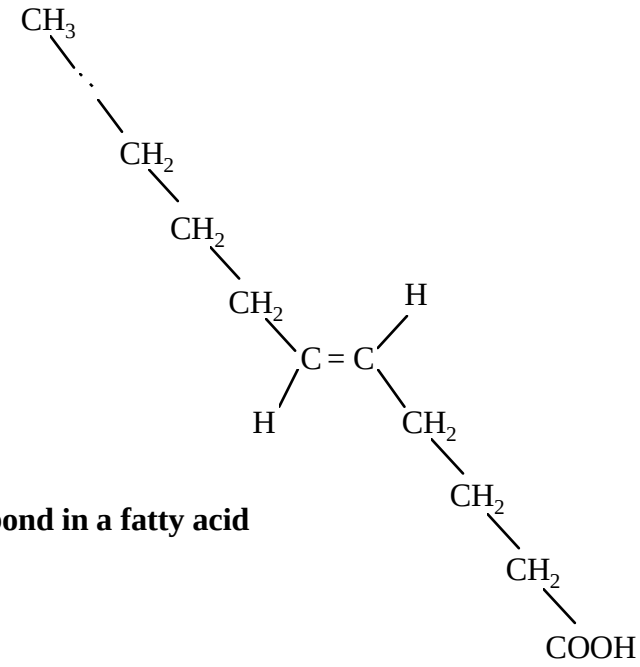
In order to estimate intakes and support decision making regarding risk management for *trans* fatty acids in New Zealand, the content of *trans* fats in the foods available in New Zealand is required. The objective of this project is to analyse selected foods to determine whether the levels of *trans* fats in manufactured foods in New Zealand has changed over the past decade, and review results from this project and previous ones.

## 1.1 *Trans* Fatty Acids

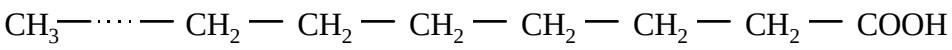
In naturally occurring mono and polyunsaturated fatty acids the predominant double bond configuration is "*cis*" and the fatty acid chain is "bent" at the double bond position. The other isomer is "*trans*", where the fatty acid chain continues more or less straight on through the double bond. *Trans* fatty acids thus behave more like saturated (straight chain) fatty acids, with higher melting points than *cis* isomers. The structures are shown in Figure 1.




**“cis” double bond in a fatty acid**




**“trans” double bond in a fatty acid**




**“saturated” fatty acid**

**Figure 1: Fatty acid double bond types and saturated fatty acid**

Hydrogenation involves the addition of hydrogen to the double bond of an unsaturated fatty acid, thus making it saturated. During the process of hydrogenation, isomerisation reactions can also occur. These reactions can include the conversion of a *cis* double bond to *trans*, without net uptake of hydrogen as well as movement of the double bond to other positions in the chain (Mensink and Katan, 1993). Partial hydrogenation of fats creates *trans* fatty acids along with fully saturated fatty acids.

*Trans* fatty acids have always been part of the human diet through consumption of the milk and body fat of ruminant animals, particularly cows. In the rumen of these animals microbial hydrogenation of polyunsaturated fatty acids results in the formation of a proportion of *trans* fatty acids (Sommerfeld, 1983). These *trans* fatty acids end up in both the milk and meat of the animals.

Plant based oils such as soybean, safflower, sunflower and groundnut (peanut) oils, contain large proportions of the monounsaturated fatty acid, oleic acid (C18:1), and the polyunsaturated fatty acid, linoleic acid (C18:2). Hardening of such oils through hydrogenating some of the double bonds, produces stearic acid (C18:0) from oleic acid and oleic acid from linoleic. In the conversion process some of the remaining double bonds become isomerised, producing principally *trans* isomers of oleic acid. The *trans* fatty acids, having a higher melting point, make the resulting product "harder", without requiring full hydrogenation to the saturated equivalent, stearic acid. Reducing the number of double bonds in the oil also gives greater protection from oxidation and subsequent rancidity.

*Trans* fatty acids also occur naturally in some plants and vegetables (Sommerfeld, 1983) but the contribution to the dietary fat intake of humans is minimal (Mensink and Katan, 1993).

*Trans* fatty acids in human milk and adipose tissue are derived from the diet as they are not synthesised as end products of metabolism *in vivo* (Aro *et al.*, 1995; Mensink and Katan, 1993).

## 1.2 Previous Studies of *Trans* Fatty Acids in the New Zealand Food Supply

### 1.2.1 Analytical studies

A study by ESR in 1994-1995 (Lake *et al.*, 1995) included a wide range of samples. Results are given in Table 1.

**Table 1: Results from 1995 ESR survey (Lake *et al*., 1995)**

| Food | Number of samples | Fat content (%) | *Trans* fatty acid content (g/100 g total fatty acids) |
|---|---|---|---|
| Margarines and table spreads | 12 | 48 – 85 | 12.6 – 19.7 |
| Butters | 6 | 77 – 100 | 5.4 – 9.3 |
| Butter/margarine blends | 2 | 70 – 79 | 6.1 – 13.1 |
| French fried potatoes | 5 | 11 – 20 | 0.5 – 10.3 |
| Potato crisps | 3 | 30 – 35 | 0.3 – 0.7 |
| Muesli bars | 2 | 11 – 14 | 17.9 – 25.0 |
| Sweet biscuits | 5 | 11 – 14 | 1.1 – 3.5 |
| Crackers | 5 | 8 – 25 | 1.2 – 3.9 |
| Pastry | 5 | 13 – 20 | 3.6 – 7.5 |
| Cakes | 5 | 9 – 19 | 2.5 – 8.2 |

The *trans* fatty acid content of manufactured foods was examined in a study by the New Zealand Dairy Research Institute in 1997 (Richardson *et al*., 1997). Results are shown in Table 2.

**Table 2: Results from Dairy Research Institute 1997 survey (Richardson *et al.*, 1997)**

| Food | Number of samples | Fat content (%) | *Trans* fatty acid content (g/100 g total fatty acids) |
|---|---|---|---|
| Margarine | 2 | 81.8 – 81.8 | 14.3 – 14.7 |
| Commercial pastry fat | 3 | 81.7 – 85.1 | 5.4 – 7.0 |
| Retail pastry | 1 | 23.5 | 5.6 |
| Homogenised milk | 1 | 2.6 | 4.8 |
| Reduced fat milk | 1 | 1.4 | 5.8 |
| Butter | 1 | 82.7 | 6.7 |
| Shortening | 1 | 81.6 | 4.6 |
| Meat pie | 1 | 13.9 | 3.9 |
| Meat patty | 1 | 24.6 | 4.3 |
| Luncheon meat | 1 | 13.0 | 5.0 |
| Muesli bar | 1 | 19.9 | 0.9 |
| Chocolate coated biscuit | 1 | 26.3 | 1.7 |
| Plain sweet biscuit | 1 | 15.2 | 4.5 |
| Savoury cracker biscuit | 1 | 23.7 | 0.7 |
| White bread | 1 | 1.4 | 2.2 |

A study by ESR in 1997-1998 (Lake *et al.*, 1998) analysed margarines (24), butters (3), and blends (5). The study was prompted by the recognition that the composition of margarines had changed since the previous survey, and margarines/blends are the key source of *trans* fatty acids in the New Zealand diet (Lake and Thomson, 1996). The report found two groups of margarine/table spread products; those with less than 1% *trans* fatty acids, and those with 12 – 18% *trans* fatty acids. An important result of this study was that label claims, when made, for fatty acid content, were generally reliable. Results are summarised in Table 3.

**Table 3: Results from ESR 1998 survey (Lake *et al.*, 1998)**

| Food | Number of samples | Fat content , mean (range) (%) | *Trans* fatty acid content, mean (range) (g/100 g total fatty acids) |
|---|---|---|---|
| Margarines and table spreads | | | |
| - low *trans* fatty acids | 8 | 71.6 (64.4 – 77.8) | (ND – 1.1)* |
| - high *trans* fatty acids | 16 | 77.7 (61.5 – 85.0) | 14.5 (12.0 – 18.2) |
| Blends | 5 | 67.9 (59.3 – 83.6) | 10.6 (8.5 – 11.8) |
| Butters | 3 | 82.6 (82.4 – 82.9) | 6.9 (5.8 – 7.9) |

ND = Not Detected

* No mean could be calculated due to the presence of samples where the result was 'Not Detected'

In 1998-1999 a nationally representative sample of fast food outlets (148) was sampled to obtain fat from the deep fat fryers (Morley-John *et al.*, 2005). These were analysed for *trans* fatty acid content, along with other fat types, by the National Heart Foundation of New Zealand (NHF).

This study found that of 148 deep frying fats sampled the *trans* content had a mean of 4.8% (standard error 0.4) and a range of 0.5-36.1%. There was a broad range of *trans* fatty acid content, with the mean (standard deviation, range) content of hydrogenated canola products being 26.4% (9.31, 18.4-36.1) and of tallow-based products being 5.11% (1.04, 3.4-8.4). The majority of outlets were using tallow-based products (82%), with palm-based products the next most common (7% of outlets). Canola-based products were only used by 4% of outlets.

An Australian study is in progress, which includes the following food groups:

- Fast foods (hamburgers/deep fried fish)
- Oils/chips/pizza
- Muesli bars
- Chocolate
- Dairy foods and soy
- Meat and meat products
- Fish
- Oil and products (including margarine)
- Breads and bakery products

This study was commissioned by the New South Wales Food Authority, with analyses conducted by the Division of Analytical Laboratories, Western Sydney Area Health Service. ESR has received the sampling plan, but results are not yet available.

### 1.2.2 Other studies

A market study collating the label claims of 45 butters and table spreads for Consumer magazine in 2005 showed the composition of these foods for *trans* fat, as well as other fat types (Consumer, 2005). The numerical data from the examination of labels was kindly supplied by Belinda Allan at Consumer magazine, and are included with the data shown in Table 6 below.

A postal survey of food manufacturers/marketers was conducted in 2005 (Vather, 2005). Information from the industry suggested widespread use of hydrogenated vegetable fats/oils but manufacturers were unable to supply much detailed information regarding the actual *trans* fatty acid content of their foods or ingredients. Analytical determination of this information was recommended as an alternative.

## 2 SAMPLES AND METHODOLOGY

Decision making regarding samples for this survey took note of the following information.

Major fat sources in the New Zealand diet can be derived from the 1997 National Nutrition Survey (NNS) and the 2002 National Children's Nutrition Survey (CNS):

> NNS major fat sources for adults (5% or more): butter and margarine (16%), potatoes and kumara (6 – presumably including hot chips and crisps), beef and veal (6), milk (6), cakes and muffins (6), pies and pastries (6), bread based dishes (6), sausages and processed meats (5), fats and oils (5).
>
> CNS major fat sources for children (5% or more): potatoes, kumara and taro (9, including potato chips and wedges), milk (8), biscuits (7), butter and margarine (6), pies and pastries (6), sausages and processed meats (5).

In discussion with the NZFSA (July 2005) it was agreed that:

> Animal fats (meat, poultry and dairy) would be excluded; the *trans* fatty acid content of these will be available from the literature, and previous studies.
>
> Margarine and blends would be excluded, on the basis that the 1998 survey found good agreement between label claims and fatty acid content. Thus the labels of margarines currently on the market could supply this information, and this has been collated by the Consumer study. Exceptions would be such products without a relevant label claim.
>
> Deep frying fats would be excluded: The NHF study found that these were predominantly beef fat, and for those that were not, the fatty acid profile can be derived from the analytical data. An exception would products from a major fast food chain, that reported that they were intending to alter their deep frying fat formulation to an all-vegetable blend in mid-2005 (Consumer, 2005).

This meant that the survey would focus on baked goods/pastry/pies/biscuits/cakes/snack foods (including chocolate, which may include vegetable fats), along with table spreads without a label claim. Specific sample selection was assisted by a number of supermarket visits to review product labels of potential samples.

A list of foods for which the *trans* fatty acid content was already recorded in the Food Composition Database was obtained (Nelofar Athar, Crop and Food Research Ltd, personal communication). A number of these analytical results had been obtained from composite samples of a number of different branded products. The proposed list of samples for this project was reviewed in the light of this information, with the intention that this survey would fill gaps in existing data.

## 2.1 Sample List

The samples included in this survey were:

*Biscuits and cakes:*

1. Raspberry lamington (filled)
2. Lolly cake
3. Ginger kisses
4. Chocolate thins (Brand 1)
5. Chocolate thins (Brand 2)
6. Chocolate creams
7. Chocolate sandwich cookies
8. Double chocolate biscuits
9. Crackers
10. Snack crackers (Brand 1)
11. Snack crackers (Brand 2)
12. Snack crackers (Brand 3)

*Margarine/table spreads:*

13. 'Lite' original spread
14. 'Table' spread
15. 'Original' spread
16. Sunflower spread
17. 'Southern' blend
18. 'Semi-Soft' blend

*Fast food:*

19. French fries

*Chocolate:*

20. Double blend milk chocolate
21. Dairy milk chocolate
22. Classic dark chocolate (70% cocoa)
23. Creamy milk chocolate

*Snack bars:*

24. Yoghurt coated muesli snack
25. Muesli snack bar
26. Fruit twists (strawberry variety)
27. Muesli chocolate snack bar
28. Chocolate snack bar
29. Cookie Bar

*Pies and pastry:*

30. Flaky puff pastry
31. Ready-rolled puff pastry
32. Filo pastry
33. Feather flake puff pastry
34. Flaky puff pastry
35. Mince & cheese pies (complete sample of six analysed)
36. Sweet short pastry
37. Savoury short pastry
38. Steak & cheese hot pie from a dairy/service station
39. Apple pie

*Popcorn:*

40. Natural microwavable popcorn
41. Butter flavoured microwaveable popcorn

*Chips/crisps:*

42. Potato chips (brand 1), cooked in vegetable oil
43. Potato chips (brand 2), cooked in sunflower oil

*Partially cooked chips/wedges (most are labelled as being cooked in canola oil; we chose samples claiming to be cooked in animal fat):*

44. Straight cut potato fries (brand 1)
45. Straight cut potato fries (brand 2)
46. Super oven fries

*Shortening (one shortening derived from vegetable oil was located:*

47. Shortening

## 2.2 Analytical Methods

The analyses conducted on these samples were: moisture content, fat content, and fatty acid analysis of the extracted fat. Brief details of the methods are given below. Full details are recorded in the Food Chemistry Manual for the Christchurch Science Centre.

### 2.2.1 Moisture

Analysis of duplicate samples from a homogenised food sample was carried out by drying at 103 ± 2°C for two hours. Drying is repeated until successive weighings differ by less than 0.1%. Reference: Pearsons's Composition and Analysis of Foods, Kirk, Sawyer: 9$^{th}$ edition, 1991, p 498.

### 2.2.2 Fat

Soxhlet extraction of duplicate samples of a dried sample of the homogenised food was carried out using a 1:1 mixture of petroleum ether: diethyl ether. Following extraction the solvent is removed and the fat dried at 102°C. Reference: AOAC Official Methods 920.39, 945.16, 948.22.

For table spreads, the sample was acidified with dilute hydrochloric acid, heated in a water bath between 70 and 80ºC for 30 minutes, then allowed to cool and extracted twice with a diethyl ether, petroleum ether (40 - 60ºC bp) mixture. Solvent extracts were combined and evaporated on a water bath, then dried at 102ºC. The fat content was calculated by difference. Reference: AOAC Official Methods 992.06 (16th Edition).

### 2.2.3 Fatty acid methyl ester analysis

Derivatisation of extracted fat was carried out using methanolic potassium hydroxide. Gas chromatographic analysis of methyl esters was performed on a 50 m Carbowax 20M column. Approximately half of the samples were analysed for fatty acids in duplicate. Following analysis, chromatogram peaks are assigned manually, on the basis of comparison with reference standards (see below), and the integrated peak areas used to assign percentage composition. Reference: British Standard Methods of Analysis of Fats and Fatty Oils, BS684: Section 2.35: 1980.

## 2.3 Quality control

For fat and moisture content, the ESR CSC Chemistry Laboratory participates in the Anaqual rounds conducted by AgriQuality.

For fatty acid methyl ester analyses, ESR participates in an AOCS Proficiency Programme involving the analysis of a number of different types of fat, including:

- AOCS *trans* fatty acid standard #1 (includes 15.21% (standard deviation 4.69%) total *trans* fatty acids along with C16:0, C18:0, C18:1, C18:2);
- AOCS *trans* fatty acid standard #2 (includes C18:1 *trans* (mean 13.58%, standard deviation 2.16%), C18:2 *trans* (mean 6.63%, standard deviation 0.99%) , C18:3 *trans* (mean 0.37%, standard deviation 0.21%), total *trans* (mean 20.34%, standard deviation 2.72%) along with other fatty acids);
- AOCS Animal Fat Reference #3; and
- AOCS Olive Oil Reference #8.

These fat samples are derivatised to the methyl esters using the same method as the extracted fat from the samples. The means and standard deviations for *trans* fatty acid content given above are derived from the reported results of participating laboratories (7 laboratories for #1, 31 laboratories for #2). The analytical samples for this survey were grouped into 5 batches for separate gas chromatography runs, and the above samples analysed within each batch. Results for *trans* fatty acid content were all within one standard deviation of the mean interlaboratory value. Results are summarised in Table 4.

**Table 4: *Trans* fat content of AOCS proficiency samples used as batch quality control**

| Run Number | Total *trans* fatty acid content (%) | |
|---|---|---|
| | AOCS #1 | AOCS #2 |
| 1 | 11.8 | 19.6 |
| 2 | 14.9 | 21.8 |
| 3 | 14.9 | 22.1 |
| 4 | 13.2 | 19.6 |
| 5 | 14.0 | 19.6 |
| **Expected value - Mean** | **15.21** | **20.34** |
| **Range (±1 standard deviation)** | **10.52 – 19.90** | **17.62 – 23.06** |

Derivatised samples were grouped into batches for gas chromatographic runs. During the gas chromatographic analysis a number of additional reference standards of fatty acid methyl esters are included:

- Nu-Chek #87 reference standard
- Nu-Chek #68D reference standard
- Alltech K-108
- Alltech K110
- Alltech K3000

All these standards are used to confirm retention times for peak identification, as well as to confirm that peak areas reflect actual composition of these mixtures.

2.3.1 Interlaboratory comparison

Subsamples from two of the food samples analysed for this survey were sent to the Division of Analytical Laboratories (DAL), Western Sydney Area Health Service, which is the laboratory conducting the analyses for the Australian survey. The comparison results are given in Table 5. The agreement for *trans* fatty acid content is within the standard deviation range of interlaboratory variation seen in the AOCS samples described above.

**Table 5: Results from interlaboratory comparison of samples**

| Sample | Moisture (%) | | Fat (%) | | Total *trans* fatty acid content of fat (%) | |
|---|---|---|---|---|---|---|
| | ESR | DAL | ESR | DAL | ESR | DAL |
| Chocolate biscuits | 2.3 | 3.0 | 27.6 | 28.3 | 0.2 | 0.35 |
| Table spread | 28.4 | 28.3 | 68.5 | 68.8 | 6.8 | 5.8 |

DAL = Division of Analytical Laboratories, Western Sydney Area Health Service

## 3 RESULTS

Results from the analyses are given in Table 6. More detailed fatty acid composition information is given in Appendix 1.

**Table 6: Moisture, fat, *trans* and saturated fatty acid content of selected foods available in New Zealand, 2006**

| Sample (specific fat ingredient, if listed on label) | Moisture (%) | Fat (%) | Total *trans* fatty acids in fat (%) | Total saturated fatty acids in fat (%) |
|---|---|---|---|---|
| ***Biscuits and cakes:*** | | | | |
| Raspberry lamington (animal and vegetable fats/oils) | 11.3 | 16.0 | 1.4 | 71.2 |
| Lollie cake (vegetable fat, animal and vegetable fats/oils) | 20.3 | 17.5 | 0.8 | 89.7 |
| Ginger kisses | 17.2 | 20.5 | 3.5 | 65.9 |
| Chocolate thins (vegetable fat, milk solids) - Brand 1 | 2.3 | 20.0 | 1.0 | 71.1 |
| Chocolate thins (vegetable fat) - Brand 2 | 2.8 | 19.5 | 1.0 | 69.3 |
| Chocolate creams (vegetable oil, milk solids) | 2.6 | 21.0 | 3.3 | 53.5 |
| Chocolate sandwich cookies (vegetable shortening) | 1.9 | 20.0 | 10.6 | 43.0 |
| Double chocolate biscuits (cocoa butter, milk fat) | 2.3 | 27.5 | 0.2 | 76.3 |
| Crackers | 2.1 | 26.5 | 0.4 | 46.8 |
| Snack crackers - Brand 1 | 3.2 | 23.0 | <0.1 | 48.4 |
| Snack crackers - Brand 2 | 1.6 | 23.0 | 0.3 | 48.2 |
| Snack crackers - Brand 3 | 3.9 | 17.5 | 0.4 | 48.6 |
| ***Margarine/table spreads*** | | | | |
| Lite Original Spread (blended vegetable oils) | 38.8 | 59.0 | 6.5 | 17.9 |
| Table spread (vegetable oils) | 31.7 | 65.5 | 6.1 | 17.5 |
| Original spread (vegetable oils) | 28.4 | 68.5 | 6.8 | 17.8 |
| Sunflower spread (vegetable oils) | 30.4 | 66.0 | 6.1 | 20.9 |
| Southern blend (cream, canola oil, vegetable oil) | 34.6 | 60.0 | 2.8 | 41.9 |
| Semi-soft (butter, canola oil, vegetable oil) | 25.8 | 71.0 | 3.5 | 50.0 |
| ***Fast food*** | | | | |
| French fries | 36.3 | 17.0 | 0.3 | 35.0 |
| ***Chocolate*** | | | | |
| Double blend milk chocolate (cocoa butter, vegetable fat) | 0.8 | 31.7 | 0.6 | 66.8 |
| Dairy milk chocolate (full cream | 1.1 | 28.0 | 3.4 | 64.2 |

| Sample (specific fat ingredient, if listed on label) | Moisture (%) | Fat (%) | Total *trans* fatty acids in fat (%) | Total saturated fatty acids in fat (%) |
|---|---|---|---|---|
| milk, cocoa butter) | | | | |
| Classic dark chocolate (cocoa butter) | 0.9 | 35.5 | <0.1 | 64.9 |
| Creamy milk chocolate (cocoa butter, milk powder) | 1.4 | 36.5 | 1.1 | 65.1 |
| ***Snack Bars*** | | | | |
| Yoghurt coated muesli snack | 6.2 | 16.0 | <0.1 | 97.3 |
| Muesli snack bar | 7.5 | 6.0 | 0.8 | 90.8 |
| Fruit twists, strawberry variety (butter) | 15.8 | 0.5 | 0.7 | 47.6 |
| Muesli chocolate snack bar (milk chocolate including vegetable oil, hydrogenated vegetable oil) | 5.8 | 17.5 | 0.6 | 94.2 |
| Chocolate snack bar (milk chocolate, vegetable oil) | 5.5 | 20.5 | 0.3 | 45.4 |
| Cookie bar (sunflower oil) | 7.7 | 16.5 | 0.4 | 54.9 |
| ***Pies and Pastry*** | | | | |
| Flaky puff pastry | 26.0 | 19.0 | 3.4 | 64.6 |
| Ready rolled puff pastry | 32.4 | 13.5 | 4.3 | 61.9 |
| Filo pastry | 25.6 | <0.5 | Not analysed* | Not analysed* |
| Feather flake puff pastry (animal and vegetable fats/oils) | 32.8 | 22.5 | 2.8 | 60.4 |
| Flaky puff pastry (animal and vegetable fats/oils) | 33.7 | 16.0 | 6.6 | 38.1 |
| Mince & cheese pies (animal and vegetable fats/oils) | 50.9 | 14.0 | 5.1 | 59.9 |
| Sweet short pastry (butter) | 16.7 | 19.0 | 2.6 | 81.3 |
| Savoury short pastry (animal and vegetable fats/oils) | 30.3 | 20.0 | 2.1 | 78.8 |
| Steak & cheese hot pie from dairy/service station | 49.5 | 11.5 | 5.5 | 57.9 |
| Apple pie (margarine including animal and vegetable fat) | 50.8 | 9.0 | 7.1 | 52.5 |
| ***Popcorn*** | | | | |
| Natural microwavable popcorn (partially hydrogenated soybean oil) | 1.5 | 24.0 | 47.3 | 22.0 |
| Butter flavoured microwaveable popcorn (partially hydrogenated soybean oil) | 1.4 | 26.5 | 48.2 | 22.2 |
| ***Chips/crisps*** | | | | |
| Potato chips (vegetable oil) - Brand 1 | 1.3 | 36.0 | 0.4 | 46.5 |
| Potato chips (sunflower oil) - Brand 2 | 2.3 | 26.0 | <0.1 | 12.1 |
| ***Partially cooked chips/wedges*** | | | | |
| Straight cut potato fries (refined pure beef fat) - Brand 1 | 69.5 | 4.5 | 7.5 | 51.0 |
| Straight cut potato fries (refined beef | 70.5 | 3.5 | 1.2 | 8.4 |

| Sample (specific fat ingredient, if listed on label) | Moisture (%) | Fat (%) | Total *trans* fatty acids in fat (%) | Total saturated fatty acids in fat (%) |
|---|---|---|---|---|
| fat) - Brand 2 | | | | |
| Super oven fries (refined pure beef fat) | 68.6 | 3.5 | 3.8 | 39.1 |
| ***Shortening*** | | | | |
| Shortening (hardened coconut oil) | 1.0 | 99.0 | 1.0 | 97.1 |

* Insufficient fat content

## 4 DISCUSSION

Apart from the popcorn products, *trans* fatty acid levels in New Zealand foods are generally below 10% of the fat component. For some of these foods (pies, table spread/butter blends, dairy milk chocolate) there will be a contribution from naturally occurring *trans* fatty acids. Between 2 and 9 g *trans* fatty acids per 100 g fat for ruminant meat and milk fat would be expected (British Nutrition Foundation, 1995).

The popcorn products were manufactured in the United States, where declaration of partially hydrogenated fats amongst ingredients is required. In New Zealand and Australia such labelling is voluntary under the FSANZ Food Standards Code 2002.

The observed levels of *trans* fatty acids in the biscuits, cakes, and snack bars (0.1 – 3.5%) suggest that partially hydrogenated fats are not widely used in the food manufacturing and baking industry in New Zealand. The exception is the chocolate sandwich cookies at 10.6%. These are not of local manufacture, but are made in China for an Australian company.

The *trans* fat content of the two snack bars analysed in 1995 (Table 1) was considerably higher than in the similar products analysed in this survey. Only one of the products in this survey was also analysed in 1995, so comparative data are limited.

The claim by a major fast food chain that they will be using a vegetable blend for the entire cooking process by the middle of 2004 (Consumer, 2004) is confirmed by the result for *trans* fatty acid content of the french fries. Previously beef fat was used to pre-cook french fries from this source, which would have a *trans* fatty acid content of perhaps 3-6%.

The shortening sample did not contain significant amounts of *trans* fatty acids, despite the word "hardened" in the ingredients. The fatty acid profile suggests that it may be derived from coconut oil.

The partially cooked chips/wedges all claim to contain beef fat. The variable results for *trans* fatty acids in these samples will reflect variability in the naturally occurring level in beef fat, although the result of 7.5% is quite high. The saturated fat content of one of the chips/wedges products is lower than would be expected for beef fat; the fatty acid profile for this product suggests that they are in fact cooked in a plant based oil.

It is difficult to make generalisations about the table spread products on the market in New Zealand at present. While label claim information is likely to be reliable, it will still represent average figures from formulations that may vary in both the ingredient mix and seasonally.

The label claim information collated by Consumer magazine, analytical results from this project, and historical information from the 1998 survey have been assembled into Table 7. Many of the products available in 1998 have disappeared or been rebranded. There are apparently still two major groups of plant oil based products with respect to *trans* fatty acid content: those with 1% or less *trans* fatty acid content, and those with a higher percentage of *trans* fatty acids. The amount of *trans* fatty acids in the latter group appears to have declined; in the 1998 survey the range was 12-18% of total fatty acids. The data in Table 7 suggest that this has declined to approximately 6-12%.

On 1 May 2006 the NHF introduced new criteria for their "Pick the Tick" programme, including a requirement that the level of *trans* fatty acids in table spreads be less than 1% of total fat. This may have prompted reformulation some products in this category to continue using the "Pick the Tick" endorsement.

In 1998 the range of *trans* fatty acid content in butter/plant oil blends was 8.5 – 11.8%. The *trans* fatty acid content from analytical data and label claims in Table 7 (2.8 – 4.3%) may simply represent the naturally occurring *trans* fatty acid content of dairy fats. It may be that the plant oil based component of these products is no longer hydrogenated.

Comparisons with earlier results need to be made cautiously, as all the surveys include only a subset of the wide variety of products on the market. Declines in *trans* fatty acid content of New Zealand foods between 1995, 1998 and the present survey are suggested by results for snack bars, table spreads, and butter/vegetable oil blends.

## Table 7: Comparison of results from table spreads

| Product | Label claim (2005 - 2006) | | TFA as a % of fat claimed** | Results from 1998 study*** |
|---|---|---|---|---|
| | TFA | Fat (%) | | |
| ***Monounsaturated spreads*** | | | | |
| 1 | 1.00 | 46.00 | 2.17 | |
| 2 | 0.50 | 54.00 | 0.93 | |
| 3 | 5.00 | 55.00 | 9.09 | |
| 4 | 0.50 | 55.20 | 0.91 | |
| 5 | 0.50 | 55.00 | 0.91 | |
| 6 | 4.70 | 59.00 | 7.97 | |
| 7 | 4.70 | 59.00 | 7.97 | |
| 8 | 6.00 | 60.00 | 10.00 | |
| 9 | 8.00 | 70.00 | 11.43 | |
| 10 | 8.00 | 70.00 | 11.43 | |
| 11 | 0.60 | 70.00 | 0.86 | 0.20 |
| 12 | 0.63 | 70.00 | 0.90 | |
| 13 | 8.00 | 70.00 | 11.43 | 16.00 |
| 14 | 8.00 | 70.00 | 11.43 | 18.20 |
| 15 | 0.63 | 70.00 | 0.90 | |
| 16 | 0.63 | 70.00 | 0.90 | |
| 17 | 8.00 | 75.00 | 10.67 | 12.10 |
| 18 | 7.00 | 70.00 | 10.00 | 13.60 |
| ***Polyunsaturated spreads*** | | | | |
| 19 | 1.00 | 47.00 | 2.13 | ND |
| 20 | 5.50 | 55.00 | 10.00 | |
| 21 | 4.40 | 60.00 | 7.33 | 14.60 |
| 22 | 0.63 | 70.00 | 0.90 | 1.10 |
| 23 | 0.63 | 70.00 | 0.90 | ND |
| ***Butter Blends*** | | | | |
| 24 | 2.00 | 61.00 | 3.28 | |
| 25 | 2.50 | 60.00 | 4.17 | 11.80 |
| 26 | 3.00 | 70.00 | 4.29 | |
| 27 | 3.00 | 70.00 | 4.29 | 11.70 |
| 28 | 2.00 | 70.00 | 2.86 | |
| ***Plant sterols*** | | | | |
| 29 | 1.00 | 40.00 | 2.50 | |
| 30 | 1.00 | 48.00 | 2.08 | |
| 31 | 1.00 | 49.00 | 2.04 | |
| 32 | 0.60 | 64.00 | 0.94 | |
| 33 | 0.60 | 67.00 | 0.90 | |
| ***Butter*** | | | | |
| 34 | 4.00 | 81.40 | 4.91 | 7.90 |
| 35 | 3.50 | 81.50 | 4.29 | |
| 36 | 4.00 | 81.50 | 4.91 | |
| 37 | 3.50 | 81.50 | 4.29 | |
| ***Incomplete information on label*** | | | | |
| 38 | | 59.00* | 6.50* | |
| 39 | | 65.50* | 6.10* | 12.40 |

| Product | Label claim (2005 - 2006) | | TFA as a % of fat claimed** | Results from 1998 study*** |
|---|---|---|---|---|
| | TFA | Fat (%) | | |
| 40 | | 68.5* | 6.80* | |
| 41 | | 66.0* | 6.10* | |
| 42 | | 81.50 | ND | |
| 43 | | 60.0* | 2.80* | 8.50 |
| 44 | | 71.00* | 3.50* | |

TFA = *Trans* fatty acids
ND = Not Determined
*Analytical determination by this project
** Calculated from previous two columns
*** Empty cells represent products not on the market in 1998

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## APPENDIX 1: MOISTURE AND FAT CONTENT, AND FATTY ACID PROFILES

### 1. Biscuits and cakes

| Fatty Acid | Ester | Sample Number | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3A | 3B | 4 | 5A | 5B | 6A | 6B | 7A | 7B | 8 | 9A | 9B | 10A | 10B | 11A | 11B | 12A | 12B |
| C6:0 | Methyl hexanoate | 0.3 | 0.7 | 0.7 | 0.6 | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - |
| C8:0 | Methyl octanoate | 2.3 | 0.8 | 0.8 | 0.6 | 0.7 | 0.7 | 0.6 | - | - | - | - | 1.9 | 0.1 | 0.0 | - | - | 0.1 | 0.1 | - | - |
| C10:0 | Methyl decanoate | 2.3 | 1.5 | 1.4 | 1.3 | 1.0 | 0.9 | 1.0 | - | - | - | - | 1.9 | - | - | - | - | 0.1 | 0.1 | - | - |
| C12:0 | Methyl laurate | 18.8 | 3.5 | 3.3 | 3.0 | 20.0 | 18.2 | 18.9 | 0.4 | 0.4 | 0.1 | 0.1 | 16.7 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 |
| C13:0 | Methyl tridecanoate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C14:0 | Methyl myristate | 9.4 | 8.6 | 7.8 | 7.0 | 9.2 | 8.4 | 8.8 | 1.1 | 1.2 | 0.7 | 0.7 | 7.7 | 0.9 | 0.9 | 1.1 | 1.1 | 1.2 | 1.2 | 1.0 | 1.0 |
| C14:1 | Methyl myristoleate | 0.1 | 0.5 | 0.5 | 0.6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C15:0 | Methyl pentadecanoate | 0.2 | 0.9 | 1.0 | 0.9 | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | - | - |
| C16:0 | Methyl palmitate | 31.3 | 56.0 | 32.6 | 29.7 | 30.6 | 32.1 | 31.5 | 45.5 | 46.6 | 34.4 | 34.8 | 24.8 | 40.6 | 39.8 | 42.2 | 42.0 | 41.4 | 41.4 | 42.7 | 42.4 |
| C16:1 | Methyl palmitoleate | 0.3 | 1.6 | 2.0 | 2.2 | 0.1 | - | - | 0.1 | 0.2 | - | - | 0.1 | - | - | - | - | 0.1 | 0.1 | - | - |
| C16:1T | Methyl palmitelaidate | - | 0.3 | 0.5 | 0.4 | - | - | - | 0.0 | - | - | - | - | - | - | 0.0 | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 |
| C17:0 | Methyl heptadecanoate | 0.2 | 0.9 | 1.2 | - | 0.0 | - | - | 0.1 | 0.1 | - | - | 0.1 | - | - | - | - | - | - | - | - |
| C18:0 | Methyl stearate | 6.3 | 16.5 | 20.6 | 19.1 | 9.6 | 8.6 | 8.8 | 5.4 | 5.4 | 7.2 | 7.2 | 22.5 | 5.1 | 4.8 | 4.3 | 4.3 | 4.5 | 4.5 | 4.4 | 4.4 |
| C18:1 | Methyl oleate | 23.8 | 1.8 | 23.5 | 27.3 | 22.0 | 24.0 | 23.3 | 35.8 | 36.1 | 30.7 | 30.3 | 20.7 | 41.3 | 40.7 | 40.5 | 40.6 | 40.9 | 40.8 | 39.5 | 39.4 |
| C18:1T | Methyl elaidate | 1.4 | 0.5 | 2.2 | 3.4 | 1.0 | 0.9 | 0.8 | 3.7 | 2.3 | 9.3 | 9.7 | 0.2 | - | - | - | - | - | - | 0.1 | 0.4 |
| C18:1 | Methyl vaccenate | - | - | 0.9 | 1.1 | - | - | - | - | - | - | - | - | 0.9 | 0.9 | 0.8 | 0.9 | 0.9 | 0.9 | 0.8 | 0.8 |
| C18:2 | Methyl linoleate | 3.0 | 5.2 | 0.7 | 2.5 | 5.8 | 6.3 | 6.0 | 7.0 | 7.1 | 14.5 | 14.3 | 2.5 | 10.2 | 12.1 | 10.0 | 10.0 | 9.7 | 9.6 | 10.5 | 10.5 |
| C18:2T | Methyl linoelaidate | - | - | 0.2 | 0.2 | - | - | - | 0.2 | 0.2 | 0.8 | 0.8 | - | - | - | - | - | - | 0.1 | - | - |
| C18:3 | Methyl gamma linolenate | - | - | - | - | - | - | - | 0.2 | 0.2 | 1.5 | 1.4 | - | - | - | - | - | - | - | - | - |
| C18:3 | Methyl linolenate | 0.2 | 0.5 | - | - | - | - | - | - | - | - | - | 0.1 | - | - | - | - | - | - | 0.3 | 0.3 |
| C18:3T | Methyl linolenate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C19:0 | Methyl nonadecanoate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:0 | Methyl arachidate | 0.2 | 0.3 | 0.2 | 0.2 | - | - | - | 0.4 | 0.4 | 0.4 | 0.4 | 0.6 | 0.5 | 0.4 | 0.3 | 0.4 | 0.3 | 0.4 | 0.3 | 0.4 |
| C20:1 | Methyl 11-eicosenoate | - | - | - | - | - | - | - | - | - | - | - | - | 0.1 | - | 0.1 | 0.1 | 0.1 | 0.1 | - | - |
| C20:3 | Methyl homogamma linolenate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:3 | Methyl 11-14-17 eicosatrienoate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:4 | Methylarachidonate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:5 | Methyl eicosapentaenoate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C22:0 | Methyl behenate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.2 | 0.2 | 0.2 | 0.2 | - | - |
| C22:1 | Methyl erucate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C22:2 | Methyl docosadienoate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C22:6 | Methyl docosahexaenoate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C24:0 | Methyl lignocerate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C24:1 | Methyl nervonate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| Fatty Acid | Ester | Sample Number | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3A | 3B | 4 | 5A | 5B | 6A | 6B | 7A | 7B | 8 | 9A | 9B | 10A | 10B | 11A | 11B | 12A | 12B |
| | | | | | | | | | | | | | | | | | | | | | |
| | %(w/w) | | | | | | | | | | | | | | | | | | | | |
| | Saturated | 71.2 | 89.7 | 69.5 | 62.3 | 71.1 | 68.8 | 69.7 | 52.9 | 54.0 | 42.8 | 43.2 | 76.3 | 47.6 | 45.9 | 48.5 | 48.3 | 48.1 | 48.3 | 48.7 | 48.4 |
| | Monounsaturated (incl trans) | 25.5 | 4.7 | 29.6 | 35.0 | 23.1 | 24.9 | 24.3 | 39.5 | 38.5 | 40.5 | 41.4 | 21.1 | 42.3 | 41.6 | 41.5 | 41.6 | 42.1 | 42.1 | 44.9 | 40.8 |
| | Polyunsaturated (incl trans) | 3.2 | 5.7 | 0.9 | 2.7 | 5.8 | 6.3 | 6.0 | 7.5 | 7.5 | 16.7 | 16.7 | 2.6 | 10.2 | 12.1 | 10.0 | 10.0 | 9.7 | 9.6 | 10.8 | 10.8 |
| | Trans | 1.4 | 0.8 | 2.9 | 4.0 | 1.0 | 0.9 | 1.1 | 4.0 | 2.5 | 10.6 | 10.6 | 0.2 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.3 | 0.2 | 0.5 |
| | | | | | | | | | | | | | | | | | | | | | |
| | Moisture %(w/w) | 11.3 | 20.3 | 17.2 | 17.2 | 2.3 | 2.8 | 2.8 | 2.6 | 2.6 | 1.9 | 1.9 | 2.3 | 2.1 | 2.1 | 3.2 | 3.2 | 1.6 | 1.6 | 3.9 | 3.9 |
| | Total fat (obtained) %(w/w) | 15.8 | 17.6 | 20.6 | 20.6 | 20.0 | 19.5 | 19.5 | 21.0 | 21.0 | 20.0 | 20.0 | 27.6 | 26.3 | 26.3 | 22.7 | 22.8 | 22.8 | 22.8 | 17.3 | 17.3 |
| | Total Fat (label claim) %(w/w) | 18.3 | 21.0 | 20.0 | 20.0 | 22.3 | 15.0 | 15.0 | 21.1 | 21.1 | 19.8 | 19.8 | 28.5 | 27.8 | 27.8 | 27.9 | 27.9 | 21.7 | 21.7 | 17.5 | 17.5 |

A and B in sample numbers refer to duplicate analysis of the same sample

1 = Raspberry lamington (filled)
2 = Lolly cake
3 = Ginger kisses
4 = Chocolate thins (Brand 1)
5 = Chocolate thins (Brand 2)
6 = Chocolate creams
7 = Chocolate sandwich cookies
8 = Double chocolate biscuits
9 = Crackers
10 = Snack crackers (Brand 1)
11 = Snack crackers (Brand 2)
12 = Snack crackers (Brand 3)

## 2. Margarine/Table spreads

| Fatty Acid | Ester | Sample Numbers | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 13A | 13B | 14A | 14B | 15A | 15B | 16A | 16B | 17A | 17B | 18A | 18B |
| C6:0 | Methyl hexanoate | - | - | - | - | - | - | - | - | 0.7 | 0.7 | 1.0 | 1.0 |
| C8:0 | Methyl octanoate | - | - | - | - | - | - | - | - | 0.5 | 0.5 | 0.7 | 0.7 |
| C10:0 | Methyl decanoate | - | - | - | - | - | - | - | - | 1.3 | 1.4 | 1.8 | 1.8 |
| C12:0 | Methyl laurate | 0.3 | 0.4 | 0.0 | - | 0.1 | 0.1 | - | - | 2.0 | 2.1 | 2.3 | 2.3 |
| C13:0 | Methyl tridecanoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C14:0 | Methyl myristate | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 5.8 | 5.9 | 7.3 | 7.3 |
| C14:1 | Methyl myristoleate | - | - | - | - | - | - | - | - | 0.4 | 0.4 | 0.4 | 0.4 |
| C15:0 | Methyl pentadecanoate | - | - | - | - | - | - | - | - | 0.6 | 0.6 | 0.8 | 0.8 |
| C16:0 | Methyl palmitate | 11.3 | 11.8 | 11.3 | 11.4 | 11.8 | 11.7 | 14.2 | 13.3 | 22.5 | 22.9 | 25.2 | 25.3 |
| C16:1C | Methyl palmitoleate | 0.1 | 0.1 | - | - | 0.2 | 0.2 | 0.1 | 0.1 | 0.9 | 0.9 | 1.3 | 1.4 |
| C16:1T | Methyl palmitelaidate | - | - | - | - | - | - | - | - | 0.2 | 0.3 | 0.4 | 0.4 |
| C17:0 | Methyl heptadecanoate | - | - | 0.2 | 0.2 | 0.0 | 0.0 | 0.1 | - | - | - | - | - |
| C18:0 | Methyl stearate | 5.0 | 5.1 | 5.1 | 5.1 | 5.0 | 5.0 | 6.2 | 5.9 | 7.7 | 7.7 | 10.7 | 10.7 |
| C18:1 | Methyl oleate | 48.5 | 48.4 | 49.7 | 50.1 | 48.7 | 49.0 | 32.3 | 31.3 | 39.5 | 39.9 | 34.1 | 34.1 |
| C18:1T | Methyl elaidate | 6.4 | 6.5 | 6.1 | 6.1 | 6.9 | 6.7 | 6.2 | 5.7 | 1.6 | 1.7 | 2.9 | 2.4 |
| C18:1 | Methyl vaccenate | 5.3 | 4.0 | 4.1 | 4.0 | 4.2 | 4.2 | 2.3 | 2.3 | 2.0 | 2.0 | 1.4 | 1.7 |
| C18:2 | Methyl linoleate | 14.5 | 14.9 | 15.4 | 15.3 | 14.7 | 14.5 | 35.4 | 37.6 | 9.7 | 9.2 | 6.4 | 6.3 |
| C18:2T | Methyl linoelaidate | - | - | 0.0 | - | - | - | - | - | - | - | 0.3 | 0.5 |
| C18:3 | Methyl gamma linolenate | - | - | - | - | - | - | - | - | - | - | - | - |
| C18:3 | Methyl linolenate | 7.0 | 7.2 | 7.3 | 7.1 | 7.4 | 6.9 | 1.9 | 2.2 | 3.2 | 2.8 | 2.3 | 2.2 |
| C18:3T | Methyl linolenate | - | - | - | - | - | - | - | - | 0.9 | 0.9 | - | 0.2 |
| C19:0 | Methyl nonadecanoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:0 | Methyl arachidate | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.3 | 0.3 | 0.4 | 0.3 | 0.3 | 0.3 |
| C20:1 | Methyl 11-eicosenoate | 0.7 | 0.7 | - | - | 0.0 | 0.8 | 0.3 | 0.3 | - | - | - | 0.4 |
| C20:3 | Methyl homogamma linolenate | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:3 | Methyl 11-14-17 eicosatrienoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:4 | Methylarachidonate | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:5 | Methyl eicosapentaenoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C22:0 | Methyl behenate | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 | 0.1 | 0.4 | 0.4 | 0.1 | - | 0.1 | - |
| C22:1 | Methyl erucate | - | - | - | - | - | - | - | - | - | - | - | - |
| C22:2 | Methyl docosadienoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C22:6 | Methyl docosahexaenoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C24:0 | Methyl lignocerate | - | - | - | - | - | - | - | - | - | - | - | - |
| C24:1 | Methyl nervonate | - | - | - | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | |

| Fatty Acid | Ester | Sample Numbers | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 13A | 13B | 14A | 14B | 15A | 15B | 16A | 16B | 17A | 17B | 18A | 18B |
| | %(w/w) | | | | | | | | | | | | |
| | Saturated | 17.5 | 18.2 | 17.4 | 17.5 | 17.9 | 17.7 | 21.4 | 20.3 | 41.7 | 42.1 | 50.0 | 50.0 |
| | Monounsaturated (incl trans) | 61.0 | 59.7 | 59.8 | 60.2 | 60.0 | 60.9 | 41.2 | 40.0 | 44.3 | 44.0 | 40.9 | 40.7 |
| | Polyunsaturated (incl trans) | 21.5 | 22.0 | 22.8 | 22.3 | 22.1 | 21.4 | 37.3 | 39.3 | 13.7 | 12.8 | 9.0 | 9.3 |
| | Trans | 6.4 | 6.5 | 6.1 | 6.1 | 6.9 | 6.7 | 6.2 | 6.0 | 2.7 | 2.8 | 3.5 | 3.5 |
| | | | | | | | | | | | | | |
| | Moisture %(w/w) | 38.8 | 38.8 | 31.7 | 31.7 | 28.4 | 28.4 | 30.4 | 30.4 | 34.6 | 34.6 | 25.8 | 25.8 |
| | Total fat (obtained) %(w/w) | 58.9 | 58.9 | 65.3 | 65.6 | 68.8 | 68.2 | 67.6 | 64.1 | 60.8 | 59.0 | 69.5 | 72.1 |
| | Total Fat (label claim) %(w/w) | 59.0 | 59.0 | 65.0 | 65.0 | 70.0 | 70.0 | 70.0 | 70.0 | 58.6 | 58.6 | 73.0 | 73.0 |

A and B in sample numbers refer to duplicate analysis of the same sample

13 = Lite' original spread
14 = 'Table' spread
15 = 'Original' spread
16 = Sunflower spread
17 = 'Southern' blend
18 = 'Semi-Soft' blend

## 3. Fast Food – Chocolate – Snack Bars

| Fatty Acid | Ester | Sample Numbers | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 19A | 19B | 20 | 21 | 22 | 23 | 24A | 24B | 25A | 25B | 26 | 27 | 28A | 28B | 29 |
| C6:0 | Methyl hexanoate | - | - | 0.3 | 0.4 | - | - | 0.3 | 0.3 | 0.3 | 0.3 | - | - | - | - | - |
| C8:0 | Methyl octanoate | - | - | 0.3 | 0.3 | - | - | 4.2 | 4.0 | 3.5 | 3.6 | - | 3.5 | - | - | 3.8 |
| C10:0 | Methyl decanoate | - | - | 0.6 | 0.7 | - | 0.6 | 4.2 | 4.0 | 3.7 | 3.7 | 0.4 | 3.6 | 0.0 | 0.2 | 3.3 |
| C12:0 | Methyl laurate | 0.3 | 0.3 | 0.8 | 0.9 | 0.5 | 0.7 | 44.4 | 43.4 | 39.0 | 39.7 | 0.7 | 42.2 | 0.2 | 0.3 | 25.0 |
| C13:0 | Methyl tridecanoate | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | - |
| C14:0 | Methyl myristate | 0.7 | 0.6 | 3.2 | 3.0 | 0.4 | 2.5 | 19.4 | 18.8 | 17.4 | 17.4 | 2.2 | 18.8 | 1.0 | 1.0 | 9.9 |
| C14:1 | Methyl myristoleate | - | - | 0.2 | 0.2 | - | - | - | - | - | - | - | - | - | - | - |
| C15:0 | Methyl pentadecanoate | - | - | 0.3 | 0.3 | - | - | - | - | 0.1 | 0.1 | - | - | - | - | - |
| C16:0 | Methyl palmitate | 27.5 | 27.6 | 30.8 | 26.6 | 25.1 | 26.9 | 12.6 | 12.4 | 13.5 | 13.2 | 37.3 | 12.8 | 30.6 | 31.0 | 9.0 |
| C16:1 | Methyl palmitoleate | - | - | 0.6 | - | 0.2 | 0.0 | - | - | - | - | - | - | 0.1 | 0.2 | - |
| C16:1T | Methyl palmitelaidate | - | - | 0.1 | 0.2 | - | 0.5 | - | - | - | - | - | - | 0.0 | - | - |
| C17:0 | Methyl heptadecanoate | - | - | 0.3 | 0.4 | 0.2 | 0.3 | - | - | - | - | - | - | 0.1 | 0.2 | - |
| C18:0 | Methyl stearate | 5.5 | 5.6 | 29.4 | 30.6 | 37.5 | 33.1 | 13.3 | 13.0 | 12.9 | 13.0 | 6.8 | 13.2 | 12.8 | 12.5 | 3.5 |
| C18:1 | Methyl oleate | 59.4 | 60.0 | 29.3 | 29.6 | 32.3 | 30.9 | 0.1 | 3.7 | 5.2 | 4.8 | 37.3 | 3.9 | 45.4 | 44.9 | 17.6 |
| C18:1T | Methyl elaidate | 1.1 | 0.2 | 0.5 | 3.1 | 0.0 | 0.6 | - | - | 0.8 | 0.8 | 0.7 | 0.6 | 0.2 | 0.2 | - |
| C18:1 | Methyl vaccenate | 4.2 | 1.4 | - | 0.4 | - | - | - | - | 0.1 | - | - | - | - | - | - |
| C18:2 | Methyl linoleate | 0.6 | 3.1 | 2.1 | 2.3 | 2.4 | 2.5 | 1.4 | 1.4 | 3.6 | 3.3 | 13.8 | 1.4 | 8.8 | 8.9 | 27.0 |
| C18:2T | Methyl linoelaidate | - | - | - | 0.1 | - | - | - | - | - | - | - | - | - | - | 0.4 |
| C18:3 | Methyl gamma linolenate | - | - | - | 0.3 | 0.1 | 0.3 | - | - | - | - | - | - | 0.3 | 0.4 | - |
| C18:3 | Methyl linolenate | - | - | 0.4 | - | - | - | - | - | - | - | 0.5 | - | - | - | - |
| C18:3T | Methyl linolenate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C19:0 | Methyl nonadecanoate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:0 | Methyl arachidate | 0.6 | 0.6 | 0.8 | 0.9 | 1.2 | 1.0 | 0.1 | 0.1 | 0.1 | - | 0.2 | - | 0.5 | 0.5 | 0.1 |
| C20:1 | Methyl 11-eicosenoate | 0.3 | 0.3 | - | 0.3 | - | 0.0 | - | - | - | - | - | - | - | - | - |
| C20:3 | Methyl homogamma linolenate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:3 | Methyl 11-14-17 eicosatrienoate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:4 | Methylarachidonate | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - |
| C20:5 | Methyl eicosapentaenoate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C22:0 | Methyl behenate | 0.5 | 0.4 | - | 0.2 | 0.2 | - | - | - | - | - | - | - | - | - | - |
| C22:1 | Methyl erucate | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - |
| C22:2 | Methyl docosadienoate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C22:6 | Methyl docosahexaenoate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C24:0 | Methyl lignocerate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C24:1 | Methyl nervonate | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | | | |

| Fatty Acid | Ester | Sample Numbers | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 19A | 19B | 20 | 21 | 22 | 23 | 24A | 24B | 25A | 25B | 26 | 27 | 28A | 28B | 29 |
| | %(w/w) | | | | | | | | | | | | | | | |
| | Saturated | 35.0 | 35.0 | 66.8 | 64.2 | 64.9 | 65.1 | 98.5 | 96.1 | 90.4 | 91.1 | 47.6 | 94.2 | 45.2 | 45.6 | 54.9 |
| | Monounsaturated (incl trans) | 62.3 | 61.9 | 30.7 | 33.1 | 32.5 | 32.1 | 0.1 | 3.7 | 6.1 | 5.6 | 38.1 | 4.5 | 45.7 | 45.3 | 17.6 |
| | Polyunsaturated (incl trans) | 2.8 | 3.1 | 2.5 | 2.7 | 2.5 | 2.8 | 1.4 | 1.4 | 3.6 | 3.3 | 14.3 | 1.4 | 9.1 | 9.2 | 27.4 |
| | Trans | 1.1 | 0.2 | 0.6 | 3.4 | 0.0 | 1.1 | 0.0 | 0.0 | 0.8 | 0.8 | 0.7 | 0.6 | 0.3 | 0.3 | 0.4 |
| | | | | | | | | | | | | | | | | |
| | Moisture %(w/w) | 36.3 | 36.8 | 0.8 | 1.1 | 0.9 | 1.4 | 6.2 | 6.2 | 7.5 | 7.5 | 15.8 | 5.8 | 5.5 | 5.5 | 7.7 |
| | Total fat (obtained) %(w/w) | 16.7 | 16.7 | 31.7 | 28.0 | 35.5 | 36.5 | 15.8 | 15.8 | 6.0 | 6.0 | 0.5 | 17.5 | 20.5 | 20.5 | 16.5 |
| | Total Fat (label claim) %(w/w) | not given | not given | 33.0 | 29.0 | 42.1 | 35.6 | 18.4 | 18.4 | 7.4 | 7.4 | 3.9 | 17.8 | 22.0 | 22.0 | 24.0 |

A and B in sample numbers refer to duplicate analysis of the same sample

19 = French fries
20 = Double blend milk chocolate
21 = Dairy milk chocolate
22 = Classic dark chocolate (70% cocoa)
23 = Creamy milk chocolate
24 = Yoghurt coated muesli snack
25 = Muesli snack bar
26 = Fruit twists (strawberry variety)
27 = Muesli chocolate snack bar
28 = Chocolate snack bar
29 = Cookie Bar

## 4. Pies and Pastry

| Fatty Acid | Ester | Sample Numbers | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 30A | 30B | 31A | 31B | 32A | 32B | 33 | 34 | 35 | 36 | 37 | 38 | 39 |
| C6:0 | Methyl hexanoate | 0.3 | 0.3 | - | - | Insufficient sample for analysis | | - | - | - | - | - | - | - |
| C8:0 | Methyl octanoate | 0.2 | 0.3 | 0.0 | - | | | - | - | - | 1.4 | 0.3 | 0.3 | 0.5 |
| C10:0 | Methyl decanoate | 0.5 | 0.5 | 0.1 | - | | | 0.4 | - | 0.3 | 3.2 | - | 0.6 | 1.0 |
| C12:0 | Methyl laurate | 0.7 | 0.7 | 0.4 | 0.4 | | | 0.5 | 1.2 | 0.4 | 4.4 | 0.8 | 0.8 | 2.0 |
| C13:0 | Methyl tridecanoate | - | - | - | - | | | - | - | - | - | - | - | - |
| C14:0 | Methyl myristate | 4.3 | 4.2 | 3.5 | 3.4 | | | 3.5 | 3.7 | 4.0 | 14.3 | 4.0 | 4.6 | 4.7 |
| C14:1 | Methyl myristoleate | 0.4 | 0.3 | 0.4 | 0.3 | | | 0.3 | 0.4 | 0.3 | 0.7 | 0.2 | 0.4 | 0.3 |
| C15:0 | Methyl pentadecanoate | 0.7 | 0.7 | 0.7 | 0.4 | | | 0.6 | 0.7 | 0.7 | 1.5 | 0.7 | 0.7 | 0.5 |
| C16:0 | Methyl palmitate | 33.8 | 33.7 | 28.8 | 28.9 | | | 32.0 | 2.9 | 27.5 | 39.7 | 46.1 | 27.8 | 28.5 |
| C16:1 | Methyl palmitoleate | 1.9 | 1.9 | 2.5 | 2.5 | | | 2.0 | 0.5 | 2.2 | 1.0 | 0.8 | 2.5 | - |
| C16:1T | Methyl palmitelaidate | 0.1 | 0.1 | 0.1 | 0.2 | | | 0.4 | - | 0.6 | 0.6 | 0.4 | - | - |
| C17:0 | Methyl heptadecanoate | 1.3 | 1.3 | 1.9 | 1.9 | | | 1.1 | 1.8 | 1.5 | 0.8 | 1.3 | 0.1 | - |
| C18:0 | Methyl stearate | 22.5 | 22.8 | 26.4 | 26.6 | | | 22.1 | 30.6 | 25.5 | 16.0 | 25.4 | 22.8 | 15.1 |
| C18:1 | Methyl oleate | 27.3 | 27.5 | 27.4 | 27.7 | | | 30.8 | 46.8 | 30.0 | 14.5 | 18.1 | 31.2 | 32.6 |
| C18:1T | Methyl elaidate | 3.2 | 3.2 | 3.9 | 3.9 | | | 2.4 | 5.2 | 3.8 | 1.9 | 1.7 | 4.8 | 6.5 |
| C18:1 | Methyl vaccenate | - | - | 1.4 | 1.3 | | | - | - | - | - | - | - | - |
| C18:2 | Methyl linoleate | 1.0 | 1.0 | 1.9 | 1.9 | | | 3.0 | 4.4 | 1.6 | - | - | 2.0 | 5.1 |
| C18:2T | Methyl linoelaidate | 0.2 | 0.2 | 0.2 | 0.3 | | | - | 0.9 | 0.7 | 0.1 | - | 0.7 | 0.6 |
| C18:3 | Methyl gamma linolenate | - | - | - | - | | | - | 0.8 | - | - | - | 0.4 | 1.3 |
| C18:3 | Methyl linolenate | - | - | 0.2 | 0.2 | | | 0.8 | - | 1.0 | - | - | - | - |
| C18:3T | Methyl linolenate | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C19:0 | Methyl nonadecanoate | - | - | - | - | | | - | - | - | - | - | - | - |
| C20:0 | Methyl arachidate | 0.2 | 0.2 | 0.3 | 0.3 | | | 0.2 | - | - | - | 0.3 | 0.2 | 0.2 |
| C20:1 | Methyl 11-eicosenoate | - | - | - | - | | | - | - | - | - | - | - | - |
| C20:3 | Methyl homogamma linolenate | - | - | - | - | | | - | - | - | - | - | - | - |
| C20:3 | Methyl 11-14-17 eicosatrienoate | - | - | - | - | | | - | - | - | - | - | - | - |
| C20:4 | Methylarachidonate | - | - | - | - | | | - | - | - | - | - | - | - |
| C20:5 | Methyl eicosapentaenoate | - | - | - | - | | | - | - | - | - | - | - | - |
| C22:0 | Methyl behenate | - | - | - | - | | | - | - | - | - | - | - | - |
| C22:1 | Methyl erucate | - | - | - | - | | | - | - | - | - | - | - | - |
| C22:2 | Methyl docosadienoate | - | - | - | - | | | - | - | - | - | - | - | - |
| C22:6 | Methyl docosahexaenoate | - | - | - | - | | | - | - | - | - | - | - | - |
| C24:0 | Methyl lignocerate | - | - | - | - | | | - | - | - | - | - | - | - |
| C24:1 | Methyl nervonate | - | - | - | - | | | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | | |

| Fatty Acid | Ester | Sample Numbers | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 30A | 30B | 31A | 31B | 32A | 32B | 33 | 34 | 35 | 36 | 37 | 38 | 39 |
| | %(w/w) | | | | | | | | | | | | | |
| | Saturated | 64.6 | 64.6 | 61.9 | 61.8 | | | 60.4 | 38.1 | 59.9 | 81.3 | 78.8 | 57.9 | 52.5 |
| | Monounsaturated (incl trans) | 34.2 | 34.2 | 35.1 | 35.9 | | | 35.9 | 55.5 | 36.9 | 18.7 | 21.2 | 38.9 | 39.8 |
| | Polyunsaturated (incl trans) | 1.3 | 1.2 | 2.3 | 2.4 | | | 3.8 | 6.1 | 3.2 | 0.1 | - | 3.2 | 7.1 |
| | Trans | 3.3 | 3.5 | 4.3 | 4.3 | | | 2.8 | 6.6 | 5.1 | 2.6 | 2.1 | 5.5 | 7.1 |
| | | | | | | | | | | | | | | |
| | Moisture %(w/w) | 26.0 | 26.0 | 32.4 | 32.4 | 25.6 | 25.6 | 32.8 | 33.7 | 50.9 | 16.7 | 30.3 | 49.5 | 50.8 |
| | Total fat (obtained) %(w/w) | 19.3 | 19.3 | 13.6 | 13.6 | <0.5 | <0.5 | 22.7 | 22.5 | 14.0 | 19.0 | 20.0 | 11.5 | 9.0 |
| | Total Fat (label claim) %(w/w) | 23.7 | 23.7 | 40.7 | 40.7 | 1.6 | 1.6 | 24.1 | 20.7 | 13.9 | 19.6 | 20.6 | Not Given | 9.7 |

A and B in sample numbers refer to duplicate analysis of the same sample

30 = Flaky puff pastry
31 = Ready-rolled puff pastry
32 = Filo pastry
33 = Feather flake puff pastry
34 = Flaky puff pastry
35 = Mince & cheese pies
36 = Sweet short pastry
37 = Savoury short pastry
38 = Steak & cheese hot pie
39 = Apple pie

## 5. Popcorn – Chips/Crisps – Partially Cooked Chips/Wedges - Shortening

| Fatty Acid | Ester | Sample Numbers | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 40 | 41A | 41B | 42A | 42B | 43 | 44 | 45A | 45B | 46A | 46B | 47 |
| C6:0 | Methyl hexanoate | - | - | - | - | - | - | - | - | - | - | - | 0.5 |
| C8:0 | Methyl octanoate | - | - | - | - | - | - | - | - | - | - | - | 6.5 |
| C10:0 | Methyl decanoate | - | - | - | - | - | - | 0.2 | - | - | - | - | 5.7 |
| C12:0 | Methyl laurate | - | - | - | 0.4 | 0.4 | - | 0.8 | 0.0 | 0.0 | 0.4 | 0.4 | 43.5 |
| C13:0 | Methyl tridecanoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C14:0 | Methyl myristate | - | 0.1 | - | 1.0 | 1.0 | - | 2.8 | - | - | 2.0 | 2.0 | 18.0 |
| C14:1 | Methyl myristoleate | - | - | - | - | - | - | 0.4 | - | - | 0.3 | 0.2 | - |
| C15:0 | Methyl pentadecanoate | - | - | - | - | - | - | 0.6 | - | - | 0.4 | 0.4 | - |
| C16:0 | Methyl palmitate | 10.2 | 10.5 | 10.3 | 41.2 | 40.1 | 4.3 | 24.7 | 4.6 | 4.8 | 19.6 | 19.8 | 10.4 |
| C16:1 | Methyl palmitoleate | - | - | - | - | 0.2 | - | 2.7 | 0.2 | 0.2 | 2.0 | 1.9 | - |
| C16:1T | Methyl palmitelaidate | - | - | - | - | - | - | - | - | - | - | - | - |
| C17:0 | Methyl heptadecanoate | - | - | - | - | - | - | - | - | - | 0.8 | 0.8 | - |
| C18:0 | Methyl stearate | 11.8 | 11.7 | 11.2 | 4.3 | 4.2 | 5.9 | 21.8 | 2.6 | 2.7 | 15.4 | 15.6 | 12.3 |
| C18:1 | Methyl oleate | 24.6 | 24.3 | 25.0 | 43.6 | 44.7 | 83.9 | 37.7 | 64.1 | 64.2 | 45.9 | 46.2 | 1.3 |
| C18:1T | Methyl elaidate | 47.3 | 48.3 | 46.8 | 0.2 | 0.3 | 0.0 | 4.5 | - | - | 2.8 | 2.9 | 1.0 |
| C18:1 | Methyl vaccenate | - | - | - | - | - | - | - | - | - | - | - | - |
| C18:2 | Methyl linoleate | 6.1 | 4.3 | 6.2 | 8.7 | 9.1 | 3.4 | 2.1 | 18.9 | 18.8 | 6.6 | 6.5 | 0.6 |
| C18:2T | Methyl linoelaidate | - | 0.6 | 0.6 | 0.2 | - | - | 0.7 | - | - | 0.5 | 0.6 | - |
| C18:3 | Methyl gamma linolenate | - | - | - | - | - | 0.1 | 0.6 | 8.5 | 8.3 | 2.2 | 2.4 | - |
| C18:3 | Methyl linolenate | - | - | - | - | - | - | - | - | - | - | - | - |
| C18:3T | Methyl linolenate | - | - | - | - | - | - | - | - | - | - | - | - |
| C19:0 | Methyl nonadecanoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:0 | Methyl arachidate | - | 0.3 | 0.3 | 0.4 | - | 0.6 | 0.2 | 0.7 | 0.7 | 0.3 | 0.3 | 0.2 |
| C20:1 | Methyl 11-eicosenoate | - | - | - | - | - | 0.2 | - | - | - | - | - | - |
| C20:3 | Methyl homogamma linolenate | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:3 | Methyl 11-14-17 eicosatrienoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:4 | Methylarachidonate | - | - | - | - | - | - | - | - | - | - | - | - |
| C20:5 | Methyl eicosapentaenoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C22:0 | Methyl behenate | - | - | - | - | - | - | - | 0.3 | - | - | - | - |
| C22:1 | Methyl erucate | - | - | - | - | - | - | - | - | - | - | - | - |
| C22:2 | Methyl docosadienoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C22:6 | Methyl docosahexaenoate | - | - | - | - | - | - | - | - | - | - | - | - |
| C24:0 | Methyl lignocerate | - | - | - | - | - | - | - | - | - | - | - | - |
| C24:1 | Methyl nervonate | - | - | - | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | |

| Fatty Acid | Ester | Sample Numbers | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 40 | 41A | 41B | 42A | 42B | 43 | 44 | 45A | 45B | 46A | 46B | 47 |
| | %(w/w) | | | | | | | | | | | | |
| | Saturated | 22.0 | 22.5 | 21.9 | 47.3 | 45.6 | 12.1 | 51.0 | 8.3 | 8.5 | 38.8 | 39.3 | 97.1 |
| | Monounsaturated (incl trans) | 71.9 | 72.5 | 71.4 | 43.8 | 45.2 | 84.1 | 45.2 | 64.3 | 64.4 | 51.4 | 51.1 | 2.3 |
| | Polyunsaturated (incl trans) | 6.1 | 4.9 | 6.7 | 8.9 | 9.3 | 3.8 | 3.8 | 27.5 | 27.1 | 9.8 | 9.5 | 0.6 |
| | Trans | 47.3 | 49.0 | 47.4 | 0.4 | 0.5 | 0.0 | 5.7 | 1.2 | 1.1 | 3.6 | 3.9 | 1.0 |
| | | | | | | | | | | | | | |
| | Moisture %(w/w) | 1.5 | 1.4 | 1.4 | 1.3 | 1.3 | 2.3 | 69.5 | 70.5 | 70.5 | 68.6 | 68.6 | 1.0 |
| | Total fat (obtained) %(w/w) | 24.0 | 26.5 | 26.5 | 36.0 | 36.0 | 26.0 | 4.5 | 3.5 | 3.5 | 3.5 | 3.5 | 99.0 |
| | Total Fat (label claim) %(w/w) | 19.5 | 25.5 | 25.5 | 32.6 | 32.6 | 34.7 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 100.0 |

A and B in sample numbers refer to duplicate analysis of the same sample

40 = Natural microwavable popcorn
41 = Butter flavoured microwaveable popcorn
42 = Potato chips (brand 1), cooked in vegetable oil
43 = Potato chips (brand 2), cooked in sunflower oil
44 = Straight cut potato fries (brand 1)
45 = Straight cut potato fries (brand 2)
46 = Super oven fries
47 = Shortening