Global Organization for EPA and DHA Omega-3s

Total Intakes of Long Chain Omega-3 Polyunsaturated Fatty Acids (LCPUFA) in the EU from the Background Diet, Supplements and Fortified Food-Uses

Prepared with assistance from Intertek Cantox, for and on behalf of the GOED membership.

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Listing of Abbreviations

AI	Adequate Intake
ALSPAC	Avon Longitudinal Study of Parents and Children
ANSES	French Food Safety Agency
BEIS	British Egg Information Service
BfR	German Federal Institute for Risk Assessment
BLS	Bundeslebensmittelschlüssel
CALIPSO	Consommations ALimentaires de poissons et produits de la per et Imprégation aux éléments traces, PolluantS et Oméga 3
CAM	Complementary and Alternative Medicine
CAPI	Computer Assisted Personal Interview
CHD	Coronary Heart Disease
CL	Consumer Loyalty
CVA	Cerebrovascular disease
DHA	Docosahexaenoic acid
DONALD	DOrtmund Nutritional and Anthropometric Longitudinally Designed
DPA	Docosapentaenoic acid
DSP	UK Food Standards Agency's, Dietary Survey Programme
EC	European Commission
EFSA	European Food Safety Authority
EPA	Eicosapentaenoic acid
EPIC	European Prospective Investigation into Cancer and Nutrition Study
EU	European Union
FFQ	Food Frequency Questionnaire
GOED	Global Organisation for EPA and DHA
HNR	MRC Human Nutrition Research
LCPUFA	Long Chain Polyunsaturated Fatty Acid
LDL	Low-Density Lipoprotein
MAFF	Ministry of Agriculture, Fisheries, and Food
MMSE	Mini-Mental State Examination
MORGEN	Monitoring Project on Risk Factors for Chronic Diseases
NatCen	National Centre for Social Research
NDNS	UK National Diet and Nutrition Surveys
NEVO	Dutch food composition database
NLCS	Netherlands Cohort Study
NO	Nitric Oxide
NORKOST	Norway through a national dietary survey
NSIFCS	North South Ireland Food Consumption Survey
NV-AMD	Neovascular Age-related Macular Degeneration
NVS II	German Second National Nutrition Survey
PUFA	Polyunsaturated Fatty Acids
SACN	UK Scientific Advisory Committee on Nutrition
TRANSFAIR	*Trans*Fatty Acids in Foods in Europe
U.K.	United Kingdom
UCL	University College London Medical School
UK	United Kingdom
UKDA	U.K. Data Archive
UL	Upper Limit
US	United States

USDA United States Department of Agriculture

Total Intakes of Long Chain Omega-3 Polyunsaturated Fatty Acids (LCPUFA) in the EU from the Background Diet, Supplements and Fortified Food-Uses

EXECUTIVE SUMMARY

Recently, concern has been raised amongst some EU Member States over consumption levels of the long chain omega-3 polyunsaturated fatty acids (LCPUFAs), including eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA) and docosapentaenoic acid (DPA) in the EU. A complete evaluation of LCPUFA intake in the EU has been now been completed which includes an examination of background, current and potential future intake, *i.e.:*

1. Background Intake
    a. Literature survey of LCPUFA in the EU
    b. Deterministic assessment based on the most recent UK consumption database
2. Current Intake
    a. Based on consumption data from the NDNS databases
    b. Based on consumption data from the EFSA Comprehensive database

3. Potential Future Intake
    a. Based on consumption data from the NDNS databases
    b. Based on consumption data from the EFSA Comprehensive database

Assessment of intake from the background diet was undertaken through both a survey of published literature of LCPUFA intakes in the diets of various EU populations and also through deterministic calculations utilising the most recent UK National Diet and Nutrition Survey (NDNS) published results of the Rolling Programme 2008/9-2009/10.

Current intake utilised occurrence data supplied by GOED as current market practice concerning the products groups currently fortified in the EU. Potential future intake utilised occurrence data that reflects potential future market practice based on commercial interests and technical feasibility across the EU. In the case of both current and potential future intake, 3 concentration scenarios were utilised:

- Current/potential market practice supplied by GOED
- Normalisation to 40mg/100g subsequent to Nutrition Claim Regulation 116/2006
- Normalisation to 80mg/100g subsequent to Nutrition Claim Regulation 116/2006

Furthermore, as the assessment of intake from fortified foods is conservative due to the real versus assumed high market penetration, probabilistic assessments were undertaken using various parameters of brand loyalty.

1. Background Intake - results

Background LCPUFA dietary intake was found to be overwhelmingly driven by fish consumption, as would be expected. Individuals who did not consume fish had very low levels of dietary intake of EPA and DHA. In many cases, non-fish consumers represent the majority of their respective population group. However, in the majority of publications it was not possible to distinguish non-fish consumers and therefore to separate the reported LCPUFA intakes reported into fish and non-fish consumers. Also, care should be exercised in the use of intake values reported as 'means', as mean values may lead to a misrepresentation of actual intake. Despite this, the majority of studies reported LCPUFA intakes in terms of mean per day. In women, mean EPA and DHA intakes were found to range from 126.6 mg/day in German women aged 18 to 24 years to 700 mg/day in Finnish women. Intakes of mean EPA and DHA intake ranged from 140 mg/day in a sub-cohort of Dutch men to 1000 mg/day in Finnish fishermen. The intake of LCPUFA from dietary supplements was found to vary greatly between countries and between studies. In a cross-sectional European study, it was found that 7.9% of participants were users of an omega-3 supplement, and 5% were users of a fish oil supplement.

2. Current Intake - results

With respect to current fortification practice based on the current concentration data for five major food categories (bread, eggs, margarine/spreads, milk and yogurt)and using a deterministic approach (using conservative assumption of complete penetration of the fortified products in their respective food categories) the highest mean, 90th and 95thpercentile intakes of EPA and DHA by the U.K. population were observed in male adults at 378.8, 629.7, and 729.1 mg/person/day, respectively, while children had the lowest mean, 90th, and 95th percentile intakes of 267.9, 444.4, and 529.4 mg/person/day, respectively. On a body weight basis, children were identified as having the highest mean, 90th, and 95th percentile intakes of any population group, of 19.9, 34.1, and 40.5 mg/kg body weight/day, respectively. Female adults had the lowest mean, 90th and 95th percentile intakes at 4.0, 7.0, and 8.1 mg/kg body weight/day. Incorporating market share data (of 5 to 10% share of fortified foods per food category) reduced the exposure estimates by a similar magnitude.

Using data from the EFSA Comprehensive database, mean EPA and DHA intakes ranged from 156.5 to 239.6 mg/day in infants, from 248.6 to 451.7 mg/day in toddlers, from 255.7 to 659.2 mg/day in other children, from 300.6 to 630.5 mg/day in adolescents, from 363.3 to 623.9 mg/day in adults, from 376.9 to 629.2 mg/day in the elderly and from 413.8 to 661.5 mg/day in the very elderly.

3. Potential Future Intake - results

Potential future fortification practices were also examined, with the inclusion of 25 food categories identified by GOED as being fortified with EPA and DHA in certain regions of the EU market. For this assessment the highest mean, 90th and 95th percentile intakes of EPA and DHA by the U.K. population were observed in male adults, at 528.0, 837.9, and 962.3 mg/person/day, respectively, while children also had the lowest mean, 90th, and 95th percentile intakes of 381.5, 566.1, and 644.0 mg/person/day, respectively.

Using data from the EFSA Comprehensive database, mean EPA and DHA intakes ranged from 257.5 to 322.4 mg/day in infants, from 390.1 to 773.4 mg/day in toddlers, from 659.9 to 973.5 mg/day in other children, from 698.3 to 1,200.9 mg/day in adolescents, from 770.7 to 1112.7 mg/day in adults, from 670.4 to 946.0 mg/day in the elderly and from 785.4 to 932.5 mg/day in the very elderly.

Overall Conclusions

This report provides support that LCPUFA intake from the background diet is relatively low across the EU (especially if fish consumers are removed from consideration and if median intakes are used) and that intakes from fortified sources can be used in the diet to ameliorate current LCPUFA intakes.

This report is not intended to be an estimation of the safe UL of consumption of LCPUFA, it is only 1 part of the standard equation for assessing risk – the exposure component, *i.e.* risk = hazard x exposure. The assessment of the safety data in relation to LCPUFA, *i.e.* the "hazard", is presented separately. However, the establishment of an upper limit (UL) for LCPUFA could provide an appropriate bench-mark for assessing LCPUFA intakes in various EU populations.

Utilising realistic but conservative assumptions on occurrence and concentration data and within calculation methodologies, the intake of EPA and DHA in the general EU population from all sources is found to approximate a maximum of 1 g/day at a mean level and to not be greater than 2 g/day for very high consumers, even in the case of substantial future expansion in the availability of fortified products.

Total Intakes of Long Chain Omega-3 Polyunsaturated Fatty Acids (LCPUFA) in the EU from the Background Diet, Supplements and Fortified Food-Uses

SECTION 1: SUMMARY AND OVERVIEW

1.1 INTRODUCTION

On the 27 June 2011 the European Food Safety Authority (EFSA) received a request from the European Commission (DG SANCO) for scientific advice on the safety of long chain omega-3 polyunsaturated fatty acid (LCPUFA) (Mandate no. M-2001-0236: 'Commission request for a scientific opinion on the safety of omega-3 long chain polyunsaturated fatty acids [eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA) and docosapentaenoic acid (DPA)]'). This request is a result of a communication from the Government of the Federal Republic of Germany to the EU Commission related to Regulation (EC) No 1925/2006 on the addition of vitamins and minerals and of certain other substances to foods and the need to initiate the procedure under Article 8(2) of the Regulation in relation to LCPUFA (European Parliament and the Council of the European Union, 2006a). The German Federal Institute for Risk Assessment (BfR) consider it essential that DHA and EPA are placed in Annex III, Part B of Regulation No 1925/2006, as certain conditions and restrictions on the addition of these fatty acids to foods are necessary to avoid excessive intake and possible undesirable consequences for health. The BfR provided a health assessment related to the intake of LCPUFA in Germany as part of their communication, and it is the purpose of the current report to provide a comprehensive summary of intake of LCPUFA in the European Union (EU).

Therefore Intertek Cantox, working on behalf of the Global Organisation for EPA and DHA (GOED), has examined prevailing intakes of LCPUFA in EU populations from all possible sources *i.e.,* from the background diet, from dietary supplements and from their intake through fortified foods. It is the aim of the present report to summarise these main findings and put into context with current trends of intake and concern of intakes in the EU.

1.2 LCPUFA INTAKE FROM THE BACKGROUND DIET

Regarding available literature, a large variation is found in the intake estimations of LCPUFA, specifically EPA and DHA (and where available, DPA) between studies and countries within the EU. Differences in intakes can reflect differences in the underlying food consumption patterns (*i.e.*, fish consumption), or the demographic profiles examined in the studies, but also may be due to methodological differences in the studies (*i.e*., dietary assessment methods, source and totality of fatty acid composition data, nationally representative sample or from a regional or convenience sample). This makes it difficult to directly compare intakes across the EU. Despite methodological, sample and geographical

differences, it is possible to provide some generalisations about the range of LCPUFA intakes across the EU.

- In women, mean EPA and DHA intakes were found to range from an estimated 126.6 mg/day (German women aged 18 to 24 years, Bauch *et al*., 2006) to 700 mg/day (Finnish women, Suominen-Taipale *et al*., 2010).
- In men, intakes of mean EPA and DHA intake ranged from 140 mg/day (Dutch men, Schuurman *et al*., 1999) to 1,000 mg/day in Finnish fishermen (Suominen-Taipale *et al*., 2010).
- Only 3 studies examined LCPUFA intakes in children and adolescents in the EU. For children, mean intakes ranged from 42 to 49 mg/day in those aged <4 years and 58 to 66 mg/day in those aged 4 to 6 years (German children, Sichert-Hellert *et al*., 2009) to 65 mg/day in 2.5 to 3 year olds and 75 mg/day in 4 to 6.5 year olds (Belgian children, Sioen *et al*., 2007a).
- Mean intakes of EPA and DHA in Belgian adolescents were 167.3 mg/day (Sioen *et al*., 2007b), compared to 92 to 141 mg/day in German adolescents (Sichert-Hellert *et al*., 2009).
- Only a few published studies reported DPA intakes, along with EPA and DHA intakes. In Belgian children aged 2.5-6.5 years, total mean EPA, DHA and DPA intake was 82 mg/day (Sioen *et al*., 2007a), while in Norwegian children aged 1 to 13 years, mean intakes ranged from 100 to 200 mg/day (or 300 to 600 mg/day when supplements were taken into account) (VKM, 2011).
- Total mean EPA, DHA, and DPA intakes in adults ranged from 281.5 mg/day in UK adults (Givens and Gibbs, 2006) to 570 mg/day in Danish young adults (Marckmann *et al*., 1995). Mean intakes were higher in Norwegian adults of up to 1080 mg/day reported in men (Johansson *et al*., 1998).

Consumption data and information pertaining to the individual food-uses for LCPUFA (EPA, DHA, and DPA) were used to estimate total population intakes of specific demographic groups in the U.K. using the most recent data available from the Rolling Programme 2008/9-2009/10. In summary, total LCPUFA intakes were seen to increase with age, with an intake of 117.88 mg/day in toddlers, increasing to an intake of 538.98 mg/day in elderly males. Fish was the main contributor to total EPA and DHA intakes in each population group, and therefore was responsible for driving LCPUFA intakes. Consumers of white fish ranged from 15% (girls aged 11 to 18 years) to 44% (boys aged 4 to 10 years), and for oil-rich fish ranged from 7% (boys aged 11 to 18 years) to 38% (men aged 65+ years).

One major issue with published LCPUFA intakes across the EU is that the majority of studies present mean intakes for the study population, which can mask the effect of very low intakes, resulting from sections of the population not consuming fish. Where provided, 5th percentile intakes often revealed zero intakes or very low intakes compared to mean values, indicating that median values may be more indicative of actual intakes compared to the mean. Data on non-fish or low-fish consumers emphasise the important contribution fish makes to LCPUFA intakes, and that ultimately intakes of LCPUFA will be extremely low in

the sub-section of the population that do not consume fish. Based on fish consumption only, intakes of LCPUFA were found to range from 92 mg/day EPA and DHA in low-fish consumers (4.9 g/day) in Finland to 1820 mg/day related to intakes of >2 servings of fatty fish per week in Sweden. The lowest LCPUFA intake of only 14.7 mg/day EPA and DHA was observed in a group of non-fish consumers in elderly Dutch men.

Another major issue with interpretation of the published data on LCPUFA intakes in the EU is in relation to the reliability of the LCPUFA composition data on which the intakes are calculated. It has been documented that EPA and DHA concentrations in farmed fish fat in the EU (such as in Norway, where a lot of farmed Salmon for example is sourced) have been declining in recent years. Fats and fatty acids are the nutrients whose levels vary the most between fish species, according to the season, the reproduction cycle and the animal's diet: for example, for sardines, the muscle's fat content varies from 1.2 to 18.4 g per 100 g over the course of the year (Bandarra *et al.*, 1997). The LCPUFA content of fish flesh almost exclusively depends on the animal's diet, *i.e.,* the aquatic food chain (algae, phytoplankton and zooplankton) for wild fish, and feed constituents (mainly oils) for farmed fish (Corraze and Kaushik, 1999). Therefore, any changes to the fish's feed will directly impact on the LCPUFA content of the fish. For preparing samples for estimating LCPUFA composition data there can be immense variations between individual samples within 1 year and also very strong variations between different years. This means that nutrition surveys which base their LCPUFA intakes of data calculated from old composition data, or composition data which did not account for seasonal variation or have a large number of samples is likely to be very unreliable for calculating LCPUFA intakes of a population and will largely overestimate actual intakes.

In general, it has been found that the practice of preparing food composition tables may not always be appropriate for deriving data on LCPUFA intake out of nutrition surveys based on those. For instance, the German nutritional table BLS (Bundeslebensmittelschlüssel) does not differentiate between wild and farmed fish species, although farmed fish have gained overwhelming market share in some categories. Also here, nutritional profiles of some fish species are used which do not properly document when the analysis was performed, how the fish samples were obtained and prepared. Furthermore in some cases, generic fat profiles for one species are used also for different sub-species, which may not sufficiently reflect the true range and deviation. In the opinion of the French Food Safety Agency (ANSES, formally AFSSA) regarding the benefits/risks of fish consumption, they concluded that fat and LCPUFA content varies significantly between fish species and according to the season, the reproduction period and the fish's diet (AFSSA, 2010).

1.3 LCPUFA INTAKE FROM SUPPLEMENTS

Supplements are designed to deliver amounts of EPA and DHA that are recommended by expert bodies (*i.e.,* EFSA, 2009), therefore most adult supplements deliver 250 to 500 mg/day EPA and/or DHA in one or multiple doses, the small number of child supplements on the market are designed to provide 100 mg/day. Regarding available

literature on reported intake in the community, the intake of LCPUFA from dietary supplements was found to vary greatly between countries and between studies. Relevant information on the intake of LCPUFA from dietary supplements can be summarised as follows:

- In a cross-sectional European study in 2007, it was found that 7.9% of participants were users of an omega-3 supplement, and 5% were users of a fish oil supplement (Augood *et al*., 2008). In other studies, the reported use of fish oil and cod liver oil supplements ranged from less than 0.5% in the Netherlands (Dijkstra *et al*., 2009) through to 33% of participants in a particular study in the United Kingdom (Myint *et al*., 2006).
- EPA and DHA content in different supplements can vary widely, in particular in cod liver oil compared to fish body oil. In general the intake of cod liver oil was found to exceed that of other fish oil supplements.
- In some populations, fish oil supplements may account for up to 33% of the total LCPUFA intake (Johansson *et al*., 1998).

Therefore, it becomes apparent that the intake of fish oil supplements must be considered when assessing total intakes of LCPUFA. A high intake of supplement use, especially cod liver oil, in some countries may also stem from cultural reasons such as the traditional recommendation to use cod liver oil during the dark period of the year in Nordic countries.

1.4 LCPUFA INTAKE FROM FORTIFIED SOURCES

GOED has collected data on fortification levels of EPA and DHA in foods consumed across the EU. These data gathered by GOED on occurrence and actual use levels have been used to assess exposure to LCPUFA in the EU by Intertek Cantox, pertinent details from this report are now summarised.

Intake assessments were conducted at a detailed food-code level in the UK using the National Diet and Nutrition Surveys. To provide an impression of the level of intakes across the EU, further intake assessments were conducted at a food category level in many Member States using published statistics from the EFSA Comprehensive database (EFSA, 2011). For the detailed UK assessments, 3 scenarios of EPA and DHA concentration data were examined,

1. Based on actual market data provided by GOED
2. Based on the requirements for “Source of Omega-3 fatty acids’ as defined in Commission Regulation (EU) No 116/2010 of 9 February 2010 amending Regulation (EC) No 1924/2006 of the European Parliament and of the Council with regard to the list of nutrition claims (Commission Regulation 1924/2006): “A claim that a food is a source of omega-3 fatty acids, and any claim likely to have the same meaning for the consumer, may be only made where the product contains at least 0.3 g alpha-linolenic acid per 100g and per 100 kcal, or at least 40mg of the sum of

eicosapentaenoic acid and docosahexaenoic acid per 100g and per 100 kcal" (European Parliament and the Council of the European, 2006b; European Commission, 2010)

3. Based on the requirements for "High in Omega-3 fatty acids" as defined in Commission Regulation 1924/2006: "A claim that a food is high in omega-3 fatty acids, and any claim likely to have the same meaning for the consumer, may be only made where the product contains at least 0.6 g alpha-linolenic acid per 100g and per 100 kcal, or at least 80mg of the sum of eicosapentaenoic acid and docosahexaenoic acid per 100g and per 100 kcal"

Scenarios 2 and 3 represent the commercial realities of omega-3 fortification of foods. Generally there would be no commercial benefit for a food company to enrich beyond the minimum requirements for "high in omega-3 fatty acids". Whilst some proposed health claims for higher levels up to 3 g per day (in relation to triglyceride and blood pressure maintenance) such products will likely be limited to dietary supplements and or very specialised food products, such as foods for particular nutritional uses or complete meal replacements.

Both the calculated mean concentration value per food category and the full range of concentration data available were used in different assessments in an attempt to ensure that all aspects of utilising the data at hand according to current practices of conducting exposure assessments were addressed. Finally, assumptions on market share of fortified foods within each food category for the EU were incorporated into the exposure assessments, along with aspects of consumer loyalty to try and achieve a realistic overview of exposure to EPA and DHA from fortified foods.

Based on the intake of the five food categories considered to be of most relevance for fortification within the setting of the EU by GOED members (*i.e.,* bread, eggs, margarine/ spreads, milk and yogurt), a 'current market' intake assessment was conducted, and the following results were observed:

- The highest mean, 90th and 95th percentile intakes of EPA and DHA by the United Kingdom (U.K.) population from the five major fortified food-uses in the current market assessment were observed in male adults at 378.75, 629.69, and 729.10 mg/ person/day, respectively.
- Children had the lowest mean intake of 267.93 mg/person/day, while young people had the lowest 90th and 95th percentile intakes of 433.21 and 506.28 mg/person/day, respectively.

When the results based on all food categories that could be fortified ("potential future") provided by GOED were considered (Scenario 1 using mean EPA and DHA per food category), the following intakes were calculated:

- The highest mean, 90th and 95thpercentile intakes of EPA and DHA by the U.K. population from all fortified food-uses in the EU were observed in male adults on an absolute basis, at 528.0, 837.9, and 962.3 mg/person/day, respectively.
- Children had the lowest mean, 90th, and 95th percentile intakes of 381.5, 566.1, and 644.0 mg/person/day, respectively.
- Incorporating market share data (of 5 to 10% share of fortified foods per food category) substantially reduced the exposure estimates.

Using data from the EFSA Comprehensive database some overall observations can be made on the range of intakes across the EU from the 5 main fortified food categories for the current market assessment (EFSA, 2011). Mean EPA and DHA intakes ranged from:

- 156.5 mg/day to 239.6 mg/day in infants,
- 248.6 to 451.7 mg/day in toddlers,
- 255.7 to 659.2 mg/day in other children,
- 300.6 to 630.5 mg/day in adolescents,
- 363.3 to 623.9 mg/day in adults,
- 376.9 to 629.2 mg/day in the elderly,
- 413.8 to 661.5 mg/day in the very elderly.

Overall, the range of EPA and DHA intakes based on the Comprehensive database extended greater than those observed in the UK National Diet and Nutrition Surveys (NDNS) survey population groups. This is because the exposure assessment conducted in the NDNS surveys was possible at a food-code level, allowing a much more specific matching of the fortified food-use concentration data than was possible using the Comprehensive data, which was forced at a cruder food category level.

1.5 METHODS & UNCERTAINTIES

Through the assessments of LCPUFA intakes from the background diet and from fortified sources, there have been many methodological issues and uncertainties which needed to be considered in the current reports. These can be summarised as follows:

<u>Assessment of intake from the background diet</u>

- A major issue with the published data on LCPUFA intakes in background diets is that usually only mean values are reported. Due to the large proportion of non-fish consumers in most populations will result in skewing of the intake data. Median values would be better considered.
- Separation of fish consumers and/or non-consumers was generally not provided.
- The LCPUFA composition data used in the publications may have been inaccurate, as in particular levels in the fat component of farmed fish have reduced dramatically in the past number of years.

- Some studies selected populations not representative of the national population, focused on particular demographics and did not state whether the intakes calculated included contribution from dietary supplements.

Assessment of intake from fortified foods

- In general, the approach for the exposure estimates was a very conservative one that assumed that all food groups when consumed are fortified with EPA and DHA. Market share data was incorporated to provide a more realistic estimate of intakes across the EU.
- The number of fortified products on market and their category penetration is in reality very low, however the current fortified assessments assumes that categories of interest to the industry are at high prevalence in mainstream shopping baskets, which is of course not reality, but is a very conservative assumption.
- The EPA and DHA concentration data collected by GOED were very comprehensive, but as markets change these fortification levels in certain food groups may change over time.
- Detailed assessments of fortified intakes were conducted using the NDNS as the assessments could be conducted at a very detailed level. However dietary patterns in the UK may not reflect those of other EU member states. To address this, data from the EFSA Comprehensive database were also considered (EFSA, 2011). However these data are only available at an aggregated food category level, thereby producing a cruder exposure assessment to EPA and DHA than from the NDNS.
- Many scenarios of exposure were considered, and some of these scenarios were introduced based on EFSA guidance for nutrient claims on food labels as these assessments are intended to be protective for any future foreseeable practices. However, possible future legislative restrictions may impact on the fortification level of particular food categories which cannot be foreseen for the current assessments.

1.6 COMPARISON OF FINDINGS OF LCPUFA INTAKES WITH THOSE OF THE GERMAN: FEDERAL INSTITUTE FOR RISK ASSESSMENT (BfR)

1.6.1 BfR Assessment of LCPUFA in German Adults

The BfR have communicated with the European Commission for scientific advice on the safety of LCPUFA and in August 2010 they expressed that they consider it essential that DHA and EPA are placed in Annex III, Part B of Regulation No 1925/2006, as certain conditions and restrictions on the addition of these fatty acids to foods are necessary to avoid excessive intake and possible undesirable consequences for health (European Parliament and the Council of the European Union, 2006a). In the absence of EU advice on a tolerable upper intake level (UL) for omega-3 fatty acids, the BfR has established a level of 1.5 g per day as the recommended UL. The BfR provided a health assessment related to the intake of LCPUFA in Germany as part of their communication, and in this they provided

details of enrichment scenarios which they ran to assess the potential intake of LCPUFA in Germany.

To this end, background intake from the diet was calculated based on the German Second National Nutrition Survey (NVS II) – these calculations and data are unpublished and are only available through this communication. From these calculations, the average daily intake of EPA, DPA, and DHA (without enriched foodstuffs and supplements) was 344 mg in women and 459 mg in men. These intakes were almost twice as high as those reported from the previous German National Dietary Survey in 1998 (Bauch *et al*. 2006), where for men, the 45 to 54 year age group had the highest mean EPA and DHA intake of 295 mg/day, and for women, 55 to 64 year age group had the highest mean EPA and DHA intake of 218.9 mg/day (however these older data did not include DPA). This disparity in increase in LCPUFA intakes in 10 years in Germany warrants closer investigation of the calculations and to the LCPUFA composition data used to ensure accuracy of the intake assessment. Concerns on the methodology and validity of the composition data used (BLS) have been raised in Section 1.3 of this report.

To assess the intake of LCPUFA from fortified foods on the German market, 2 model scenarios were run. The first included 4 enriched foodstuffs (EPA and DHA) that were available on the German market (bread, bread rolls, margarine, and eggs). A second model scenario included nine foodstuffs hypothetically enriched with DHA. For both model scenarios, it was assumed that all subjects in NVS II survey consumed the enriched varieties, which is a worst-case scenario. The results of the intake scenarios carried out by the BfR are detailed in Table 1.6.1-1.

Table 1.6.1-1 Summary of the BfR Assessments: Intakes of EPA, DPA and DHA in German Adults

	Male (mg/d)			Female (mg/d)		
	Mean	**Median**	**P95**	**Mean**	**Median**	**P95**
Background Diet (NVS II*)	459	314	1307	344	247	943
Scenario 1 (incl background)	656	519	1559	489	400	n/a
Scenario 2 (incl background)	1200	1071	2374	932	854	n/a
Dietary Supplements	200-1200			200-1200		

*Background diet includes DPA, along with EPA and DHA
n/a = not available for population

Using an upper level of 1.5 g/day, the BfR felt that intakes at Scenario 2 were 2 to 3 times greater than ”those reasonably expected to be ingested under normal conditions of consumption of a balanced and varied diet” if the 95th percentile intakes are considered. This finding was the foundation for their concerns of the intake of LCPUFA in Germany. However, Scenario 2 is based on a very hypothetical situation of fortification of food products in Germany and is not based on actual fortification practices, which are assessed through Scenario 1.

1.6.2 Summary of the Assessment of LCPUFA in UK Adults for Comparison

Published background intakes of LCPUFA in the UK, and in general throughout the EU are lower than those calculated in the German NVS II survey. However, intakes at the upper percentiles in the UK for the NDNS rolling surveys 2008/9-2009/10 have not yet been published for direct comparison. Intakes from the fortified assessment in the NDNS also indicate estimated LCPUFA intakes that were lower than those generated by the BfR. However, different intake scenarios were explored by the BfR, while the scenarios assessed by Intertek Cantox can be more closely compared to the actual current fortification practices of foods across Europe.

Table 7.2-1 Summary of the Intertek Cantox Assessments: Intakes of EPA, DPA and DHA in UK Adults

	Adults (mg/d)		
	Mean	**Median**	**P95**
Background (NDNS*)	281.5	n/a	n/a
Fortified intakes: Current (not incl. background)	321.9	n/a	654.1
Fortified intakes: Potential future (not incl. background)	455.3	n/a	865.2
Dietary Supplements**	450		

*Based on Givens and Gibbs (2006) published results of UK intakes in the 2000-2001 NDNS survey. Background diet includes DPA, along with EPA and DHA. Mean intakes only reported
** Assume intake from supplements is the Adequate Intake (AI) of 450 mg/day
n/a = not available for population

Based on crude calculations of fortified LCPUFA intakes across the EU from data in the EFSA Comprehensive database, mean intakes for adults range from approximately 770.7 to 1112.7 mg/day from all food categories which could potentially be fortified, which is also lower than what the BfR estimated for their assessment that raised concern (Scenario 2), and these intakes for the EU are very crude assessments, which in reality would be expected to be lower if more refined data were available on which to base the calculations (EFSA, 2011).

In summary, although the concerns of the BfR about the intakes of LCPUFA may be justified through their in-house calculations, their findings are not supported through the current comprehensive intake assessment for LCPUFA intakes across the EU. The current intake assessments has been based on a complete overview of background intakes of LCPUFA across the EU alongside intake estimates from fortified foods based on realistic current practice and future potential fortification practices.

1.7 CONCLUSIONS

Intertek Cantox have provided a comprehensive and objective review of background intakes of LCPUFA in the EU along with a detailed assessment of LCPUFA (EPA and DHA) intakes from fortified sources using current fortification practices in the models. These reports provide support that LCPUFA intakes from the background diet are relatively low (especially

if fish consumers are removed from consideration and if median intakes are used). However, the establishment of a UL for LCPUFA is pivotal in this reasoning and once in place could provide an appropriate bench-mark for assessing LCPUFA intakes in various EU populations.

From the review of background LCPUFA intakes in the EU, this report has found low EPA and DHA intakes in certain sub-groups, in particular in young women and children who are non- or low-fish consumers. To support brain and eye development during pregnancy and early post-natal life it is recommended that pregnant and nursing women consume up to 450 mg EPA and DHA, including at least 200 mg DHA, per day. Adequate daily DHA consumption by pregnant and nursing women is needed to compensate for increased metabolic demands associated with pregnancy and lactation, and accumulation of DHA by the foetus/infant while meeting minimum adult requirements for cardiovascular health (EFSA, 2009, 2010). A fortified diet and/or LCPUFA dietary supplements are important to bridge the gap between the low intake provided by the habitual diet of most women and the recommendations for increased DHA intake.

Utilising realistic but conservative assumptions on occurrence and concentration data and within calculation methodologies, the intake of EPA and DHA in the general EU population from all sources – background diet, supplements and fortified sources (in the unlikely event they are consumed by the same individuals) is found to approximate a maximum of 1 g/day at a mean level and to not be greater than 2 g/day for very high consumers, even in the case of substantial future expansion in the availability of fortified products.

SECTION 2: BACKGROUND INTAKES OF LCPUFA

SUMMARY

The focus of this report is on the intake of LCPUFA EU populations from the background diet, however for completeness, intakes in Norwegian populations are also described due to the large number of studies on LCPUFA in Norway, and their traditional dietary patterns containing fish and cod liver oil. Along with this primary objective, this report also details studies that have investigated fish intake as the sole source of LCPUFA, also detailed are studies that examined incidence of disease risk with LCPUFA from diet alone, and finally the intakes of LCPUFA from dietary supplements are examined.

Data was available for 9 EU countries, however drawing conclusions from these studies was difficult due to lack of coherence and consistency in the methods, reporting and in demographic groups included. Furthermore, it is clear that LCPUFA concentration data derived from old composition tables is likely to be incorrect as the LCPUFA content of common foodstuffs has changed over recent years (*e.g.*, farmed *versus* wild salmon).

LCPUFA intakes increased with age. Intakes in Belgian children and adolescents were slightly greater than those in their German age-matched counterparts, with intakes of EPA and DHA in Belgian children ranging from 65 mg/day in 2.5 to 3 year olds to 75 mg/day in 4 to 6.5 year olds. In German children intakes were 42 to 49 mg/day in those aged <4 years and were 58 to 66 mg/day in those aged 4 to 6 years. Intakes of EPA and DHA in Belgian adolescents were 167.3 mg/day, compared to 92 to 141 mg/day in German adolescents. Intakes for both children and adolescents were reported to be higher for EPA and DHA in Norway, although the data are not directly comparable to those in Belgium and Germany, with median intakes of 200 mg/day for 2- to 13-year-old children (or 300 to 600 mg/day including supplements).

In European women, mean EPA and DHA intakes were found to range from 126.6 mg/day in German women aged 18 to 24 years to 700 mg/day in Finnish women, with an intake of 800 mg/day reported in the wives of Finnish fishermen. Intakes of mean EPA and DHA intake ranged from 140 mg/day in a sub-cohort of Dutch men to 1000 mg/day in Finnish fishermen.

In most developed countries with the so-called 'Western' diet, the intake of LCPUFA is low owing to low-fish consumption. When LCPUFA intakes from fish only was examined, most studies divided their sample into groups of fish consumption (*i.e.*, based on grams per day or number of fish servings per week), and examined LCPUFA intake across these groups. Based on fish consumption only, intakes of LCPUFA were found to range from 92 mg/day EPA and DHA in low-fish consumers (4.9 g/day) in Finland to 1820 mg/day related to intakes of >2 servings of fatty fish per week in Sweden. The lowest LCPUFA intake of only 14.7 mg/day EPA and DHA was observed in a group of non-fish consumers in Dutch men >55 years of age.

The intake of LCPUFA from supplements varies greatly between countries and between studies in Europe. The reported use of fish oil and cod liver oil supplements ranges from less than 0.5% in the Netherlands though to 33% of participants in studies in the United Kingdom, respectively. In general the intake of cod liver oil was found to exceed that of other fish oil supplements. In a cross-sectional European study in 2007, it was found that 7.9% of participants were users of an omega-3 supplement, and 5% were users of a fish oil supplement. A further survey observed that total intakes of EPA and DHA from dietary sources can range up to over 1 g/day when fish oil supplements are taken into account. When considering the contribution of fish oils or supplements to intakes of total LCPUFA, the intake of fish oil supplements may account for up to 33% of the intake. Therefore, it becomes apparent that the intake of fish oil supplements must be considered when assessing total intakes of LCPUFA. A high intake of supplement use, especially cod liver oil, in some countries may also stem from cultural reasons such as the traditional recommendation to use cod liver oil during the dark period of the year in Nordic countries.

It should however be noted that there is wide variation in the EPA and DHA content of supplements. Compared to other supplements cod liver oil has a low concentration of EPA and DHA, and although 33% of the UK population are reported as consuming, any of these consumers are unlikely to be receiving more than 100 mg/day of supplemental EPA and DHA. In general supplements based on fish body oil are designed to deliver EPA and DHA in-line with recommendations of 250 mg/day for adults (up to 450 mg/day for pregnant and nursing women) and 100 mg/day for children (EFSA, 2010).

2.1 INTRODUCTION

Omega-3 fatty acids are a family of polyunsaturated fatty acids (PUFA) that are considered nutritionally essential. The main types of omega-3 fatty acids, ranked in ascending order by the length of each molecule's carbon chain, include:

Common name	Lipid name	Chemical name
α-Linolenic acid (ALA)	18:3 (*n*−3)	*all-cis*-9,12,15-octadecatrienoic acid
Stearidonic acid (SDA)	18:4 (*n*−3)	*all-cis*-6,9,12,15-octadecatetraenoic acid
Eicosapentaenoic acid (EPA)	20:5 (*n*−3)	*all-cis*-5,8,11,14,17-eicosapentaenoic acid
Docosapentaenoic acid (DPA), Clupanodonic acid	22:5 (*n*−3)	*all-cis*-7,10,13,16,19-docosapentaenoic acid
Docosahexaenoic acid (DHA)	22:6 (*n*−3)	*all-cis*-4,7,10,13,16,19-docosahexaenoic acid

The 2 major omega-3 PUFAs explored in this report are EPA and DHA, which are considered to be the primary markers used to assess intake of LCPUFA. These 2 fatty acids are primarily derived from marine and algae sources, and each has an important role in the promotion of health. The beneficial effects have been well documented in the scientific literature, extending from infancy through to adult life and include anti-atherogenic, anti-thrombotic and anti-inflammatory effects, and overall it has been demonstrated that an

increased intake leads to a reduced risk of coronary heart disease (CHD) (Simopoulos, 1991). Taking into account the importance of these fatty acids for human health, several national and international organizations have formulated dietary recommendations for EPA and DHA (Table 2.1-1). For example, the UK Scientific Advisory Committee on Nutrition (SACN) recommends an intake of 450 mg/day EPA plus DHA, and this could be achieved by consuming at least 2 portions of fish a week, 1 of which should be oily (SACN, 2004). Recently, the EFSA reviewed these recommendations and provided advice on labelling reference values and "Adequate Intake" (AI) for EPA and DHA and set an AI of 250 mg per day for EPA and DHA for adults; set an AI of 100 mg DHA for infants (>6 months) and young children <24 months; and set an AI of at least 200 mg preformed DHA for women as an adequate supply of n-3 LCPUFA during pregnancy and lactation (EFSA, 2009, 2010). However, despite widespread evidence of their favourable health effects, it has been repeatedly reported that modern diets in developed countries are very low in LCPUFA.

Table 2.1-1 Recommendations for n-3 LCPUFA and/or EPA + DHA Intakes for Healthy Populations from European Government and Health Organisations

Organisation	Year	Recommendation
Scientific Committee on Food (SCF, 1993)	1993	1 to 3 year olds: n-3 PUFA 0.5% total energy / 0.7 g/day 4 to 6 year olds: n-3 PUFA 0.5% total energy / 1 g/day
Eurodiet conference- Eurodiet, 2000	2000	200 mg/d EPA + DHA
AFSSA, France – AFSSA, 2001	2001	500 mg/d EPA + DHA
UK Scientific Advisory Committee on Nutrition (SACN. 2004)	2004	450 mg/d EPA + DHA
Superior Health Council of Belgium, 2004	2004	Children: n-3 PUFA up to 2% total energy Adults: EPA + DHA >0.3% total energy, n-3 PUFA 1.3 to 2% total energy
Health Council of the Netherlands, 2006	2006	450 mg/d n-3 LCPUFA
European Food Safety Authority (EFSA, 2009)	2009	> 250 mg/d EPA + DHA

Information on dietary intake of LCPUFA in the general population and in certain subgroups, such as children, the elderly and pregnant women, are the basis to identify risk groups for inadequacy and high intake as well as the basis for which to establish intake calculations for the assessing the potential impact of fortification of the food supply. It is also important to identify the main contributing food sources in the diet which contribute to total EPA and DHA intakes with the goal of developing appropriate food-based dietary guidelines that are either country-specific or specific for Europe as a whole.

2.2 LCPUFA INTAKES FROM ALL DIETARY SOURCES IN THE EU

The primary objective of this report is to collate data on published intakes from natural dietary sources of EPA and DHA, along with DPA where available, in different population groups in Europe. A thorough literature search was conducted to find studies that examined omega-3 intakes in Europe, and 28 studies were identified from 9 EU countries: Belgium (3 studies), Denmark (2 studies), France (1 study), Finland (1 study), Germany (4 studies), Ireland (1 study), the Netherlands (6 studies), Sweden (2 studies) and the UK (2 studies). In Norway[1], 5 studies plus 1 review of an additional 5 reports were also identified. These studies are summarized in Tables 2.2-1a and 2.2-1b. Different studies focused on different population and demographic groups, used different methodologies for collecting the samples and dietary information and also reported on different statistical parameters and aspects of LCPUFA were reported, all of this variability making cross-Europe comparisons difficult.

There are several explanations why data on LCPUFA intakes were only available in 9 EU countries. Not all countries in the EU have detailed food consumption data available that can be interrogated at a comprehensive level to assess the intake of individual fatty acids. In some countries, food composition tables may only provide data on total fatty acids, thereby making it very difficult to obtain reliable estimates of specific LCPUFA in the population. Furthermore, over time the fatty acid profile of many commonly consumed foods have changed (*e.g.*, margarine, milk and meat), thereby increasing the difficulty of updating food consumption databases with reliable composition data (Sanders, 2000).

[1] Although Norway is not an European Union Member State, it is included in this report to include comprehensive coverage of all Europe

Table 2.2-1a Intakes of Omega-3 Polyunsaturated Fatty Acids in Children from Total Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details		Total EPA and DHA (mg/day)				Total EPA, DHA, and DPA (mg/day)			EPA (mg/day)				DHA (mg/day)				Percent Contribution of Dietary Sources
					Mean	Median	P5	P95	Mean	P5	P95	Mean	Median	P5	P95	Mean	Median	P5	P95	
Belgium																				
Sioen *et al*., 2007a	2002 - 2003	661 pre-school children (338 boys, 323 girls) 2.5-6.5 years. Flanders.	Parentally-reported 3 day diaries	All children	72	-	-	-	82	-	-	25	-	-	-	47	-	-	-	Fatty fish contributed 43.4% EPA and 48.1% DHA
				2.5 - 3 years old (n 197)	65	-	-	-	75	-	-	22	-	-	-	43	-	-	-	
				4-6.5 years old (n 464)	75	-	-	-	85	-	-	26	-	-	-	49	-	-	-	
Sioen *et al*., 2007b	1997	341 adolescents (129 boys, 212 girls) aged 13 to 18 years. Ghent.	7-day estimated food record (semi-structured diary)	Adolescents (13 - 18 yrs)	167.3	96.9	11.2	603	-	-	-	55.9	25.4	0.6	244.2	111.4	72.4	10.2	363.2	EPA: Total fish and seafood contributed to 84.1% (fatty fish contributed to 42.36% of total intake, lean fish contributed to 17.2%, molluscs and crustaceans contributed to 15.8%), total meat, poultry, and eggs contributed to 10%, etc.
																				DHA: Total fish and seafood contributed to 65.4% (fatty fish contributed to 29.9%, lean fish contributed to 16.6%,half-fatty fish contributed to 9.4%), total meat, poultry, and eggs contributed to 36.6% (poultry contributed to 19.6%), *etc*.

Table 2.2-1a Intakes of Omega-3 Polyunsaturated Fatty Acids in Children from Total Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details		Total EPA and DHA (mg/day)				Total EPA, DHA, and DPA (mg/day)			EPA (mg/day)				DHA (mg/day)				Percent Contribution of Dietary Sources
					Mean	Median	P5	P95	Mean	P5	P95	Mean	Median	P5	P95	Mean	Median	P5	P95	
Germany																				
Sichert-Hellert *et al.*, 2009	1985-2005	DONALD cohort - Sample of 1024 children aged 2 to 18 years	3-day weighted diet records	Males <4 yrs	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				Males 4-6 yrs	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				Males 7-9 yrs	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				Males 10-12 yrs	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				Males 13-14 yrs	141	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				Males 15-18 yrs	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				Females <4 yrs	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				Females 4-6 yrs	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				Females 7-9 yrs	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				Females 10-12 yrs	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				Females 13-14 yrs	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				Females 15-18 yrs	102	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Norway																				
VKM, 2011 - Summary of Norwegian reports	Unkost: 2000 and 2001	Ungkost 2000: 815 9-year-old children and 1009 13-year-old adolescents	4-day food intake registration	Inc. supplement (13 years)	-	-	-	-	300	0	1,100	-	-	-	-	-	-	-	-	
				No supplement 13 years)	-	-	-	-	200	0	700	-	-	-	-	-	-	-	-	
				Inc. supplement (9 years)	-	-	-	-	300	0	1,200	-	-	-	-	-	-	-	-	
				No supplement 9 years)	-	-	-	-	200	0	700	-	-	-	-	-	-	-	-	

Table 2.2-1a Intakes of Omega-3 Polyunsaturated Fatty Acids in Children from Total Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details		Total EPA and DHA (mg/day)				Total EPA, DHA, and DPA (mg/day)			EPA (mg/day)				DHA (mg/day)				Percent Contribution of Dietary Sources
					Mean	Median	P5	P95	Mean	P5	P95	Mean	Median	P5	P95	Mean	Median	P5	P95	
	Unkost: 2000/2001	Ungkost 2001 391 4-year-old children	4-day food intake registration	Inc. supplement (4 years)	-	-	-	-	400	0	1,400	-	-	-	-	-	-	-	-	
				No supplement (4 years)	-	-	-	-	200	0	600	-	-	-	-	-	-	-	-	
	Sambarnskost: 1998/1999	Smabarnskost: 1,720 2-year-old children	Semi-quantitative FFQ	Inc. supplement (2 years)	-	-	-	-	600	0	1,700	-	-	-	-	-	-	-	-	
				No supplement (2 years)	-	-	-	-	200	0	700	-	-	-	-	-	-	-	-	
	Spedkost: 1998/1999	Spedkost: 1,231 1-year-old children	Semi-quantitative FFQ	Inc. supplement (1 years)	-	-	-	-	400	0	1,400	-	-	-	-	-	-	-	-	
				No supplement (1 years)	-	-	-	-	100	0	400	-	-	-	-	-	-	-	-	

EPA = eicosapentaenoic acid; DHA = docosahexaenoic acid; DPA = decosapentaenoic acid; FFQ = food frequency questionnaire; P5 = 5th percentile; P95 = 95th percentile

Table 2.2-1b Intakes of Omega-3 Polyunsaturated Fatty Acids in Adults from Total Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details		Total EPA and DHA (mg/day)				Total EPA, DHA, and DPA (mg/day)			EPA (mg/day)				DHA (mg/day)				Percent Contribution of Dietary Sources
					Mean	Median	P5	P95	Mean	P5	P95	Mean	Median	P5	P95	Mean	Median	P5	P95	
Belgium																				
Sioen *et al*., 2006	2002	461 women aged 18-30 years from Ghent, Flanders. Epidemiological study	2-day food records using diaries	Females	208.9	-	0	1,115	-	-	-	77.8	-	0	427.7	131.2	-	0	647.1	Total fish and seafood (87% to EPA, 80% to DHA), Meat and meat dishes (2% to EPA, 2% to DHA), Eggs (0.2% to EPA, 6% to DHA), Snacks (4% to EPA, 6% to DHA).
Denmark																				
Marckmann *et al.*, 1995	Not provided	24 volunteers (17 men, 7 women), 20-29 years, from a control group of a dietary intervention trial	Three 7-day weighed food records collected over 8 months	Total population	500	-	-	-	570	-	-	260	-	-	-	240	-	-	-	
Tjønneland *et al.*, 1993	Not provided	Validation study in 86 people (23 men, 63 women)., aged 40-64 yrs living in Copenhagen.	Two 7-day weighed diet records	Males	516	-	-	-	-	-	-	258	-	-	-	258	-	-	-	Not reported
				Females	465							229	-	-	-	236	-	-	-	
France																				
Astorg *et al.*, 2004	SU.VI.MAX study: 1994-95 with 8 year follow up	4884 adults - Randomized, double blind placebo controlled primary prevention trial in men (n=2099) and women (n=2785)	24 hour dietary questionnaire: 6 per year. Randomised to assess 4 weekdays and 2 weekend days each year	Males	422.5	-	-	-	-	-	-	149.9	-	27.5	375.1	272.6	-	66	668.4	Total fish and seafood (72% to EPA, 65% to DHA), Meat and meat dishes (8% to EPA, 2% to DHA), Eggs (0.6% to EPA, 10% to DHA), Processed meats (4.5% to EPA, 3% to DHA).
				Females	343.7	-	-	-	-	-	-	117.8	-	19.2	308.5	225.9	-	50	574.2	
Finland																				
Suominen-Taipale *et al.*, 2010	Health 2000 Survey: 2000-2001	5,840 adults. Nationally representative survey	Validated FFQ containing 128 items	Men	700	-	-	-	-	-	-	200	-	-	-	500	-	-	-	Not reported
				Women	700	-	-	-	-	-	-	200	-	-	-	500	-	-	-	
	Fisherman Study: 2004-2005	308 fishermen and wives	Validated FFQ containing 128 items	Men	1,000	-	-	-	-	-	-	300	-	-	-	700	-	-	-	
				Women	800	-	-	-	-	-	-	200	-	-	-	600	-	-	-	

Table 2.2-1b Intakes of Omega-3 Polyunsaturated Fatty Acids in Adults from Total Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details		Total EPA and DHA (mg/day)				Total EPA, DHA, and DPA (mg/day)			EPA (mg/day)				DHA (mg/day)				Percent Contribution of Dietary Sources
					Mean	Median	P5	P95	Mean	P5	P95	Mean	Median	P5	P95	Mean	Median	P5	P95	
Germany																				
Nimptsch *et al.*, 2010	1994-1998	EPIC-Heidelberg cohort, 9182 men (40-64 yrs) and 10,867 women (35-64 yrs)	Self-administered 158-item FFQ	Males	303.9	-	-	-	-	-	-	102.6	-	-	-	201.3	-	-	-	
				Females	216.6	-	-	-	-	-	-	69.7	-	-	-	146.9	-	-	-	
Bauch *et al.*, 2006	1997-1999	German Nutrition Survey,4030 adults (1763 men, 2267 women)	Modified dietary history method	Males (18-24 years)	232.1	-	-	790.3	-	-	-	-	-	-	-	-	-	-	-	On average, 68% EPA and DHA provided by fish, 12% by eggs, 7% by poultry and 7% by meat and sausages
				Females (18-24 years)	126.6	-	-	367.8	-	-	-	-	-	-	-	-	-	-	-	
				Males (25-34 years)	212	-	-	553.2	-	-	-	-	-	-	-	-	-	-	-	
				Females (25-34 years)	167.4	-	-	501	-	-	-	-	-	-	-	-	-	-	-	
				Males (35-44 years)	238.3	-	-	643.5	-	-	-	-	-	-	-	-	-	-	-	
				Females (35-44 years)	196.6	-	-	471.8	-	-	-	-	-	-	-	-	-	-	-	
				Males (45-54 years)	295	-	-	826.6	-	-	-	-	-	-	-	-	-	-	-	
				Females (45-54 years)	207.1	-	-	587.3	-	-	-	-	-	-	-	-	-	-	-	
				Males (55-64 years)	274.4	-	-	794.5	-	-	-	-	-	-	-	-	-	-	-	
				Females (55-64 years)	218.9	-	-	560.1	-	-	-	-	-	-	-	-	-	-	-	
				Males (65-79 years)	277.7	-	-	668.3	-	-	-	-	-	-	-	-	-	-	-	
				Females (65-79 years)	199.9	-	-	556.3	-	-	-	-	-	-	-	-	-	-	-	
Linseisen *et al.*, 2003	1994-1998	1,976 women aged 35 to 64 years, and 2,045 men aged 40 to 64 years.	Self-administered FFQ and 24-hour dietary recalls	Men (Potsdam site)	340	-	-	-	-	-	-	130	-	-	-	210	-	-	-	
				Women (Potsdam site)	220	-	-	-	-	-	-	80	-	-	-	140	-	-	-	
				Men (Heidelberg site)	290	-	-	-	-	-	-	100	-	-	-	190	-	-	-	

Table 2.2-1b Intakes of Omega-3 Polyunsaturated Fatty Acids in Adults from Total Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details		Total EPA and DHA (mg/day)				Total EPA, DHA, and DPA (mg/day)			EPA (mg/day)				DHA (mg/day)				Percent Contribution of Dietary Sources
					Mean	Median	P5	P95	Mean	P5	P95	Mean	Median	P5	P95	Mean	Median	P5	P95	
				Women (Heidelberg site)	210	-	-	-	-	-	-	70	-	-	-	140	-	-	-	
Ireland																				
Leite *et al.*, 2010	NSIFCS: 1997 to 1999	1097 adults, 555 males and 542 females, 18-64 years. Nationally representative survey	Food and beverage intake determined using a 7-day estimated food record. Total EPA and DHA were quantified	Total population	275	-	38	1,147	-	-	-	-	-	-	-	-	-	-	-	72% from fish and fish products, 4% from nutritional supplements, 3% from poultry and 3% bacon and ham
				Males	199	-	49	1,159	-	-	-	-	-	-	-	-	-	-	-	
				Females	250	-	32	1,146	-	-	-	-	-	-	-	-	-	-	-	
				18-35 years	187	-	30	825	-	-	-	-	-	-	-	-	-	-	-	
				36-50 years	297	-	44	1,160	-	-	-	-	-	-	-	-	-	-	-	
				51-64 years	386	-	45	1,278	-	-	-	-	-	-	-	-	-	-	-	
Netherlands																				
de Goede *et al.*, 2010	1993-1997	MORGEN Study - 22,654 adults aged 20-65 years	Self-administered FFQ containing 178 items	Overall	-	114	-	-	-	-	-	-	-	-	-	-	-	-	-	EPA and DHA from fish:
				1st quartile (DHA and EPA intake)	39	40	-	-	-	-	-	-	-	-	-	-	-	-	-	1st quartile: 13 of 39 mg;
				2nd quartile (DHA and EPA intake)	86	84	-	-	-	-	-	-	-	-	-	-	-	-	-	2nd quartile: 53 of 86 mg;
				3rd quartile (DHA and EPA intake)	152	151	-	-	-	-	-	-	-	-	-	-	-	-	-	4th quartile: 255 of 295 mg
				4th quartile (DHA and EPA intake)	295	234	-	-	-	-	-	-	-	-	-	-	-	-	-	4th quartile: 255 of 295 mg
Heine-Bröring *et al.*, 2010	1990 and 1993	1570 adults (686 men and 884 women) aged 55 and above	Semi-quantitative 170-item FFQ	≥ 55 yrs	97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table 2.2-1b Intakes of Omega-3 Polyunsaturated Fatty Acids in Adults from Total Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details		Total EPA and DHA (mg/day)				Total EPA, DHA, and DPA (mg/day)			EPA (mg/day)				DHA (mg/day)				Percent Contribution of Dietary Sources
					Mean	Median	P5	P95	Mean	P5	P95	Mean	Median	P5	P95	Mean	Median	P5	P95	
Dijkstra *et al.*, 2009	1990 - 1993	Rotterdam Study - population-based prospective cohort study in 5299 men and women aged 55 years and older	Interview-administered validated, semi-quantitative FFQ. Intakes of specific fatty acids based on food consumption database derived from TRANSFAIR study	Overall	-	88	-	-	-	-	-	-	-	-	-	-	-	-	-	
				1st quintile	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				2nd quintile	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				3rd quintile	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				4th quintile	161	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				5th quintile	313	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Brouwer *et al.*, 2006	1990 - 1993	Rotterdam Study - population-based prospective cohort study in 5184 men and women aged 55 years and older	Validated, semi-quantitative FFQ. Intakes of specific fatty acids based on food consumption database derived from TRANSFAIR study	Overall	146	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				1st tertile (DHA and EPA intake)	19.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				2nd tertile (DHA and EPA intake)	87.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				3rd tertile (DHA and EPA intake)	330	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Schuurman *et al.*, 1999	1986	Netherlands Cohort Study - 1,525 men aged 55-69 years in sub-cohort examined	Self-administered semi-quantitative FFQ containing 150 items	Men	140	-	-	-	-	-	-	50	-	-	-	90	-	-	-	
v. Houwelingen *et al.*, 1989	1986	Dutch cohort of the Seven Countries Study - 61 men aged 67-82 years	Cross-check diet history	Men	141	-	-	-	-	-	-	64	30	-	-	77	30	-	-	
Sweden																				
Hedelin *et al.,* 2010	1991-1992 (enrolment), 2002-2003 (questionnaire)	33,623 women aged 30-49	6-month FFQ	Low level psychotic-like symptoms	-	-	-	-	270	70	600	-	-	-	-	-	-	-	-	Not reported
				Mid level psychotic-like symptoms	-	-	-	-	270	60	600	-	-	-	-	-	-	-	-	
				High level psychotic-like	-	-	-	-	260	50	700	-	-	-	-	-	-	-	-	

Table 2.2-1b Intakes of Omega-3 Polyunsaturated Fatty Acids in Adults from Total Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details		Total EPA and DHA (mg/day)				Total EPA, DHA, and DPA (mg/day)			EPA (mg/day)				DHA (mg/day)				Percent Contribution of Dietary Sources
					Mean	Median	P5	P95	Mean	P5	P95	Mean	Median	P5	P95	Mean	Median	P5	P95	
				symptoms																
Wallström *et al.*, 2007	1991-1996	10,564 male subjects born between 1923 and 1945	A combined interview-based dietary history method, a FFQ containing 168 items, and a 45-minute complementary interview	1st quintile	160	-	-	-	-	-	-	30	-	-	-	120	-	-	-	
				2nd quintile	280	-	-	-	-	-	-	80	-	-	-	200	-	-	-	
				3rd quintile	440	-	-	-	-	-	-	140	-	-	-	300	-	-	-	
				4th quintile	720	-	-	-	-	-	-	230	-	-	-	480	-	-	-	
				5th quintile	1,300	-	-	-	-	-	-	440	-	-	-	860	-	-	-	
UK																				
Givens and Gibbs, 2006	NDNS 2000-2001, SACN, 2004, BEIS, 2005	NDNS - adults, 18-65 years. Nationally representative survey	Estimated the intake of VLC n-3 fatty acids: EPA, DHA and DPA	Total population	244.4	-	-	-	281.5	-	-	88.7	-	-	-	155.7	-	-	-	81% from fish, 15% from meats, 4% from eggs (Percentages were calculated from the contribution of the 3 databases to the total EPA and DHA intakes)
Sanders and Roshanai, 1992	Not provided	20 vegan subjects recruited through the UK Vegan society, 20 age- and sex-matched omnivore controls from staff and student population of University of London	7-day weighed food intake record, including duplicate diets for 3 days	Vegans: Males	0	-	-	-	-	-	-	0	-	-	-	0	-	-	-	
				Vegans: Females	0	-	-	-	-	-	-	0	-	-	-	0	-	-	-	
				Omnivores: Males	600	-	-	-	-	-	-	210	-	-	-	390	-	-	-	
				Omnivores: Females	130	-	-	-	-	-	-	70	-	-	-	60	-	-	-	
Norway																				
VKM, 2011 - Summary	Norkost: 1997	Norkost: 2,672 adults aged 16 to 79	Quantitative FFQ	Inc. supplement (16-79 years)	-	-	-	-	900	100	2,700	-	-	-	-	-	-	-	-	Not reported
				No supplement (16-79 years)	-	-	-	-	600	100	1,400	-	-	-	-	-	-	-	-	
Manger *et al.*, 2010	1999-2004	2412 adults (1941 men, 471 women) over 18 years old	FFQ containing 169 food items	1st quartile	-	-	-	-	580	-	-	-	-	-	-	-	-	-	-	Not reported
				2nd quartile	-	-	-	-	830	-	-	-	-	-	-	-	-	-	-	
				3rd quartile	-	-	-	-	1,360	-	-	-	-	-	-	-	-	-	-	
				4th quartile	-	-	-	-	2,640	-	-	-	-	-	-	-	-	-	-	

Table 2.2-1b Intakes of Omega-3 Polyunsaturated Fatty Acids in Adults from Total Consumption in the EU and Norway

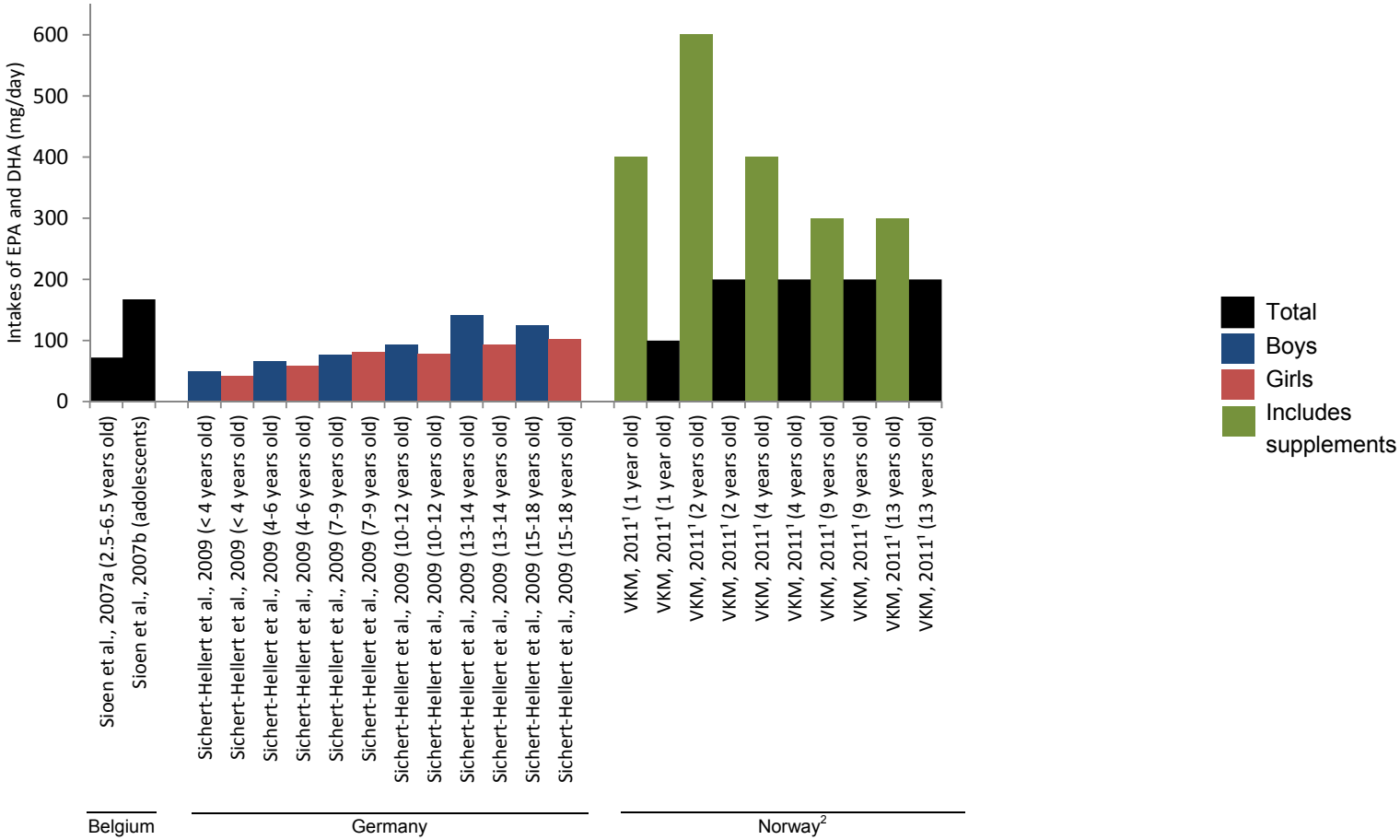
Reference	Years of Study	Study sample	Report Details		Total EPA and DHA (mg/day)				Total EPA, DHA, and DPA (mg/day)			EPA (mg/day)				DHA (mg/day)				Percent Contribution of Dietary Sources
					Mean	Median	P5	P95	Mean	P5	P95	Mean	Median	P5	P95	Mean	Median	P5	P95	
Andersen *et al.*, 1999	1995-1996	119 men working at Orland flight-station military facility, 20-55 yrs of age, West Norway	14-day weighed food records and self-administered FFQ-180 items. FFQ used to estimate intakes of n-3 PUFA	Males	-	740	-	-	-	810	-	-	280	-	-	-	460	-	-	
Johansson *et al.*, 1998	1997	3144 subjects aged 16-79	Self-administered 180-item FFQ	Men (Baseline intakes)	1,000	-	-	-	1,080	-	-	410	-	-	-	590	-	-	-	EPA, DPA, and DHA: 56% fish, 33% cod liver oil, 6% meat, 2% fish oil, 2% other
																				EPA: 55% fish, 39% cod liver oil, 3% fish oil, 3% meat
				Women (Baseline intakes)	670	-	-	-	720	-	-	60	-	-	-	400	-	-	-	DHA: 57% fish, 32% cod liver oil, 4% meat, 2% fish oil, 4% other
																				DPA: 43% fish, 43% meat, 14% cod liver oil
Andersen *et al.*, 1996	Not provided	579 men (n 462) and women (n 117) from 3 intervention trials	180-item quantitative FFQ	Men	940	-	-	-	-	-	-	340	-	-	-	600	-	-	-	Not reported
				Women	540	-	-	-	-	-	-	190	-	-	-	350	-	-	-	
Bønaa *et al.*, 1992	1986 -1987	Tromso study, Northern Norway; 144 subjects: men 20-61yrs, women 20-56 yrs and random sample of 12-19 yrs	2x24-hr recalls, 15 wks apart and self-administered FFQ. 24-hr recall used for n-3 PUFA estimation	Total population	880	460	-	-	920	490	-	310	140	-	-	570	320	-	-	

2.2.1 LCPUFA Intakes in Children and Adolescents

From all the studies reported on LCPUFA intakes in the EU, only 3 examined LCPUFA intakes in children and adolescents, in Belgium and Germany, and further one report on intakes in Norway (the Norwegian report can be further separated into 4 studies). These studies are summarized in Table 2.2-1a and are illustrated in Figure 2.2.1-1, and are discussed in detail in the following sub-sections.

As expected, LCPUFA intakes in childhood increased with age. Intakes in Belgian children and adolescents were slightly greater than those in their German age-matched counterparts, with intakes of EPA and DHA in Belgian children ranging from 65 mg/day in 2.5-3 year olds to 75 mg/day in 4 to 6.5 year olds (Sioen et al., 2007a). In German children intakes were 42 to 49 mg/day in those aged <4 years and were 58 to 66 mg/day in those aged 4 to 6 years (Sichert-Hellert et al., 2009). Intakes of EPA and DHA in Belgian adolescents were 167.3 mg/day (Sioen et al., 2007b), compared to 92 to 141 mg/day in German adolescents (Sichert-Hellert et al., 2009). Intakes for both children and adolescents were reported to be higher for EPA and DHA in Norway, although the data are not directly comparable to those in Belgium and Germany, with mean intakes calculated for EPA, DHA and DPA of 200 mg/day for 2- to 13-year-old children (or 300 to 600 mg/day including supplements) (VKM (2011).

Figure 2.2.1-1 Mean intakes of EPA and DHA from total consumption in children in the EU and Norway



DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid; VKM = Norwegian Committee for Food Safety
[1] Includes intakes of docosapentaenoic acid; [2]Mean intakes of EPA, DHA and DPA for Norway are presented for comparison purposes

2.2.1.1 Belgium

LCPUFA intakes in pre-school children living in Flanders, Belgium were examined by Sioen *et al*. (2007a). In this study, LCPUFA (EPA, DPA, and DHA) for 661 children (338 boys and 323 girls) aged 2.5 to 6.5 years are presented. Dietary intake was assessed through 3-day food diaries, which were completed by the parents. No child took LCPUFA-containing supplements. To determine LCPUFA concentrations of all food items consumed, a specific food consumption database was developed, similar to the method used by Sioen *et al*. (2006) for describing intakes in adult women (Section 2.2.2). EPA intakes were found to be 25 mg/day in all children (0.02% energy), 22 mg/day in 2.5 to 3 year olds (0.01% energy) and 26 mg/day in 4 to 6.5 year olds (0.02%). DHA intakes were 47 mg/day in all children (0.03% energy), 43 mg/day in 2.5 to 3 year olds (0.03% energy) and 49 mg/day in 4 to 6.5 year olds (0.03%). Fish and seafood were the major source of LCPUFA, with fatty fish contributing 53.4% to total EPA and 48.1% to total DHA. These EPA and DHA intakes were low compared to Belgian recommendations for this age group [of 0.05 to 0.15% energy intake from EPA and 0.10 to 0.40% energy intake from DHA (Superior Health Council of Belgium, 2004)]. Based on food composition data it was calculated that two 50 g portions of fatty fish per week are needed to fulfil the requirements for EPA and DHA for pre-school children. However, mean seafood consumption over the 3 days was only 8.6 g/day for the total sample and 27.4 g/day for fish consumers.

Sioen *et al.* also examined the LCPUFA intakes of adolescent subjects aged 13 to 18 years in Sioen *et al*. (2007b). The intakes of 129 boys and 212 girls were assessed *via* 7-day estimated food records. EPA, DHA, and other PUFAs were calculated from a compilation of 7 databases including the Dutch food composition databases, the extended French food composition database, the United States Department of Agriculture (USDA) National Nutrient Database, the UK McCance and Widdowson's food composition database, the Danish Food Composition Database, the Finnish Food Composition Database, and the German Food Composition and Nutrition Table. Data from food producers also were used. The adolescents were reported to have a mean intake of 55.8 mg/day EPA, and 111.4 mg/day DHA. A total of 84.1% of EPA intake came from fish and seafood, which included the contribution of fatty fish (42.4%), lean fish (17.2%), and molluscs and crustaceans (15.7%). Total meat, poultry, and eggs accounted for 10% of the intake of EPA. For DHA, fish and seafood (65.4%) also were the main contributors to total intake, including fatty fish (29.9%), lean fish (16.6%), and half-fatty fish (9.4%). Total meat, poultry, and eggs accounted for another 27.9%. Median intakes were lower at 96.9 mg/day EPA and DHA, with a range of 11.2 (5^{th} percentile) to 603 mg/day (95^{th} percentile).

2.2.1.2 Germany

The intakes of EPA and DHA were examined in German children and adolescents by Sichert-Hellert *et al.* (2009). A total of 1,024 subjects sampled from the DOrtmund Nutritional and Anthropometric Longitudinally Designed (DONALD) Study cohort, aged 2 to 18 years old, completed a 3-day weighed food record. Nutrient intakes were calculated from

an in-house food and nutrient database called “LEBTAB”. LCPUFA intakes were stratified by age categories and by consumers and non-consumers of fish. In the total sample, intakes of EPA plus DHA ranged from 49 to 141 mg/day in males, and 42 to 102 mg/day in females. In non-consumers of fish, these values ranged from 11 to 19 mg/day. In consumers of fish, the intakes of EPA plus DHA were reported to range from 118 to 324 mg/day in males, and 100 to 264 mg/day in females. Furthermore, the authors reported the intakes of EPA and DHA may reach as high as 838 mg/day for male participants aged 13 to 14 years, and as high as 685 mg/day in female participants aged 15 to 18 years on days of fish consumption.

2.2.1.3 Norway

For comparison purposes, intakes of LCPUFA in Norwegian children and adolescents are also included as they were available. In a summary of Norwegian reports published by the Norwegian Scientific Committee for Food Safety (VKM, 2011), 5 study cohorts were analysed for LCPUFA intakes, including 4 related to the intakes of children and adolescents. All nutritional intakes from food and drinks, including those of the LCPUFAs, were based on the Norwegian Food Composition Table of 1995. In the Ungkost cohort of 2000, children aged 9 and 13 years old were enrolled in a 4-day food intake study. Mean EPA, DHA, and DPA intake in 1009 13-year-old subjects was reported as 0.2 g/day (not including supplements) and 0.3 g/day (including supplements). In 9-year-old subjects, mean intake of EPA, DHA, and DPA in 815 participants was also reported to be 0.2 g/day (not including supplements) and 0.3 g/day (including supplements). The Ungkost cohort of 2001 was used to assess dietary intakes of 391 4-year-old children based on a 4-day food intake records. Mean intake of EPA, DHA, and DPA was reported as 0.2 g/day (not including supplements) and 0.4 g/day (including supplements). The Småbarnskost cohort of 1998 and 1999 assessed diet through a semi-quantitative food frequency questionnaire (FFQ) on behalf of 1720 children aged 2 years old (completed by parents/guardians). Mean intake of EPA, DHA, and DPA in these participants was 0.2 g/day (not including supplements) and 0.6 g/day (including supplements). Lastly, a Spedkost cohort of 1998 and 1999 examined intakes of 1,932 1-year-old children by a semi-quantitative FFQ. Mean intake of EPA, DHA, and DPA was determined to be 0.1 g/day (not including supplements) and 0.4 g/day (including supplements).

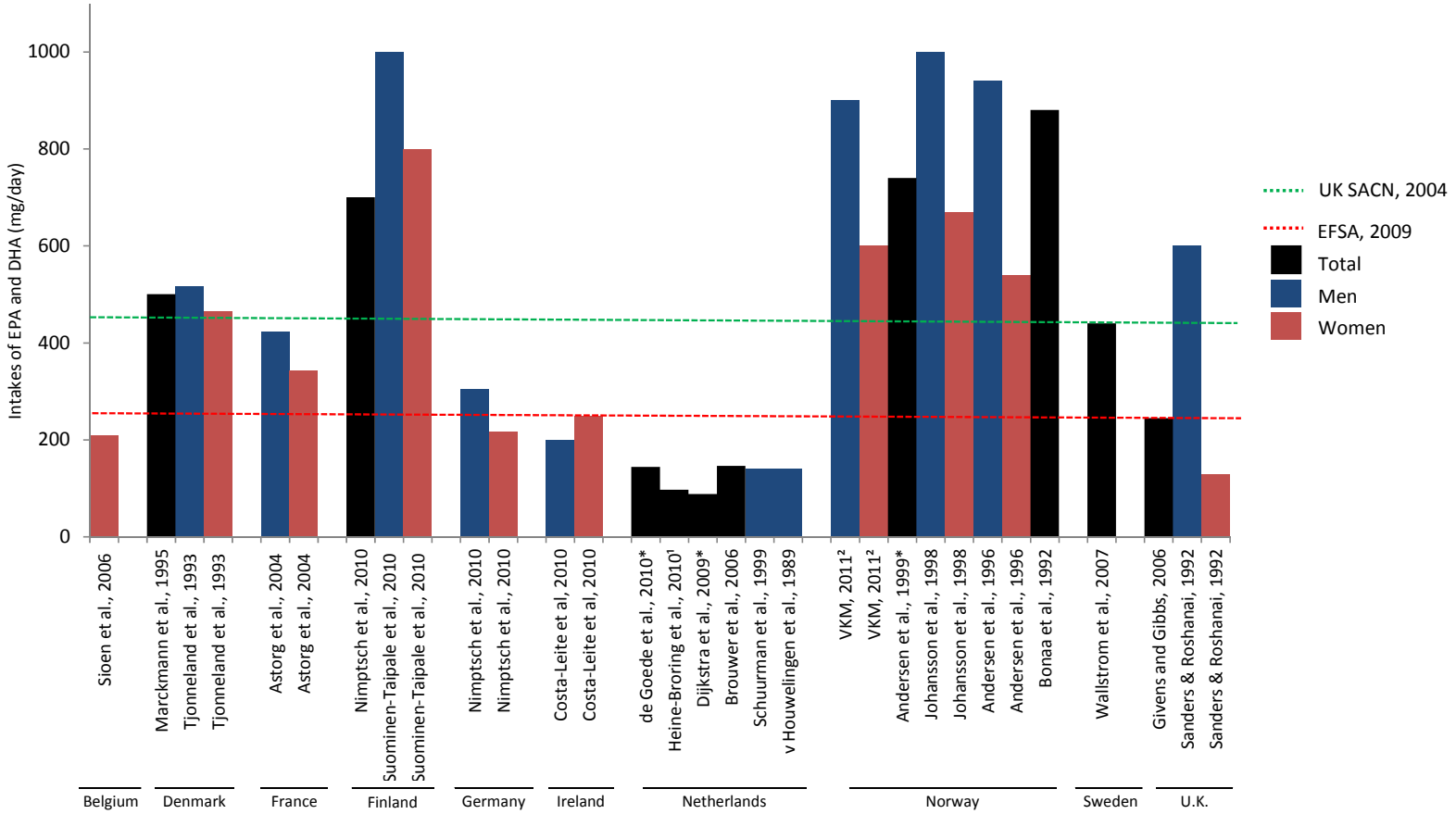
2.2.2 LCPUFA Intakes in European Adults

There are 19 studies that report on LCPUFA intakes for adults in the EU, along with an additional 6 studies in Norway. However, all of these studies were conducted slightly differently, for example, some studies only examined women (Sioen *et al*., 2006; Hedelin *et al*., 2010) or men (v. Houwelingen *et al*., 1989; Schuurman *et al*., 1999; Wallström *et al*., 2007). And some studies used study populations that were not representative of the general population for that country, *e.g*., Marckmann *et al*. (1995) used volunteers from a dietary intervention trial, Tjønneland *et al*. (1993) examined people living in Copenhagen only and Heine-Broring *et al*. (2010) only examined people aged 55 years and older. Furthermore, a

study in the UK examined LCPUFA intakes in vegans compared to omnivores (Sanders and Roshanai, 1992). However, it is possible to provide some generalizations about the range of LCPUFA intakes across the EU, and these intakes are summarized in Table 2.2-1b and are illustrated in Figure 2.2.2-1 and are described in detail per country in the following sub-sections. In general, data are provided as mean intakes, with some studies providing intake data at the 5th and 95th percentiles of intakes.

In women, mean EPA and DHA intakes were found to range from 126.6 mg/day in German women aged 18 to 24 years (Bauch et al., 2006) to 700 mg/day in Finnish women, with an intake of 800 mg/day reported in the wives of Finnish fishermen (Suominen-Taipale et al., 2010). In men, intakes of mean EPA and DHA intake ranged from 140 mg/day in a sub-cohort of Dutch men (Schuurman et al., 1999) to 1000 mg/day in Finnish fishermen (Suominen-Taipale et al., 2010).

Figure 2.2.2-1 Mean intakes of EPA and DHA from total consumption in adults in the EU and Norway



DHA = docosahexaenoic acid; EFSA = European Food Safety Authority; EPA = eicosapentaenoic acid; U.K. = United Kingdom; UK SACN = United Kingdom Scientific Advisory Committee on Nutrition; VKM = Norwegian Committee for Food Safety

* Represents median intakes (mean not available)

[1] In adults 55 years or older; [2] Includes intakes of docosapentaenoic acid

The dashed line represents the recommended intakes of omega-3 fatty acids by EFSA and the SACN.

2.2.2.1 Belgium

Sioen *et al*. (2006) investigated the dietary intakes and food sources of LCPUFA in Belgian women of reproductive age (18 to 39 years). Participants came from Ghent, Flanders and dietary data was collected for 461 women using a 2-day food records during 2002. The Belgian and the Dutch food composition databases were used to calculate the fatty acid contents of food consumed, along with additional information from the composition databases in France, Finland, the UK (McCance & Widdowson's tables – MAFF, 1998), Denmark, Germany, the United States (U.S.) (the USDA national nutrient database) and Canada (the Canadian nutrient file), and from the food industry. In Belgian women, mean intake for EPA was 77.8 mg/day (0.04% energy) and for DHA was 131.2 mg/day (0.06% energy). Intakes at the 95th percentile were 427.7 mg/day EPA and 647.1 mg/day DHA. Total fish and seafood accounted for 87.3% intake of EPA and 80.0% intake of DHA, while meat, poultry and eggs accounted for 5.2% EPA intake and 11.8% DHA intake.

2.2.2.2 Denmark

Intakes of LCPUFA were examined in 2 Danish studies. In the first, Tjønneland *et al*. (1993) evaluated the relationship between the fatty acid composition of fat-tissue biopsies and the dietary intake of fatty acids. This was part of a validation study preceding a prospective study on diet, cancer and health in a random sample of people aged 40 to 64 years in Copenhagen. Dietary intake was assessed using two 7-day weighed food records, and nutrient data were obtained with a computer program based on Danish food tables. The intake of LCPUFA was calculated from detailed Danish food-composition tables for 23 men and 63 women, and it was observed that EPA intake was 258 mg/day in men (0.29% of total fat) and 229 mg/day in women (0.36% of total fat), and that DHA intake was also 258 mg/ day in men (0.29% of total fat) and 236 mg/day in women (0.37% of total fat).

In a second study of LCPUFA intakes of Danish adults (Marckmann *et al*., 1995), 24 healthy volunteers (17 men and 7 women), aged 20 to 29 years, from the control group of a dietary intervention trial participated. Dietary intake data was collected from the volunteers over an 8-month period using three 7-day food records, and from these daily averages were calculated to estimated habitual intakes. Similar to the previous study, nutrient data were obtained with a computer program based on Danish food tables and the intake of LCPUFA was calculated from detailed Danish food-composition tables. For the total sample, habitual EPA was determined to be 260 mg/day and DHA was 240 mg/day, which was similar to the intakes found in the previous study. This study also concluded that consumption of fish (found to be on average 24 g/day) and marine n-3 PUFAs was strongly associated with the DHA content of adipose tissue.

2.2.2.3 France

Astorg *et al*. (2004) examined the dietary intakes and food sources of LCPUFA in French adult men and women. These were estimated in 4884 participants (2099 men aged 45 to 63

years and 2785 women aged 35 to 63 years at baseline) in the SU.VI.MAX intervention trial in 1994-95 with a planned follow up of 8 years. Food intakes from each subject were recorded in at least ten 24-hour record questionnaires, completed over a 2.5-year period. A food composition table adapted for the present study was developed and used to estimate the fatty acid content of foods consumed, along with information from the USDA national nutrient database, UK McCance & Widdowson's food composition tables and original publications (MAFF, 1998). Mean LCPUFA intakes were 497 mg/day in men and 400 mg/day in women, representing 0.21% of total energy intake and consisting of 55% DHA (mean intake of 272.6 mg/day in men and 225.9 mg/day in women) and 30% EPA (mean intake of 149.9 mg/day in men and 117.8 mg/day in women). The main sources of EPA and DHA were fish, seafood, and animal products. Fish and seafood contributed 72 and 65% respectively to these total intakes.

2.2.2.4 Finland

Two study cohorts were used to assess EPA and DHA intakes in Finland (Suominen-Taipale *et al.*, 2010). The nationally representative Health 2000 survey was conducted in 2000-2001 and comprised of 8,208 adults aged 30 years or older. The Fishermen study conducted from 2004-2005 comprised of 309 Finnish fishermen, wives, and other family members. A total of 1288 participants in the Health 2000 survey and 1410 participants from the Fishermen Study were sampled for dietary assessments. The participants completed a validated FFQ containing 128 items and were assessed for nutrient intakes using the Finnish Food Composition Database. From the Health 2000 survey, mean EPA intakes were found to be 200 mg/kg for men and women. DHA intakes were found to be 500 mg/day for men and women. From the Fisherman study, EPA intakes were reported as 300 mg/day in men, and 200 mg/day in women. DHA intakes were 700 mg/day in men, and 600 mg/day in women.

2.2.2.5 Germany

In a recent study, Nimptsch *et al*. (2010) examined LCPUFA intake in the Heidelberg cohort of the European Prospective Investigation into Cancer and Nutrition (EPIC) study. The sample for this analysis comprised of 9182 men (40 to 64 years) and 10,867 women (35 to 64 years) recruited during 1994-1996. Habitual dietary intake was assessed by a validated self-administered 158-item semi-quantitative FFQ. Food coding and calculation of intake of individual fatty acids was carried out using the German Food Code software. Men had significantly greater intakes of both EPA and DHA than women ($p<0.001$). Mean intakes of EPA were found to be 102.6 mg/day and 69.7 mg/day for men and women, respectively, and mean intakes of DHA were found to be 201.3 mg/day and 146.9 mg/day for men and women, respectively.

The dietary intake and sources of LCPUFAs were examined in a nationally representative sample of German adults by Bauch *et al*. (2006). They assessed intakes using the German Nutrition Survey 1998, which used the modified dietary history method to collect dietary data.

The German food code and nutrient database was used to calculate nutrient intakes, including DHA and EPA. The daily intake of DHA and EPA was significantly lower in women than in men, except for the 55 to 64 year age group. For men, the age group with the highest mean EPA and DHA intake was 45 to 54 years (295 mg/day), and those with the lowest intake were aged 25 to 34 years (212 mg/day). For women, the age group with the highest mean EPA and DHA intake was 55 to 64 years (218.9 mg/day), and those with the lowest intake were aged 18 to 24 years (126.6 mg/day). On average, 68% EPA and DHA intake among German adults was provided by fish, and further contributions from eggs (12%), poultry (7%), and meat and sausages (7%).

In another study based on the EPIC study conducted in Germany, 2 cohorts were sampled for dietary intakes of LCPUFA (Linseisen *et al.*, 2003). A total of 1976 women aged 35 to 64 years, and 2045 men aged 40 to 64 years were sampled from the Potsdam and Heidelberg EPIC cohorts. Diet was assessed by a self-administered FFQ and a 24-hour dietary recall, and nutrient intakes were calculated based on the German Nutrient Database. In the Potsdam cohort, the mean intake of EPA was reported as 130 mg/day in men and 80 mg/day in women and DHA intakes of 210 mg/day in men and 140 mg/day in women. The cohort in Heidelberg found slightly lower intakes of LCPUFA, with EPA intakes of 100 mg/day in men and 70 mg/day in women and DHA intakes of 190 mg/day in men and 140 mg/day in women, which were very similar to the intakes found in the more recent analysis of this cohort by Nimptsch *et al*. (2010).

2.2.2.6 Ireland

In an Irish study, Leite *et al*. (2010) quantified the intake of EPA and DHA in a representative sample of Irish adults, using the North South Ireland Food Consumption Survey (NSIFCS). This survey collected detailed dietary information on 662 men and 717 women aged 18 to 64 years during 1997-99 using a 7-day food record. EPA and DHA composition of foods consumed were estimated using a variety of data sources, including brand level information, the Fatty Acid Supplement to McCance & Widdowson 5th Edition (MAFF, 1998) and published references. The total mean intake of EPA and DHA for the population was 275 mg/day (299 mg/day for males and 250 mg/day for females). Younger adults (18 to 35 years) had significantly lower intakes than older adults (51 to 64 years) (187 mg/day *vs*. 386 mg/day, respectively, $p<0.05$). At an individual level, only 15.8% of the total population met the UK SACN recommendation of an intake ≥450 mg/day, but at a population level, 54.1% of the population was found to be in compliance with this recommendation. The majority of EPA and DHA intakes came from fish, fish products and fish dishes (198 mg/day, 72% of total intake). The intakes of meat and meat products, eggs and milk products provided about 70 mg/day which contributed to just over 25% of total EPA and DHA intake.

2.2.2.7 The Netherlands

The intakes of EPA and DHA in the Netherlands were examined in 6 studies, 3 of which examined cohorts from the Rotterdam population-based prospective study. The Rotterdam

Study is a cohort started in 1990, and subsequent follow-up assessments were performed in 1993-94, 1997-99, and 2002-04. Heine-Bröring and colleagues recently examined intakes of fish and marine LCPUFAs from a cohort of the Rotterdam Study (2010). The diets of 1570 subjects aged 55 years or older were assessed by a semi-quantitative FFQ containing 170 items. The intakes of fatty acids were derived from the TRANSFAIR (*Trans*Fatty Acids in Foods in Europe) study. The median EPA and DHA intake was reported to be 97 mg/day. In fish eaters, 83% of the EPA and DHA consumed originated from fish. The intake of fish oil capsules was reported in less than 0.5% of the study participants and did not play a significant impact in the intake analysis

Dijkstra and colleagues recruited 2164 men and 3135 women, aged 55 or older living in the suburb of Rotterdam (2009). Habitual diet was assessed by a dietician-administered validated, semi-quantitative FFQ. Dietary intake data were converted to energy and nutrient intakes using 2003 Dutch Food Composition Tables, and intakes of specific fatty acids were based on values derived from the TRANSFAIR study. In the study population, the median intake of EPA and DHA was 88 mg/day. Mean daily intakes of EPA and DHA were categorized in quintiles, and were 14, 42, 89, 161, and 313 mg/day for the first, second, third, fourth, and fifth quintiles respectively. The authors also noted that less than 0.5% of the population consumed fish oil supplements.

The Rotterdam cohort was recruited again for a study by Brouwer *et al.* (2006). A total of 5184 subjects with no history of atrial fibrillation participated in the study. As with the previous study, diet was assessed by a dietician-administered validated semi-quantitative FFQ, and dietary intake data were converted to nutrient intakes using a computerized Dutch Food Composition Tables. Fatty acid values also were derived from the TRANSFAIR study. The mean intake of EPA and DHA was reported to be 146 mg/day. EPA and DHA intakes were further categorized in tertiles and mean intakes were 19.4, 87.8, and 330 mg/day for the first, second, and third tertiles respectively.

In a more recent study in the Netherlands, conducted by de Goede *et al*. (2010) based on a sample from the Monitoring Project on Risk Factors for Chronic Diseases (MORGEN) Study, information on diet, lifestyle, and cardiovascular risk factors were collected from 1993 to 1997. From the study population, 21,342 participants with no history of myocardial infarction (MI) or stroke were included for analysis. Dietary information was assessed *via* a self-administered 178-item FFQ and was analysed for nutritional intakes based on the Dutch food composition database (NEVO) of 1996 and 2001 for fatty acid values. Median intakes of EPA and DHA in the study population were 114 mg/day. The median and mean intakes also were categorized into quartiles of EPA and DHA intakes and were 40 and 39 mg/day for the first quartile; 84 and 86 mg/day for the second quartile; 151 and 152 mg/day for the third quartile; and 234 and 295 mg/day for the fourth quartile, respectively.

Schuurman and colleagues (1999) conducted an intake study recruiting subjects from a Netherlands Cohort Study (NLCS) conducted in 1986. A total of 1525 men aged 55 to 65 years from across the country were given a self-administered semi-quantitative FFQ

containing 150 items. The mean intake of EPA and DHA in these men was 40 mg/day and 60 mg/day respectively.

Lastly, a Dutch cohort of the Seven Countries Study was sampled by v. Houwelingen *et al.* (1989) for intakes of EPA and DHA. A total of 61 men aged 67 to 82 were assessed for diet by a cross-check dietary history method and nutrient intakes were calculated using the Uniform Food Encoding System. The mean intake of EPA was 64 mg/day and reported values ranged from 0 to 830 mg/day. The mean intake of DHA was 77 mg/day and ranged from 0 to 1020 mg/day. Total fish consumption was 16 g/day.

2.2.2.8 Sweden

Swedish intakes of EPA and DHA were assessed in 2 studies (Wallström *et al.*, 2007; Hedelin *et al.*, 2010). Hedelin and colleagues examined the intakes of 33,623 women aged 30 to 49 years as it related to psychotic-like symptoms. Enrolment occurred over the period of 1991 to 1992, and diet was assessed by a 6-month FFQ administered from 2002 to 2003. Nutrient intake was based on a database generated by the Swedish National Food Administration. Results were stratified according to frequency of psychotic-like symptoms. The mean intakes of EPA, DHA, and DPA were found to range from 260 to 270 mg/day in the study population.

Wallström and colleagues (2007) examined the intake of EPA and DHA from a sample cohort in the Malmö Diet and Cancer study during the period of 1991 to 1996. A total of 10,564 male subjects born between 1923 and 1945 were enrolled in the study. An interview-based modified dietary history method containing 168 items was used to assess diet, and intakes of fatty acid were converted using the Malmö Diet and Cancer nutrient database based primarily on the PC-KOST2-93 database from the National Food Administration of Sweden. Intakes of each nutrient were categorized into quintiles, adjusted for energy intakes. The values of EPA intake were 30, 80, 140, 230, and 440 mg/day for the first, second, third, fourth, and fifth quintiles, respectively, and values of DHA intake were 120, 200, 300, 480, and 860 mg/day for the corresponding quintiles. The intakes of EPA and DHA were also reported as 160, 280, 440, 720, and 1,300 mg/day for the first, second, third, fourth, and fifth quintiles, respectively.

2.2.2.9 United Kingdom (UK)

In the UK, Givens and Gibbs (2006) used data based on intakes of fish, meat and eggs from the National and Diet Nutrition Survey (NDNS) 2001-2002, along with the SACN (2004) and the British Egg Information Service (BEIS, 2005) to estimate intakes of EPA and DHA in adults. Total EPA and DHA intake for the adult population was found to be 244.4 mg/day, and of this 54% came from oil-rich fish and 81.3% from total fish intake. Of all the meats, poultry was found to contribute the most to total intake (10.9%).

In an earlier UK study, LCPUFA intakes were examined in vegans and compared to those of age- and sex-matched omnivore controls (Sanders and Roshanai, 1992). Twenty vegan

subjects were recruited through the Vegan Society, and they had to be following a vegan diet for at least 1 year. Twenty omnivore controls came from the staff and student population of the University of London. All subjects kept a 7-day weighed food intake record and collected duplicate portions of all foods consumed for 3 consecutive days. Nutrient intakes were calculated using the Foodtabs software package which uses McCance & Widdowson composition data (MAFF, 1998). Fatty acids in the duplicate portions were determined by gas-liquid chromatography. Vegans had zero intakes of both EPA and DHA, compared to a mean EPA intake of 210 mg/day in male omnivores and 70 mg/day in female omnivores and DHA intakes of 290 mg/day in male omnivores and 60 mg/day in female omnivores. This is as a result of vegans consuming no foods of animal origin. Also the proportions of EPA and DHA in platelet lipids were much lower in the vegans than in the omnivores. However, platelet function and bleeding time appeared to be normal in vegans.

2.2.2.10 Norway

LCPUFA intakes in Norwegian adults were also included in this report for comparison purposes. Norwegian intakes of EPA and DHA have been examined in 6 studies, including one review report (Bønaa *et al.*, 1992; Andersen *et al*., 1996; Johansson *et al.*, 1998; Andersen *et al.*, 1999; Manger *et al.*, 2010; VKM, 2011). In a summary of Norwegian reports published by the Norwegian Scientific Committee for Food Safety (VKM, 2011), one cohort was analysed for EPA and DHA intakes in adults, while the others were on children and adolescents (Section 2.2.1). All nutritional intakes from food and drinks, including those of the LCPUFA, were based on the Norwegian Food Composition Table of 1995. The Norkost cohort of 1997 consisted of 2672 adults aged 16 to 79 years. A quantitative FFQ was used to determine dietary consumption and the total intakes of EPA, DHA, and DPA were reported as 0.6 g/day (not including supplements) and 0.9 g/day (including supplements).

In Western Norway, the dietary intake of LCPUFA was examined by Manger *et al.* (2010). A total of 2412 subjects >18 years completed a validated semi-quantitative FFQ containing 169 items. Nutrient intakes included those contributed by supplements, and were calculated using Kostberegnings system, a database and software system developed at the University of Oslo. Intakes EPA, DPA, plus DHA were categorized into quartiles, and the mean intakes were reported to be 580, 830, 1360, and 2640 mg/day for quartiles 1 through 4, respectively.

In another study in Norway, Andersen *et al*. (1999) examined fatty acid intakes in 125 healthy men who worked at Orland flight-station, a military facility during 1995-1996, aged 20 to 55 years. Dietary intakes were assessed using 14-day weighed food records. The 14 days were not all consecutive, but split into shorter periods, and the total 14-day period consisted of 10 week days and 4 weekend days (*i.e*., 2 of each day of the week). A postal quantitative FFQ was also completed by the participants, and this FFQ was the basis for the fatty acids intake assessment. Daily intake of nutrients was computed using a Norwegian software and food composition system. From the FFQ, median intake of EPA was found to be 280 mg/day (0.26% total fat), and for DHA was 460 mg/day (0.42% total fat).

In an earlier study, Andersen *et al*. (1996) examined the dietary intake of LCPUFA in a sample of adults participating in 3 different intervention trials (the Skin study, which was a double blind multi-centre study to investigate the link between LCPUFA and dermatitis and psoriasis; the ODES study, which was a randomized trial investigating the effects of different diet and exercise regimens; and the SHOT study, which was a randomized, prospective, controlled trial to investigate the effects of LCPUFA supplementation in patients undergoing coronary artery bypass grafting). A 180-item FFQ was used to assess the habitual food intake, and nutrient intakes were analysed using databases and software based on the official Norwegian Food Table. Cod liver oil was included in the nutrient calculations. Fatty acids intakes were calculated for 462 men and 117 women. EPA intake was 340 mg/day (0.43% total fat) in men and 190 mg/day (0.32% total fat) in women and DHA intake was 600 mg/day (0.75% total fat) in men and 350 mg/day (0.56% total fat) in women. This study observed a significant correlation between dietary intake of LCPUFA and the corresponding fatty acids in plasma phospholipids.

Johansson *et al.* (1998) examined the intakes of LCPUFA in Norway through a national dietary survey (NORKOST). A total of 3144 subjects aged 16 to 79 years completed a self-administered quantitative FFQ containing 180 items. The intakes of the LCPUFA were calculated from the Norwegian food composition table of 1995. The mean intakes of EPA, DHA, and DPA were 330, 490, and 70 mg/day, respectively. The mean intake of these LCPUFA was reported to be 890 mg/day. Fish and cod liver oil contributed to 56% and 33% of the total intake of LCPUFA, respectively. Furthermore, the mean intake of fish was reported to be 67 g/day.

Lastly, in a study in Tromso, Norway, Bønaa *et al*. (1992) investigated LCPUFA intakes of 144 people aged 12 to 61 years (mean age 48.5 years). Dietary intake was assessed through 2 unannounced standardised 24-hour dietary recalls. Only 10.5% of subjects reported that they consumed fatty fish more than once a week. Fish consumption was found to increase with age. Mean EPA intake was 310 mg/day and for DHA was 570 mg/day. For both, mean intakes increased significantly with increased intake of fish dishes per week ($p=0.0003$).

2.3 LCPUFA FROM FISH INTAKES IN THE EU

Along with studies that have estimated intakes of LCPUFA from the total diet, certain studies have focused on LCPUFA intakes based on fish intake only, as fish, in particular oily-fish, is a major contributor to total EPA and DHA intakes (usually >60% of total intakes) when contributions from natural sources only are examined. The LCPUFA content of fish varies widely, fresh water fish contain very little, whereas oceanic cold water fish may be rich in EPA and DHA. In most developed countries with the so-called 'Western' diet, the intake of LCPUFA is low owing to low-fish consumption (Sanders, 2000). In an investigation into fish intakes in different regions in Europe (García-Closas *et al*., 1993), the authors found that Spain had the highest intake of fish, along with Norway and Denmark, and that Italy and former Yugoslavia had lower intakes. Intakes of fish and seafood in Ireland is 24 g/day for

women and 30 g/day for men (Leite *et al*., 2010), in the UK is 31 g/day for the total population (SACN, 2004), in Poland is 14 g/day for the total population (Kolanowski, 2008), in Germany is 16 to 20 g/day for women and 16 to 24 g/day for men and in the Netherlands is 13 g/day for women and 18 g/day for men (Welch *et al*., 2002). Even within a country, fish consumption can vary widely, whereby coastal communities are often reported as having greater intakes than inland areas (Bemrah *et al*., 2009). However, whether presumed benefits often attributed to fish consumption can be based on their LCPUFA content or on other associated factors remains uncertain, and has been the focus of many studies in Europe. Some of these studies are presented in Table 2.3-1, and a detailed description of each of these reports is now presented.

In total, 11 studies reported on LCPUFA intakes from fish and seafood in the EU. These were based on populations in Denmark (1 study), Finland (3 studies), France (1 study), the Netherlands (3 studies), Spain (1 study) and Sweden (1 study). There also was a study that examined 7 EU centres (Augood *et al*., 2008). A further 2 studies were identified from Norway. As with the studies that reported on LCPUFA intakes from all sources, described in Section 2.2.2, some of the studies described here focused on only a particular demographic group (*e.g.*, women only examined by Järvinen *et al*., 2006, and men only examined by Levitan *et al*., 2009). Also, 1 study in France, did not examine intake of fish at the individual level, but rather used reported *per capita* and seafood production figures as the basis for their study.

When LCPUFA intakes from fish only was examined, most studies divided their sample into groups of fish consumption (i.e., based on grams per day or number of fish servings per week), and examined LCPUFA intake across these groups. Based on fish consumption only, intakes of LCPUFA were found to range from 92 mg/day EPA and DHA in low fish consumers (4.9 g/day) in Finland (Anttolainen et al., 1996) to 1,820 mg/day related to intakes of >2 servings of fatty fish per week in Sweden (Levitan et al., 2009). It is important to note that in general fish intakes, in particular oily fish intakes, are low across the EU and the lowest LCPUFA intake of only 14.7 mg/day EPA and DHA was observed in a group of non-fish consumers in Dutch men (van Gelder et al., 2007).

Table 2.3-1 Intakes of Omega-3 Polyunsaturated Fatty Acids from Fish Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details	Fish consumption	EPA and DHA (mg/day)				EPA, DHA and DPA (mg/day)			EPA (mg/day)			DHA (mg/day)			Study observations
					Mean	Median	P5	P95	Mean	P5	P95	Mean	P5	P95	Mean	P5	P95	
Europe (7 centres)																		
Augood *et al.*, 2008	2007	EUREYE study - cross sectional population-based study in 2275 adults greater than 65 yrs in 7 centres in Europe.	Semi-quantitative FFQ - from the EPIC study	< 1 serving oily fish/week	137.8	-	-	-	-	-	-	43.6	-	-	94	-	-	
				1 serving oily fish/week	290.7	-	-	-	-	-	-	97.8	-	-	192.8	-	-	
				2+ serving oily fish/week	686.3	-	-	-	-	-	-	230	-	-	456.1	-	-	
Denmark																		
Joensen *et al.*, 2010	1993-1997	53,803 adults (24,786 men, 29,017 women) aged 50 to 64	FFQ containing 192 food items	Men	-	-	-	-	690	-	-	180	-	-	430	-	-	Intakes calculated from fish, but not supplements
				Women	-	-	-	-	570	-	-	150	-	-	360	-	-	
Finland																		
Montonen *et al.*, 2009	1966-1972	10,054 adults aged 15 years or older	Dietary history interview; 100 food items and mixed dishes common in the Finnish diet; food composition data on fatty acids were completed using values from Finnish foods	1st quartile	124	-	-	-	-	-	-	-	-	-	-	-	-	Fatty acid intake calculated from all sources and presented according to fish intake
				2nd quartile	222	-	-	-	-	-	-	-	-	-	-	-	-	
				3rd quartile	350	-	-	-	-	-	-	-	-	-	-	-	-	
				4th quartile	728	-	-	-	-	-	-	-	-	-	-	-	-	
Järvinen *et al.*, 2006	1966-1972	2775 men and 2445 women aged 30 to 79 free of chronic heart disease	Dietary history interview method; preformed questionnaire listing more than 100 foods and food groups, including 26 different fish items	**Men**														
				1st quintile	150	-	-	-	-	-	-	-	-	-	-	-	-	
				2nd quintile	240	-	-	-	-	-	-	-	-	-	-	-	-	
				3rd quintile	340	-	-	-	-	-	-	-	-	-	-	-	-	
				4th quintile	480	-	-	-	-	-	-	-	-	-	-	-	-	
				5th quintile	930	-	-	-	-	-	-	-	-	-	-	-	-	
				Women														
				1st quintile	110	-	-	-	-	-	-	-	-	-	-	-	-	

Table 2.3-1 Intakes of Omega-3 Polyunsaturated Fatty Acids from Fish Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details	Fish consumption	EPA and DHA (mg/day)				EPA, DHA and DPA (mg/day)			EPA (mg/day)			DHA (mg/day)			Study observations
					Mean	Median	P5	P95	Mean	P5	P95	Mean	P5	P95	Mean	P5	P95	
				2nd quintile	160	-	-	-	-	-	-	-	-	-	-	-	-	
				3rd quintile	220	-	-	-	-	-	-	-	-	-	-	-	-	
				4th quintile	300	-	-	-	-	-	-	-	-	-	-	-	-	
				5th quintile	550	-	-	-	-	-	-	-	-	-	-	-	-	
Anttolainen *et al.*, 1996	Spring 1992	Large survey of Finnish adults from 4 areas (East, Southwest and Southern Finland). Adults aged 25-64 years, 82 subjects selected for current study	3-day food record and a quantitative FFQ	Low fish consumers (n 41): 4.9 g/d	92	-	-	-	-	-	-	30	-	-	62	-	-	A very high fish diet was found to be more pro-oxidant than a low-fish diet
				High fish consumers (n 41): 103 g/d	1000	-	-	-	-	-	-	310	-	-	690	-	-	
France																		
Bourre and Paquotte, 2008	2005	Annual estimates of fisheries and farming production in France. DHA examined	Total seafood in France examined - average yearly consumption per inhabitant	Total fish consumption	-	-	-	-	-	-	-	-	-	-	187.04	-	-	DHA intakes from fish only
Bemrah *et al.*, 2009	2004	CALIPSO study - 1,011 adults with at least 2 servings of fish or seafood per week	Interviewer-administered FFQ containing 82 fishes, molluscs, crustaceans, and seafood-based dishes;	Men (18 to 64 years)	-	-	-	-		-	-	419-517	-	-	739-960	-	-	Contribution of the total intake of n-3 PUFA (including ALA, EPA, DPA, and DHA) from fish: 26.6% from salmon, 11.5 from mackerel, 9.53% from sardine, 4.85% from anchovy, etc
				Women (18 to 64 years)	-	-	-	-		-	-	403-509	-	-	713-885	-	-	
				Adults (older than 64 years)	-	-	-	-		-	-	388-693	-	-	686-1,164	-	-	
				Women (18 to 44 years)	-	-	-	-		-	-	389-472	-	-	678-837	-	-	

Table 2.3-1 Intakes of Omega-3 Polyunsaturated Fatty Acids from Fish Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details	Fish consumption	EPA and DHA (mg/day)				EPA, DHA and DPA (mg/day)			EPA (mg/day)			DHA (mg/day)			Study observations
					Mean	Median	P5	P95	Mean	P5	P95	Mean	P5	P95	Mean	P5	P95	
Netherlands																		
de Goede *et al.*, 2010	1993-1997	MORGEN Study - 22,654 adults aged 20-65 years	Self-administered FFQ containing 178 items	1st quartile (DHA and EPA intake)	-	13	-	-	-	-	-	-	-	-	-	-	-	Intakes of EPA and DHA from fish sources
				2nd quartile (DHA and EPA intake)	-	53	-	-	-	-	-	-	-	-	-	-	-	
				3rd quartile (DHA and EPA intake)	-	117	-	-	-	-	-	-	-	-	-	-	-	
				4th quartile (DHA and EPA intake)	-	255	-	-	-	-	-	-	-	-	-	-	-	
				1st quartile (fish)	-	39	-	-	-	-	-	-	-	-	-	-	-	Intakes of EPA and DHA from all sources, stratified by fish intake
				2nd quartile (fish)	-	82	-	-	-	-	-	-	-	-	-	-	-	
				3rd quartile (fish)	-	148	-	-	-	-	-	-	-	-	-	-	-	
				4th quartile (fish)	-	228	-	-	-	-	-	-	-	-	-	-	-	
Streppel *et al.*, 2008	1985 cohort. Follow up 1990, 1995, 2000	Zutphen study - longitudinal study, 825 men	Cross-check dietary history	Total1985 = 17 ± 19 g/d	173	-	-	-	-	-	-	-	-	-	-	-	-	Inverse association between fish consumption, EPA and DHA from fish and CHD death risk
				Total 1990 = 16 ± 20 g/d	142	-	-	-	-	-	-	-	-	-	-	-	-	
				Total1995 = 19 ± 19 g/d	193	-	-	-	-	-	-	-	-	-	-	-	-	
				Total 2000 = 21 ± 21 g/d	186	-	-	-	-	-	-	-	-	-	-	-	-	
van Gelder *et al.*, 2007	1990 and 1995	Zutphen Elderly prospective cohort study, Eastern Netherlands, 210	Cross-check dietary history	No consumption	14.7	-	-	-	-	-	-	-	-	-	-	-	-	Fatty acid intake calculated from all sources and presented
				Low (0-20 g/day)	126.1	-	-	-	-	-	-	-	-	-	-	-	-	

Table 2.3-1 Intakes of Omega-3 Polyunsaturated Fatty Acids from Fish Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details	Fish consumption	EPA and DHA (mg/day)				EPA, DHA and DPA (mg/day)			EPA (mg/day)			DHA (mg/day)			Study observations
					Mean	Median	P5	P95	Mean	P5	P95	Mean	P5	P95	Mean	P5	P95	
		men, 75-94 yrs		High (>20 g/day)	346.8	-	-	-	-	-	-	-	-	-	-	-	-	according to fish intake
Spain																		
Amiano *et al.*, 2001	1992-1995	EPIC cohort of Gipuzkoa, Basque region, 120 subjects aged 35 to 65 yrs	Dietary history questionnaire	Occasional (<31 g/day)	240	-	-	-	-	-	-	50	-	-	190	-	-	Concentrations of VLV n-3 PUFA are useful biomarkers
				Low (32 to 64 g/day)	570	-	-	-	-	-	-	130	-	-	440	-	-	
				Moderate (65 to 115 g/day)	790	-	-	-	-	-	-	210	-	-	580	-	-	
				High (> 115 g/day)	1170	-	-	-	-	-	-	320	-	-	850	-	-	
Sweden																		
Levitan *et al.*, 2009	1997-1998	39,367 men aged 45-70 years	Self-administered FFQ containing 96 items	Never	130	-	-	-	-	-	-	-	-	-	-	-	-	Intake calculated from fish intake and supplements (if taken)
				< 1 serving/ week	270	-	-	-	-	-	-	-	-	-	-	-	-	
				1 serving/ week	430	-	-	-	-	-	-	-	-	-	-	-	-	
				2 servings/ week	740	-	-	-	-	-	-	-	-	-	-	-	-	
				> 2 servings/ week	1,820	-	-	-	-	-	-	-	-	-	-	-	-	
Norway																		
Hjartåker *et al.*, 1997	1995	234 women aged 40-42	Semi-quantitative FFQ	Women	710	450	-	-	-	-	-	300	-	-	410	-	-	Intakes calculated from fish intake and supplements (if taken).

Table 2.3-1 Intakes of Omega-3 Polyunsaturated Fatty Acids from Fish Consumption in the EU and Norway

Reference	Years of Study	Study sample	Report Details	Fish consumption	EPA and DHA (mg/day)				EPA, DHA and DPA (mg/day)			EPA (mg/day)			DHA (mg/day)			Study observations
					Mean	Median	P5	P95	Mean	P5	P95	Mean	P5	P95	Mean	P5	P95	
Bønaa *et al*., 1992	1986 - 1987	Tromso study, Northern Norway; 144 subjects: men 20-61yrs, women 20-56 yrs and random sample of 12-19 yrs	2x24-hr recalls, 15 wks apart and self-administered FFQ. 24-hr recall used for n-3 PUFA estimation	< 2 dishes of fish/week	470	-	-	-	-	-	-	160	-	-	310	-	-	
				2 dishes of fish/week	550	-	-	-	-	-	-	180	-	-	370	-	-	
				3 dishes of fish/week	1090	-	-	-	-	-	-	390	-	-	700	-	-	
				4 or more dishes of fish/week	1570	-	-	-	-	-	-	580	-	-	990	-	-	
				Total	880	-	-	-	-	-	-	310	-	-	570	-	-	

EPA = eicosapentaenoic acid; DHA = docosahexaenoic acid; DPA = decosapentaenoic acid; FFQ = food frequency questionnaire; P5 = 5th percentile; P95 = 95th percentile

2.3.1 Europe

In a multi-centre on risk factors for maculopathy and macular degeneration in elderly European populations – the EUREYE study, Augood *et al*. (2008) investigated the association of oily fish and dietary DHA and EPA with neovascular age-related macular degeneration (NV-AMD). The EUREYE study is a cross-sectional population-based study in people aged ≥65 years in 7 countries located from North to South Europe. Dietary assessment used a modified version of the EPIC FFQ. EPA and DHA composition were estimated using the USDA tables. Information on fish oil and LCPUFA supplements was recorded. Dietary intake data and fundus images were available for 105 cases with NV-AMD and for 2170 controls. Oily fish was consumed less than once per week by 64% of the study population, once per week by 25% and twice per week by 12%. Dietary EPA and DHA were strongly associated with fish intake, with 137.8 mg/day of EPA and DHA in participants who consumed oily fish less than once per week and 686.3 mg/d EPA and DHA in those who consumed oily fish at least twice per week. Eating oily fish at least once per week compared with than less than once per week was associated with a halving of the odds of the risk of NV-AMD. Compared with the lowest quartile, there was a significant trend for decreasing odds with increasing quartiles of either DHA or EPA.

2.3.2 Denmark

A cohort sample from the Diet, Cancer and Health cohort conducted in Denmark examined the dietary patterns of 24,786 men and 29,875 women aged 50 to 64 years between 1993 and 1997 (Joensen *et al.*, 2010). Participants completed a detailed validated FFQ containing 192 items (including 28 fish items) and the intakes of marine EPA, DHA, and DPA was assessed by "FoodCalc", based on Danish food composition tables. Insufficient information on the intake of fish oil capsules were reported, thus they were not included in the assessment. Mean total intake of LCPUFA was 700 mg/day in men and 570 mg/day in women from marine sources only. The 25th and 75th percentiles also were stated as being 470 and 1000 mg/day in men, and 380 and 830 mg/day in women. The breakdowns of EPA, DHA, and DPA revealed median intakes of 180, 430, and 80 mg/day in men, and 150, 360, and 60 mg/day in women, respectively.

2.3.3 Finland

Montonen and colleagues assessed Finnish intakes in 3958 subjects aged 15 or older who completed the same dietary history interview (2009). The aim of the study was to investigate the relationship between the consumption of different types of fish and the subsequent incidence of cerebrovascular disease (CVA) Food composition of fatty acids was computed from analysed values of Finnish foods, and results were categorized according to quintiles of fish intakes. In the lowest quintile, intake of EPA and DHA were reported as 124 g/day. In the highest quintile, intake of EPA and DHA were 728 g/day. Overall, the mean dietary intake of EPA and DHA for the study population was 350 to 358 g/mol.

In an earlier study by the same research group, Järvinen and colleagues examined the intake of LCPUFA in Finnish adults (2006). A total of 2775 men and 2445 women aged 30 to 79, without any previous diagnosis of heart disease, were included in the study. Habitual food consumption was assessed by a dietary history interview method containing 100 foods, 26 of which were fish items. The Finnish food composition tables were used to compute nutrient intakes. The dietary intake of EPA and DHA were categorized into quintiles of fish intakes. In the lowest quintile, subjects consuming 11 g/day of fish or less took in an average of 150 mg/day of EPA and DHA. In the highest quintile, subjects consuming 41 g/day or more of fish took in an average of 550 mg/day of EPA and DHA.

In a sample of Finnish adults, Anttolainen *et al*. (1996) investigated the fatty acid profile of the diets of adults aged 25 to 64 years who consumed either a low-fish diet (intake of 4.9±12.3 g/day) or a high-fish diet (intake of 103±74.1 g/day). There were 41 subjects in each group, matched for age and sex. Total dietary intake was assessed through a 3-day food record, and Finnish food and nutrient databases were used to estimate fatty acid intakes. No fish-oil supplements were consumed by the subjects. EPA intake was estimated to be significantly lower in the low-fish group (30±32 mg/day) than in the high-fish group (310±210 mg/day) ($p<0.001$). Similarly, DHA intake was also significantly lower in the low-fish group (62±57 mg/day) than in the high-fish group (690±540 mg/day) ($p<0.001$). Dietary fatty acid intakes in both groups were also reflected in the plasma fatty acid profile; EPA and DHA were 2- and 1.5-fold higher, respectively, in the high-fish than the low-fish group.

2.3.4 France

French intakes of LCPUFA from seafood were examined in a study conducted in the coastal regions of Havre, Lorient, La Rochelle, and Toulon (Bemrah *et al.*, 2009). Participants were sampled from the Consommations ALimentaires de poissons et produits de la per et Imprégation aux éléments traces, PolluantS et Oméga 3 (CALIPSO) study examining intakes of high fish and seafood consumers. Subjects were excluded from the study if they did not eat fish or seafood, or did not consume seafood at least twice weekly. A validated interview-administered FFQ containing 82 fish and seafood dishes were collected and intakes of lipids and fatty acids were assessed by sampling 824 local products to generate a 138-item composition database. Average EPA intakes derived from fish ranged from 419 to 517 mg/day for adult males and 403 to 509 mg/day for adult females. DHA intakes were 739 to 960 mg/day for adult men and 713 to 885 mg/day for adult women. In adults older than 64 years, EPA intakes ranged from 388 to 693 mg/day, and DHA intakes ranged from 686 to 1164 mg/day. Though cod was the highest reported consumed fish by the high seafood consumers, the highest contributor to LCPUFA intake was salmon at 26.6%, followed by mackerel at 11.5%.

The contribution of seafood to the French recommended daily intakes of DHA was examined by Bourre and Paquotte (2008). Production data were taken from the annual estimates of fisheries and farming production, including import and export data. The consumption of fish

per French inhabitant was determined using these data and French tables of edible consumption, and DHA in seafood was calculated using composition tables, the USDA database, published laboratory data, and various other publications. The total DHA intake from all individual fish species was 187.04 mg/day. The greatest contributors to DHA intakes were salmon, sardines, mackerel, herring, anchovy, tuna, trout, Alaskan Pollack, and cod. It is assumed that these data are underestimates of true DHA intake from fish in France, as not all seafood consumed in France was examined (as approximately 23% of seafood not included in official statistics). But composition data will have overestimated intakes, as factors such as wastage, processing and cooking were not taken into account.

2.3.5 The Netherlands

In a recent study in the Netherlands, de Goede *et al.* (2010) examined the intakes of EPA and DHA in 22,654 adults aged 20 to 65 years sampled from the MORGEN Study (discussed previously in Section 2.2). Intakes of EPA and DHA specifically from fish were stratified according to quartiles of EPA and DHA intakes and were reported as 13 mg/day in the lowest quartile, and 255 mg/day in the highest quartile. The total mean intake of EPA plus DHA from the total diet was reported as 114 mg/day.

Streppel *et al*. (2008) assessed the relationship between fish consumption, EPA and DHA intake from fish and coronary disease in the Netherlands. Data from the Zutphen cohort study was examined, which has collected data among middle-aged men since 1960, with follow up studies and an extension to the cohort in 1985. Information on habitual food consumption was collected by the cross-check diet history method, which reports on the participant's habitual food intake. The daily intake of EPA and DHA from fish was calculated using Dutch food composition tables. Participants were grouped into 3 groups according to their recent and long-term intake of EPA and DHA from fish: 0 mg/day, 0 to 250 mg/day and >250 mg/day. The percentage of fish consumers varied between 71 and 81% between 1960 and 2000, and average fish consumption ranged from 16 to 21 g/day. Average EPA and DHA intake from fish varied between 136 and 236 mg/day in the same period. Long-term fish consumption was inversely associated with CHD death. However there was no clear dose-response relationship between EPA and DHA intake and CHD death.

van Gelder *et al*. (2007) also examined participants in the Zutphen cohort study, however this study only examined the most elderly participants *i.e.,* 210 people aged 70 to 89 years old, and focused on the relationship between fish consumption, intake of EPA and DHA from fish and other foods, and subsequent 5-year cognitive decline. The Mini-Mental State Examination (MMSE) was used as a screening test to assess global cognitive functioning. Fish consumption was divided into 3 groups: 0 g/day, 0 to 20 g/day and >20 g/day, and EPA and DHA intakes from the total diet were compared across these groups. Recently available data on the content of EPA and DHA in fish and seafood, other animal foods (eggs and meat) and in plant foods (vegetables and cereal-based products) were used. EPA and DHA intakes increased significantly from non-fish consumers (24% 14.7 mg/day) to fish consumers >20 g/day (35% 346.8 mg/day), $p<0.001$. Fish consumers had significantly less

5-year cognitive decline than non-consumers (p=0.01), and a linear relationship was observed between the intake of EPA and DHA and cognitive decline (p=0.01). The authors concluded that an intake of approximately 400 mg/day EPA and DHA (about 6 servings of lean fish per week or 1 serving of fatty fish per week) was associated with less subsequent cognitive decline in elderly men.

2.3.6 Spain

In the EPIC cohort of Gipuzkoa in Northern Spain, Amiano *et al*. (2001) assessed the relationship between habitual fish intake and fatty acid levels. The sample included 120 healthy volunteers, 35 to 65 years old, and was divided into groups based on fish consumption – 'occasional' (<31g/day), 'low' (32 to 64 g/day), 'moderate' (65 to 115 g/day) and 'high' (>115 g/day), and fatty acid intakes and amount present in serum were compared across these groups. Total LCPUFA intake increased significantly from low-fish intake (1 g/day) to high-fish intake (2.1 g/day), p<0.001. Both EPA and DHA also increased significantly across the fish intake categories, from 0.05 g/day and 0.19 g/day, respectively in the low-fish category to 0.32 g/day and 0.85 g/day, respectively in the high-fish category (p<0.001). Habitual fish intake was also reflected in the content of LCPUFA in serum and in low-density lipoprotein (LDL) fractions of serum phospholipids and cholesteryl esters.

2.3.7 Sweden

In Sweden, Levitan and colleagues (2009) examined marine LCPUFA intakes in 39,367 men aged 45 to 79 years. Diet was assessed through a self-administered FFQ, and nutritional intake was calculated using food composition data from the Swedish National Food Administration. EPA and DHA intakes were estimated from food and supplement sources, assuming 0.3 g of EPA and DHA per supplement capsule. Data were categorized according to frequency of fish intake. Subjects who reported no consumption of fatty fish had a mean EPA and DHA intake of 130 mg/day, whereas subjects consuming 3 or more servings of fatty fish per week had an intake of 1820 mg/day.

2.3.8 Norway

Intakes of LCPUFA from Norwegian-based studies that only examined fish intakes were also included for comparison purposes. Hjartåker and colleagues examined the intake of fatty acids in 234 women aged 40 to 42 years living in Norway (1997). The habitual consumption of fish, and fish products including cod liver oil were assessed in a self-administered semi-quantitative FFQ. Dietary intakes were calculated using fatty acid values from the Norwegian Food Table and recipes from some fish dishes not included in the database. Furthermore, the intake of fatty acids from some fish oil supplements were estimated based on units of cod liver oil. The median intake of EPA from all marine food items and supplements was 180 mg/day (mean intake of 300 mg/day), and the median intake of DHA was 270 mg/day (mean intake of 410 mg/day).

In a study in Tromso, Norway, Bønaa *et al.* (1992) investigated the fatty acid and fish intakes of 144 people aged 12 to 61 years (mean age was 48.5 years). Dietary intake was assessed through 2 unannounced standardised 24-hour dietary recalls. Only 10.5% of subjects reported that they consumed fatty fish more than once a week. Fish consumption was found to increase with age. Habitual fish consumption was divided into 4 groups: <2 fish dishes per week (n=22), 2 fish dishes per week (n=50), 3 fish dishes per week (n=51), and ≥4 fish dishes per week (n=21). Both EPA and DHA intakes increased significantly as the number of fish dishes increased (p=0.0003 for both). Mean EPA intakes ranged from 160 mg/day for those who consumed <2 fish dishes per week to 580 mg/day for those who consumed ≥4 fish dishes per week, and mean intakes of DHA ranged from 310 mg/day for those who consumed <2 fish dishes per week to 990 mg/day for those who consumed ≥4 fish dishes per week.

2.4 LCPUFA INTAKES AND ASSOCIATION WITH DISEASE RISK

The beneficial effects of LCPUFA on human health, particularly with respect to cardiovascular health, have been widely studied. Therefore, food guidelines recommend regular fish consumption in the general population as a main source of LCPUFA. For primary and secondary prevention of coronary heart disease 0.25 and 1 g per day of n-3 LCPUFA, respectively, are deemed to be adequate, whilst up to 3 g per day are considered to be safe (EFSA, 2010). Many studies have been conducted with high-dose fortified sources of LCPUFA, including supplements, to investigate the potential beneficial effects at relatively high intakes, which are often not achievable through diet alone. However, there are some studies which have focused on assessing the link with LCPUFA from the diet alone and risk of diseases in European populations. These studies form the basis of this section and the studies presented in Table 2.4-1.

Overall, from the available studies that have examined the link between dietary intakes of LCPUFA, fish and disease risk (such as CVD, asthma and mental illness), it appears that the majority of associations observed were non-significant. This would imply that the levels of EPA and DHA intakes in the diet in Europe are generally not at high enough dose-levels to produce significant quantifiable associations with disease risk, thereby consolidating the evidence that supplementing natural dietary intakes of LCPUFA either through food supplements or through fortification of the food supply is necessary for beneficial effects on disease risk.

Table 2.4-1 Intakes of Omega-3 Polyunsaturated Fatty Acids and Disease Risk in the EU						
Reference	**Years of Study**	**Study sample**	**Food intake assessment**	**Aim of study**	**Study endpoints**	**Study results**
Netherlands						
de Goede *et al.*, 2010	1993-97	MORGEN study - Prospective cohort, 21,342 subjects, men and women aged 20-65 yrs	Self-administered 178-item FFQ	Investigate the dose-response relations of habitual intake of EPA and DHA intake and fish on fatal CHD and fatal and non-fatal MI	Relative risks of fatal CHD and fatal and non-fatal MI in quartiles of EPA, DHA and total fish intake	Median intakes in quartiles of EPA and DHA were 40, 84, 151 and 234 mg/d. Compared with the lowest quartile of EPA and DHA, subjects in the top quartile had a 49% lower risk of fatal CHD and a 62% lower risk of fatal MI. Results were similar for fish consumption
van de Rest *et al.*, 2010	2006	Alpha Omega Trial baseline data.644 men (n=500) and women (n=144) 60-80 yrs with history of MI within past 10yrs.	203-item FFQ	Examine association of mental well-being with EPA and DHA and fish intake in a population with a history of CHD	Depressive symptoms (Geriatric depression scale) and dispositional optimism	At baseline, median intakes of EPA were 50 mg/day in men and 50 mg/day in women, and of DHA were 90 mg/day in men and 70 mg/day in women. Median total fish intake was 15 g/day. Compared with lower tertile, subjects in the higher tertile of EPA and DHA intake had a lower prevalence of depressive symptoms, but not statistically significant.
Devore *et al.*, 2009	1990-93, follow up in 1993-94, 1997-99, 2002-04	Rotterdam Study population-based cohort, 5395 subjects >55yrs, free of dementia at baseline	Validated semi-quantitative FFQ, 170-items	To study the dietary consumption of fish and omega-3 PUFAs in relation to long-term dementia risk	Diagnosis of dementia	During average follow-up of 9.6yrs dementia developed in 8.6% subjects. Total fish intake and dietary intakes of omega-3 PUFA were unrelated to dementia risk
Portugal						
Lopes *et al.*, 2007		Case subjects were patients of Cardiology Dept of a hospital in Porto with a diagnosis of first acute MI (n=297 men). Population controls from households in hospital catchment area (n=310 men)	Validated semi-quantitative 82-item FFQ	To investigate the role of fatty acids in nonfatal acute MI	Fatty acid intake in case *vs*. control subjects	EPA intake in cases was 166 mg/day (0.212% total fat) and in controls was 159 mg/day (0.199% total fat) (p=0.248). DHA intake in cases was 360 mg/day (0.459% total fat) and in controls was 359 mg/day (0.43% total fat) (p=0.219). The association of PUFA with risk of acute MI was non-significant after adjustment for energy intake and confounders.

Table 2.4-1 Intakes of Omega-3 Polyunsaturated Fatty Acids and Disease Risk in the EU						
Reference	**Years of Study**	**Study sample**	**Food intake assessment**	**Aim of study**	**Study endpoints**	**Study results**
Barros *et al.*, 2011		Cross-sectional study of 174 patients >16 years old attending an outpatient Asthma and Allergy clinic with a medical diagnosis of asthma	Validated semi-quantitative 86-item FFQ	To investigate the association between fatty acids and asthma control, measured by symptoms, lung function and airway inflammation	Improved asthma control	Median EPA intake in subjects with controlled asthma (n=40) was 120 mg/day, while it was 90 mg/day in those with non-controlled asthma (n=134) (P=0.016). Median DHA intake in subjects with controlled asthma (n=40) was 250 mg/day, while it was 210 mg/day in those with non-controlled asthma (n=134) (P=0.021).
Spain						
Sanchez-Villegas *et al.*, 2007	1999-2006	7,903 adults. SUN Prospective cohort study, 2 year follow up	Semi-quantitative 136-item FFQ	To assess association between n-3 PUFA intake and fish consumption and mental health disorders	Incidence of mental disorder, incidence of depression, incidence of anxiety	Subjects with a moderate consumption of fish (median intake 83.3 -112 g/day) had a RR reduction of 30%.
Sweden						
Hedelin *et al.,* 2010	1991/92, follow-up 2002/03	33,623 women aged 30-49	6-month FFQ	Evaluate the association between intake of fish, PUFA and vitamin D and the prevalence of psychotic-like symptoms	Symptoms classified into low, middle and high frequency of symptoms	55% classified into low-level, 43% into middle-level and 2.4% into high level group. Risk of high-level symptoms was 53% lower among women who ate fish 3-4 times/wk compared to those who never ate fish. Risk also lower for those with a higher intake of omega-3 and omega-6 PUFA

EPA = eicosapentaenoic acid; DHA = docosahexaenoic acid; DPA = decosapentaenoic acid; FFQ = food frequency questionnaire; P5 = 5th percentile; P95 = 95th percentile

2.4.1 The Netherlands

In a Dutch study, de Goede *et al*. (2010) assessed the dose-response relations between LCPUFA, fish consumption and risk of fatal and non-fatal CHD. This study involved 21,342 participants of the MORGEN cohort study, aged 20 to 65 years at baseline (1993-97). Dietary information was assessed with a self-administered 178-item FFQ and the Dutch food-composition database NEVO (1996 and 2001) was used to convert the dietary data into nutrient intakes, including fatty acids. Information on mortality follow-up was available from baseline until 2007. Cox proportional-hazard models with follow-up time were used to estimate relative risks of fatal CHD, fatal MI and non-fatal MI in quartiles of habitual intakes of EPA and DHA and total fish. Median intakes of EPA and DHA and fish were 114 (62 to 195) mg/day and 7.4 (3.3 to 14.0) g/day, respectively. The main source of EPA and DHA was fish (63%). During 9 to 14 years of follow up, 82 (0.4%) participants died of CHD, and 252 (1.2%) of participants survived an MI. After adjustment for confounders, the risk of fatal CHD was inversely associated with EPA and DHA intake, with a 49% lower risk in the top quartile of EPA and DHA compared with the lowest quartile. There was a stronger association between fatal MI and EPA and DHA intake, with 62% lower risk in the top quartile. EPA and DHA intake was not associated with nonfatal MI. Similarly, consuming more fish was associated with a lower risk of fatal CHD and fatal MI, but not nonfatal MI, and the associations were dose dependent.

In another Dutch study, van de Rest *et al*. (2010) examined the association of EPA and DHA and fish intake with mental well-being in 644 participants (500 men and 144 women), aged 60 to 80 years, with a history of MI. Habitual food intake was assessed with a 203-item FFQ, adapted for the age-range of the participants and including questions to estimate intakes of EPA and DHA. Baseline data from the Alpha Omega Trial was used, and participants were excluded if they had habitual fish intake of >150 g/day, habitual alcohol intake of >6 drinks/ day, recent or current use of fish oil or omega-3 capsules, dementia or severe cognitive impairment. Depressive symptoms were assessed with the self-report geriatric depression scale, and dispositional optimism was assessed with the life orientation test and a 4-item questionnaire. A total of 17% of subjects had depressive symptoms and 15 to 22% had low dispositional optimism. Median fish intake was 15 g/day and the median intake of EPA and DHA was 130 mg/day. Compared with the lowest tertile, subjects in the highest tertile of EPA and DHA had a lower prevalence of depressive symptoms, which was not significant after adjustment for confounders. Intake of EPA and DHA was positively associated with dispositional optimism assessed with the 4-item questionnaire. Fish intake was not related to either depressive symptoms or dispositional optimism.

Devore *et al*. (2009) studied the dietary consumption of fish and LCPUFA in relation to long-term dementia in 5395 participants aged ≥55 years in the Rotterdam Study. The diagnosis of dementia was made at baseline and follow-up using the MMSE and GMS. If subjects were suspected of having dementia they were evaluated by a clinical specialist. Diet was measured at baseline using a validated 170-item semi-quantitative FFQ. Dietary data were converted into nutrients by using the 2006 version of the Dutch Food & Nutrition Tables.

Total fish intake was assessed per 3 categories – none, low, and high. Age- and sex-adjusted Cox proportional hazard models and multivariate-adjusted models to evaluate the risk of dementia and Alzheimer's disease and evaluated across energy-adjusted sex-specific quartiles values of LCPUFA. During average follow-up of 9.6 years, dementia developed in 465 (8.6%) participants (365 with a diagnosis of Alzheimer's disease). Total fish intake was unrelated to dementia risk, and dietary intakes of omega-3 PUFAs were also not associated with dementia risk.

2.4.2 Portugal

Two separate studies in Portugal examined the association between dietary intakes of fatty acids and asthma control (Barros *et al*., 2011) and in relation to the incidence of acute MI (Lopes *et al*., 2007). In the recent study by Barros *et al*. (2011), 174 patients with a medical diagnosis of asthma, mean age 40 years were examined with respect to their dietary intakes of fatty acids and level of asthma control. Dietary intake was obtained by a validated semi-quantitative 86-item FFQ that assessed intake over the previous 12 months. Nutritional intake was calculated using as adapted Portuguese analysis software. Asthma control was defined by combining the results of lung function, exhaled nitric oxide (NO) and the Asthma Control Questionnaire score. Regression models were performed to analyse the associations between fatty acids and asthma outcomes, adjusting for confounders. Median EPA intake in subjects with controlled asthma (n=40) was 120 mg/day, while it was 90 mg/day in those with non-controlled asthma (n=134) (p=0.016). Median DHA intake in subjects with controlled asthma (n=40) was 250 mg/day, while it was 210 mg/day in those with non-controlled asthma (n=134) (p=0.021). In the regression models no significant associations between EPA or DHA and asthma outcomes were observed.

Lopes *et al*. (2007) evaluated the relation between LCPUFA intake and acute myocardial infarction Portuguese men. Case patients were derived from 297 patients >40 years old from a hospital cardiology department in Porto, Northern Portugal with a diagnosis of first acute MI. Control patients were 310 men from households in the catchment area of the hospital. Dietary intake was assessed using a validated semi-quantitative 26-item FFQ that assessed intake over the previous 12 months. Nutritional intake was calculated using as adapted Portuguese analysis software, similar to the previous study. Logistic regression models were created to test the associations between fatty acid intakes and disease risk. EPA intake in cases was 166 mg/day (0.21% total fat) and in controls was 159 mg/day (0.20% total fat) (p=0.248). DHA intake in cases was 360 mg/day (0.46% total fat) and in controls was 359 mg/day (0.43% total fat) (p=0.219). The association of LCPUFA with risk of acute MI was non-significant after adjustment for energy intake and confounders.

2.4.3 Spain

Sanchez-Villegas *et al*. (2007) assessed the association between LCPUFA intake, fish consumption and mental disorders in the SUN cohort study in Spain in 7903 participants. Dietary intake was ascertained through a validated 136-food item semi-quantitative FFQ,

and Spanish food composition tables were used. LCPUFA intake and fish consumption were adjusted for total energy intake. Non-conditional logistic regression models were fit to assess the relationship between LCPUFA intake or fish consumption and the incidence of mental disorder (depression, anxiety, and stress) in the cohort. One hundred seventy-three (173) cases of depression, 335 cases of anxiety and 4 cases of stress were observed during 2 years of follow up. Subjects with a moderate consumption of fish (median fish intakes of 83.3 to 112 g/day), had a relative risk reduction of greater than 30%. While a potential benefit of LCPUFA intake on total mental disorders is suggested, no linear trend was apparent.

2.4.4 Sweden

The dietary intake of fish and LCPUFA and the prevalence of psychotic-like symptoms were examined in a cohort of 33,000 women from the general population in Sweden (Hedelin *et al*., 2010). Dietary intake was estimated using a FFQ in women aged 30 to 49 years at enrolment (1991-92). Foods were converted into nutrients by linkage to the Swedish database of nutrients. EPA, DHA, and DPA were combined to estimate the total intake of marine fatty acids. Information on psychotic-like symptoms was derived from a follow-up questionnaire in the years 2002-03. Participants were classified into 3 predefined levels of symptoms: low (n=18,411), middle (n=14,395) and high (n=817) frequency. Energy-adjusted multinomial logistic regression models were created to evaluate the association between fish, fatty acids and psychotic-like symptoms in terms of relative risk ratios. The risk of high level symptoms was 53% lower among women who ate fish 3 to 4 times per week compared to women who never ate fish. The risk was lower for women with a high intake of LCPUFA compared to women with a lower intake.

2.5 LCPUFA SUPPLEMENT INTAKES IN THE EU

Surveys show that consumers are increasingly turning to EPA and DHA supplements as part of their daily routines. Owing to the low acceptance of fish in many Western societies, dietary supplementation with fish oil may be a suitable alternative. Such supplements usually contain well-refined fish oils from fish liver or whole fish. Also, some supplements may contain algae oil. It should be noted that the content of EPA and DHA within a supplement is highly variable. There are multiple types of fish oil available such as native fish body oil (predominantly anchoveta), native fish liver oil (which may have a lower concentration of EPA and DHA), and reconfigured oils in the form of concentrated ethyl esters and triglycerides. Supplements are designed to deliver recommended amounts of EPA and DHA, therefore most adult supplements deliver 250 to 450 mg/day EPA and/or DHA in 1 or multiple doses, and child supplements are designed to provide 100 mg/day in-line with EFSA recommendations (EFSA, 2010).

A total of 14 studies conducted in the EU reported on the use of fish oil/cod liver oil supplements among their participants as part of their habitual dietary intakes. These studies such as a multi-centre study in Europe (Augood *et al.*, 2008), along with studies conducted

in Belgium (1 study), Denmark (2 studies), Finland (2 studies), the Netherlands (1 study), Sweden (2 studies) and the United Kingdom (5 studies), along with a further 3 studies in Norway, are summarized in Table 5 and the percentage of supplement users are illustrated in Figure 2.5-1 and are discussed in the sub-sections below.

The intake of LCPUFA from supplements varies greatly between countries and between studies in the EU. The reported use of fish oil and cod liver oil supplements ranges from less than 0.5% in the Netherlands (Dijkstra et al., 2009), though to 33% of participants in a particular study in the United Kingdom (Myint et al., 2006). However this is a higher penetration than in the most recent representative NDNS sample which found a maximum of 23% adults (aged 65+ years) consumed cod liver oil and other fish oil supplements (FSA, 2010). In general the intake of cod liver oil was found to exceed that of other fish oil supplements. In a cross-sectional European study in 2007, it was found that 7.9% of participants were users of an omega-3 supplement, and 5% were users of a fish oil supplement (Augood et al., 2008).

When considering the contribution of fish oils or supplements to intakes of total LCPUFA, the intake of fish oil supplements may account for up to 33% of the intake (Johansson et al., 1998). Furthermore, plasma levels of LCPUFA were shown to be 20% higher in fish-oil supplement consumers compared to non-fish-oil supplement consumers (Welch et al., 2006). Therefore, it becomes apparent that the intake of fish oil supplements must be considered when assessing total intakes of LCPUFA. When taking fish oil supplements into account, it is also important to recognize the effect the season can have, as Kolanowski (2008) found a strong seasonal variation of fish oil supplement sales in Poland, with the highest level of sales between October and February, and the lowest from May to July. A high intake of supplement use, especially cod liver oil, in some countries may also stem from cultural reasons such as the traditional recommendation to use cod liver oil during the dark period of the year in Norway (Johansson et al., 1998).

Table 2.5-1 Frequency of Use of Omega-3 Polyunsaturated Fatty Acids Supplements and Intakes of EPA and DHA in the EU and Norway

Reference	Years of Study	Study sample	Report Details	Supplement	Percent Supplement Users			Total EPA and DHA (mg/day), incl supplements								Notes
					Average	Men	Women	Men	Women	Men	Women	Mean	Median	P5	P95	
Europe (7 centres)																
Augood *et al.*, 2008	2007	EUREYE study - cross sectional population-based study in 2276 adults greater than 65 yrs in 7 centres in Europe.	Semi-quantitative FFQ - from the EPIC study	n-3 supplement use	7.9	-	-	-	-	-	-	-	-	-	-	Participants in the highest intake of oily fish were more likely to be users of n-3 supplements (11.7% of those who consumed oily fish ≥ 2/week)
				Fish-oil supplement use	5	-	-	-	-	-	-	-	-	-	-	
Belgium																
Sioen *et al.*, 2010	2009	414 women 18-39yrs, convenience sample, Flanders, Belgium	Market study on all n-3 PUFA supplements (Aug - Oct 2008). Semi-quantitative FFQ	n-3 PUFA supplements	5	-	5	-	-	-	-	1067	998	-	-	From the market survey, 139 different n-3 PUFA supplements were found (oils, capsules and tablets). Several brands had a special supplement for children
Denmark																
Joensen *et al.*, 2010	1993-1997	53,803 adults (24,786 men, 29,017 women) aged 50 to 64 years	Validated FFQ containing 192 food items	Fish oil capsules	-	15.8	17.3	-	-	-	-	-	-	-	-	
Knudsen *et al.* 2002	1997-1998	Danish Investigation on	Personal interview on supplement use	Fish-oil supplement	-	14.0	1.1 (*18-22 yrs*) 1.2 (*25-*									

Table 2.5-1 Frequency of Use of Omega-3 Polyunsaturated Fatty Acids Supplements and Intakes of EPA and DHA in the EU and Norway

Reference	Years of Study	Study sample	Report Details	Supplement	Percent Supplement Users			Total EPA and DHA (mg/day), incl supplements								Notes
					Average	Men	Women	Men	Women	Men	Women	Mean	Median	P5	P95	
		Iodine Intake & Thyroid disease. 3707 women (18-65 yrs), 942 men (60-65 yrs)					*30 yrs*) 4.0 (*40-45 yrs*) 18.3 (*60-65 yrs*)									
Finland																
Hameen-Antilla *et al.*, 2011	2007	Parents of children <12 years old	Questionnaire to parents on supplement use	Fish oil and fatty acid supplements		-	-									
Suominen-Taipale *et al.*, 2010	Health 2000 Survey: 2000-2001	5,840 adults. Nationally representative survey	Validated FFQ containing 128 items	Fish-oil supplement	-	1	3	-	-	-	-	-	-	-	-	
	Fishermen Study: 2004-2005	308 fishermen and wives	Validated FFQ containing 128 items	Fish-oil supplement	-	5	8	-	-	-	-	-	-	-	-	
Netherlands																
Dijkstra *et al.*, 2009	1990 - 1993	Rotterdam Study - population-based prospective cohort study in 5299 men and women aged 55 years and older	Interview-administered validated, semi-quantitative FFQ. Intakes of specific fatty acids based on food consumption database derived from TRANSFAIR study	Fish oil supplement	0.45	-	-	-	-	-	-	-	-	-	-	
Norway																
Manger *et al.*, 2010	1999-2004	2412 adults (1941 men, 471 women) over 18 years old	FFQ containing 169 food items	Fish-oil supplement	16.2	-	-	-	-	-	-	-	-	-	-	
				Cod liver oil	27.2	-	-	-	-	-	-	-	-	-	-	

Table 2.5-1 Frequency of Use of Omega-3 Polyunsaturated Fatty Acids Supplements and Intakes of EPA and DHA in the EU and Norway

Reference	Years of Study	Study sample	Report Details	Supplement	Percent Supplement Users			Total EPA and DHA (mg/day), incl supplements								Notes
					Average	Men	Women	Men	Women	Men	Women	Mean	Median	P5	P95	
Johansson *et al.*, 1998	1997	3144 subjects aged 16-79	Self-administered 180-item food frequency questionnaire	Cod liver oil	-	37	34	1.3	1.3	1.4	1.1	-	-	-	-	
Hjartåker *et al.*, 1997	1995	234 women aged 40-42	Semi-quantitative FFQ	Cod liver oil	37.6	-	-	-	-	-	-	-	-	-	-	
				Fish oil supplements	3.8	-	-	-	-	-	-	-	-	-	-	
Sweden																
Levitan *et al.*, 2009	1997-1998	39,367 men aged 45-70 years	Self-administered FFQ containing 96 items	Fish-oil capsule	-	5	-	-	-	-	-	-	-	-	-	5% of participants reported consuming 1 or more fish oil capsule(s) per week.
Wallström *et al.*, 2007	1991-1996	10,564 male subjects born between 1923 and 1945	A combined interview-based dietary history method, a FFQ containing 168 items, and a 45-minute complementary interview	EPA or DHA supplement	-	3	-	-	-	-	-	-	-	-	-	327 men (of 10,564) were reported to be taking EPA/DHA supplements at time of screening.

Table 2.5-1 Frequency of Use of Omega-3 Polyunsaturated Fatty Acids Supplements and Intakes of EPA and DHA in the EU and Norway

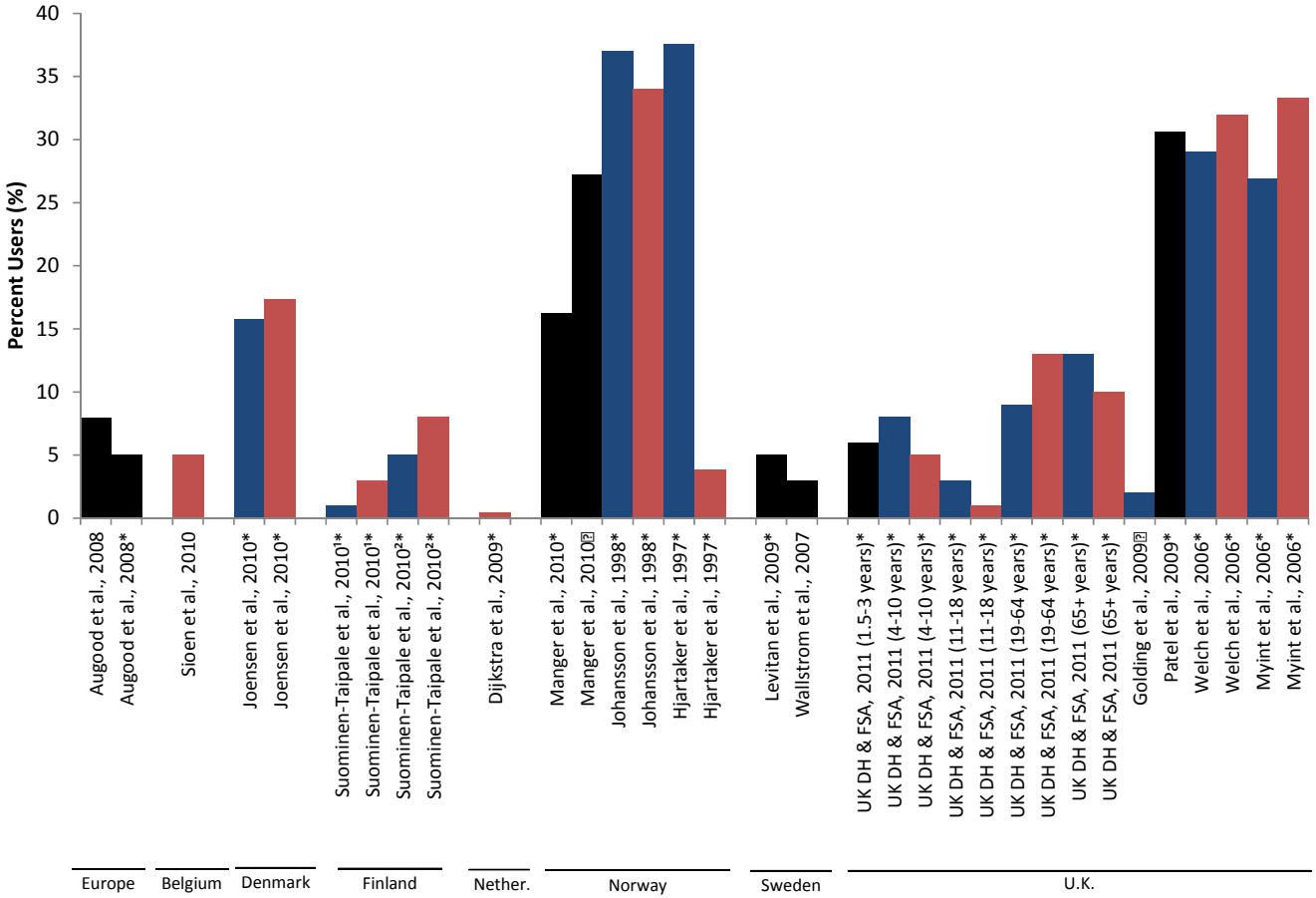
Reference	Years of Study	Study sample	Report Details	Supplement	Percent Supplement Users			Total EPA and DHA (mg/day), incl supplements								Notes
					Average	Men	Women	Men	Women	Men	Women	Mean	Median	P5	P95	
United Kingdom																
FSA, 2010	2008-2010	NDNS Rolling programme. Nationally representative survey. Results from the first 2 years	4-day food diary or CAPI (Computer Assisted Personal Interview)	Cod liver oil and other supplements	-	-	-	-	-	-	-	-	-	-	-	
				4-day Food diary:	-	-	-	-	-	-	-	-	-	-	-	
				1.5-3 yrs (n 219)	6	-	-	-	-	-	-	-	-	-	-	
				4-10 yrs (n 423)	-	8	5	-	-	-	-	-	-	-	-	
				11-18 yrs (n 453)	-	3	1	-	-	-	-	-	-	-	-	
				19-64 yrs (807)	-	9	13	-	-	-	-	-	-	-	-	
				65+ yrs (n 224)	-	13	10	-	-	-	-	-	-	-	-	
				CAPI - intake over past year:	-	-	-	-	-	-	-	-	-	-	-	
				1.5-3 yrs (n 219)	6	-	-	-	-	-	-	-	-	-	-	
				4-10 yrs (n 423)	-	11	9	-	-	-	-	-	-	-	-	
				11-18 yrs (n 453)	-	9	7	-	-	-	-	-	-	-	-	
				19-64 yrs (807)	-	10	15	-	-	-	-	-	-	-	-	
				65+ yrs (n 224)	-	23	19	-	-	-	-	-	-	-	-	

Table 2.5-1 Frequency of Use of Omega-3 Polyunsaturated Fatty Acids Supplements and Intakes of EPA and DHA in the EU and Norway

Reference	Years of Study	Study sample	Report Details	Supplement	Percent Supplement Users			Total EPA and DHA (mg/day), incl supplements								Notes
					Average	Men	Women	Men	Women	Men	Women	Mean	Median	P5	P95	
Golding *et al.*, 2009	1991-1992	ALSPAC sample - 14,541 pregnant women, excluding women with outcomes of foetal or infant death and those with multiple births	Self-administered FFQ	Omega-3 supplement users in pregnant women	-	-	2	-	-	-	-	-	-	-	-	
Patel *et al.*, 2009	1993-1997	9,801 men, 12,183 women aged 40-79 years without prevalent diabetes, cardiovascular disease, or cancer	Validated FFQ containing 130 items about habitual diet and dietary supplement use	Fish oil supplement (at baseline)	30.6	-	-	-	-	-	-	-	-	-	-	
Welch *et al.*, 2006	1993-1997	2597 men, 2352 women	Questionnaire on fish oil supplement consumption	Cod liver oil and other fish-oil containing supplements	-	29	32	-	-	-	-	-	-	-	-	
Myint *et al.*, 2006	1993-1997	24,321 adults aged 40-79 years; part of EPIC cohort	In FFQ, subjects asked to report intake of food supplements	Cod liver oil supplement use	30.4	26.9	33.3	-	-	-	-	-	-	-	-	

EPA = eicosapentaenoic acid; DHA = docosahexaenoic acid; DPA = decosapentaenoic acid; FFQ = food frequency questionnaire; P5 = 5th percentile; P95 = 95th percentile

Figure 2.5-2 Average use of omega-3 supplements in the EU and Norway



Nether. = Netherlands; UK DH and FSA = United Kingdom Department of Health and the Food Standards Agency.
* Users of fish oil supplements (including cod liver oil)
[a] Cod liver oil use only; [b] Pregnant women.
[1] From the Health 2000 Survey; [2] From the Fishermen Study

2.5.1 Europe

A 7-center cross-sectional population-based European study conducted by Augood *et al*. (2008) demonstrated that of 2276 adults older than 65 years, 7.9% were users of an omega-3 supplement, and 5% were users of a fish oil supplement in 2007.

2.5.2 Belgium

In Belgium, Sioen and colleagues (2010) conducted a market survey in 414 women aged 18 to 39 years in 2009. Omega-3 PUFA supplement use was reported in 5% of the female participants, with a mean total consumption of 1067 mg/day of EPA and DHA from foods and supplements. The median consumption was 998 mg/day. Omega-3 supplements contributed 31.5 mg/day of EPA and DHA, which comprised 11.4% of the total intake. The greatest contributor of EPA and DHA intakes were fatty fish at 47.5% of the total intake.

2.5.3 Denmark

Joensen and colleagues (2010) examined the percent users of fish oil capsules in 53,803 subjects in Denmark from 1993 to 1997. The reported users were 15.8% of male participants, and 17.3% of female participants.

In an earlier study, Knudsen *et al.* (2001) investigated the users of dietary supplements, including fish oils as part of the Danish Investigation on iodine and Thyroid Disease. A total of 3707 women aged 18 to 65 years and 942 men aged 60 to 65 years from 2 Danish cities were included in the study, and supplement use was examined through personal interview. The percent of fish oil supplement users was found to rise with increasing age with 1.1% of women aged 18 to 22 years classified as users, compared to 18.3% of 60- to 65-year-old women. For men aged 60 to 65 years, 14% were classified as users of fish oil supplements.

2.5.4 Finland

In Finland in 2007 survey, Hameen-Antilla and colleagues (2011) questioned 4032 parents of children less than 12 years old on their complementary and alternative medicine product intake (CAM). CAM included dietary supplements such as fish oil and fatty acids. Just over 30% of the total sample were CAM consumers (all products), and when broken by age group, it was found that 6.1% of the sample aged <30 years were fish oil and fatty acid supplement consumers, while 13.7% of those aged ≥40 years were consumers.

Suominen-Taipale and colleagues (2010) examined supplement use in 2 cohort samples taken from the National Health survey conducted in 2000 to 2001, and the Fishermen Study conducted from 2004 to 2005. In the National Health survey conducted in 58,400 adults, the percent users of fish oil supplements was 1% in men and 3% in women. In the Fishermen Study conducted in 308 fishermen and family members, the percent users of fish oil supplements was 5% in men and 8% in women.

2.5.5 The Netherlands

The lowest reported usage of fish oil supplements was observed in a study by Dijkstra and colleagues (2009) conducted in the Netherlands. The cohort was sampled from the Rotterdam Study, which was conducted from 1990 to 1993. A sample of 5,299 subjects aged 55 years and older revealed that only 0.45% of the cohort were users of fish oil supplements.

2.5.6 Sweden

Levitan and colleagues (2009) observed that 5% of 39,367 Swedish male participants aged 45 to 79 years reported using fish oil capsules at least once a week.

The use of an EPA and/or a DHA-containing supplement was also examined in 10,564 male subjects aged 46 to 68 years (Wallström *et al.*, 2007). It was reported that the number of men who used omega-3 supplements at least once a week was 3.1% (327 subjects).

2.5.7 France

The intake of LCPUFA has also been examined in the context of vitamin and mineral supplement use in France. Touvier and colleagues (2006) examined the intakes of 67,229 women aged 40 to 65 years sampled from the E3N (Etude Epidémiologique de Femmes de la Mutelle Générale de l'Education Nationale) cohort in France. A self-administered FFQ containing 208 items and a questionnaire regarding supplement use were used to assess dietary consumption. Nutrient intakes were estimated from a French food composition table. Vitamin and mineral supplement users represented 26.9% of the study population, mainly accounted for in calcium supplementation (12.5% of the population). Though LCPUFA consumption was not broken down into specific fatty acids, total LCPUFA intake was reported as 1500 mg/day both in users and non-users of nutritional supplements, without considering the intake from supplements, as fish oil supplementation was not reported in this study. Taking into account age and energy intake, supplement users had an odds ratio of 1.09 compared to non-users for being in the top 3 tertile for LCPUFA intake from diet alone ($p=0.0006$). Intakes of fish also were similar between the groups, with supplement users consuming 38.8 g/day and non-users consuming 36.9 g/day. Authors noted that the prevalence of inadequate intakes of specific nutrients were similar or lower between users and nonusers for all nutrients examined with the exception of magnesium.

2.5.8 United Kingdom

Usage of cod liver oil and fish oil supplements were reported for a representative sample of the UK population as part of its Rolling programme of the NDNS (FSA, 2010). Intakes of supplements were comprehensively assessed through both a 4-day food diary or through a CAPI (Computer Assisted Personal Interview). Through the 4-day diary, fish oil and cod liver oil supplements were found to be used by 6% of toddlers (1.5 to 3 years, n=219), by 5 to 8% children (4 to 10 years, n=423), by 1 to 3% adolescents (11 to 18 years, n=453), by 9 to 13%

adults (19 to 64 years, n=807) and by 10 to 13% elderly (65+ years, n=224). Through the CAPI, fish oil and cod liver oil supplements were found to be used by 6% of toddlers, by 9 to 11% children, by 7 to 9% adolescents, by 10 to 15% adults, and by 19 to 23% elderly. Therefore, it appears that the percent users of these supplements are more likely to increase in a population with increasing age.

In the United Kingdom, 4 other studies have examined the use of cod liver oil or fish oil use. Patel and colleagues (2009) reported overall fish oil supplement use as 30.6% of 21,984 UK participants aged 40 to 79 years during the period of 1993 to 1997.

A sample of subjects from the UK component of the Avon Longitudinal Study of Parents and Children (ALSPAC) were assessed for fish intakes (Golding *et al.*, 2009). A total of 14,541 women from southwest England were enrolled in the study, and those with outcomes of foetal or infant death or those with multiple births were excluded from the study. In a self-reported FFQ completed on week 32 of pregnancy, it was estimated that 2% of the study participants were taking omega-3 supplements.

Welch and colleagues (2006) reported the percent users of cod liver oil from 1993 to 1997 as 29% of male participants and 32% of female participants from a total of 4949 subjects. These findings were supported in another study published in 2006 by Myint and colleagues examining the use of supplements in 24,321 adults aged 40 to 79 years as a sample of the EPIC cohort. Percent users of cod liver oil supplements in the period from 1993 to 1997 represented 30.4% of the study population. This was further broken down by gender, revealing 26.9% male and 33.3% female supplement users.

2.5.9 Norway

Along with the studies already presented from the EU in this section, an additional 3 studies of cod liver oil and/or fish oil supplement use in Norway were examined. Recently, Manger and colleagues (2010) examined the percent of supplement users among 2412 subjects over the period of 1999 to 2004. The use of fish oil supplements was observed in 16.2% of participants, and the use of cod liver oil was observed in 27.2% of participants.

In 1998, Johansson and colleagues examined cod liver oil use in 3144 subjects aged 16 to 79. It was reported that 37 and 34% of male and female participants were users of cod liver oil. Within the study population, the mean frequency of use of cod liver oil was 1.3 times per week for both men and women, whereas the user population reported a frequency of 3.7 times per week. In the study population, the mean intake of cod liver oil was 1.4 g/day in men, and 1.1 g/day in women. Furthermore, cod liver oil supplements contributed 39% to total intakes of EPA, 32% of total intakes of DHA, 14% of total intakes of DPA, and 33% of total intakes of EPA, DHA, and DPA combined. Conversely, fish oil supplements contributed to only 3% of intakes of EPA, 2% of total intakes of DHA, and 2% of total intakes of EPA, DHA, and DPA combined. Fish remained the major contributor of intakes for all the LCPUFA, contributing from 43 to 56% of the intakes of these nutrients.

In an earlier study by Hjartåker and colleagues (1997), the intake of supplements was assessed in 234 women, aged 40 to 42 years, living in Trondheim, Norway, using a semi-quantitative FFQ. The use of fish oil supplements was reported in 37.6% of the participants, and the use of fish oil capsules was reported to be 3.8%. Approximately 17.5% of the study participants consumed cod liver oil throughout the entire year, and an additional 20.1% consumed it during winter months. The use of other kinds of fish oil supplements was less than 4%.

2.6 CONCLUSIONS

A large variation is found in the intake estimations of LCPUFA, specifically EPA and DHA between studies and countries within the EU. Differences in intakes can reflect differences in the underlying food consumption patterns (*i.e.*, fish consumption), or to the demographic profiles being examined in the studies, but also may be due to methodological differences in the studies (*i.e*., dietary assessment methods, source and totality of fatty acid composition data, nationally representative sample or from a regional or convenience sample). This makes it difficult to directly compare intakes across the EU.

Despite methodological, sample and geographical difference, it is possible to provide some generalizations about the range of LCPUFA intakes across the EU. In women, mean EPA and DHA intakes were found to range from an estimated 126.6 mg/day (German women aged 18 to 24 years, Bauch *et al*., 2006) to 700 mg/day, with an intake of 800 mg/day reported in fishermen's wives (Finnish women, Suominen-Taipale *et al*., 2010). In men, intakes of mean EPA and DHA intake ranged from 140 mg/day (Dutch men, Schuurman *et al*., 1999) to 1000 mg/day in Finnish fishermen (Suominen-Taipale *et al*., 2010). Only 3 studies examined LCPUFA intakes in children and adolescents in the EU. For children, intakes ranged from 42 to 49 mg/day in those aged <4 years and 58 to 66 mg/day in those aged 4 to 6 years (German children, Sichert-Hellert *et al*., 2009) to 65 mg/day in 2.5 to 3 year olds and 75 mg/day in 4 to 6.5 year olds (Belgian children, Sioen *et al*., 2007a). Intakes of EPA and DHA in Belgian adolescents were 167.3 mg/day (Sioen *et al*., 2007b), compared to 92 to 141 mg/day in German adolescents (Sichert-Hellert *et al*., 2009).

Compliance of LCPUFA intake with current national and/or international recommendations depends on what recommendation is being considered. The SACN recommends an intake of 450 mg/day of EPA and DHA (SACN, 2004), while EFSA propose an AI of 250 mg/day for adults (EFSA, 2009, 2010). The majority of studies reported EPA and DHA intakes of less than the 450 mg/day recommended by the UK SACN, with studies in Belgium, the Netherlands and the UK further reporting mean intakes of less than the 250 mg/day recommended by EFSA. However, intakes in the Nordic countries, such as in Finland and Denmark, revealed dietary intakes in line with EFSA and the UK SACN guidelines, demonstrating a differential geographical intake pattern of EPA and DHA in Europe.

One major issue with published LCPUFA intakes across the EU is that the majority of studies present mean intakes for the study population, which can mask the effect of very low

intakes, resulting from sections of the population not consuming fish. Where provided, 5th percentile intakes often reveal zero intakes or very low intakes compared to mean values, indicating that median values may be more indicative of actual intakes compared to the mean. Data on non-fish or low-fish consumers as per Section 2.3 emphasise the important contribution fish makes to LCPUFA intakes, and that ultimately intakes of LCPUFA will be extremely low in the sub-section of the population that do not consume fish.

Another issue with interpretation of the published data on LCPUFA intakes in the EU is in relation to the reliability of the LCPUFA composition data on which the intakes are calculated. It has been documented that EPA and DHA concentrations in farmed fish in the EU (such as in Norway, where a lot of farmed Salmon for example is sourced) are declining in recent years. Therefore, the intakes of EPA and DHA in the studies provided in this report may present an over-estimate of current intakes in the EU.

The intake of LCPUFAs from supplements is also a very important and growing source of LCPUFA in Europe. Supplement use and types of supplement use (*e.g.*, cod liver oil *versus* fish oil supplements) varies greatly between countries and between studies in Europe. However, the intake of LCPUFA supplements in general appears to be strongly influenced by seasonal and cultural factors. The reported use of fish oil and cod liver oil supplements ranges from less than 0.5% in the Netherlands (Dijkstra *et al*., 2009), though to 33% of participants in studies in the United Kingdom (Myint *et al.*, 2006).

One issue with advising increased intakes of fish in order to increase the intakes of LCPUFA in the population is the sustainability and acceptance of such a recommendation. This emphasizes the importance of dietary supplements as a future source of LCPUFA in the diet of Europeans. According to Bauch *et al*. (2006), stimulating fish consumption has only little potential to enhance the LCPUFA intakes in substantial parts of the German population. This observation could be applied more widely to Europe, as fish intakes are relatively stable and low across most parts of Europe. Fatty fishes such as tuna and mackerel are globally limited food sources. A concerted food fortification plan with DHA and EPA is a reasonable measure to overcome these limits. Indeed, from the literature described in Section 2.5 on the association between dietary intakes of LCPUFA and disease risk, it seems prudent to conclude that in order to observe the widely reported beneficial health effects of LCPUFA, their intake needs to be at a level some order of magnitude greater than is currently consumed across most of the EU.

2.7 DETERMINISTIC ASSESSMENT OF BACKGROUND INTAKE IN THE UK

Estimates for the intake of LCPUFA in the UK were based on the food consumption data collected as part of the most recently available data in the United Kingdom (UK) Food Standards Agency's, Dietary Survey Programme (DSP). Previous UK food consumption surveys (UKDA 1995, 2001; Office for National Statistics, 2005) were not used in this assessment of LCPUFA intakes, as information on the intakes of LCPUFA from previous surveys on UK populations is already published and available (Givens and Gibbs, 2006),

and it was felt that the most recent data available on UK population groups would be the most relevant for the present assessment.

2.8 FOOD CONSUMPTION SURVEY DATA

2.8.1 Survey Description

This report presents combined results from Years 1 and 2 of the rolling programme (2008/09 – 2009/10) for a sample of the UK population designed to be nationally representative. The NDNS is a programme of surveys designed to assess the diet, nutrient intake, and nutritional status of the general population aged 18 months upwards living in private households in the UK. The NDNS is jointly funded by the Department of Health in England and the UK Food Standards Agency and carried out by a consortium of 3 organisations: National Centre for Social Research (NatCen), MRC Human Nutrition Research (HNR) and the University College London Medical School (UCL).

The sample was drawn from the Postcode Address File. Where there were multiple households at an address a single household was selected at random. For each household, either 1 adult and 1 child, or 1 child only were selected for inclusion. Food consumption and nutrient intakes for 2126 participants was collected using a 4-day diary with estimated portion weights. The response rate for completion of the diary was 55%. The survey also included an interview to collect background information on dietary habits, socio-demographic status and lifestyle, collection of a blood sample to assess biochemical indices of nutritional status and a 24-hour urine collection to assess salt intake.

Because of small numbers in each year, no comparisons have been made between individual years of the survey. Results are presented for both sexes combined for the age groups: 1.5 to 3 years, 4 to 10 years, 11 to 18 years, 19 to 64 years and 65 years and over. For those aged 65 years and over, numbers are still relatively small and this should be taken in to account when reviewing the data for this age group. Results are also subdivided by sex for all age groups, except for children aged 1.5 to 3 years as these do not vary by sex and are traditionally reported in NDNS for both sexes combined.

Results are based on dietary assessment using a 4-day food diary and represent a daily average of the days assessed.

2.8.2 Methods

In order to estimate mean daily intakes of n-3 LCPUFA (EPA, DHA, and DPA) from the total diet in the UK, intakes of relevant food groups were multiplied by LCPUFA concentration data available for these foods. Intakes of food groups consumed by all participants in the NDNS rolling surveys are publicly available (mean, median and percentage consumers) for

the total population and for consumers only of each food group[2]. Median food group intakes are only available for consumers and not for the total population. Intakes for upper percentile food group intakes (*e.g.*, 95th percentile) were not available for the intake current assessment. To calculate the composition of LCPUFA in each of the food groups containing LCPUFA, concentration data from the previous examination of LCPUFA intakes in the UK was used (Givens and Gibbs, 2006). This provided EPA, DHA, and DPA composition for fish (white fish, oily fish and other fish), meat and meat products (beef and veal, lamb, pork, bacon and ham, poultry, sausages, and other meat products) and eggs.

Mean daily intakes were calculated for the total population and median daily intakes were calculated for consumers only of each food group (*i.e.*, consumers only refer to those people who consumed the relevant food on at least one of the survey days, while total population intakes includes the total sample, whether or not they were consumers). As there is unlikely to be a normal distribution of intake within populations due to segmentation into fish and non-fish consumers (oily fish consumers range from 7 to 38% in the current study), it is preferable to base the intakes assessment on median food group intakes as this provides a more reasonable indicator of intakes in the whole population. However, median intakes were only available for consumers only data.

2.9 FOOD SURVEY RESULTS

Mean daily LCPUFA intakes for EPA, DHA, and DPA were calculated for all population groups in the NDNS, and are presented in Table 2.9-1 for the total population and median LCPUFA intakes are presented in Table 2.9-2 for consumers only. In general, EPA, DHA, and DPA intakes were seen to increase with age, with a mean intake of 117.88 mg/day in toddlers, increasing to a mean intake of 538.98 mg/day in elderly males for the total population. Intakes in males were greater than those in females (mean intake of EPA, DHA, and DPA was 369.08 mg/day in adult men and 353.36 mg/day in adult women). For consumers only, greater EPA, DHA, and DPA intakes were observed as would be expected due to the very conservative nature of the assessment, with a median intake of 1.25 g/day in male adults.

[2] http://tna.europarchive.org/20110116113217/tna.europarchive.org/20110116113217/http://www.food.gov.uk/science/dietarysurveys/ndnsdocuments/ndns0809year1

Table 2.9-1 Mean Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Split by Population Groups in the NDNS Rolling Programme 2008/9-2009/10 for the Total Population						
	Age group (years)	Sample size	Mean n-3 LCPUFA intakes (mg/person/day)			
			EPA	DHA	DPA	EPA + DHA + DPA
Toddlers	1.5-3	219	37.39	65.75	14.74	117.88
Children- boys	4-10	210	38.64	75.18	20.00	133.82
Children- girls	4-10	213	43.86	78.64	21.66	144.16
Teenagers - male	11-18	238	45.01	83.23	30.55	158.79
Teenagers - female	11-18	215	46.66	81.27	25.20	153.13
Adults - male	19-64	346	119.83	198.84	50.41	369.08
Adults - female	19-64	461	118.86	190.89	43.61	353.36
Elderly - male	65+	96	188.52	291.85	58.61	538.98
Elderly - female	65+	128	137.96	226.18	44.79	408.92

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid; DPA: docosapentaenoic acid

Table 2.9-2 Median Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Split by Population Groups in the NDNS Rolling Programme 2008/9-2009/10 for Consumers Only						
	Age group (years)	Sample size	Median n-3 LCPUFA intakes (mg/person/day)			
			EPA	DHA	DPA	EPA + DHA + DPA
Toddlers	1.5-3	219	155.27	239.88	53.01	448.16
Children- boys	4-10	210	188.45	303.10	66.54	558.09
Children- girls	4-10	213	237.89	379.89	75.46	693.23
Teenagers - male	11-18	238	272.04	438.32	96.46	806.83
Teenagers - female	11-18	215	260.94	406.72	89.98	757.63
Adults - male	19-64	346	462.89	650.84	137.00	1250.73
Adults - female	19-64	461	328.58	511.85	110.50	950.93
Elderly - male	65+	96	389.56	609.47	126.03	1125.06
Elderly - female	65+	128	280.07	452.34	99.78	832.19

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid; DPA: docosapentaenoic acid

2.9.1 Intakes of n-3 LCPUFA in the Total Population

LCPUFA intakes (EPA, DHA, and DPA) were calculated per population group per contributing food group separately, and are presented in Table 2.9.1-1 (toddlers), 2.9.1-2 (boys 4 to 10 years and 11 to 18 years), 2.9.1-3 (girls 4 to 10 years and 11 to 18 years), 2.9.1-4 (male adults 19 to 64 years and 65+ years) and 2.9.1-5 (female adults 19 to 64 years and 65+ years). EPA, DHA, and DPA concentrations per food type were derived from Givens and Gibbs (2006). In general, fish was the main contributor to total EPA and DHA intakes in each population group (84.7% EPA and 84.2% DHA intakes in toddlers; 74.2% EPA, and 77.9% DHA intakes in 4- to 10-year-old boys; 57.7% EPA and 61.1% DHA in 11- to 18-year-old boys; 75.4% EPA and 75.5% DHA in 4- to 10-year-old girls; 69.4% EPA and 70.8% DHA in 11- to 18-year-old girls; 81.3% EPA and 81.2% DHA in 19- to 64-year-old

men; 90.8% EPA and 91.4% DHA in 65+ year-old men; 85.6% EPA and 85.0% DHA in 19- to 64-year-old women; 90.1% EPA and 89.8% DHA in 65+ year-old women). Total meat was a greater contributor to DPA intakes than for fish intakes, apart from elderly men and women, contributing 50% DPA intakes in toddlers, 63.2% DPA intakes in 4- to 10-year-old boys; 78.3% DPA intakes in 11- to 18- year-old boys; 63.7% DPA intakes in 4- to 10-year-old girls; 70.1% DPA intakes in 11- to 18-year-old girls; 57.3% DPA intakes in 19- to 64-year-old men; and 49.9% DPA intakes in 19- to 64-year-old women

Within the Meat category, poultry was the main contributor to EPA intake (ranging from 3.3% contribution to total intake in elderly men aged 65+years to 22.7% contribution to total intake in male teenagers aged 11 to 18 years), to DHA intake (ranging from 4.9% contribution to total intake in elderly men aged 65+years to 28.6% contribution to total intake in male teenagers aged 11 to 18 years) and also to DPA intake (ranging from 10.5% contribution to total intake in elderly men aged 65+years to 33.4% contribution to total intake in male teenagers aged 11 to 18 years).

Table 2.9.1-1 Mean Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Per Food Group in Toddlers Aged 1-3 Years in the NDNS Rolling Programme 2008/9-2009/10

		Concentration (mg/g)*			Toddlers			
					1.5-3 years (n=219)			
Food	**Food description**	**EPA**	**DHA**	**DPA**	**Intake (g/d)**	**EPA (mg)**	**DHA (mg)**	**DPA (mg)**
FISH	White fish	0.68	1.94	0.23	7	4.76	13.58	1.61
	Oil-rich fish	7.8	10.6	1.5	3	23.40	31.80	4.50
	Other fish, incl shellfish	0.7	2	0.2	5	3.50	10.00	1.00
	TOTAL FISH					*31.66*	*55.38*	7.11
MEAT	Beef & Veal	0.0995	0.0163	0.161	14	1.39	0.23	2.25
	Sheep meat	0.21	0.072	0.242	4	0.84	0.29	0.97
	Pork	0.0651	0.0833	0.129	3	0.20	0.25	0.39
	Bacon & Ham	0.0362	0.0463	0.0717	4	0.14	0.19	0.29
	Poultry	0.15	0.35	0.15	18	2.70	6.30	2.70
	Sausages	0.012	0.015	0.023	11	0.13	0.17	0.25
	Other products	0.036	0.006	0.058	9	0.32	0.05	0.52
	TOTAL MEAT					*5.73*	*7.47*	7.37
EGGS		0	0.322	0.029	9	0.00	2.90	0.26
	TOTAL INTAKE					**37.39**	**65.75**	**14.74**

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid; DPA: docosapentaenoic acid
*EPA, DHA, and DPA concentrations derived from Givens and Gibbs, 2006

Table 2.9.1-2 Mean Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Per Food Group in Boys Aged 4-10 Years and 11-18 Years in the NDNS Rolling Programme 2008/9-2009/10

		Concentration (mg/g)*			Boys							
					4-10 years (n=210)				11-18 years (n=238)			
FOOD	**Food description**	EPA	DHA	DPA	Intake (g/d)	EPA (mg)	DHA (mg)	DPA (mg)	Intake (g/d)	EPA (mg)	DHA (mg)	DPA (mg)
FISH	White fish	0.68	1.94	0.23	11	7.48	21.34	2.53	6	4.08	11.64	1.38
	Oil-rich fish	7.8	10.6	1.5	2	15.60	21.20	3.00	2	15.60	21.20	3.00
	Other fish, incl shellfish	0.7	2	0.2	8	5.60	16.00	1.60	9	6.30	18.00	1.80
	TOTAL FISH				*21*	*28.68*	*58.54*	7.13	*17*	*25.98*	*50.84*	6.18
MEAT	Beef & Veal	0.0995	0.0163	0.161	24	2.39	0.39	3.86	39	3.88	0.64	6.28
	Sheep meat	0.21	0.072	0.242	5	1.05	0.36	1.21	11	2.31	0.79	2.66
	Pork	0.0651	0.0833	0.129	4	0.26	0.33	0.52	9	0.59	0.75	1.16
	Bacon & Ham	0.0362	0.0463	0.0717	9	0.33	0.42	0.65	17	0.62	0.79	1.22
	Poultry	0.15	0.35	0.15	35	5.25	12.25	5.25	68	10.20	23.80	10.20
	Sausages	0.012	0.015	0.023	15	0.18	0.23	0.35	18	0.22	0.27	0.41
	Other products	0.036	0.006	0.058	14	0.50	0.08	0.81	34	1.22	0.20	1.97
	TOTAL MEAT				*106*	*9.96*	*14.06*	12.64	*196*	*19.03*	*27.24*	23.91
EGGS		0	0.322	0.029	8	0.00	2.58	0.23	16	0.00	5.15	0.46
	TOTAL INTAKE					**38.64**	**75.18**	**20.00**		**45.01**	**83.23**	**30.55**

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid; DPA: docosapentaenoic acid
* EPA, DHA and DPA concentrations derived from Givens and Gibbs, 2006

Table 2.9.1-3 Mean Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Per Food Group in Girls Aged 4-10 Years and 11-18 Years in the NDNS Rolling Programme 2008/9-2009/10

		Concentration (mg/g)*			Girls							
					4-10 years (n=213)				11-18 years (n=215)			
FOOD	**Food description**	EPA	DHA	DPA	Intake (g/d)	EPA (mg)	DHA (mg)	DPA (mg)	Intake (g/d)	EPA (mg)	DHA (mg)	DPA (mg)
FISH	White fish	0.68	1.94	0.23	7	4.76	13.58	1.61	5	3.40	9.70	1.15
	Oil-rich fish	7.8	10.6	1.5	3	23.40	31.80	4.50	3	23.40	31.80	4.50
	Other fish, incl shellfish	0.7	2	0.2	7	4.90	14.00	1.40	8	5.60	16.00	1.60
	TOTAL FISH				*17*	*33.06*	*59.38*	7.51	*16*	*32.40*	*57.50*	7.25
MEAT	Beef & Veal	0.0995	0.0163	0.161	26	2.59	0.42	4.19	30	2.99	0.49	4.83
	Sheep meat	0.21	0.072	0.242	5	1.05	0.36	1.21	9	1.89	0.65	2.18
	Pork	0.0651	0.0833	0.129	7	0.46	0.58	0.90	6	0.39	0.50	0.77
	Bacon & Ham	0.0362	0.0463	0.0717	9	0.33	0.42	0.65	9	0.33	0.42	0.65
	Poultry	0.15	0.35	0.15	38	5.70	13.30	5.70	52	7.80	18.20	7.80
	Sausages	0.012	0.015	0.023	15	0.18	0.23	0.35	12	0.14	0.18	0.28
	Other products	0.036	0.006	0.058	14	0.50	0.08	0.81	20	0.72	0.12	1.16
	TOTAL MEAT				*114*	*10.80*	*15.39*	13.80	*138*	*14.26*	*20.55*	17.66
EGGS		0	0.322	0.029	12	0.00	3.86	0.35	10	0.00	3.22	0.29
	TOTAL INTAKE					**43.86**	**78.64**	**21.66**		**46.66**	**81.27**	**25.20**

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid; DPA: docosapentaenoic acid
*EPA, DHA and DPA concentrations derived from Givens and Gibbs, 2006

Table 2.9.1-4 Mean Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Per Food Group in Men Aged 19-64 Years and 65+ Years in the NDNS Rolling Programme 2008/9-2009/10

		Concentration (mg/g)*			Men							
					19-64 years (n=346)				65+ years (n=96)			
FOOD	**Food description**	EPA	DHA	DPA	Intake (g/d)	EPA (mg)	DHA (mg)	DPA (mg)	Intake (g/d)	EPA (mg)	DHA (mg)	DPA (mg)
FISH	White fish	0.68	1.94	0.23	9	6.12	17.46	2.07	10	6.80	19.40	2.30
	Oil-rich fish	7.8	10.6	1.5	10	78.00	106.00	15.00	19	148.20	201.40	28.50
	Other fish, incl shellfish	0.7	2	0.2	19	13.30	38.00	3.80	23	16.10	46.00	4.60
	TOTAL FISH					*97.42*	*161.46*	20.87		*171.10*	*266.80*	35.40
MEAT	Beef & Veal	0.0995	0.0163	0.161	58	5.77	0.95	9.34	36	3.58	0.59	5.80
	Sheep meat	0.21	0.072	0.242	13	2.73	0.94	3.15	23	4.83	1.66	5.57
	Pork	0.0651	0.0833	0.129	15	0.98	1.25	1.94	10	0.65	0.83	1.29
	Bacon & Ham	0.0362	0.0463	0.0717	18	0.65	0.83	1.29	16	0.58	0.74	1.15
	Poultry	0.15	0.35	0.15	73	10.95	25.55	10.95	41	6.15	14.35	6.15
	Sausages	0.012	0.015	0.023	18	0.22	0.27	0.41	13	0.16	0.20	0.30
	Other products	0.036	0.006	0.058	31	1.12	0.19	1.80	41	1.48	0.25	2.38
	TOTAL MEAT					*22.41*	*29.97*	28.87		*17.42*	*18.61*	22.63
EGGS		0	0.322	0.029	23	0.00	7.41	0.67	20	0.00	6.44	0.58
	TOTAL INTAKE					**119.83**	**198.84**	**50.41**		**188.52**	**291.85**	**58.61**

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid; DPA: docosapentaenoic acid
*EPA, DHA and DPA concentrations derived from Givens and Gibbs, 2006

Table 2.9.1-5 Mean Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Per Food Group in Women Aged 19-64 Years and 65+ Years in the NDNS Rolling Programme 2008/9-2009/10

		Concentration (mg/g)*			Women							
					19-64 years (n=461)				65+ years (n=128)			
FOOD	**Food description**	EPA	DHA	DPA	Intake (g/d)	EPA (mg)	DHA (mg)	DPA (mg)	Intake (g/d)	EPA (mg)	DHA (mg)	DPA (mg)
FISH	White fish	0.68	1.94	0.23	7	4.76	13.58	1.61	10	6.80	19.40	2.30
	Oil-rich fish	7.8	10.6	1.5	11	85.80	116.60	16.50	13	101.40	137.80	19.50
	Other fish, incl shellfish	0.7	2	0.2	16	11.20	32.00	3.20	23	16.10	46.00	4.60
	TOTAL FISH					*101.76*	*162.18*	21.31		*124.30*	*203.20*	26.40
MEAT	Beef & Veal	0.0995	0.0163	0.161	48	4.78	0.78	7.73	37	3.68	0.60	5.96
	Sheep meat	0.21	0.072	0.242	10	2.10	0.72	2.42	13	2.73	0.94	3.15
	Pork	0.0651	0.0833	0.129	8	0.52	0.67	1.03	7	0.46	0.58	0.90
	Bacon & Ham	0.0362	0.0463	0.0717	11	0.40	0.51	0.79	13	0.47	0.60	0.93
	Poultry	0.15	0.35	0.15	57	8.55	19.95	8.55	37	5.55	12.95	5.55
	Sausages	0.012	0.015	0.023	12	0.14	0.18	0.28	7	0.08	0.11	0.16
	Other products	0.036	0.006	0.058	17	0.61	0.10	0.99	19	0.68	0.11	1.10
	TOTAL MEAT					*17.10*	*22.91*	21.78		*13.66*	*15.89*	17.75
EGGS		0	0.322	0.029	18	0.00	5.80	0.52	22	0.00	7.08	0.64
	TOTAL INTAKE					**118.86**	**190.89**	**43.61**		**137.96**	**226.18**	**44.79**

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid; DPA: docosapentaenoic acid
*EPA, DHA and DPA concentrations derived from Givens and Gibbs, 2006

2.9.2 Median Daily Intakes of N-3 LCPUFA in Consumers Only

LCPUFA intakes (EPA , DHA and DPA) were also calculated for consumers only for each food group per population group per contributing food group separately, and are presented in Table 2.9.2-1 (toddlers), 2.9.2-2 (boys 4 to 10 years and 11 to 18 years), 2.9.2-3 (girls 4 to 10 years and 11 to 18 years), 2.9.2-4 (male adults 19 to 64 years and 65+ years) and 2.9.2-5 (female adults 19 to 64 years and 65+ years). As for the total population, EPA, DHA and DPA concentrations per food type were derived from Givens and Gibbs (2006). Median intakes of n-3 LCPUFA were greater in consumers only than the mean intakes calculated for the total population (Section 2.9.1), but it is important to note that it is very unlikely that people would be consumers of all the food groups as presented in the tables in this section (Section 2.9.2). Therefore, the following tables should be examined with respect to intakes of LCPUFA from individual food groups rather than with respect to total daily intake from all food groups.

Fish was the main source of LCPUFA in all UK population groups. Consumers of white fish ranged from 15% (girls aged 11 to 18 years) to 44% (boys aged 4 to 10 years), and for oil-rich fish ranged from 7% (boys aged 11 to 18 years) to 38% (men aged 65+ years). Median daily intakes of white fish ranged from 14 g/day (toddlers) to 45 g/day (men aged 65+ years). Intakes of oily fish ranged from 15 g/day (toddlers) to 39 g/day (men aged 19 to 64 years).

Table 2.9.2-1 Median Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Per Food Group in Toddlers Aged 1-3 Years in the NDNS Rolling Programme 2008/9-2009/10 in Consumers Only

		Concentration (mg/g)*			Toddlers				
					1.5-3 years (n=219)				
FOOD	**Food description**	EPA	DHA	DPA	Intake (g/d)	% consumers	EPA (mg)	DHA (mg)	DPA (mg)
FISH	White fish	0.68	1.94	0.23	14	41	9.52	27.16	3.22
	Oil-rich fish	7.8	10.6	1.5	15	10	117.00	159.00	22.50
	Other fish, incl shellfish	0.7	2	0.2	16	24	11.20	32.00	3.20
	TOTAL FISH						137.72	218.16	28.92
MEAT	Beef & Veal	0.0995	0.0163	0.161	27	40	2.69	0.44	4.35
	Sheep meat	0.21	0.072	0.242	27	12	5.67	1.94	6.53
	Pork	0.0651	0.0833	0.129	23	11	1.50	1.92	2.97
	Bacon & Ham	0.0362	0.0463	0.0717	9	45	0.33	0.42	0.65
	Poultry: coated	0.15	0.35	0.15	13	26	1.95	4.55	1.95
	Poultry: fresh & dishes	0.15	0.35	0.15	18	55	2.70	6.30	2.70
	Sausages	0.012	0.015	0.023	17	44	0.20	0.26	0.39
	Other: Liver	0.036	0.006	0.058	24	1	0.86	0.14	1.39
	Other: Burgers	0.036	0.006	0.058	15	8	0.54	0.09	0.87
	Other: Meat pies & pastries	0.036	0.006	0.058	17	23	0.61	0.10	0.99
	Other: products & dishes	0.036	0.006	0.058	14	11	0.50	0.08	0.81
	TOTAL MEAT						17.55	16.24	23.59
EGGS		0	0.322	0.029	17	39	0.00	5.47	0.49
	TOTAL INTAKE						**155.27**	**239.88**	**53.01**

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid
*EPA and DHA concentrations derived from Givens and Gibbs, 2006

Table 2.9.2-2 Median Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Per Food Group In Boys Aged 4-10 Years and 11-18 Years in the NDNS Rolling Programme 2008/9-2009/10 in Consumers Only

		Concentration (mg/g)*			Boys									
					4-10 years (n=210)					11-18 years (n=238)				
FOOD	**Food description**	EPA	DHA	DPA	Intake (g/d)	% cons	EPA (mg)	DHA (mg)	DPA (mg)	Intake (g/d)	% cons	EPA (mg)	DHA (mg)	DPA (mg)
FISH	White fish	0.68	1.94	0.23	25	44	17.00	48.50	5.75	27	20	18.36	52.38	6.21
	Oil-rich fish	7.8	10.6	1.5	17	10	132.60	180.20	25.50	25	7	195.00	265.00	37.50
	Other fish, incl shellfish	0.7	2	0.2	22	28	15.40	44.00	4.40	36	20	25.20	72.00	7.20
	TOTAL FISH						165.00	272.70	35.65			238.56	389.38	50.91
MEAT	Beef & Veal	0.0995	0.0163	0.161	40	45	3.98	0.65	6.44	71	43	7.06	1.16	11.43
	Sheep meat	0.21	0.072	0.242	35	11	7.35	2.52	8.47	24	22	5.04	1.73	5.81
	Pork	0.0651	0.0833	0.129	22	11	1.43	1.83	2.84	38	21	2.47	3.17	4.90
	Bacon & Ham	0.0362	0.0463	0.0717	13	51	0.47	0.60	0.93	19	63	0.69	0.88	1.36
	Poultry: coated	0.15	0.35	0.15	24	33	3.60	8.40	3.60	38	32	5.70	13.30	5.70
	Poultry: fresh & dishes	0.15	0.35	0.15	29	65	4.35	10.15	4.35	52	72	7.80	18.20	7.80
	Sausages	0.012	0.015	0.023	30	50	0.36	0.45	0.69	30	40	0.36	0.45	0.69
	Other: Liver	0.036	0.006	0.058	0	1	0.00	0.00	0.00	15	1	0.54	0.09	0.87
	Other: Burgers	0.036	0.006	0.058	14	25	0.50	0.08	0.81	52	29	1.87	0.31	3.02
	Other: Meat pies & pastries	0.036	0.006	0.058	27	26	0.97	0.16	1.57	38	28	1.37	0.23	2.20
	Other: products & dishes	0.036	0.006	0.058	12	9	0.43	0.07	0.70	16	11	0.58	0.10	0.93
	TOTAL MEAT						23.45	24.92	30.39			33.48	39.61	44.71
EGGS		0	0.322	0.029	17	34	0.00	5.47	0.49	29	29	0.00	9.34	0.84
	TOTAL INTAKE						**188.45**	**303.10**	**66.54**			**272.04**	**438.32**	**96.46**

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid
*EPA and DHA concentrations derived from Givens and Gibbs, 2006

Table 2.9.2-3 Median Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Per Food Group in Girls Aged 4-10 Years and 11-18 Years in the NDNS Rolling Programme 2008/9-2009/10 in Consumers Only

		Concentration (mg/g)*			Girls									
					4-10 years (n=210)					11-18 years (n=238)				
FOOD	**Food description**	EPA	DHA	DPA	Intake (g/d)	% cons	EPA (mg)	DHA (mg)	DPA (mg)	Intake (g/d)	% cons	EPA (mg)	DHA (mg)	DPA (mg)
FISH	White fish	0.68	1.94	0.23	25	29	17.00	48.50	5.75	30	15	20.40	58.20	6.90
	Oil-rich fish	7.8	10.6	1.5	23	11	179.40	243.80	34.50	25	10	195.00	265.00	37.50
	Other fish, incl shellfish	0.7	2	0.2	28	24	19.60	56.00	5.60	20	28	14.00	40.00	4.00
	TOTAL FISH						216.00	348.30	45.85			229.40	363.20	48.40
MEAT	Beef & Veal	0.0995	0.0163	0.161	42	47	4.18	0.68	6.76	64	41	6.37	1.04	10.30
	Sheep meat	0.21	0.072	0.242	29	13	6.09	2.09	7.02	40	15	8.40	2.88	9.68
	Pork	0.0651	0.0833	0.129	23	19	1.50	1.92	2.97	21	20	1.37	1.75	2.71
	Bacon & Ham	0.0362	0.0463	0.0717	13	57	0.47	0.60	0.93	13	58	0.47	0.60	0.93
	Poultry: coated	0.15	0.35	0.15	23	37	3.45	8.05	3.45	29	33	4.35	10.15	4.35
	Poultry: fresh & dishes	0.15	0.35	0.15	26	58	3.90	9.10	3.90	48	66	7.20	16.80	7.20
	Sausages	0.012	0.015	0.023	30	53	0.36	0.45	0.69	30	34	0.36	0.45	0.69
	Other: Liver	0.036	0.006	0.058	5	<1	0.18	0.03	0.29	8	2	0.29	0.05	0.46
	Other: Burgers	0.036	0.006	0.058	20	18	0.72	0.12	1.16	30	28	1.08	0.18	1.74
	Other: Meat pies & pastries	0.036	0.006	0.058	20	29	0.72	0.12	1.16	35	24	1.26	0.21	2.03
	Other: products & dishes	0.036	0.006	0.058	9	13	0.32	0.05	0.52	11	8	0.40	0.07	0.64
	TOTAL MEAT						21.89	23.21	28.85			31.54	34.18	40.74
EGGS		0	0.322	0.029	26	42	0.00	8.37	0.75	29	33	0.00	9.34	0.84
	TOTAL INTAKE						**237.89**	**379.89**	**75.46**			**260.94**	**406.72**	**89.98**

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid
*EPA and DHA concentrations derived from Givens and Gibbs, 2006

Table 2.9.2-4 Median Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Per Food Group in Men Aged 19-64 Years and 65+ Years in the NDNS Rolling Programme 2008/9-2009/10 in Consumers Only

		Concentration (mg/g)*			Men									
					19-64 years (n=346)					65+ years (n=96)				
FOOD	**Food description**	EPA	DHA	DPA	Intake (g/d)	% cons	EPA (mg)	DHA (mg)	DPA (mg)	Intake (g/d)	% cons	EPA (mg)	DHA (mg)	DPA (mg)
FISH	White fish	0.68	1.94	0.23	42	20	28.56	81.48	9.66	45	23	30.60	87.30	10.35
	Oil-rich fish	7.8	10.6	1.5	39	19	304.20	413.40	58.50	38	38	296.40	402.80	57.00
	Other fish, incl shellfish	0.7	2	0.2	46	33	32.20	92.00	9.20	34	41	23.80	68.00	6.80
	TOTAL FISH						364.96	586.88	77.36			350.80	558.10	74.15
MEAT	Beef & Veal	0.0995	0.0163	0.161	76	56	7.56	1.24	12.24	65	38	6.47	1.06	10.47
	Sheep meat	0.21	0.072	0.242	47	17	9.87	3.38	11.37	48	33	10.08	3.46	11.62
	Pork	0.0651	0.0833	0.129	50	25	3.26	4.17	6.45	40	23	2.60	3.33	5.16
	Bacon & Ham	0.0362	0.0463	0.0717	23	60	0.83	1.06	1.65	22	57	0.80	1.02	1.58
	Poultry: coated	0.15	0.35	0.15	38	18	5.70	13.30	5.70	36	1	5.40	12.60	5.40
	Poultry: fresh & dishes	0.15	0.35	0.15	81	67	12.15	28.35	12.15	54	48	8.10	18.90	8.10
	Sausages	0.012	0.015	0.023	45	37	0.54	0.68	1.04	35	22	0.42	0.53	0.81
	Other: Liver	0.036	0.006	0.058	25	4	0.90	0.15	1.45	30	14	1.08	0.18	1.74
	Other: Burgers	0.036	0.006	0.058	52	15	1.87	0.31	3.02	30	4	1.08	0.18	1.74
	Other: Meat pies & pastries	0.036	0.006	0.058	38	26	1.37	0.23	2.20	38	38	1.37	0.23	2.20
	Other: products & dishes	0.036	0.006	0.058	24	23	0.86	0.14	1.39	38	20	1.37	0.23	2.20
	TOTAL MEAT						97.93	53.01	58.66			38.76	41.71	51.01
EGGS		0	0.322	0.029	34	49	0.00	10.95	0.99	30	57	0.00	9.66	0.87
	TOTAL INTAKE						**462.89**	**650.84**	**137.00**			**389.56**	**609.47**	**126.03**

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid
*EPA and DHA concentrations derived from Givens and Gibbs, 2006

Table 2.9.2-5 Median Daily Intakes of Omega-3 Long Chain Polyunsaturated Fatty Acids (LCPUFA) Per Food Group in Women Aged 19-64 Years and 65+ Years in the NDNS Rolling Programme 2008/9-2009/10 in Consumers Only

		Concentration (mg/g)*			Women									
					19-64 years (n=346)					65+ years (n=96)				
FOOD	**Food description**	EPA	DHA	DPA	Intake (g/d)	% cons	EPA (mg)	DHA (mg)	DPA (mg)	Intake (g/d)	% cons	EPA (mg)	DHA (mg)	DPA (mg)
FISH	White fish	0.68	1.94	0.23	30	20	20.40	58.20	6.90	34	27	23.12	65.96	7.82
	Oil-rich fish	7.8	10.6	1.5	32	28	249.60	339.20	48.00	25	34	195.00	265.00	37.50
	Other fish, incl shellfish	0.7	2	0.2	30	37	21.00	60.00	6.00	38	42	26.60	76.00	7.60
	TOTAL FISH						291.00	457.40	60.90			244.72	406.96	52.92
MEAT	Beef & Veal	0.0995	0.0163	0.161	82	50	8.16	1.34	13.20	82	45	8.16	1.34	13.20
	Sheep meat	0.21	0.072	0.242	34	19	7.14	2.45	8.23	40	21	8.40	2.88	9.68
	Pork	0.0651	0.0833	0.129	30	18	1.95	2.50	3.87	20	24	1.30	1.67	2.58
	Bacon & Ham	0.0362	0.0463	0.0717	15	52	0.54	0.69	1.08	15	60	0.54	0.69	1.08
	Poultry: coated	0.15	0.35	0.15	40	12	6.00	14.00	6.00	40	7	6.00	14.00	6.00
	Poultry: fresh & dishes	0.15	0.35	0.15	65	65	9.75	22.75	9.75	45	55	6.75	15.75	6.75
	Sausages	0.012	0.015	0.023	30	30	0.36	0.45	0.69	23	24	0.28	0.35	0.53
	Other: Liver	0.036	0.006	0.058	21	7	0.76	0.13	1.22	21	6	0.76	0.13	1.22
	Other: Burgers	0.036	0.006	0.058	26	13	0.94	0.16	1.51	30	9	1.08	0.18	1.74
	Other: Meat pies & pastries	0.036	0.006	0.058	30	20	1.08	0.18	1.74	30	25	1.08	0.18	1.74
	Other: products & dishes	0.036	0.006	0.058	25	20	0.90	0.15	1.45	28	25	1.01	0.17	1.62
	TOTAL MEAT						37.58	44.79	48.73			35.35	37.33	46.14
EGGS		0	0.322	0.029	30	45	0.00	9.66	0.87	25	69	0.00	8.05	0.73
	TOTAL INTAKE						**328.58**	**511.85**	**110.50**			**280.07**	**452.34**	**99.78**

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid
*EPA and DHA concentrations derived from Givens and Gibbs, 2006

2.10 CONCLUSIONS

Consumption data and information pertaining to the individual food-uses for LCPUFA (EPA, DHA, and DPA) were used to estimate total population intakes of specific demographic groups in the U.K. population. In summary, total LCPUFA intakes were seen to increase with age, with an intake of 117.88 mg/day in toddlers, increasing to an intake of 538.98 mg/day in elderly males, for total population intakes of EPA, DHA, and DPA. Fish was the main contributor to total EPA and DHA intakes in each population group, followed by poultry, while meat was the main contributor to DPA intakes. Consumers of white fish ranged from 15% (girls aged 11 to 18 years) to 44% (boys aged 4 to 10 years), and for oil-rich fish ranged from 7% (boys aged 11 to 18 years) to 38% (men aged 65+ years). As oily fish is the main source of EPA and DHA in the diet, the higher intake of total LCPUFA in elderly adults can be explained by the increased consumers of oily fish in this population group compared to other age groups.

SECTION 3: INTAKES OF LCPUFA FROM FORTIFIED FOODS

3.1 SUMMARY

On the 27 June 2011 the EFSA received a request from the European Commission for scientific advice on the safety of LCPUFA. This report presents an up-to-date conservative assessment of EPA and DHA intakes from fortified foods across the EU. GOED has collected data on current and potential future foods fortified with their respective levels of EPA and DHA, and these data have been used to run the intake assessments reported herein.

Intake assessments were conducted at a detailed food-code level in the U.K. using the NDNS. To provide an impression of the level of intakes across the EU, further intake assessments were conducted at a food category level in many Member States using published statistics from the EFSA Comprehensive database (EFSA, 2011). For the detailed U.K. assessments, 3 scenarios of EPA and DHA concentration data were examined, the first related to the actual data provided by GOED, and the 2nd and 3rd related to adjusting the concentration data to keep in line with the current Regulation on nutrition labelling claims for 'Source of' and 'High in' omega-3 fatty acids, respectively. Both the calculated mean concentration value per food category and the full range of concentration data available were used in different assessments in an attempt to ensure that all aspects of utilizing the data at hand according to current practices of conducting exposure assessments were addressed. Finally, assumptions on market share of fortified foods within each food category for the EU were incorporated into the exposure assessments, along with aspects of consumer loyalty to try and achieve a realistic overview of exposure to EPA and DHA from fortified foods.

Regarding current market practice (*i.e.,* fortification of breads, eggs, margarine, milk and yogurts), based on the NDNS database and mean concentration data provided by GOED, the highest mean, 90th and 95th percentile intakes of EPA and DHA by the U.K. population were observed in male adults, at 378.8, 629.7, and 729.1 mg/person/day, respectively, while children had the lowest mean, 90th, and 95th percentile intakes of 267.9, 444.4, and 529.4 mg/person/day, respectively. Incorporating market share data (of 1 to 5% share of fortified foods per food category) reduced the exposure estimates by a similar magnitude.

Potential future fortification practices were also examined, with the inclusion of 25 food categories identified by GOED as being fortified with EPA and DHA in certain regions of the EU market. For this assessment the highest mean, 90th and 95th percentile intakes of EPA and DHA by the U.K. population were observed in male adults, at 528.0, 837.9, and 962.3 mg/person/day, respectively, while children also had the lowest mean, 90th, and 95th percentile intakes of 381.5, 566.1, and 644.0 mg/person/day, respectively.

Using data from the Comprehensive database some overall observations can be made on the range of intakes across the EU from these five fortified sources. Mean EPA and DHA intakes ranged from 156.5 to 239.6 mg/day in infants, from 248.6 to 451.7 mg/day in

toddlers, from 255.7 to 659.2 mg/day in other children, from 300.6 to 630.5 mg/day in adolescents, from 363.3 to 623.9 mg/day in adults, from 376.9 to 629.2 mg/day in the elderly and from 413.8 to 661.5 mg/day in the very elderly. Overall, EPA and DHA intakes based on the Comprehensive database were higher than those observed in the NDNS survey population groups. This is because the exposure assessment conducted in the NDNS surveys was possible at a food-code level, allowing a much more specific matching of the fortified food-use concentration data than was possible using the Comprehensive data, which was forced at a cruder food category level.

3.2 INTRODUCTION

Recently, concern has been raised amongst some EU Member States over consumption levels of the LCPUFAs, including DHA and EPA in the EU. Specifically, on the 27 June 2011 the EFSA received a request from the European Commission for scientific advice on the safety of LCPUFA (Ref.Ares(2011)632774).

GOED has collected data on fortification levels of EPA and DHA in foods consumed across the EU. Data on the fortified use of DPA have not been gathered by GOED, due the limited commercial value and use of this LCPUFA, therefore intakes of DPA from fortified sources are not considered in this assessment. These data gathered by GOED on occurrence and actual use levels have now been used to assess exposure to LCPUFA in the EU. Intertek Cantox has formatted the data so they are amenable for intake assessments. These assessments have been carried out at a detailed level using the NDNS, and also at a broader level in other EU countries using the EFSA comprehensive dataset[3]. These surveys provide published data on the intakes of food categories by children, adolescents, adults, and elderly populations in 22 EU Member States. The present report provides a more accurate and detailed estimate of exposure to LCPUFA in fortified foods than has been previously possible.

3.3 FOOD CONSUMPTION SURVEY DATA

3.3.1 U.K. National Diet and Nutrition Survey: Survey Description

Detailed estimates for the intake of EPA and DHA were based on the fortified use-levels and food consumption data collected as part of the U.K. Food Standards Agency's DSP. Calculations for the mean and high-level (95th percentile) all-person and all-user intakes, and percent consuming were performed for each of the individual fortified food-uses for EPA and DHA. Similar calculations were used to determine the estimated total intake of EPA and DHA from all fortified food-uses combined. In both cases, the per-person and per-kilogram body weight intakes were reported for the following population groups:

[3] http://www.efsa.europa.eu/en/press/news/datex110302.htm

children, ages 1½ to 4½
young people, ages 4 to 10;
female teenagers, ages 11 to 18;
male teenagers, ages 11 to 18;
female adults, ages 19 to 64;
male adults, ages 19 to 64.

The Ministry of Agriculture, Fisheries, and Food (MAFF) and the Department of Health were responsible for the joint commission of the NDNS program in 1992. The responsibility for the program was subsequently transferred from MAFF to the FSA upon its inception in April 2000. The NDNS program itself consists of 4 different surveys targeting specific age groups, which were conducted every 3 years in succession. Separate survey data are available from the U.K. Data Archive (UKDA) for the NDNS: Adults Aged 19 to 64 years collected in 2000-2001 (NDNS 2000-2001) (Office for National Statistics, 2005), the National Diet, Nutrition and Dental Survey of Children Aged 1½ to 4½ Years, 1992-1993 (NDNS 1992-1993) (UKDA, 1995), the National Diet and Nutrition Survey: Young People aged 4 to 18 Years (NDNS 1997) (UKDA, 2001), and the National Diet and Nutrition Survey: People Aged 65 Years and Over, 1994-1995. Although all 4 surveys are available, only the former 3 were utilized in the generation of estimates in the current intake analysis. When combined, the survey results provide the most current data for use in the evaluation of food-use, food-consumption patterns, and nutritional status for individuals residing within the U.K. Weighted 4- or 7-day food records for individuals were selected using a stratified multi-stage random probability design, with sampling of private households throughout Great Britain using postal sectors (UKDA, 1995, 2001; Office for National Statistics, 2005) as the primary sampling unit.

NDNS data were collected from individuals as well as households *via* 4- (children, aged 1½ to 4½) or 7-day (young people, aged 4 to 18 and adults, aged 16 to 64) weighed dietary intake records throughout all 4 seasons of the year (4 fieldwork waves of 3 months duration), in order to address variability in eating behaviours due to seasonality. Dietary data were recorded by survey respondents or by parents or guardians in the case of the children's survey for the duration of the survey period. NDNS 2000-2001 contains 7-day weighed dietary records for more than 1724 individuals aged 19 to 64, while, NDNS 1992-1993 contributes 4-day data from an additional 1592 children 1½ to 4½ years of age. NDNS 1997 adds 7-day records for approximately 1,700 youth aged 4 to 18 (UKDA, 1995, 2001; Office for National Statistics, 2005). Initial postal questionnaires and interviews were employed to identify eligible children, youth, or adults, respectively, for the surveys. Overall, response rates of 93%, 92%, and 73% were achieved; the maximum response rate (individuals agreeing to the initial dietary interview) from the eligible sample selected for participation in the survey were, 88%, 80%, and 61%, respectively, while only 81%, 64%, and 47% of surveyed individuals completed a full dietary record (Gregory *et al*., 1995; UKDA, 2001; Office for National Statistics, 2005).

The NDNS program collects physiological, anthropometric and demographic information from individual survey participants, such as sex, age, measured height and weight (by the interviewer), blood analytes, and other variables useful in characterizing consumption in addition to collecting information on the types and quantities of foods being consumed. Further assessment of food intake based on consumption by specific population groups of interest within the total surveyed samples was made possible by the inclusion of this information. In order to compensate for the potential under-representation of intakes from specific population groups resulting from sample variability due to differential sampling probabilities and differential non-response rates [particularly the lower response rate among males aged 15 to 18 years (UKDA, 2001), sample weights were developed and incorporated with the youth survey (NDNS, 1997).

Weighting the children's survey data to 7 days facilitated the comparison of adult and youth 7-day dietary survey data to dietary data obtained in the 4-day children's survey. This change was based on the assumption that intake patterns on non-recording weekdays were similar to the intakes on recorded weekdays. The 2 weekend days were not re-weighted. All food and drinks consumed on the 2-recorded weekdays were averaged to obtain a daily intake value, which was then multiplied by 5 to approximate intakes for all weekdays. This data was combined with consumption data from weekend dietary records. The full details of the weighting method employed are provided in Appendix J of the report on the children's diet and nutrition study (Gregory *et al*., 1995).

3.3.2 Statistical Methods

Statistical analysis and data management were conducted in Creme software (Creme Software, 2012). Creme Food 3.0 is a probabilistic modelling software tool that uses high-performance computing to allow accurate estimate of exposure to contaminants, food additives, flavourings, nutrients, food packaging migratory compounds, novel foods, pesticide residues, and microbial contaminants. The main input components are concentration (use level) data and food consumption data. Data sets are combined using the Creme Food 3.0 model to provide accurate and efficient exposure assessments. This software has the facility for advanced exposure assessments, including probabilistic assessments.

Both deterministic and probabilistic approaches[4] were used in the current exposure assessment. The results of these can be compared to provide a greater understanding of the intake of EPA and DHA in the U.K. population. For the deterministic approach, single point-estimates per food groups to represent the EPA and DHA concentration data were used (mean value), while for the probabilistic approach, the full range of EPA and DHA concentration data were used. The scenarios used in the assessments are outlined in detail

[4] A deterministic approach refers to an assessment which uses single fixed points to represent input parameters, such as a mean value for a chemical concentration. A probabilistic approach uses a range or distribution of values to represent some or all input parameters, such as a range of chemical concentration values. This approach will incorporate aspects of uncertainty and inherent variability present in the data into the exposure model.

in Section 3.3. Furthermore, estimated market share data and assumptions regarding loyalty to fortified food uses were used in the assessments to provide a more realistic overview of intakes in the U.K. from fortified sources. Results for the deterministic assessments, probabilistic assessments and the market share and loyalty assessments are provided separately in Section 3.4.

For the deterministic assessment, estimates for the intake of EPA and DHA by the U.K. population was generated by Creme software, using consumption data from individual dietary records, detailing food items ingested by each survey participant on each of the survey days (Crème Software, 2012). Estimates for the daily intake of EPA and DHA represent projected 7-day averages for each individual from days 1 to 7 of NDNS data. The distribution from which mean and percentile intake estimates were produced was comprised of these average amounts. Mean and percentile estimates were generated using ratio estimation and nonparametric techniques, incorporating survey weights where appropriate (*i.e.,* when using youth data to estimate intakes, as described in Section 3.3.1) in order to provide representative intakes for specific U.K. population groups. All-person intake refers to the estimated intake of EPA and DHA averaged over all individuals surveyed regardless of whether they consumed food products in which EPA and DHA is currently proposed for use, and therefore includes "zero" consumers (those who reported no intake of food products for which EPA and DHA is proposed for use during the 7 survey days). All-user intake refers to the estimated intake of EPA and DHA by those individuals consuming food products in which the use of EPA and DHA is currently under consideration, hence the 'all-user' designation. Individuals were considered users if they consumed one or more food products in which EPA and DHA is proposed for use on one of the 7 survey days.

For the probabilistic assessment, in place of a fixed mean value, consumption data for each individual was multiplied by one concentration data point from the range of possible concentration data values per food group per food per eating occasion per subject per model run. The sample was run 10 times to ensure that the actual range of possible concentration values was accounted for. While the mean consumer will have very similar 7-day EPA and DHA exposures as in the deterministic case, the higher percentile consumers will have higher 7-day exposures and the lower percentile consumers will have lower 7-day exposures. Especially when there is a wide range of values, probabilistic methods can provide crucial insight into high and low consumers. Even when the mean population intake is acceptable, the risk of low consumers not benefiting as much from the fortification as the deterministic calculation can be highlighted. The corresponding risk of excess intake is also highlighted, especially when consumer loyalty is taken into account.

The impact of market share and consumer loyalty to fortified food products were also considered in separate intake assessments. Advice on market share data was sought from GOED and different loyalty models were applied to the intake assessments to understand the impact of including these additional specifications into the exposure models.

Mean, 90th, 95th percentile intake estimates based on sample sizes of less than 30, 80, and 160, respectively, may not be considered statistically reliable due to the limited sampling size (LSRO, 1995). As such, the reliability of estimates for the intake of EPA and DHA based on the consumption of these foods may be questionable for certain individual population groups.

3.4 FOOD USAGE DATA

The individual fortified use-levels for EPA and DHA employed in the intake analysis are summarized in Table 3.4-1, and these are based on the data supplied by GOED. Food codes representative of each potential fortified food-use were chosen from the MAFF food code list associated with each food consumption survey (UKDA, 1995, 2001; Office for National Statistics, 2005) and grouped in food-use categories according to the food categorisation system for food additives recently published in Commission Regulation 1129/2011 (European Commission, 2011). All food codes used in the current assessment are detailed in Appendix C. A given food code may not be associated with all 3 surveys; as with each new survey the food code list has been updated to reflect the availability of new foods and the discontinuation of certain obsolete codes.

For each fortified food-use, GOED provided concentration data per each individual fortified food identified in their database of use in the EU in mg per 100 g of food. From these data, deterministic assessments were run using the mean concentration value calculated from the total data, and probabilistic assessments were run using the complete range of concentration data as supplied (Table 3.4-1).

For the deterministic assessments (using the mean concentration value per food group) and the probabilistic assessments (using the full range of concentration data per food group), 3 intake assessment scenarios were conducted and these are presented in Table 3.4-1:

Scenario 1: Mean and range values per food group as supplied by GOED used.

Scenario 2: Minimum threshold of 40 mg EPA & DHA per 100 g of each food applied to each food group. This is to coincide with Commission Regulation 116/2010 with regard to nutrition claims, which states that *'a claim that a food is a source of omega-3 fatty acids…may only be made where the product contains at least 40 mg of the sum of EPA and DHA per 100 g and per 100 kcal'.* Mean concentration values were recalculated based on this cut-off (European Commission, 2010).

Scenario 3: Minimum threshold of 80 mg EPA & DHA per 100 g of each food applied to each food group. This is to coincide with Commission Regulation 116/2010 with regard to nutrition claims, which states that *'a claim that a food is high in omega-3 fatty acids…may only be made where the product contains at least 80 mg of the sum of EPA and DHA per 100 g and per 100 kcal'.* Mean concentration values were recalculated based on this cut-off.

Scenarios 2 and 3 represent the commercial realities of omega-3 fortification of foods. It could be assumed that there would be no commercial benefit for a company to enrich beyond (or lower than) the minimum requirements for being able to post a claim 'high in omega-3 fatty acids'.

Table 3.4-1 Summary of the Individual Fortified Food-Uses and Use-Levels for EPA and DHA in the EU for Three Scenarios of Concentration Data

EU Food Category	EU Food Sub-Category	Current Fortified Food-Use (GOED database)	Scenario 1: Use levels (mg/100g)		Scenario 2: Use levels (mg/100g)		Scenario 3: Use levels (mg/100g)	
			Mean	Range	Mean	Range	Mean	Range
Dairy products and analogues	Unflavoured pasteurised and sterilised (including UHT) milk	Milk (including flavoured milk)	57.33	4.8,9,15,18.8,18.8, 20,20,20,20,20,20.3,25,25,25,30,30,30, 30,30,30,30,30,37.5, 37.5,37.5,37.5,40,40,40,50,55,55,60,60, 65,72,75,75,75,75, 76,80,90,110,175, 250, 425	65.6	40,40,40,40,40,40, 40,40,40,40,40,40, 40,40,40,40,40,40, 40,40,40,40,40,40, 40,40,40,40,40,50, 55,55,60,60,65,72, 75,75,75,75,76,80, 90,110,175,250, 425	93.83	80,80,80,80,80,80, 80,80,80,80,80,80, 80,80,80,80,80,80, 80,80,80,80,80,80, 80,80,80,80,80,80, 80,80,80,80,80,80, 80,80,80,80,80,80, 90,110,175,250, 425
	Flavoured fermented milk products including heat treated products	Yogurts	137.71	20,20,20,20.8,22,25, 30,30,30,30,75,75, 75,75,75,75,100,100,100,100,100,150, 150,150,167,167, 167,333.3,333.3, 333.3,333.3,400,400,400	142.19	40,40,40,40,40,40, 40,40,40,40,75,75, 75,75,75,75,100, 100,100,100,100, 150,150,150,167, 167,167,333.3, 333.3,333.3,333.3, 400, 400,400	154.83	80,80,80,80,80,80, 80,80,80,80,80,80, 80,80,80,80,100, 100,100,100,100, 150,150,150,167, 167,167,333.3, 333.3,333.3,333.3, 400,400,400
	Cream and cream powder	Cream	90	90	90	90	90	90
	Cheese and cheese products	Processed cheese (Fromage frais, cottage cheese, cheese spread)	159.86	18,70,90,230, 391.3	164.26	40,70,90,230, 391.3	174.26	80,80,90,230, 391.3

Table 3.4-1 Summary of the Individual Fortified Food-Uses and Use-Levels for EPA and DHA in the EU for Three Scenarios of Concentration Data

EU Food Category	EU Food Sub-Category	Current Fortified Food-Use (GOED database)	Scenario 1: Use levels (mg/100g)		Scenario 2: Use levels (mg/100g)		Scenario 3: Use levels (mg/100g)	
			Mean	Range	Mean	Range	Mean	Range
Fats and oils, and fat emulsions	Fats and oils essentially free from water (excluding anhydrous milkfat)	Oils (Not in cooking)	729.16	200,300,300,500, 500,500,533.3, 3000	729.16	200,300,300,500, 500,500,533.3, 3000	729.16	200,300,300,500, 500,500,533.3, 3000
	Fat and oil emulsions mainly of type water-in-oil	Margarine and Spreads (Not in cooking)	545.66	70,86,86,90,90,140, 240,240,275,400, 400,400,450,493, 500,500,500,500, 500,500,500,500, 500,500,500,500, 500,500,500,500, 675,700,700,700, 750,750,800, 4200	545.66	70,86,86,90,90,140,240,240,275,400, 400,400,450,493, 500,500,500,500, 500,500,500,500, 500,500,500,500, 500,500,500,500, 675,700,700,700, 750,750,800, 4200	545.92	80,86,86,90,90,140,240,240,275,400, 400,400,450,493, 500,500,500,500, 500,500,500,500, 500,500,500,500, 500,500,500,500, 675,700,700,700, 750,750,800, 4200
Fruit and vegetables	Processed fruit and vegetables	Olives	54.82	0.12,50,72,72,80	62.8	40,50,72,72,80	80	80
		Processed potatoes (frozen varieties)	20	20	40	40	80	80
Confectionery	Cocoa and Chocolate products as covered by Directive 2000/36/EC	Chocolate Bars	300	300	300	300	300	300
Cereals and cereal products	Breakfast cereals	RTE Breakfast Cereals	16.83	9.7,24	40	40	80	80

Table 3.4-1 Summary of the Individual Fortified Food-Uses and Use-Levels for EPA and DHA in the EU for Three Scenarios of Concentration Data

EU Food Category	EU Food Sub-Category	Current Fortified Food-Use (GOED database)	Scenario 1: Use levels (mg/100g)		Scenario 2: Use levels (mg/100g)		Scenario 3: Use levels (mg/100g)	
			Mean	Range	Mean	Range	Mean	Range
Bakery wares	Bread and rolls	Bread and Rolls	187.21	40,41.7,52.8,60,76.3,86.8,86.8,86.8,86.8, 86.8,86.8,86.8,102.3,200,270.8,400,400,541.7,763.9	187.21	40,41.7,52.8,60, 76.3,86.8,86.8,86.8, 86.8,86.8,86.8,86.8,102.3,200,270.8, 400,400,541.7,763.9	194.01	80,80,80,80,80,86.8,86.8,86.8,86.8,86.8,86.8,86.8,102.3,200, 270.8,400,400, 541.7,763.9
	Fine bakery wares	Snack Bars, including cereal bars and energy bars	437.3	151.1,151.1,250, 285.7,285.7,326.7, 655,655,655,655, 740	437.3	151.1,151.1,250, 285.7,285.7,326.7, 655,655,655,655, 740	437.3	151.1,151.1,250, 285.7,285.7,326.7, 655,655,655,655, 740
		Cookies/Biscuits	156.9	43.5,156,185,200, 200	156.9	43.5,156,185,200, 200	164.2	80,156,185,200,200
Meat	Processed meat	Turkey meat (*i.e.* Mince, sausages & burgers)	100	100	100	100	100	100
		Processed meat (including sausages, ham, burgers, pate, processed chicken)	117.12	25,26.7,95.7,100, 100,100,100,100, 100,100,100,100, 112.5,112.5,112.5, 125,195.7,200,200, 236.8	118.54	40,40,95.7,100,100,100,100,100, 100,100,100,112.5, 112.5,112.5,125, 195.7,200,200,236.8	122.54	80,80,95.7,100,100,100,100,100, 100,100,100,112.5, 112.5,112.5,125, 195.7,200,200,236.8
	Meat analogues	Quorn	100	100	100	100	100	100
Fish and fisheries products	Processed fish and fishery products including molluscs and crustaceans	Processed fish (Canned tuna & fish fingers)	372.24	125,238.1,238.1,260,1000	372.24	125,238.1,238.1,260, 1000	372.24	125,238.1,238.1, 260,1000
Eggs and egg products	Unprocessed eggs	Eggs	321.67	102.5,166.7,228,250,250,250,280,280, 300,388.3,388.3, 416.7,416.7,524.6, 583.3	321.67	102.5,166.7,228, 250,250,250,280, 280,300,388.3, 388.3,416.7,416.7,524.6,583.3	321.67	102.5,166.7,228, 250,250,250,280, 280,300,388.3, 388.3,416.7,416.7,524.6,583.3

Table 3.4-1 Summary of the Individual Fortified Food-Uses and Use-Levels for EPA and DHA in the EU for Three Scenarios of Concentration Data

EU Food Category	EU Food Sub-Category	Current Fortified Food-Use (GOED database)	Scenario 1: Use levels (mg/100g)		Scenario 2: Use levels (mg/100g)		Scenario 3: Use levels (mg/100g)	
			Mean	Range	Mean	Range	Mean	Range
Foods intended for particular nutritional uses as defined by Directive 2009/39/EC	Foods for infants and young children	Infant and toddler milk	6.1	4.1,4.3,8,8	40	40	80	80
	Dietary foods for special medical purposes defined in Directive 1999/21/EC (excluding products from food category 13.1.5)	Meal replacement beverages	800	800	800	800	800	800
Beverages	Non-alcoholic beverages	Fruit Juice Drinks	48.27	10,18,23.4,30,31.3, 36,36,36,36,36,39.1,40,40,46.9,60,60, 111.2,179	54.28	40,40,40,40,40,40, 40,40,40,40,40,40, 40,46.9,60,60,111.2,179	87.23	80,80,80,80,80,80, 80,80,80,80,80,80, 80,80,80,80,111.2, 179
		Smoothies	75.79	8,10,20,20,24,24.4, 30,30,30,32,37,37, 37,37,40,40,40,50, 60,75,75,75,75,75, 75,75,77,77,80,80, 80,80,80,80,80,80, 80,85,180,180,180, 180,200,200,200	79.87	40,40,40,40,40,40, 40,40,40,40,40,40, 40,40,40,40,40,50, 60,75,75,75,75,75, 75,75,77,77,80,80, 80,80,80,80,80,80, 80,85,180,180,180, 180,200,200,200	97	80,80,80,80,80,80, 80,80,80,80,80,80, 80,80,80,80,80,80, 80,80,80,80,80,80, 80,80,80,80,80,80, 80,80,80,80,80,80, 80,85,180,180,180, 180,200,200,200
		Beverage mixes	250	250	250	250	250	250
Processed foods not covered by categories 1 to 17, excluding foods for infants and young children		Canned pasta and beans	66.77	35.7,35.7,35.7,36.5, 75,75,75,75,75,75, 75,75,75,75,75,75, 75,75,75	67.63	40,40,40,40,75,75, 75,75,75,75,75,75, 75,75,75,75,75,75, 75	80	80
		Ready meals	60	38,38,38,38,38,170	61.67	40,40,40,40,40,170	95	80,80,80,80,80,170

Scenario 1: Concentration values for EPA & DHA as provided by GOED per food group
Scenario 2: A minimum threshold of 40mg per 100g for concentration values for EPA & DHA provided by GOED per food group
Scenario 3: A minimum threshold of 80mg per 100g for concentration values for EPA & DHA provided by GOED per food group

For all assessments (*i.e.* deterministic using mean concentration data and probabilistic using the full range of concentration data), initially an intake assessment based on current market practice in the EU for fortified food use was run, which examined the intake of EPA and DHA from 5 of the 25 food groups (bread, eggs, margarine/spreads, milk and yogurt). These food groups were identified by GOED members as representing current market practice. These results are presented separately to the intake results from all food categories together which represents potential future fortification practice. Future fortification practice was identified based on technical feasibility of fortifying products, potential commercial interests, and analysis of trial marketing exercises. Furthermore, market share data and consumer loyalty factors were also considered in a separate exposure assessment as outlined in Table 3.4-2. As accurate market share data on LCPUFA fortified foods in the EU for all food categories was not readily available, a conservative assumption was made by GOED members on the upper-range of market share of foods fortified with EPA and DHA per food category with a range of 5% or 10% assigned.

Along with assumptions for market share, consumer loyalty to fortified foods was also considered. Consumer loyalty refers to the level of loyalty or repeat consumption by an individual consumer of a fortified food during the survey period. Loyalty can vary from no loyalty (0%) to complete loyalty (100%) for each eating occasion of a particular food category. In the current assessments, 3 levels of consumer loyalty were considered: 0%, 50% and 100% and these were included in the assessments that incorporated market share.

The assessments incorporating market share and consumer loyalty parameters are to demonstrate a more realistic situation than presented in the other assessments, which assumed 100% market share and no consumer loyalty as default. Therefore results are only presented for Scenario 1 using mean EPA and DHA concentration values (*i.e.*, using the data as provided by GOED without application of minimum thresholds).

Table 3.4-2 Market Share Data for Food Categories Fortified with EPA and DHA in the EU Along with 3 Options for Consumer Loyalty (CL) Models to Fortified Food Category Intake

Food Group	Market share	Loyalty to fortified food		
		CL 1	CL 2	CL 3
Bars	5%	100%	50%	0%
Beverage mixes	5%	100%	50%	0%
Bread	5%	100%	50%	0%
Canned pasta & beans	5%	100%	50%	0%
Chocolate bars	5%	100%	50%	0%
Cookies	5%	100%	50%	0%
Cream	5%	100%	50%	0%
Eggs	10%	100%	50%	0%
Fruit-juice drinks	5%	100%	50%	0%
Margarines/Spreads	10%	100%	50%	0%
Meal replacement drinks	5%	100%	50%	0%
Milk	10%	100%	50%	0%

Table 3.4-2 Market Share Data for Food Categories Fortified with EPA and DHA in the EU Along with 3 Options for Consumer Loyalty (CL) Models to Fortified Food Category Intake

Food Group	Market share	Loyalty to fortified food		
		CL 1	CL 2	CL 3
Oils	5%	100%	50%	0%
Olives	5%	100%	50%	0%
Processed cheese	5%	100%	50%	0%
Processed fish	5%	100%	50%	0%
Processed meat	5%	100%	50%	0%
Processed potatoes	5%	100%	50%	0%
Quorn	5%	100%	50%	0%
Ready meals	5%	100%	50%	0%
RTE cereals	5%	100%	50%	0%
Smoothies	5%	100%	50%	0%
Turkey meat	5%	100%	50%	0%
Yogurt	10%	100%	50%	0%

Market share data reflects current upper range of assumed Market Share in the EU:
A market share for 5-10% for eggs, margarines, milk and yogurt and a Market share between 1-5% for all other food groups
CL: Consumer loyalty. 3 options: 100% loyalty, 50% loyalty and 0% loyalty

Market share and loyalty factors were also considered in the current market food group exposure assessment, where the 5 major food groups were considered in the intakes assessment (Table 3.4-3).

Table 3.4-3 Market Share Data for the 5 Major Food Categories Fortified with EPA and DHA in the EU Along with 3 Options for Consumer Loyalty (CL) Models to Fortified Food Category Intake

Food Group	Market share	Loyalty to fortified food		
		CL 1	CL 2	CL 3
Bread	3%	100%	50%	0%
Eggs	8%	100%	50%	0%
Margarines/Spreads	5%	100%	50%	0%
Milk	8%	100%	50%	0%
Yogurt	3%	100%	50%	0%

Market share data for 5 major mortified food groups reflects current upper range of assumed Market Share in the EU according to internal GOED consensus for the current intake assessment
CL: Consumer loyalty. 3 options: 100% loyalty, 50% loyalty and 0% loyalty

3.5 FOOD SURVEY RESULTS

Estimates for the total daily intakes of EPA and DHA from the assessment based on current market practice for 5 major food groups and from potential future fortified food-uses are provided in Sections 3.5.1, 3.5.2, and 3.5.3. Estimates for the daily intake of EPA and DHA from individual fortified food-uses in the EU are summarized in Tables A-1 to A-5 and B-1 to B-5 of Appendix A and B, respectively. Tables A-1 to A-5 provide estimates for the daily intake of EPA and DHA in the U.K. per person (mg/day), whereas Tables B-1 to B-5 provide estimates on a per kilogram body weight basis (mg/kg body weight/day).

3.5.1 Deterministic Assessments: Estimated Daily Intake of EPA and DHA from Fortified Food-Uses in the EU

For the deterministic assessments, mean EPA and DHA concentrations were calculated per food category for each scenario and these mean values were used to represent the fortified use-level per category in the assessments (refer to Table 3.4-1). Intakes are presented separately for the current practice and the potential future practice intakes assessments.

To present the intakes for current market practice for fortified foods in the EU, an assessment was examined which included 5 food groups – bread, eggs, margarine/spreads, milk and yogurt ('current practice'). These results are presented only for Scenario 1 in Tables 3.5.1-1 (mg/person/day) and Table 3.5.1-2 (mg/kg body weight/day). With the current intakes assessment, data for users only are also presented as there were some people in the surveys who did not consume at least 1 out of the 5 food groups.

Overall, EPA and DHA intakes (mg/day) were lower in this current practice assessment by an average of greater than 100 mg/day in each population group compared to when all food groups were considered (Table 3.5.1-3). Almost all individuals in each population group were users of at least 1 of the 5 food groups, with 100% users in young people. In users only, EPA and DHA intakes were highest in male adults with a mean intake of 380.99 mg/day (95th percentile intake of 730.90 mg/day) and lowest in children aged 1 to 4 years, with a mean intake of 268.40 mg/day (95th percentile intake of 529.55 mg/day).

Table 3.5.1-1 Summary of the Estimated Daily Intake of EPA and DHA from the 5 Major Fortified Food Categories in the U.K. by Population Group (NDNS Data) using Mean Concentration Values*

Population Group	Age Group (Years)	Total n	All-Person Consumption			All-Users Consumption			
			Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
				90	95			90	95
Children	1-4	1717	267.93	444.41	529.43	99.83	268.40	444.45	529.55
Young People	4-10	837	272.24	433.21	506.28	100	272.24	433.21	506.28
Teenagers	11-18	862	271.69	461.54	544.73	99.75	272.38	462.15	545.09
All adults	19-64	1,724	321.91	556.53	654.12	99.45	323.69	557.55	654.61
Male Adults	19-64	958	378.75	629.69	729.10	99.41	380.99	630.71	730.90
Female Adults	19-64	766	268.75	457.82	520.68	99.49	270.14	458.88	520.78

*Scenario 1 only used for the current market intake assessment for the 5 major fortified food groups

For the current market intakes assessment, on a body weight basis looking at users only, EPA and DHA intakes were highest in children aged 1 to 4 years, with a mean intake of 19.87 mg/kg body weight/day (95th percentile intake of 40.48 mg/kg body weight/day), and lowest in female adults with a mean intake of 4.04 mg/kg body weight/day (95th percentile intake of 8.09 mg/kg body weight/day) (Table 3.5.1-4).

Table 3.5.1-2 Summary of the Estimated Daily Per Kilogram Body Weight Intake of EPA and DHA from the 5 Major Fortified Food Categories in the U.K. by Population Group (NDNS Data) using Mean Concentration Values*

Population Group	Age Group (Years)	Total n	All-Person Consumption			All-Users Consumption			
			Mean (mg/kg)	Percentile (mg/kg)		%	Mean (mg/kg)	Percentile (mg/kg)	
				90	95			90	95
Children	1-4	1717	19.83	34.09	40.48	99.83	19.87	34.09	40.48
Young People	4-10	837	10.88	18.66	22.19	100	10.88	18.66	22.19
Teenagers	11-18	862	5.12	8.91	10.35	99.75	5.14	8.92	10.35
All adults	19-64	1,724	4.32	7.42	8.54	99.45	4.34	7.42	8.54
Male Adults	19-64	958	4.63	7.71	9.24	99.41	4.65	7.72	9.25
Female Adults	19-64	766	4.02	6.99	8.09	99.49	4.04	7.00	8.09

*Scenario 1 only used for the current market intake assessment for the 5 major fortified food groups

Intakes from all 25 food categories which can potentially be fortified with EPA and DHA in the EU are presented in Tables 3.5.1-3 and 3.5.1-4. Table 3.5.1-3 summarizes the estimated total intake of EPA and DHA (mg/person/day) from all fortified food-uses by U.K. population group per intake scenario. Table 3.5.1-4 presents this data on a per kilogram body weight basis (mg/kg body weight/day). As would be expected for a 7-day survey and with the number of food categories included in the intake assessment, 100% of each of the population groups consisted of users of at least one of those food products currently fortified with EPA and DHA.

Overall, EPA and DHA intakes (mg/day) were greatest for Scenario 3 for all population groups, as this scenario used a minimum threshold of 80 mg per 100 g of EPA and DHA per food. However, the results provided in Scenario 1 reflect the current situation of how foods are fortified in the EU, using the very conservative assumption that all foods that can be fortified with EPA and DHA are actually fortified. For Scenario 1, of the individual population groups, male adults were determined to have the greatest mean, 90th, and 95th percentile intakes of EPA and DHA on an absolute basis, at 528.0, 837.9, and 962.3 mg/person/day, respectively, while children had the lowest mean, 90th, and 95th percentile intakes of 381.5, 566.1, and 644.0 mg/person/day, respectively (Table 3.5.1-3).

Table 3.5.1-3 Summary of the Estimated Daily Intake of EPA and DHA from All Fortified Food Categories in the U.K. by Population Group (NDNS Data) for 3 Scenarios using Mean Concentration Values

Population Group	Age Group (Years)	Total n	Scenario 1			Scenario 2			Scenario 3		
			Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)	
				90	95		90	95		90	95
Children	1.5 -4.5	1717	381.5	566.1	644.0	404.6	602.4	702.0	486.9	749.8	881.1
Young people	4 - 10	837	442.1	704.3	775.7	459.3	644.9	732.2	525.6	766.0	834.6
Teenagers	11 - 18	862	431.1	742.1	807.3	442.8	680.9	758.6	489.1	761.0	844.5
All Adults	19 - 64	1724	455.3	737.5	865.2	466.4	760.4	882.1	511.6	832.4	970.0
Male adults	19 - 64	766	528.0	837.9	962.3	539.5	859.3	978.4	587.4	935.1	1092.2
Female adults	19 - 64	958	387.3	596.8	691.7	398.1	608.8	719.1	440.8	689.5	818.6

Scenario 1: All product concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
Scenario 2: A minimum threshold of 40 mg per 100 g for concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
Scenario 3: A minimum threshold of 80 mg per 100 g for concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
The concentration value used in all scenarios to calculate these results was the mean value calculated per food group

For Scenario 1, on a body weight basis, children were identified as having the highest mean, 90th, and 95th percentile intakes of any population group, of 28.1, 43.5, and 50.6 mg/kg body weight/day, respectively. Female adults had the lowest mean, 90th and 95th percentile intakes at 5.8, 9.1, and 10.7 mg/kg body weight/day (Table 3.5.1-4).

Table 3.5.1-4 Summary of the Estimated Daily Per Kilogram Body Weight Intake of EPA and DHA from All Fortified Food Categories in the U.K. by Population Group (NDNS Data) for 3 Scenarios using Mean Concentration Values

Population Group	Age Group (Years)	Total n	Scenario 1			Scenario 2			Scenario 3		
			Mean (mg/kg)	Percentile (mg/kg)		Mean (mg/kg)	Percentile (mg/kg)		Mean (mg/kg)	Percentile (mg/kg)	
				90	95		90	95		90	95
Children	1.5 -4.5	1717	28.1	43.5	50.6	29.9	46.6	54.6	36.1	58.3	68.8
Young people	4 - 10	837	17.6	31.3	35.9	18.3	28.3	32.9	21.0	33.2	39.7
Teenagers	11 - 18	862	8.5	15.8	18.1	8.7	14.4	16.4	9.6	16.1	18.4
All Adults	19 - 64	1724	6.1	9.7	11.4	6.3	9.9	11.5	6.9	11.1	12.8
Male adults	19 - 64	766	6.5	10.1	12.1	6.6	10.3	12.3	7.2	11.4	13.6
Female adults	19 - 64	958	5.8	9.1	10.7	6.0	9.6	11.2	6.6	10.8	12.3

Scenario 1: All product concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
Scenario 2: A minimum threshold of 40 mg per 100 g for concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
Scenario 3: A minimum threshold of 80 mg per 100 g for concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
The concentration value used in all scenarios to calculate these results was the mean value calculated per food group

3.5.2 Probabilistic Assessments: Estimated Daily Intake of EPA and DHA from All Fortified Food-Uses in the EU

For the probabilistic assessments, the full range of EPA and DHA concentration data per food product for each scenario were used in place of mean values (refer to Table 3.4-1). Intakes are presented separately for the 'current' and the 'potential future' intakes assessments.

For the intake assessment based on current market practice 'current practice', in users only, EPA and DHA intakes were highest in male adults with a mean intake of 379.92 mg/day (95^{th} percentile intake of 773.01 mg/day) and lowest in children aged 1 to 4 years, with a mean intake of 268.49 mg/day (95^{th} percentile intake of 579.81 mg/day) (Table 3.5.2-1).

Table 3.5.2-1 Summary of the Estimated Daily Intake of EPA and DHA from the 5 Major Fortified Food Categories in the U.K. by Population Group (NDNS Data) using the Range of Concentration Values*

Population Group	Age Group (Years)	Total n	All-Person Consumption			All-Users Consumption			
			Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
				90	95			90	95
Children	1-4	1717	268.02	481.15	579.39	99.83	268.49	481.25	579.81
Young People	4-10	837	272.12	461.74	542.29	100	272.12	461.74	542.29
Teenagers	11-18	862	272.84	496.98	586.95	99.75	273.53	497.37	587.33
All adults	19-64	1,724	321.80	578.97	691.82	99.45	323.58	579.97	692.77
Male Adults	19-64	958	377.69	657.50	772.06	99.41	379.92	658.65	773.01
Female Adults	19-64	766	268.97	482.15	566.52	99.49	270.36	483.38	567.50

*Scenario 1 only used for the current market intake assessment for the 5 major fortified food groups

For the current market intakes assessment, on a body weight basis looking at users only, EPA and DHA intakes were highest in children aged 1 to 4 years, with a mean intake of 19.86 mg/kg body weight/day (95th percentile intake of 44.15 mg/kg body weight/day), and lowest in female adults with a mean intake of 4.05 mg/kg body weight/day (95th percentile intake of 8.76 mg/kg body weight/day) (Table 3.5.2-4).

Table 3.5.2-2 Summary of the Estimated Daily Per Kilogram Body Weight Intake of EPA and DHA from the 5 Major Fortified Food Categories in the U.K. by Population Group (NDNS Data) using the Range of Concentration Values*

Population Group	Age Group (Years)	Total n	All-Person Consumption			All-Users Consumption			
			Mean (mg/kg)	Percentile (mg/kg)		%	Mean (mg/kg)	Percentile (mg/kg)	
				90	95			90	95
Children	1-4	1717	19.83	36.40	44.10	99.83	19.86	36.40	44.15
Young People	4-10	837	10.86	19.29	23.32	100	10.86	19.29	23.32
Teenagers	11-18	862	5.15	9.51	11.45	99.75	5.16	9.52	11.46
All adults	19-64	1,724	4.31	7.75	9.21	99.45	4.33	7.76	9.22
Male Adults	19-64	958	4.60	8.14	9.65	99.41	4.63	8.15	9.66
Female Adults	19-64	766	4.03	7.33	8.73	99.49	4.05	7.34	8.76

*Scenario 1 only used for the current market intake assessment for the 5 major fortified food groups

Intakes from all 25 food categories which can potentially be fortified with EPA and DHA in the EU are presented in Tables 3.5.2-3 and 3.5.2-4. Table 3.5.2-3 summarizes the estimated total intake of EPA and DHA (mg/person/day) from all fortified food-uses by U.K. population group per intake scenario. Table 3.5.2-4 presents this data on a per kilogram body weight basis (mg/kg body weight/day). Overall, EPA and DHA intakes (mg/day) were greatest for Scenario 3 for all population groups, as this scenario used a minimum threshold of 80 mg per 100 g of EPA and DHA per food. However, the results provided in Scenario 1 reflect the current situation of how foods are fortified in the EU, using a very conservative assumption that all foods that can be fortified with EPA and DHA are actually fortified. For Scenario 1, of the individual population groups, male adults were determined to have the

greatest mean, 90th, and 95th percentile all-user intakes of EPA and DHA on an absolute basis, at 527.5, 870.9, and 1001.3 mg/person/ day, respectively, while children had the lowest mean, 90th, and 95th percentile all-user intakes of 381.2, 606.7, and 698.8 mg/person/ day, respectively (Table 3.5.2-3).

Table 3.5.2-3 Summary of the Estimated Daily Intake of EPA and DHA from All Fortified Food Categories in the U.K. by Population Group (NDNS Data) for 3 Scenarios using the Full Range of Concentration Values

Population Group	Age Group (Years)	Total n	Scenario 1			Scenario 2			Scenario 3		
			Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)	
				90	95		90	95		90	95
Children	1.5 -4.5	1717	381.2	606.7	698.8	403.4	637.3	735.9	487.5	780.9	908.1
Young people	4 - 10	837	439.5	651.0	732.2	456.6	676.6	761.9	523.3	775.5	869.0
Teenagers	11 - 18	862	434.5	696.2	795.4	447.2	722.7	825.5	495.4	791.8	900.0
All Adults	19 - 64	1724	455.2	763.2	899.0	466.3	774.6	920.4	512.0	851.9	1001.7
Male adults	19 - 64	766	527.5	870.9	1001.3	542.3	895.3	1038.6	589.4	956.0	1115.1
Female adults	19 - 64	958	390.0	628.0	734.7	399.0	636.2	750.1	440.6	709.4	832.2

Scenario 1: All product concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
Scenario 2: A minimum threshold of 40 mg per 100 g for concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
Scenario 3: A minimum threshold of 80 mg per 100 g for concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
The concentration value used was the range of values per food group, and the sample was run 10 times

For Scenario 1, on a body weight basis, children were identified as having the highest mean, 90th, and 95th percentile all-user intakes of any population group, of 28.1, 45.8, and 53.7 mg/kg body weight/day, respectively. Female adults had the lowest mean, 90th, and 95th percentile all-user intakes at 5.9, 9.7, and 11.4 mg/kg body weight/day (Table 3.5.2-4).

Table 3.5.2-4 Summary of the Estimated Daily Per Kilogram Body Weight Intake of EPA and DHA from All Fortified Food Categories in the U.K. by Population Group (NDNS Data) for 3 Scenarios using the full Range of Concentration Values

Population Group	Age Group (Years)	Total n	Scenario 1			Scenario 2			Scenario 3		
			Mean (mg/kg)	Percentile (mg/kg)		Mean (mg/kg)	Percentile (mg/kg)		Mean (mg/kg)	Percentile (mg/kg)	
				90	95		90	95		90	95
Children	1.5 -4.5	1717	28.1	45.8	53.7	29.8	48.6	57.0	36.1	59.9	70.4
Young people	4 - 10	837	17.5	28.0	32.3	18.3	29.3	34.4	21.0	33.9	39.6
Teenagers	11 - 18	862	8.3	13.9	16.3	8.5	14.4	16.8	9.5	16.0	18.9
All Adults	19 - 64	1724	6.1	10.2	11.9	6.3	10.4	12.2	6.9	11.4	13.4
Male adults	19 - 64	766	6.4	10.7	12.3	6.6	11.0	12.9	7.2	11.9	13.9
Female adults	19 - 64	958	5.9	9.7	11.4	6.0	9.9	11.6	6.6	11.0	13.0

Scenario 1: All product concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
Scenario 2: A minimum threshold of 40 mg per 100 g for concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
Scenario 3: A minimum threshold of 80 mg per 100 g for concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
The concentration value used was the range of values per food group, and the sample was run 10 times

3.5.3 Market Share and Loyalty Assessments: Estimated Daily Intake of EPA and DHA from All Fortified Food-Uses in the EU

For these assessments, mean EPA and DHA concentrations were calculated per food category using market share data as outlined in Table 3.4-2 along with 3 different models for consumer loyalty (*i.e.*, 100%, 50%, and 0%). Mean EPA and DHA were also calculated for the current intake assessment based on 5 major food groups using market share data as per Table 3.4-3, with the consumer loyalty models.

Table 3.5.3-1 summarizes the estimated total intake of EPA and DHA (mg/person/day) based on current market practice ('current practice') for the 5 major food groups by U.K. population groups based on the market share data assigned as per Table 3.4-3 per CL option (*i.e.,* CL 100%, CL 50%, and CL 0%). These results are presented for the total population, which includes those individuals who were not assumed to consume fortified foods based on the market share and consumer loyalty models. Table 3.5.3-2 presents these results for consumers only of fortified foods for each of the consumer loyalty options.

Overall, EPA and DHA intakes (mg/person/day) were much lower when market share data was taken into account than in the current practices detailed in Section 3.5.1 and 3.5.2. This is due to a low penetration of fortified foods in the EU market (3 to 8% market share assigned), and therefore the reduced likelihood that people will consume multiple fortified foods, as was assumed in the conservative assessments as per Section 3.5.1 and 3.5.2. Intakes presented in Tables 3.5.3-1 and 3.5.3-2 are also lower than those presented in the preceding 2 tables, due to the fact that only 5 food groups were considered in this current

practice assessment. Mean intakes of EPA and DHA were similar for each of the consumer loyalty models, however intakes at the 95th percentiles were observed to be highest where 100% consumer loyalty was applied and lowest when no consumer loyalty was applied.

Table 3.5.3-1 Summary of the Estimated Daily Intake of EPA and DHA from the 5 Major Fortified Food Categories based on Market Share Data in the U.K. by Population Group (NDNS Data) for 3 Options of Consumer Loyalty using Mean Concentration Values

Population Group	Age Group (Years)	Total n	CL 100%			CL 50%			CL 0%		
			Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)	
				90	95		90	95		90	95
Children	1.5 -4.5	1717	16.1	44.8	94.1	15.9	45.0	83.1	16.1	45.4	60.4
Young people	4 - 10	837	13.5	46.8	82.0	13.2	40.3	67.2	13.4	35.8	45.3
Teenagers	11 - 18	862	12.7	41.8	78.4	12.3	38.8	64.6	12.0	35.7	47.4
All Adults	19 - 64	1724	14.3	49.5	84.1	15.0	47.6	79.2	14.7	41.6	55.5

Mean product concentration values for EPA & DHA provided by GOED per 5 major food groups were used in the assessment.
*The sample was resampled 10 times for running the market share data

Intakes of EPA and DHA were further examined in users of the 5 fortified foods in the current practice assessment when market share data and consumer loyalty options were taken into account (Table 3.5.3-2). Similar to the observations in Table 3.5.3-2, the percentage of users of fortified foods was greatest when no consumer loyalty was applied and lowest when 100% consumer loyalty was applied. Mean intakes of EPA and DHA (mg/person/day) were greatest in users only of the 5 fortified foods when 100% consumer loyalty was applied and ranged from 49.1 mg/day in young people aged 4 to 10 years to 64.7 mg/day in children aged 1.5 to 4.5 years.

Table 3.5.3-2 Summary of the Estimated Daily Intake of EPA and DHA from the 5 Major Fortified Food Categories in Fortified Users only Based on Market Share Data in the U.K. by Population Group (NDNS Data) for 3 Options of Consumer Loyalty using Mean Concentration Values

Population Group	Age Group (Years)	% use	CL 100%			CL 50%				CL 0%			
			Mean (mg)	Percentile (mg)		% use	Mean (mg)	Percentile (mg)		% use	Mean (mg)	Percentile (mg)	
				90	95			90	95			90	95
Children	1.5 -4.5	24.8	64.7	168.6	241.3	33.0	48.1	117.8	182.4	60.1	26.8	56.2	72.1
Young people	4 - 10	27.6	49.1	119.6	162.3	36.5	36.3	83.4	123.1	65.3	20.5	42.2	51.9
Teenagers	11 - 18	24.6	51.5	118.2	162.3	33.0	37.3	88.5	124.3	53.4	22.5	46.5	58.0
All Adults	19 - 64	25.6	55.8	122.7	172.3	33.9	44.2	101.6	142.6	58.9	25.0	52.4	66.6

Mean product concentration values for EPA & DHA provided by GOED per 5 major food groups were used in the assessment.
*The sample was resampled 10 times for running the market share data

Table 3.5.3-3 summarizes the estimated total intake of EPA and DHA (mg/person/day) from all fortified food-uses in the EU by U.K. population group based on the market share data assigned as per Table 3.4-3 per CL option (*i.e.,* CL 100%, CL 50%, and CL 0%). These

results are presented for the total population, which includes those individuals who were not assumed to consume fortified foods based on the market share and consumer loyalty models. Table 3.5.3-4 presents these results for consumers only of fortified foods for each of the consumer loyalty options.

Overall, EPA and DHA intakes (mg/person/day) were much lower when market share data was taken into account than in the assessments detailed in Section 3.5.1 and 3.5.2. This is due to a low penetration of fortified foods in the EU market (5 to 10% market share assigned), and therefore the reduced likelihood that people will consume multiple fortified foods, as was assumed in the conservative assessments as per Section 3.5.1 and 3.5.2. Mean intakes of EPA and DHA were similar for each of the consumer loyalty models, however intakes at the 90th and 95th percentiles were observed to be highest where 100% consumer loyalty was applied and lowest when no consumer loyalty was applied.

Table 3.5.3-3 Summary of the Estimated Daily Intake of EPA and DHA from All Fortified Food Categories Based on Market Share Data in the U.K. by Population Group (NDNS Data) for 3 Options of Consumer Loyalty using Mean Concentration Values

Population Group	Age Group (Years)	Total n	CL 100%			CL 50%			CL 0%		
			Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)	
				90	95		90	95		90	95
Children	1.5 -4.5	1717	28.2	80.1	134.2	29.1	78.4	124.8	28.7	67.5	85.4
Young people	4 - 10	837	30.1	84.4	121.6	29.5	76.8	111.5	29.7	62.8	77.1
Teenagers	11 - 18	862	28.4	85.3	121.7	27.9	77.1	104.3	27.9	64.1	81.6
All Adults	19 - 64	1724	30.3	90.5	136.1	30.3	81.8	117.7	30.5	70.0	89.8

All product concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
The concentration value used here was the mean value calculated per food group
*The sample was resampled 10 times for running the market share data

Intakes of EPA and DHA were further examined in users of fortified foods when market share data and consumer loyalty options were taken into account (Table 3.5.3-4). As would be expected, the percentage of users of fortified foods was greatest when no consumer loyalty was applied and lowest when 100% consumer loyalty was applied. Mean intakes of EPA and DHA (mg/person/day) were greatest in users only of fortified foods when 100% consumer loyalty was applied and ranged from 46.4 mg/day in young people to 57.2 mg/day in adults.

Table 3.5.3-4 Summary of the Estimated Daily Intake of EPA and DHA from All Fortified Food Categories in Fortified Users Only Based on Market Share Data in the U.K. by Population Group (NDNS Data) for 3 Options of Consumer Loyalty using Mean Concentration Values

Population Group	Age Group (Years)	% use	CL 100%			CL 50%				CL 0%			
			Mean (mg)	Percentile (mg)		% use	Mean (mg)	Percentile (mg)		% use	Mean (mg)	Percentile (mg)	
				90	95			90	95			90	95
Children	1.5 -4.5	54.6	51.6	126.7	194.4	64.7	44.9	104.7	160.5	83.1	34.5	72.3	90.7
Young people	4 - 10	64.8	46.4	110.1	151.6	74.5	39.6	89.8	126.5	91.6	32.4	64.4	78.8
Teenagers	11 - 18	57.4	49.5	114.9	152.8	66.8	41.7	93.7	124.5	83.2	33.5	68.3	85.4
All Adults	19 - 64	53.0	57.2	131.9	180.5	62.7	48.3	105.0	148.6	82.6	36.9	75.6	95.8

All product concentration values for EPA & DHA provided by GOED per food group were used in the assessment.
The concentration value used here was the mean value calculated per food group
*The sample was resampled 10 times for running the market share data

3.5.4 Estimated Daily Intake of EPA and DHA from Individual Proposed Food-Uses in the EU

Estimates for the mean, 90th and 95th percentile daily intakes of EPA and DHA from each individual food category as per Scenario 1 for the deterministic assessment only (*i.e.,* using mean concentration values based on the LCPUFA concentration database provided by GOED) are summarized in Tables A-1 to A-5 and B-1 to B-5 on a mg/day and mg/kg body weight/day basis, respectively. The total U.K. population was identified as being significant consumers of bread (97.0 to 99.4% of users), canned pasta and beans (45.4 to 77.8% users), chocolate bars (49.0 to 77.9% users), cookies (55.0 to 88.7% users), margarine/ spreads (73.0 to 86.9% users), milk (57.5 to 88.6% users), processed meat (72.1 to 90.3% users) and eggs (41.9 to 67.9% users).

In terms of contribution to total mean intake of EPA and DHA from fortified food categories amongst the different population groups, milk (contributed 8.4 to 33% to total intakes), bread (contributed 18.3 to 37.6% to total intakes), margarine/spreads (contributed 6.7 to 11.2% to total intakes), chocolate bars (contributed 4.8 to 11.5% to total intakes) and eggs (contributed 4.6 to 10.1% to total intakes), were among the main sources of intake across all population groups on a mg/day and on a mg/kg body weight basis. Bars, beverage mixes, cream, oils, olives, processed potatoes, Quorn, ready-to-eat cereals, smoothies and turkey meat all contributed all individually contributed <1% to total mean EPA and DHA intakes across all population groups. The top 10 contributors to total EPA and DHA intakes per population group are illustrated in Figures 3.5.4-1 to 3.5.4-4.

Figure 3.5.4-1 Percentage contribution of the top 10 food categories towards total EPA and DHA intakes in UK children aged 1.5 to 4.5 years

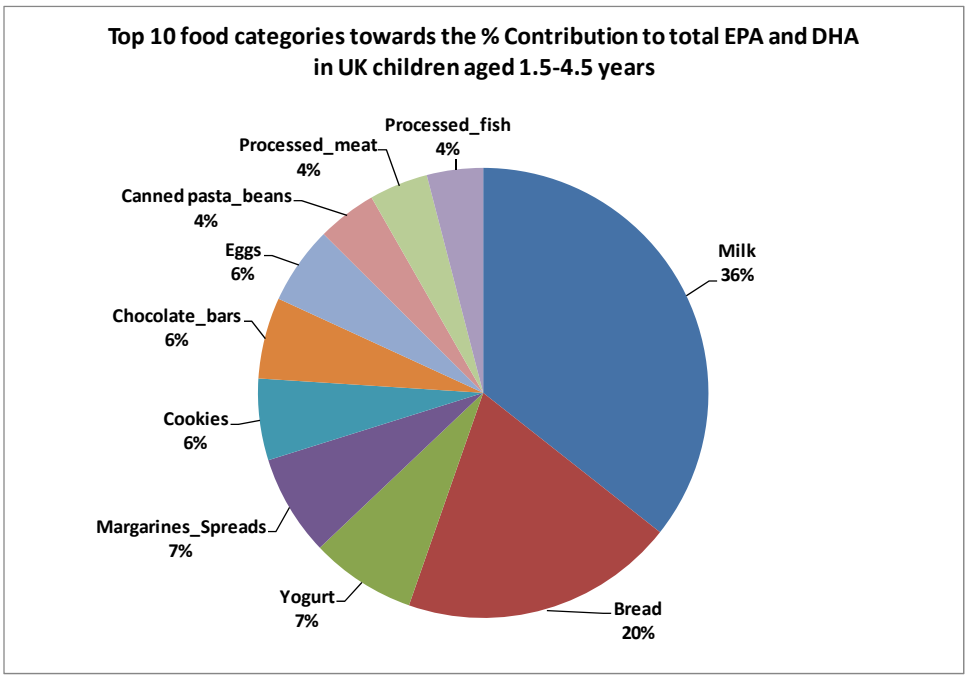


Figure 3.5.4-2 Percentage contribution of the top 10 food categories towards total EPA and DHA intakes in UK young people aged 4 to 10 years

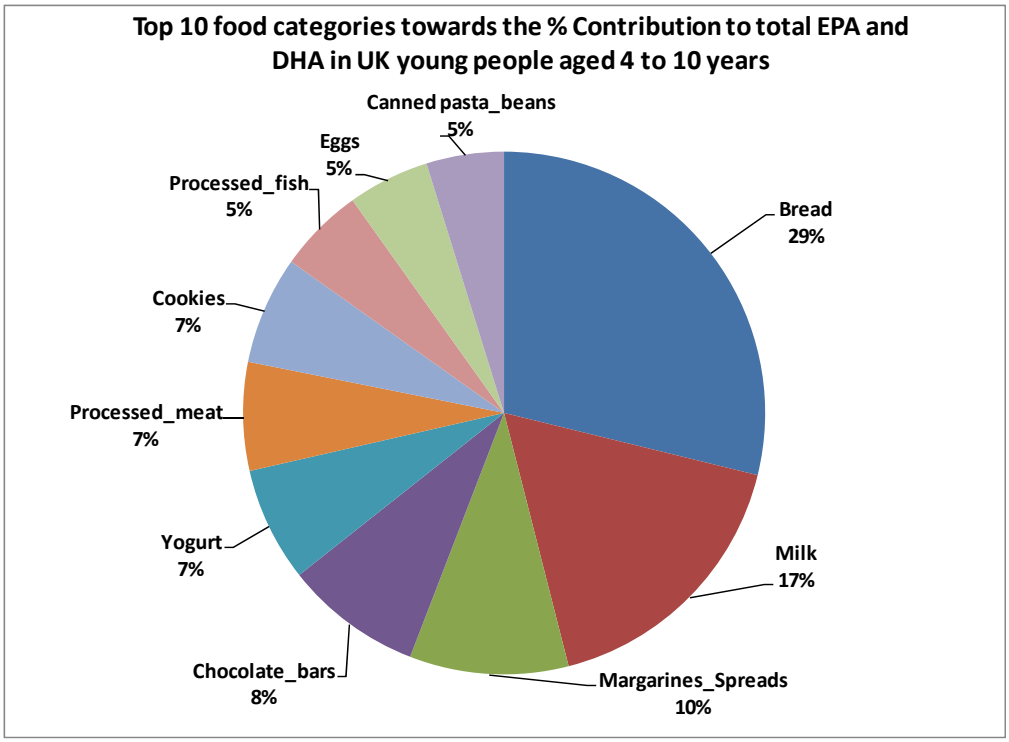


Figure 3.5.4-3 Percentage contribution of the top 10 food categories towards total EPA and DHA intakes in UK teenagers aged 11 to 18 years

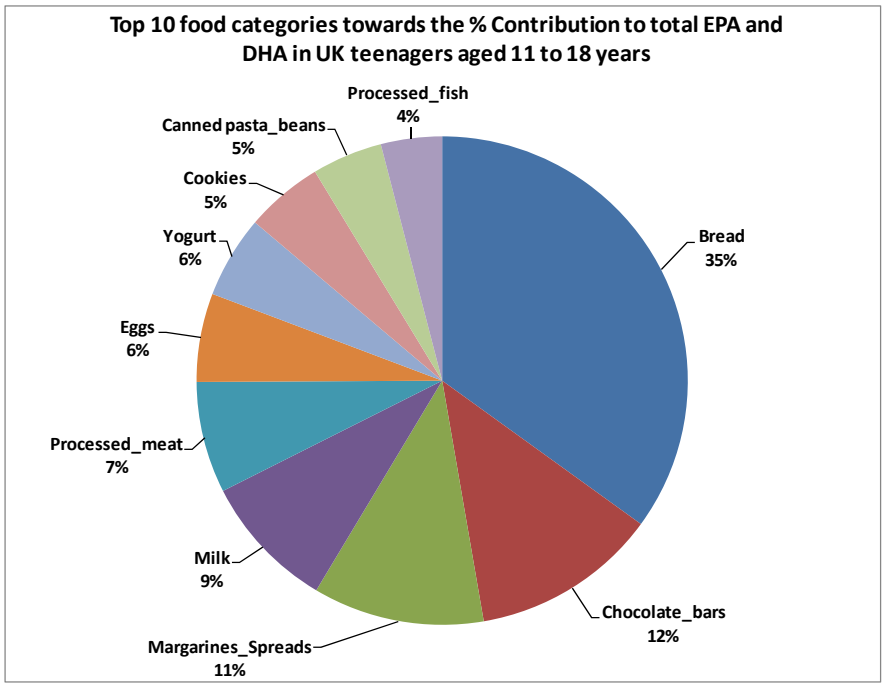
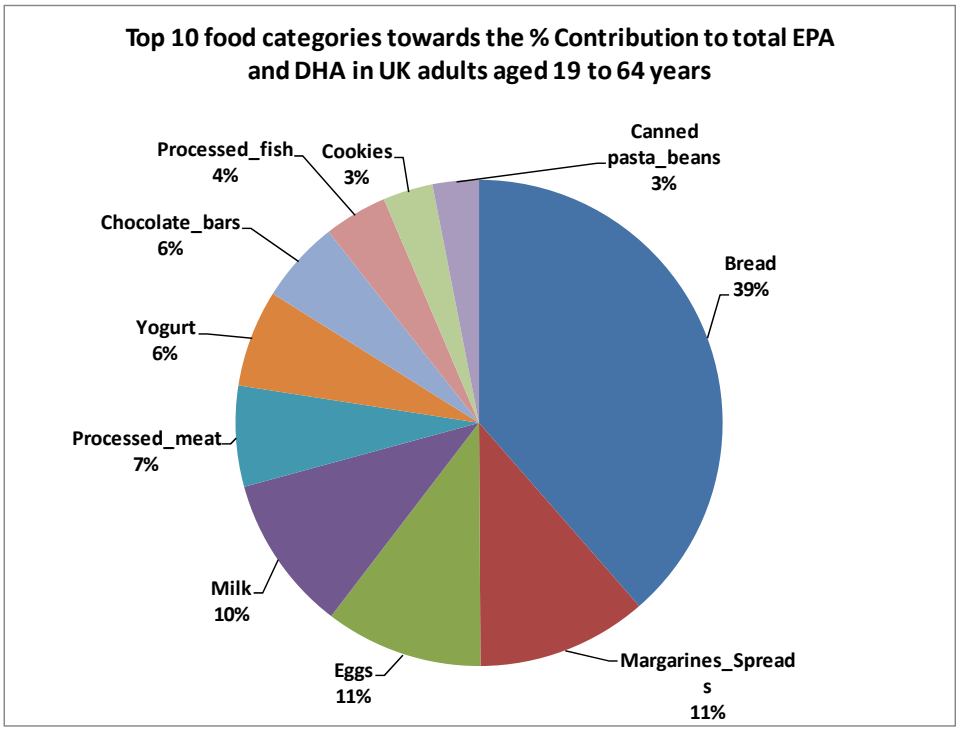


Figure 3.5.4-4 Percentage contribution of the top 10 food categories towards total EPA and DHA intakes in UK adults aged 19 to 64 years.



3.6 CONCLUSIONS: U.K. INTAKE ASSESSMENT

Consumption data and information pertaining to the individual fortified food-uses for EPA and DHA were used to estimate the all-person and all-user EPA and DHA intakes of specific demographic groups in the U.K. population. This type of intake methodology is generally considered to be 'worst case' as a result of several conservative assumptions made in the consumption estimates. For example, here it is assumed that all food products within a food category contain EPA and DHA at a maximum fortified level specified by GOED. It is for this reason that assessments also were run incorporating market share and consumer loyalty models (Section 3.4), and these assessments demonstrated that when these are taken into account, the exposure in the total population is completely reduced. In addition, it is well established that the length of a dietary survey affects the estimated consumption of individual users. Short-term surveys, such as the 4-day children's survey, may overestimate consumption of food products that are consumed relatively infrequently, particularly when weighted to 7 days (Gregory *et al.*, 1995).

Along with incorporating market share and consumer loyalty modes, this report also examined the impact of applying cut-offs to the fortified use-levels of EPA and DHA in food categories according to the minimum thresholds that are applicable for nutrition claim labelling in the EU regarding omega-3 fatty acids. This report further examined the affect on exposure to EPA and DHA when the full range of concentration data were used in the assessments, as compared to using mean concentration values for each food category. Overall, the main affect observed was an increased intake at the upper percentiles, with limited change to the mean intake. Therefore, in order to understand intakes in heavy consumers, the full range of EPA and DHA concentration data are preferable to use in the exposure assessment than mean values per food category. Due to the number of tables and results presented in various formats and under different assumptions, 2 summary tables are presented with the top-line results (Table 3.6-1 and 3.6-2).

In summary, when the results from Scenario 1 (*i.e.* the current situation of the EPA and DHA concentration levels in fortified foods in the EU) using the deterministic approach were considered for the five main food categories, the highest mean, 90th and 95thpercentile intakes of EPA and DHA by the U.K. population were observed in male adults at 378.8, 629.7, and 729.1 mg/person/day, respectively, while children had the lowest mean, 90th, and 95th percentile intakes of 267.9, 444.4, and 529.4 mg/person/day, respectively. On a body weight basis, children were identified as having the highest mean, 90th, and 95th percentile intakes of any population group, of 19.9, 34.1, and 40.5 mg/kg body weight/day, respectively. Female adults had the lowest mean, 90th and 95th percentile intakes at 4.0, 7.0, and 8.1 mg/kg body weight/day.

Table 3.6-1 Summary of all Results for the Estimated Daily Intake of EPA and DHA from Fortified Food Use in the U.K. by Population Group (NDNS Data)

Population Group	Age Group (Years)	Total n	Deterministic[1]: Current[2]			Deterministic: Potential future[3]			Probabilistic[4]: Current			Probabilistic: Potential future		
			Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)	
				90	95		90	95		90	95		90	95
Children	1.5 -4.5	1717	267.93	444.41	529.43	381.5	566.1	644.0	268.02	481.15	579.39	381.2	606.7	698.8
Young people	4 - 10	837	272.24	433.21	506.28	442.1	704.3	775.7	272.12	461.74	542.29	439.5	651.0	732.2
Teenagers	11 - 18	862	271.69	461.54	544.73	431.1	742.1	807.3	272.84	496.98	586.95	434.5	696.2	795.4
All Adults	19 - 64	1724	321.91	556.53	654.12	455.3	737.5	865.2	321.80	578.97	691.82	455.2	763.2	899.0
Male adults	19 - 64	766	378.75	629.69	729.10	528.0	837.9	962.3	377.69	657.50	772.06	527.5	870.9	1001.3
Female adults	19 - 64	958	268.75	457.82	520.68	387.3	596.8	691.7	268.97	482.15	566.52	390.0	628.0	734.7

[1] Deterministic assessment presents results based on the calculated mean concentration per food groups as per Scenario 1
[2] Current intake assessment examined intake from 5 major food groups based on current market practice. Total population results are presented
[3] Potential future assessment relates to inclusion of all 25 food categories that can be potentially fortified with EPA and DHA
[4] Probabilistic range assessment used the full range of concentration data per food group as per Scenario 1

Table 3.6-2 Summary of the Results for the Estimated Daily Intake of EPA and DHA from Fortified Food Use Based on Market Share Data in the U.K. by Population Group (NDNS Data) for 100% Consumer Loyalty

Population Group	Age Group (Years)	Total n	Total population: Current[1]			Total Population: Potential future[2]			Consumers only: Current				Consumers only: Potential future			
			Mean (mg)	Percentile (mg)		Mean (mg)	Percentile (mg)		% use	Mean (mg)	Percentile (mg)		% use	Mean (mg)	Percentile (mg)	
				90	95		90	95			90	90			90	95
Children	1.5 -4.5	1717	16.1	44.8	94.1	28.2	80.1	134.2	24.8	64.7	168.6	241.3	54.6	51.6	126.7	194.4
Young people	4 - 10	837	13.5	46.8	82.0	30.1	84.4	121.6	27.6	49.1	119.6	162.3	64.8	46.4	110.1	151.6
Teenagers	11 - 18	862	12.7	41.8	78.4	28.4	85.3	121.7	24.6	51.5	118.2	162.3	57.4	49.5	114.9	152.8
All Adults	19 - 64	1724	14.3	49.5	84.1	30.3	90.5	136.1	25.6	55.8	122.7	172.3	53.0	57.2	131.9	180.5

[1] Current intake assessment examined intake from 5 major food groups based on current market practice.
[2] Potential future assessment relates to inclusion of all 25 food categories that can be potentially fortified with EPA and DHA

3.7 INTAKE ASSESSMENT USING THE EFSA COMPREHENSIVE DATABASE

3.7.1 Survey Description

Along with the detailed exposure assessment based on individual food-code data from the NDNS surveys, a cruder intake assessment was also conducted using data from the EFSA Comprehensive dataset. Competent organisations in the EU Member States provided EFSA with data from the most recent national dietary survey in their country, at the level of consumption by the individual consumer. This included food consumption data concerning infants (2 surveys from 2 Member States), toddlers (8 surveys from 8 Member States), children (16 surveys from 14 Member States), adolescents (14 surveys from 12 Member States), adults (21 surveys from 20 Member States), elderly (9 surveys from 9 Member States) and very elderly (8 surveys from 8 Member States) for a total of 32 different dietary surveys carried out in 22 different Member States.

The preliminary version of the hierarchical food classification system 'FoodEx', developed by EFSA, was used to codify all foods and beverages present in the Comprehensive Database. FoodEx is a hierarchical system based on 20 main food categories that are further divided into subgroups up to a maximum of 4 levels.

For each country, food consumption data are presented according to the 1st (20 categories) and 2nd (160 categories) level of the preliminary FoodEx system; per age class (Infants, Toddlers, Other children, Adolescents, Adults, Elderly and Very elderly); and for the total population and for consumers only. The summary statistics include the total number of individuals and, for each of the first 2 FoodEx levels, age classes, number of consumers, the mean, median and the standard deviation, as well as low and high percentiles.

The following age classes have been considered:
1. Infants: up to and including 11 months
2. Toddlers: 12 to 35 months
3. Other children: 3 to 9 years
4. Adolescents: 10 to 17 years
5. Adults: 18 to 64 years
6. Elderly: 65 to 74 years
7. Very elderly: ≥ 75 years

3.7.2 Statistical Methods

A guidance document on using the data from the Comprehensive database is available (EFSA, 2011). Summary statistics of this database are available on the EFSA website, and these have been used to run the current intake assessment (http://www.efsa.europa.eu/en/datexfoodcdb/datexfooddb.htm). These data are downloadable in MS Excel, and deterministic calculations were run using the available data matched to use levels as described in Section 3.7.3. The intake assessment was conducted

for the total population data only due to the number of food categories that were being examined. The GOED use level for EPA and DHA (mg/100 g food) (refer to Table 3.7.3-1) per food category was multiplied by the mean daily and 95th percentile daily intake for that food category for each survey. Total mean EPA and DHA intakes were obtained by summing the mean intakes from each food category (mg EPA and DHA per day). Total 95th percentile intakes were calculated by selecting the food category with the highest 95th percentile EPA and DHA intake and adding this to the sum of the mean of the remaining food categories (mg EPA and DHA per day).

The summary statistics published on the EFSA website for the Comprehensive database include all percentiles, even if calculated on a very limited number of subjects/days. However percentiles calculated over a number of subjects/days lower than 60 (for the 95th percentile) and lower than 300 (for the 99th percentile) have been flagged with a warning, indicating the need for a cautious interpretation of the results which may not be statistically robust.

It is important to note that the use of these data for direct country-to-country comparisons is not advisable because the database comprises data collected using different methodologies. Therefore, while results are provided for the intake of EPA and DHA for all surveys and countries in this section, it is not recommended that the results are directly compared, but only serve to understand the possible intakes of EPA and DHA for a conservative assessment of intakes from fortified foods.

3.7.3 Food Usage Data

Detailed estimates for the intake of EPA and DHA were based on the fortified use-levels provided by GOED (as previously described in Section 3.4). To conduct a detailed intake assessment as possible using the Comprehensive database, fortified use level data as provided by GOED was matched as closely as possible with the 2nd level of the FoodEx food categorization system developed by EFSA (Table 3.7.3-1). Mean EPA and DHA use levels were calculated per food category (mg/100 g), and these use levels were used in the intake assessment.

Table 3.7.3-1 Summary of the Individual Fortified Food-Uses and Use-Levels for EPA and DHA in the EU matched to Level 1 and Level 2 of the FoodEx system in the EFSA Comprehensive database		
EFSA Comprehensive Level 1	**EFSA Comprehensive Level 2**	**Mean Fortified Use level provided by GOED (mg/100g)**
Animal and vegetable fats and oils	Margarine and similar products	545.66
	Vegetable oil	729.16
Composite food (including frozen products)	Beans-based meals	35.70
	Cereal-based dishes	65.45
	Meat-based meals	38.00
Eggs and egg products	Eggs, fresh	321.67
Fish and other seafood	Fish products	338.53
Food for infants and small children	Follow-on formulae, liquid	4.1
	Follow-on formulae, powder	77.90
	Infant formulae, powder	57.00
Fruit and fruit products	Oilfruits	54.82
Fruit and vegetable juices	Fruit juice	48.27
Grains and grain-based products	Bread and rolls	187.21
	Breakfast cereals	16.83
	Fine bakery wares	349.68
Meat and meat products (including edible offal)	Meat imitates	100.00
	Pastes, pâtés and terrines	125.00
	Poultry	148.11
	Preserved meat	97.24
	Sausages	101.64
Milk and dairy products	Cheese	159.86
	Cream and cream products	90.00
	Fermented milk products	102.44
	Liquid milk	57.33
Products for special nutritional use	Food for weight reduction	800.00
	Medical food (dietary management of disease; used under medical supervision)	131.26
Starchy roots and tubers	Potatoes and potatoes products	20.00
Sugar and confectionary	Chocolate (Cocoa) products	300.00

3.7.4 Results of the Intake Assessment using the EFSA Comprehensive Database

3.7.4.1 Current Intake Assessment

Similar to the intake assessment conducted for the NDNS surveys, 5 food categories were first of all selected for the intake assessment based on the EFSA Comprehensive database. At Level 2 these were: 'Margarine and similar products', 'Eggs, fresh', 'Bread and rolls', 'Fermented milk products' and 'Liquid milk'.

Intake results for exposure to EPA and DHA from the 5 fortified foods in various EU Member States as per the EFSA Comprehensive database for the different population groups are

presented in Tables 3.7.4-1 to 3.7.4-7. It is not possible to directly compare the intake results across countries due to the different methodologies used in separate surveys, however some overall observations can be made on the range of intakes.

In infants, mean EPA and DHA intakes ranged from 156.5 mg/day to 239.6 mg/day, with intakes at the 95th percentile ranging from 557.0 to 627.5 mg/day. In toddlers, mean intakes ranged from 248.6 to 451.7 mg/day, with intakes at the 95th percentile ranging from 389.5 to 836.0 mg/day. In other children, mean intakes ranged from 255.7 to 659.2 mg/day, with intakes at the 95th percentile ranging from 466.9 to 872.8 mg/day. In adolescents, mean intakes ranged from 300.6 to 630.5 mg/day, with intakes at the 95th percentile ranging from 450.7 to 952.7 mg/day. In adults, mean intakes ranged from 363.3 to 623.9 mg/day, with intakes at the 95th percentile ranging from 633.8 to 891.9 mg/day. In the elderly, mean intakes ranged from 376.9 to 629.2 mg/day, with intakes at the 95th percentile ranging from 631.8 to 834.9 mg/day. Finally in the very elderly, mean intakes ranged from 413.8 to 661.5 mg/day, with intakes at the 95th percentile ranging from 647.0 to 785.0 mg/day.

Table 3.7.4-1 Mean Daily Intake of EPA and DHA from 5 Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in Infants

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Infants (up to and including 11 months)	Bulgaria	NUTRICHILD	2007	860	156.50	556.96
	Italy	INRAN SCAI	2005-06	16*	239.56	627.52

*Survey for this population group contained <60 subjects, therefore intake results at the P95 may not be robust

Table 3.7.4-2 Mean Daily Intake of EPA and DHA from 5 Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in Toddlers

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Toddlers (12-35 months)	Belgium	FPDS 1: Flanders	2002-03	36*	402.58	733.87
	Bulgaria	NUTRICHILD	2007	428	359.07	662.11
	Germany	DONALD	2006	92	248.57	389.54
	Germany	DONALD	2007	85	283.14	470.02
	Germany	DONALD	2008	84	264.26	493.39
	Spain	enKid	1998-2000	17*	392.70	835.99
	Finland	DIPP	2003-06	497	263.49	550.89
	Italy	INRAN SCAI	2005-06	36*	279.41	586.33
	Netherlands	VCP kids	2005-06	322	451.67	784.83

* Survey for this population group contained <60 subjects, therefore intake results at the P95 may not be robust

Table 3.7.4-3 Mean Daily Intake of EPA and DHA from 5 Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in Other Children

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Other Children (3 to 9 years)	Belgium	FPDS 1: Flanders	2002-03	625	412.44	707.61
	Bulgaria	NUTRICHILD	2007	433	363.52	525.87
	Czech Republic	SISP04	2003-04	389	399.65	542.99
	Germany	DONALD	2006	211	371.49	525.22
	Germany	DONALD	2007	226	372.41	528.34
	Germany	DONALD	2008	223	379.57	530.99
	Denmark	Danish Dietary Survey	2000-02	490	659.24	893.39
	Spain	enKid	1998-2000	156	442.10	628.66
	Finland	DIPP	2003-06	933	450.06	680.17
	Finland	STRIP	2000	250	501.78	705.84
	France	INCA2	2005-07	482	319.77	466.88
	Greece	Regional Crete	2004-05	839	255.74	505.64
	Italy	INRAN SCAI	2005-06	193	346.35	540.85
	Latvia	EFSA TEST	2008	189	268.12	494.00
	Netherlands	VCP kids	2005-06	957	501.14	872.78
	Sweden	Riksmaten barn	1997-98	1473	458.28	673.90

Table 3.7.4-4 Mean Daily Intake of EPA and DHA from 5 Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in Adolescents

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Adolescents (10 to 17 years)	Belgium	Diet National 2004	2004-05	584	408.58	654.26
	Cyprus	Childhealth	2003	303	300.56	450.70
	Czech Republic	SISP04	2003-04	298	495.04	812.29
	Germany	National Nutrition Survey II	2005-07	1011	395.64	690.66
	Denmark	Danish Dietary Survey	2000-02	479	630.53	952.65
	Spain	AESAN FIAB	1999-2001	86	529.28	778.41
	Spain	enKid	1998-2000	209	507.41	885.72
	France	INCA2	2005-07	973	354.79	565.01
	Italy	INRAN SCAI	2005-06	247	380.09	623.52
	Latvia	EFSA TEST	2008	470	356.09	652.91
	Sweden	Riksmaten barn	1997-98	1018	446.35	701.00

Table 3.7.4-5 Mean Daily Intake of EPA and DHA from 5 Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in Adults

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Adults (18 to 64 years)	Belgium	Diet National 2004	2004-05	1304	442.42	740.43
	Czech Republic	SISP04	2003-04	1666	480.05	820.60
	Germany	National Nutrition Survey II	2005-07	10,419	421.18	705.39
	Denmark	Danish Dietary Survey	2000-02	2822	623.89	851.57
	Spain	AESAN	2009	410	467.40	678.74
	Spain	AESAN FIAB	1999-2001	981	487.54	683.37
	Finland	FINDIET	2007	1575	437.18	772.10
	France	INCA2	2005-07	2276	388.01	655.87
	UK	NDNS	2000-01	1724	454.96	663.11
	Hungary	National Repr Survey	2003	1074	542.14	811.87
	Ireland	NSIFCS	1997-99	958	574.16	841.86
	Italy	INRAN SCAI	2005-06	2313	363.30	633.77
	Latvia	EFSA TEST	2008	1306	390.88	777.21
	Netherlands	DNFCS	2003	750	616.47	891.87
	Sweden	Riksmaten	1997-98	1210	548.15	790.07

Table 3.7.4-6 Mean Daily Intake of EPA and DHA from 5 Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in the Elderly

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Elderly (65 to 74 years)	Belgium	Diet National 2004	2004-05	518	469.57	813.17
	Germany	National Nutrition Survey II	2005-07	2006	429.96	665.68
	Denmark	Danish Dietary Survey	2000-02	309	629.24	834.87
	Finland	FINDIET	2007	463	443.55	757.95
	France	INCA2	2005-07	264	445.78	744.05
	Hungary	National Repr Survey	2003	206	525.06	705.63
	Italy	INRAN SCAI	2005-06	290	376.85	631.77

Table 3.7.4-7 Mean Daily Intake of EPA and DHA from 5 Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in the Very Elderly						
Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Very Elderly (≥75 years)	Belgium	Diet National 2004	2004-05	712	433.56	762.03
	Germany	National Nutrition Survey II	2005-07	490	413.78	647.97
	Denmark	Danish Dietary Survey	2000-02	20*	661.50	785.04
	France	INCA2	2005-07	84	429.37	730.16
	Hungary	National Repr Survey	2003	80	502.93	753.10
	Italy	INRAN SCAI	2005-06	228	415.29	714.31

* Survey for this population group contained <60 subjects, therefore intake results at the P95 may not be robust

3.7.4.2 Potential Future Intake Assessment

Intake results for exposure to EPA and DHA from all possible fortified foods as per Table 3.7.3-1 in various EU Member States as per the EFSA Comprehensive database for the different population groups are presented in Tables 3.7.4-8 to 3.7.4-14 (EFSA, 2011).

In infants, mean EPA and DHA intakes ranged from 257.5 to 322.4 mg/day, with intakes at the 95th percentile ranging from 657.9 to 710.3 mg/day. In toddlers, mean intakes ranged from 390.1 to 773.4 mg/day, with intakes at the 95th percentile ranging from 552.5 to 1122.4 mg/day. In other children, mean intakes ranged from 659.9 to 973.5 mg/day, with intakes at the 95th percentile ranging from 837.1 to 1264.8 mg/day. In adolescents, mean intakes ranged from 698.3 to 1,200.9 mg/day, with intakes at the 95th percentile ranging from 904.1 to 1712.1 mg/day. In adults, mean intakes ranged from 770.7 to 1112.7 mg/day, with intakes at the 95th percentile ranging from 1105.6 to 1566.7 mg/day. In the elderly, mean intakes ranged from 670.4 to 946.0 mg/day, with intakes at the 95th percentile ranging from 984.8 to 1393.8 mg/day. Finally in the very elderly, mean intakes ranged from 785.4 to 932.5 mg/day, with intakes at the 95th percentile ranging from 1034.6 to 1520.7 mg/day.

Table 3.7.4-8 Mean Daily Intake of EPA and DHA from Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in Infants						
Population	**Country**	**Survey**	**Year of survey**	**n**	**Mean (mg/day)**	**P95 (mg/day)**
Infants (up to and including 11 months)	Bulgaria	NUTRICHILD	2007	860	257.46	657.92
	Italy	INRAN SCAI	2005-06	16*	322.37	710.33

*Survey for this population group contained <60 subjects, therefore intake results at the P95 may not be robust

Table 3.7.4-9 Mean Daily Intake of EPA and DHA from Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in Toddlers

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Toddlers (12-35 months)	Belgium	FPDS 1: Flanders	2002-03	36*	773.43	1122.44
	Bulgaria	NUTRICHILD	2007	428	696.31	999.36
	Germany	DONALD	2006	92	411.51	552.47
	Germany	DONALD	2007	85	442.34	629.22
	Germany	DONALD	2008	84	390.06	619.19
	Spain	enKid	1998-2000	17*	680.73	1124.03
	Finland	DIPP	2003-06	497	362.33	649.72
	Italy	INRAN SCAI	2005-06	36*	587.08	894.00
	Netherlands	VCP kids	2005-06	322	743.32	1076.48

* Survey for this population group contained <60 subjects, therefore intake results at the P95 may not be robust

Table 3.7.4-10 Mean Daily Intake of EPA and DHA from Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in Other Children

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Other Children (3 to 9 years)	Belgium	FPDS 1: Flanders	2002-03	625	781.09	1076.26
	Bulgaria	NUTRICHILD	2007	433	832.82	1112.89
	Czech Republic	SISP04	2003-04	389	840.55	1171.15
	Germany	DONALD	2006	211	671.08	824.81
	Germany	DONALD	2007	226	687.05	842.98
	Germany	DONALD	2008	223	685.65	837.07
	Denmark	Danish Dietary Survey	2000-02	490	880.06	1114.21
	Spain	enKid	1998-2000	156	914.91	1241.78
	Finland	DIPP	2003-06	933	662.34	892.46
	Finland	STRIP	2000	250	973.50	1264.78
	France	INCA2	2005-07	482	840.10	1132.12
	Greece	Regional Crete	2004-05	839	680.34	956.31
	Italy	INRAN SCAI	2005-06	193	936.72	1162.01
	Latvia	EFSA TEST	2008	189	659.86	990.28
	Netherlands	VCP kids	2005-06	957	861.28	1232.92
	Sweden	Riksmaten barn	1997-98	1473	828.25	1117.47

Table 3.7.4-11 Mean Daily Intake of EPA and DHA from Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in Adolescents

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Adolescents (10 to 17 years)	Belgium	Diet National 2004	2004-05	584	928.62	939.02
	Cyprus	Childhealth	2003	303	698.34	904.07
	Czech Republic	SISP04	2003-04	298	1087.23	1540.06
	Germany	National Nutrition Survey II	2005-07	1011	884.48	1421.65
	Denmark	Danish Dietary Survey	2000-02	479	906.92	1229.03
	Spain	AESAN FIAB	1999-2001	86	1200.85	1712.10
	Spain	enKid	1998-2000	209	1080.97	1459.29
	France	INCA2	2005-07	973	909.25	1277.77
	Italy	INRAN SCAI	2005-06	247	1058.84	1414.00
	Latvia	EFSA TEST	2008	470	818.89	1333.72
	Sweden	Riksmaten barn	1997-98	1018	822.94	1157.62

Table 3.7.4-12 Mean Daily Intake of EPA and DHA from Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in Adults

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Adults (18 to 64 years)	Belgium	Diet National 2004	2004-05	1304	883.93	1280.48
	Czech Republic	SISP04	2003-04	1666	1038.27	1566.69
	Germany	National Nutrition Survey II	2005-07	10,419	937.25	1472.60
	Denmark	Danish Dietary Survey	2000-02	2822	879.50	1107.17
	Spain	AESAN	2009	410	1049.00	1399.09
	Spain	AESAN FIAB	1999-2001	981	1092.61	1422.80
	Finland	FINDIET	2007	1575	770.65	1105.58
	France	INCA2	2005-07	2276	905.40	1259.44
	UK	NDNS	2000-01	1724	849.68	1156.38
	Hungary	National Repr Survey	2003	1074	1002.47	1272.20
	Ireland	NSIFCS	1997-99	958	995.65	1263.34
	Italy	INRAN SCAI	2005-06	2313	931.01	1201.49
	Latvia	EFSA TEST	2008	1306	824.89	1211.21
	Netherlands	DNFCS	2003	750	1112.70	1498.41
	Sweden	Riksmaten	1997-98	1210	983.40	1283.91

Table 3.7.4-13 Mean Daily Intake of EPA and DHA from Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in the Elderly

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Elderly (65 to 74 years)	Belgium	Diet National 2004	2004-05	518	851.00	1235.50
	Germany	National Nutrition Survey II	2005-07	2006	888.70	1393.83
	Denmark	Danish Dietary Survey	2000-02	309	852.06	1057.69
	Finland	FINDIET	2007	463	670.44	984.84
	France	INCA2	2005-07	264	909.48	1207.75
	Hungary	National Repr Survey	2003	206	945.98	1126.55
	Italy	INRAN SCAI	2005-06	290	889.95	1144.87

Table 3.7.4-14 Mean Daily Intake of EPA and DHA from Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database in the Very Elderly

Population	Country	Survey	Year of survey	n	Mean (mg/day)	P95 (mg/day)
Very Elderly (≥75 years)	Belgium	Diet National 2004	2004-05	712	785.37	1108.78
	Germany	National Nutrition Survey II	2005-07	490	888.58	1520.73
	Denmark	Danish Dietary Survey	2000-02	20*	911.02	1034.56
	France	INCA2	2005-07	84	932.45	1233.24
	Hungary	National Repr Survey	2003	80	908.76	1158.94
	Italy	INRAN SCAI	2005-06	228	886.90	1185.92

* Survey for this population group contained <60 subjects, therefore intake results at the P95 may not be robust

3.7.4.3 Summary of Results from the EFSA Comprehensive Database

A summary of the intakes of EPA and DHA in the different population groups from the current market and the potential future intake assessments are provided in Table 3.7.4-15.

Table 3.7.4-15 Summary of Intakes of EPA and DHA from Fortified Foods (mg/day) for Total Populations Based on the EFSA Comprehensive Database per Population Group				
Population	**Current intake assessment (5 food categories)**		**Potential future assessment: All food categories**	
	Mean (mg/day)	**P95 (mg/day)**	**Mean (mg/day)**	**P95 (mg/day)**
Infants	156.5 - 239.6	557.0 - 627.5	257.5 - 322.4	657.9 - 710.3
Toddlers	248.6 - 451.7	389.5 - 836.0	390.1 - 773.4	552.5 - 1,122.4
Other Children	255.7 - 659.2	466.9 - 872.8	659.9 - 973.5	837.1 - 1,264.8
Adolescents	300.6 - 630.5	450.7 - 952.7	698.3 - 1,200.9	904.1 - 1,712.1
Adults	363.3 - 623.9	633.8 - 891.9	770.7 - 1,112.7	1,105.6 - 1,566.7
Elderly	376.9 - 629.2	631.8 - 834.9	670.4 - 946.0	984.8 - 1,393.8
Very Elderly	413.8 - 661.5	647.0 - 785.0	785.4 - 932.5	1,034.6 - 1,520.7

3.7.5 Conclusion

Overall, EPA and DHA intakes based on the Comprehensive database were higher than those observed in the assessments for the NDNS survey population groups. This is because the exposure assessment conducted in the NDNS surveys was possible at a food-code level, allowing a much more specific matching of the fortified food-use concentration data than was possible using the Comprehensive data, which was forced at a cruder food category level. Therefore, exposure intakes of EPA and DHA should be interpreted with caution using the Comprehensive data as provided in Section 3.7 of this report.

In summary, based on current market practice, mean EPA and DHA intakes ranged from 156.5 to 239.6 mg/day in infants, from 248.6 to 451.7 mg/day in toddlers, from 255.7 to 659.2 mg/day in other children, from 300.6 to 630.5 mg/day in adolescents, from 363.3 to 623.9 mg/day in adults, from 376.9 to 629.2 mg/day in the elderly and from 413.8 to 661.5 mg/day in the very elderly. Potential future fortification practices were also examined, and for this assessment mean EPA and DHA intakes ranged from 257.5 to 322.4 mg/day in infants, from 390.1 to 773.4 mg/day in toddlers, from 659.9 to 973.5 mg/day in other children, from 698.3 to 1,200.9 mg/day in adolescents, from 770.7 to 1112.7 mg/day in adults, from 670.4 to 946.0 mg/day in the elderly and from 785.4 to 932.5 mg/day in the very elderly.

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APPENDIX A

Estimated Daily Intake of EPA and DHA from Individual Fortified Food-Uses by Different Population Groups Within the U.K.

Table A-1 Estimated Daily Intake of EPA and DHA from Individual Fortified Food-Uses by Children Aged 1.5 to 4.5 Years Within the U.K. (NDNS Data, 1992-1993)

Food-Use Category	% Contribution to total mean	All-Person Consumption (n=814)			All-Users Consumption			
		Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
			90	95			90	95
All	*100*	381.5	566.1	644.0	100	381.5	566.1	644.0
Bars	0.15	0.6*	na	na	1.6	36.3*	64.7*	89.9*
Beverage mixes	0.32	1.2	na	6.9*	9.0	13.5	27.0*	43.6*
Bread	18.29	69.8	127.1	145.9	97.4	71.6	128.2	147.2
Canned pasta & beans	3.96	15.1	40.2	54.1	67.1	22.5	48.1	58.9
Chocolate bars	5.41	20.7	56.3	74.4	59.1	34.9	69.8	88.5
Cookies	5.43	20.7	46.3	56.9	84.7	24.5	48.2	58.8
Cream	0.06	0.2	na	0.2*	5.1	4.6	9.7*	12.9*
Eggs	5.19	19.8	63.3	91.7	41.9	47.3	96.5	119.0
Fruit-juice drinks	2.24	8.6	31.6	53.0*	18.5	46.4	90.6	101.5*
Infant/toddler milk	0.02	0.1*	na	na	2.5	3.3*	5.3*	11.6*
Margarines/Spreads	6.71	25.6	56.6	70.2	82.4	31.1	60.2	74.9
Meal replacement drinks	0.03	0.1*	na	na	0.2	42.0*	72.4*	80.2*
Milk	33.02	126.0	280.4	350.1	88.6	142.2	292.1	366.2
Oils	0.08	0.3	na	na	4.7	6.7	12.9*	20.1*
Olives	<0.01	<0.1*	na	na	0.7	2.7*	3.7*	4.1*
Processed cheese	3.52	13.4	46.4	68.3	36.0	37.3	80.5	103.1
Processed fish	3.74	14.3	52.1	71.8	32.0	44.6	82.8	100.0
Processed meat	3.92	14.9	37.2	49.5	72.1	20.7	42.2	54.5
Processed potatoes	0.10	0.4	1.5	2.6*	14.6	2.6	5.0	6.3*
Quorn	<0.01	<0.1*	na	na	0.2	2.58*	3.8*	4.3*
Ready meals	0.30	1.2	na	6.8*	6.5	17.8	37.2*	49.5*
RTE cereals	0.26	1.0	3.0	4.0	51.5	1.9	4.0	5.1
Smoothies	0.06	0.2*	na	na	0.4	52.8*	87.8*	145.0*
Turkey meat	0.15	0.6	na	na	4.5	12.4	21.4*	25.6*
Yogurt	7.02	26.8	87.4	125.0	39.1	68.5	135.4	168.6

na = not available
* Indicates an intake estimate that may not be statistically reliable, as the sample size does not meet the minimum reporting requirements.

Table A-2 Estimated Daily Intake of EPA and DHA from Individual Fortified Food-Uses by Young People Aged 4 to 10 Years Within the U.K. (NDNS Data, 1997)

Food-Use Category	% Contribution to total mean	All-Person Consumption (n=837)			All-Users Consumption			
		Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
			90	95			90	95
All	*100*	442.1	704.3	775.7	100	442.1	704.3	775.7
Bars	0.41	1.8	na	23.1*	4.9	37.0	101.9*	129.7*
Beverage mixes	0.28	1.2	8.1	13.6*	11.3	10.9	30.4	36.0*
Bread	26.28	116.2	230.7	274.3	99.4	117.0	230.9	274.4
Canned pasta & beans	4.37	19.3	59.2	80.4	78.8	24.5	66.7	83.3
Chocolate bars	7.74	34.2	105	124.2	77.9	43.9	114.1	138.4
Cookies	6.10	27.0	68.6	86.5	88.7	30.4	72.2	88.6
Cream	0.08	0.4	2.4	4.2*	9.8	3.8	9.3	13.0*
Eggs	4.60	20.3	84.4	114.5	45.6	44.6	115.2	139.6
Fruit-juice drinks	4.18	18.5	89.8	107.3	39.2	47.1	112.8	138.1
Infant/toddler milk	0	0	0	0	0	0	0	0
Margarines/Spreads	8.95	39.6	98.6	132.7	86.9	45.6	106.3	138.6
Meal replacement drinks	0.13	0.6*	na	na	0.2	388.6*	388.6*	388.6*
Milk	15.68	69.3	215.6	275.9	79.2	87.5	227.6	307.5
Oils	0.11	0.5	2.1*	6.2*	5.8	8.1	18.5*	24.6*
Olives	0.01	<0.1*	na	na	0.7	3.2*	6.4*	6.7*
Processed cheese	2.31	10.2	50.9	64.0	38.2	26.7	71.1	87.9
Processed fish	4.85	21.4	87.7	108.6	45.9	46.7	110.5	120.3
Processed meat	6.13	27.1	66.0	73.9	90.3	30.0	67.8	75.9
Processed potatoes	0.25	1.1	5.0	7.3	35.0	3.2	8.8	10.5
Quorn	0.05	0.2*	na	na	2.1	10.7*	18.6*	20.2*
Ready meals	0.28	1.2	11.0*	17.1*	7.8	16.0	30.1*	41.8*
RTE cereals	0.32	1.4	5.7	7.2	52.0	2.7	7.0	9.0
Smoothies	0.01	<0.1*	na	na	0.3	13.6*	25.9*	26.5*
Turkey meat	0.43	1.9	14.0	16.6*	14.8	12.7	24.3	27.6*
Yogurt	6.47	28.6	124.6	157.7	47.9	59.7	157.9	188.9

na = not available
* Indicates an intake estimate that may not be statistically reliable, as the sample size does not meet the minimum reporting requirements.

Table A-3 Estimated Daily Intake of EPA and DHA from Individual Fortified Food-Uses by Teenagers Aged 11 to 18 Years Within the U.K. (NDNS Data, 1997)

Food-Use Category	% Contribution to total mean	All-Person Consumption (n=446)			All-Users Consumption			
		Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
			90	95			90	95
All	*100*	431.1	742.1	807.3	100	431.1	742.1	807.3
Bars	0.77	3.3	23.1*	46.4*	8.2	40.4	110.0*	127.7*
Beverage mixes	0.20	0.9*	1.6*	11.5*	5.3	16.2*	50.2*	58.1*
Bread	32.67	140.9	293.3	334.5	98.6	142.9	293.7	334.6
Canned pasta & beans	4.34	18.7	64.0	79.8	65.3	28.7	73.6	91.0
Chocolate bars	11.51	49.6	162.3	193.8	76.8	64.6	169.3	213.7
Cookies	4.79	20.6	71.5	87.7	72.6	28.4	78.4	98.9
Cream	0.07	0.3*	1.9*	4.9*	6.5	4.7*	12.6*	13.7*
Eggs	5.46	23.6	98.3	140.1	47.7	49.4	142.8	150.5
Fruit-juice drinks	2.56	11.0	64.4	90.3*	28.8	38.4	105.2	126.0*
Infant/toddler milk	0	0	0	0	0	0	0	0
Margarines/Spreads	10.55	45.5	125.5	141.9	84.4	53.9	129.4	146.5
Meal replacement drinks	0	0	0	0	0	0	0	0
Milk	8.39	36.2	167.8	208.2	61.7	58.6	197.9	244.9
Oils	0.18	0.8	6.0*	10.4*	7.5	10.2	22.4*	32.3*
Olives	<0.01	<0.1*	na	na	0.5	0.9*	1.5*	1.6*
Processed cheese	0.79	3.4	22.5*	36.7*	16.4	20.9	56.5*	90.6*
Processed fish	3.77	16.3	82.5	101.2*	30.5	53.4	123.5	156.9*
Processed meat	6.87	29.6	82.2	97.2	82.8	35.8	85.0	106.0
Processed potatoes	0.20	0.9	5.8	7.5*	20.2	4.3	10.5	14.4*
Quorn	0.09	0.4*	na	5.0*	2.8	14.3*	28.5*	36.0*
Ready meals	0.78	3.4	26.3*	31.5*	13.8	24.5	54.2*	77.8*
RTE cereals	0.45	1.9	8.9	11.0	46.9	4.1	11.0	13.3
Smoothies	0.01	0.1*	na	na	0.1	45.9*	45.9*	45.9*
Turkey meat	0.46	2.0	16.1*	20.5*	11.8	16.8	39.7*	41.7*
Yogurt	5.08	21.9	113.5	150.1	38.0	57.6	163.8	177.3

na = not available
* Indicates an intake estimate that may not be statistically reliable, as the sample size does not meet the minimum reporting requirements.

Table A-4 Estimated Daily Intake of EPA and DHA from Individual Fortified Food-Uses by Female Adults Aged 19 to 64 Years Within the U.K. (NDNS Data, 2000-2001)

Food-Use Category	% Contribution to total mean	All-Person Consumption (n=958)			All-Users Consumption			
		Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
			90	95			90	95
All	*100*	387.3	596.8	691.7	100	387.3	596.8	691.7
Bars	0.83	3.2	na	20.6*	7.6	42.0	92.2*	110.7*
Beverage mixes	0.26	1.0	na	na	4.8	20.9	43.1*	59.1*
Bread	32.46	125.7	212.1	247.7	97.0	129.5	213.9	248.8
Canned pasta & beans	2.48	9.6	29.0	39.4	45.4	21.2	40.1	51.6
Chocolate bars	5.31	20.6	60	92.6	49.0	42.0	93.4	117.4
Cookies	2.88	11.2	33.5	48.3	55.0	20.3	45.1	56.6
Cream	0.25	1.0	3.3	5.8*	14.1	7.0	14.1	19.9*
Eggs	8.98	34.8	94.1	117.2	59.9	58.0	110.3	140.9
Fruit-juice drinks	1.69	6.6	19.9	47.6*	15.1	43.5	87.9	108.6*
Infant/toddler milk	0	0	0	0	0	0	0	0
Margarines/Spreads	9.25	35.8	90.3	116.4	73.0	49.0	103.4	127.4
Meal replacement drinks	2.98	11.6*	na	na	0.9	1296.0*	2234.7*	2954.3*
Milk	10.94	42.4	140.1	189.5	62.7	67.6	164.1	210.6
Oils	0.43	1.7	5.2	11.5*	16.2	10.2	20.8	23.9*
Olives	0.03	0.1*	na	na	4.3	3.1*	6.6*	10.7*
Processed cheese	1.44	5.6	19.9	39.6*	19.6	28.4	58.4	83.7*
Processed fish	4.66	18.1	67.0	95.6	30.9	58.4	106.4	132.9
Processed meat	5.26	20.4	50.5	61.5	72.7	28.0	56.3	65.9
Processed potatoes	0.06	0.2	na	1.9*	8.1	2.9	5.6*	6.6*
Quorn	0.16	0.6	na	na	3.8	16.6	27.9*	32.0*
Ready meals	1.29	5.0	25.6	32.6	16.8	29.8	49.7	63.6
RTE cereals	0.37	1.4	4.8	6.8	38.1	3.7	7.5	9.8
Smoothies	0.04	0.2*	na	na	0.3	52.4*	66.8*	70.8*
Turkey meat	0.16	0.6	na	na	3.8	16.5	25.0*	40.7*
Yogurt	7.77	30.1	103.3	147.5	39.0	77.1	161.2	196.9

na = not available
* Indicates an intake estimate that may not be statistically reliable, as the sample size does not meet the minimum reporting requirements.

Table A-5 Estimated Daily Intake of EPA and DHA from Individual Fortified Food-Uses by Male Adults Aged 19 to 64 Years Within the U.K. (NDNS Data, 2000-2001)

Food-Use Category	% Contribution to total mean	All-Person Consumption (n=766)			All-Users Consumption			
		Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
			90	95			90	95
All	*100*	528.0	837.9	962.3	100	528.0	837.9	962.3
Bars	0.90	4.8	na	22.0*	6.5	73.1	141.2*	164.9*
Beverage mixes	0.06	0.3*	na	na	1.6	18.6*	29.9*	35.6*
Bread	37.58	198.5	344.4	398.5	97.9	202.6	345.7	399.1
Canned pasta & beans	3.07	16.2	41.1	65.8	52.3	31.0	63.5	85.2
Chocolate bars	4.80	25.3	72	112.4	49.3	51.4	113.2	152.7
Cookies	3.17	16.7	47.6	74.0	55.0	30.4	69.2	91.9
Cream	0.18	0.9	3.4	7.0*	13.8	6.9	13.9	17.7*
Eggs	10.08	53.2	136.3	178.1	67.9	78.4	162.4	216.1
Fruit-juice drinks	0.96	5.1	16.1	32.4*	13.3	38.1	82.6	102.4*
Infant/toddler milk	0	0	0	0	0	0	0	0
Margarines/Spreads	11.24	59.4	143.3	182.5	80.2	74.0	155.7	195.3
Meal replacement drinks	2.29	12.1*	na	na	0.5	2233.6*	5461.5*	6335.2*
Milk	8.38	44.3	140.0	194.9	57.5	77.0	184.8	236.1
Oils	0.47	2.5	5.2	13.9*	17.0	14.5	31.2	60.4*
Olives	0.02	0.1*	na	na	3.6	2.3*	4.4*	7.1*
Processed cheese	0.49	2.6	0.2*	13.5*	10.1	25.4	63.1*	77.4*
Processed fish	3.20	16.9	63.5	94.9	26.9	62.9	116.1	151.8
Processed meat	6.83	36.1	76.3	93.2	86.7	41.6	81.4	94.6
Processed potatoes	0.09	0.5	1.2	4.1*	12.1	4.1	8.4	9.1*
Quorn	0.10	0.6*	na	na	1.9	29.3*	49.6*	59.2*
Ready meals	1.08	5.7	25.7	34.3*	17.2	33.2	61.7	68.7*
RTE cereals	0.31	1.6	6.0	8.6	35.0	4.7	10.3	12.9
Smoothies	0.04	0.2*	na	na	0.5	41.9*	57.9*	61.4*
Turkey meat	0.22	1.1	na	na	4.8	24.0	35.0*	43.2*
Yogurt	4.44	23.5	82.8	119.4	30.0	78.3	155.5	192.4

na = not available
* Indicates an intake estimate that may not be statistically reliable, as the sample size does not meet the minimum reporting requirements

APPENDIX B

Estimated Daily Per Kilogram Body Weight Intake of EPA and DHA from Individual Fortified Food-Uses by Different Population Groups Within the U.K.

Table B-1 Estimated Daily Per Kilogram Body Weight Intake of EPA and DHA from Individual Fortified Food-Uses by Children Aged 1.5 to 4.5 Years Within the U.K. (NDNS Data, 1992-1993)

Food-Use Category	% Contribution to total mean	All-Person Consumption (n=814)			All-Users Consumption			
		Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
			90	95			90	95
All	*100*	28.12	43.50	50.56	100	28.12	43.50	50.56
Bars	0.15	0.04*	na	na	1.6	2.67*	5.11*	7.04*
Beverage mixes	0.32	0.09	na	0.52*	9.0	0.99	2.14*	3.27*
Bread	18.29	5.01	9.06	10.66	97.4	5.15	9.10	10.70
Canned pasta & beans	3.96	1.12	2.99	3.92	67.1	1.66	3.53	4.48
Chocolate bars	5.41	1.50	4.13	5.25	59.1	2.55	4.99	6.45
Cookies	5.43	1.50	3.28	4.06	84.7	1.77	3.50	4.18
Cream	0.06	0.02	na	0.01*	5.1	0.32	0.63*	0.86*
Eggs	5.19	1.45	4.75	6.70	41.9	3.47	7.00	8.64
Fruit-juice drinks	2.24	0.62	2.31	3.83*	18.5	3.33	5.93	7.27*
Infant/toddler milk	0.02	0.01*	na	na	2.5	0.27*	0.41*	0.97*
Margarines/Spreads	6.71	1.85	4.05	5.05	82.4	2.24	4.32	5.28
Meal replacement drinks	0.03	0.01*	na	na	0.2	3.75*	6.79*	7.79*
Milk	33.02	9.52	22.10	27.52	88.6	10.75	22.61	28.88
Oils	0.08	0.02	na	na	4.7	0.50	0.99*	1.66*
Olives	<0.01	<0.01*	na	na	0.7	0.20*	0.31*	0.31*
Processed cheese	3.52	1.01	3.42	5.20	36.0	2.81	6.19	8.10
Processed fish	3.74	1.05	3.78	5.20	32.0	3.27	6.13	7.38
Processed meat	3.92	1.07	2.73	3.53	72.1	1.48	3.07	3.78
Processed potatoes	0.10	0.03	0.11	0.20*	14.6	0.19	0.34	0.47*
Quorn	<0.01	<0.01*	na	na	0.2	0.21*	0.32*	0.36*
Ready meals	0.30	0.10	na	0.49*	6.5	1.46	3.37*	4.10*
RTE cereals	0.26	0.07	0.21	0.29	51.5	0.14	0.28	0.35
Smoothies	0.06	0.02*	na	na	0.4	3.86*	6.71*	11.13*
Turkey meat	0.15	0.04	na	na	4.5	0.92	1.70*	2.00*
Yogurt	7.02	1.98	6.46	9.20	39.1	5.06	9.94	12.73

na = not available
* Indicates an intake estimate that may not be statistically reliable, as the sample size does not meet the minimum reporting requirements.

Table B-2 Estimated Daily Per Kilogram Body Weight Intake of EPA and DHA from Individual Fortified Food-Uses by Young People Aged 4 to 10 Years Within the U.K. (NDNS Data, 1997)

Food-Use Category	% Contribution to total mean	All-Person Consumption (n=837)			All-Users Consumption			
		Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
			90	95			90	95
All	*100*	17.57	31.30	35.87	100	17.57	31.30	35.87
Bars	0.41	0.06	na	0.79*	4.9	1.26	2.73*	3.52*
Beverage mixes	0.28	0.05	0.35	0.64*	11.3	0.45	1.31	1.49*
Bread	26.28	4.49	9.18	10.56	99.4	4.52	9.19	10.59
Canned pasta & beans	4.37	0.77	2.43	3.17	78.8	0.98	2.66	3.51
Chocolate bars	7.74	1.31	4.11	5.16	77.9	1.68	4.53	5.50
Cookies	6.10	1.08	2.86	3.50	88.7	1.22	2.94	3.74
Cream	0.08	0.01	0.10	0.16*	9.8	0.15	0.38	0.56*
Eggs	4.60	0.78	3.23	4.30	45.6	1.71	4.48	5.14
Fruit-juice drinks	4.18	0.75	3.64	4.67	39.2	1.91	4.92	6.02
Infant/toddler milk	0	0	0	0	0	0	0	0
Margarines/Spreads	8.95	1.54	3.85	5.19	86.9	1.77	3.97	5.45
Meal replacement drinks	0.13	0.02*	na	na	0.2	13.75*	13.75*	13.75*
Milk	15.68	2.96	9.99	12.14	79.2	3.74	10.94	12.80
Oils	0.11	0.02	0.08*	0.24*	5.8	0.31	1.01*	1.02*
Olives	0.01	<0.01*	na	na	0.7	0.13*	0.30*	0.33*
Processed cheese	2.31	0.44	2.22	2.85	38.2	1.15	3.24	4.26
Processed fish	4.85	0.86	3.52	4.52	45.9	1.88	4.56	5.39
Processed meat	6.13	1.05	2.63	3.07	90.3	1.16	2.74	3.20
Processed potatoes	0.25	0.04	0.20	0.27	35.0	0.12	0.31	0.39
Quorn	0.05	0.01*	na	na	2.1	0.47*	0.85*	0.88*
Ready meals	0.28	0.05	0.43*	0.71*	7.8	0.65	1.50*	1.72*
RTE cereals	0.32	0.06	0.23	0.28	52.0	0.11	0.28	0.35
Smoothies	0.01	<0.01*	na	na	0.3	0.63*	1.26*	1.31*
Turkey meat	0.43	0.08	0.57	0.76*	14.8	0.51	0.95	1.15*
Yogurt	6.47	1.13	4.74	6.54	47.9	2.37	6.56	8.85

na = not available
* Indicates an intake estimate that may not be statistically reliable, as the sample size does not meet the minimum reporting requirements.

Table B-3 Estimated Daily Per Kilogram Body Weight Intake of EPA and DHA from Individual Fortified Food-Uses by Teenagers Aged 11 to 18 Years Within the U.K. (NDNS Data, 1997)

Food-Use Category	% Contribution to total mean	All-Person Consumption (n=446)			All-Users Consumption			
		Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
			90	95			90	95
All	*100*	8.45	15.76	18.07	100	8.45	15.76	18.07
Bars	0.77	0.07	0.41*	0.92*	8.2	0.79	2.04*	2.42*
Beverage mixes	0.20	0.02	0.03*	0.26*	5.3	0.34	0.97*	1.01*
Bread	32.67	2.70	5.53	6.29	98.6	2.74	5.57	6.33
Canned pasta & beans	4.34	0.37	1.34	1.59	65.3	0.56	1.52	1.87
Chocolate bars	11.51	0.99	3.25	4.37	76.8	1.29	3.51	4.71
Cookies	4.79	0.42	1.39	1.85	72.6	0.58	1.63	2.23
Cream	0.07	0.01	0.03*	0.08*	6.5	0.09	0.24*	0.28*
Eggs	5.46	0.46	1.90	2.53	47.7	0.96	2.61	3.50
Fruit-juice drinks	2.56	0.23	1.25	2.00*	28.8	0.81	2.41	2.63*
Infant/toddler milk	0	0	0	0	0	0	0	0
Margarines/Spreads	10.55	0.88	2.44	3.01	84.4	1.04	2.54	3.25
Meal replacement drinks	0	0	0	0	0	0	0	0
Milk	8.39	0.74	3.43	4.53	61.7	1.19	4.00	5.21
Oils	0.18	0.01	0.11*	0.21*	7.5	0.20	0.51*	0.64*
Olives	<0.01	<0.01*	na	na	0.5	0.01*	0.02*	0.02*
Processed cheese	0.79	0.07	0.42*	0.75*	16.4	0.43	1.34*	1.54*
Processed fish	3.77	0.32	1.68	2.17*	30.5	1.06	2.61	2.94*
Processed meat	6.87	0.57	1.63	2.09	82.8	0.69	1.71	2.17
Processed potatoes	0.20	0.02	0.12	0.17*	20.2	0.09	0.23	0.30*
Quorn	0.09	0.01*	na	0.10*	2.8	0.26*	0.56*	0.75*
Ready meals	0.78	0.06	0.47*	0.67*	13.8	0.45	0.93*	1.25*
RTE cereals	0.45	0.04	0.17	0.21	46.9	0.08	0.22	0.27
Smoothies	0.01	<0.01*	na	na	0.1	0.76*	0.76*	0.76*
Turkey meat	0.46	0.04	0.32*	0.44*	11.8	0.35	0.82*	1.07*
Yogurt	5.08	0.44	2.23	3.00	38.0	1.15	3.2	3.93

na = not available
* Indicates an intake estimate that may not be statistically reliable, as the sample size does not meet the minimum reporting requirements.

Table B-4 Estimated Daily Per Kilogram Body Weight Intake of EPA and DHA from Individual Fortified Food-Uses by Female Adults Aged 19 to 64 Years Within the U.K. (NDNS Data, 2000-2001)

Food-Use Category	% Contribution to total mean	All-Person Consumption (n=958)			All-Users Consumption			
		Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
			90	95			90	95
All	*100*	5.81	9.13	10.70	100	5.81	9.13	10.70
Bars	0.83	0.05	na	0.32*	7.6	0.64	1.20*	1.61*
Beverage mixes	0.26	0.01	na	na	4.8	0.31	0.61*	0.96*
Bread	32.46	1.88	3.30	3.87	97.0	1.94	3.33	3.92
Canned pasta & beans	2.48	0.14	0.43	0.57	45.4	0.31	0.59	0.75
Chocolate bars	5.31	0.31	0.85	1.36	49.0	0.63	1.38	1.69
Cookies	2.88	0.17	0.49	0.72	55.0	0.31	0.69	0.87
Cream	0.25	0.01	0.05	0.10*	14.1	0.10	0.21	0.30*
Eggs	8.98	0.52	1.40	1.78	59.9	0.86	1.65	2.08
Fruit-juice drinks	1.69	0.10	0.30	0.74*	15.1	0.67	1.40	1.73*
Infant/toddler milk	0	0	0	0	0	0	0	0
Margarines/Spreads	9.25	0.54	1.39	1.82	73.0	0.74	1.56	2.03
Meal replacement drinks	2.98	0.19*	na	na	0.9	20.96*	38.48*	49.05*
Milk	10.94	0.65	2.10	2.75	62.7	1.03	2.61	3.45
Oils	0.43	0.03	0.08	0.16*	16.2	0.16	0.36	0.50*
Olives	0.03	<0.01	na	na	4.3	0.05	0.08*	0.20*
Processed cheese	1.44	0.08	0.27	0.56	19.6	0.42	0.87	1.25
Processed fish	4.66	0.27	0.96	1.47	30.9	0.88	1.75	2.16
Processed meat	5.26	0.30	0.76	0.95	72.7	0.41	0.86	1.02
Processed potatoes	0.06	<0.01	na	0.03*	8.1	0.04	0.08*	0.10*
Quorn	0.16	0.01	na	na	3.8	0.24	0.42*	0.50*
Ready meals	1.29	0.07	0.35	0.48	16.8	0.44	0.80	0.91
RTE cereals	0.37	0.02	0.07	0.10	38.1	0.05	0.11	0.14
Smoothies	0.04	<0.01*	na	na	0.3	0.97*	1.23*	1.32*
Turkey meat	0.16	0.01	na	na	3.8	0.27	0.41*	0.61*
Yogurt	7.77	0.43	1.46	2.11	39.0	1.11	2.44	3.00

na = not available
* Indicates an intake estimate that may not be statistically reliable, as the sample size does not meet the minimum reporting requirements.

Table B-5 Estimated Daily Per Kilogram Body Weight Intake of EPA and DHA from Individual Fortified Food-Uses by Male Adults Aged 19 to 64 Years Within the U.K. (NDNS Data, 2000-2001)

Food-Use Category	% Contribution to total mean	All-Person Consumption (n=766)			All-Users Consumption			
		Mean (mg)	Percentile (mg)		%	Mean (mg)	Percentile (mg)	
			90	95			90	95
All	*100*	6.46	10.08	12.09	100	6.46	10.08	12.09
Bars	0.90	0.06	na	0.27*	6.5	0.89	1.74*	2.09*
Beverage mixes	0.06	<0.01*	na	na	1.6	0.23*	0.36*	0.49*
Bread	37.58	2.41	4.30	5.20	97.9	2.46	4.31	5.23
Canned pasta & beans	3.07	0.20	0.55	0.79	52.3	0.39	0.79	1.07
Chocolate bars	4.80	0.31	0.91	1.28	49.3	0.63	1.28	1.88
Cookies	3.17	0.20	0.60	0.89	55.0	0.37	0.82	1.05
Cream	0.18	0.01	0.04	0.08*	13.8	0.09	0.18	0.20*
Eggs	10.08	0.65	1.69	2.20	67.9	0.96	2.01	2.64
Fruit-juice drinks	0.96	0.06	0.20	0.38*	13.3	0.46	1.04	1.22*
Infant/toddler milk	0	0	0	0	0	0	0	0
Margarines/Spreads	11.24	0.72	1.65	2.20	80.2	0.89	1.84	2.30
Meal replacement drinks	2.29	0.17*	na	na	0.5	31.37*	64.62*	98.22*
Milk	8.38	0.55	1.68	2.53	57.5	0.96	2.37	3.06
Oils	0.47	0.03	0.07	0.17*	17.0	0.18	0.40	0.74*
Olives	0.02	<0.01*	na	na	3.6	0.03*	0.06*	0.08*
Processed cheese	0.49	0.03	na	0.17*	10.1	0.30	0.76*	0.97*
Processed fish	3.20	0.20	0.76	1.04	26.9	0.76	1.46	2.13
Processed meat	6.83	0.44	0.93	1.18	86.7	0.50	0.99	1.24
Processed potatoes	0.09	0.01	0.02	0.05*	12.1	0.05	0.09	0.12*
Quorn	0.10	0.01*	na	na	1.9	0.37*	0.64*	0.79*
Ready meals	1.08	0.07	0.31	0.44*	17.2	0.40	0.74	0.97*
RTE cereals	0.31	0.02	0.07	0.10	35.0	0.06	0.13	0.15
Smoothies	0.04	<0.01*	na	na	0.5	0.43*	0.58*	0.59*
Turkey meat	0.22	0.01	na	na	4.8	0.29	0.44*	0.50*
Yogurt	4.44	0.29	1.01	1.40	30.0	0.96	2.04	2.37

na = not available
* Indicates an intake estimate that may not be statistically reliable, as the sample size does not meet the minimum reporting requirements

APPENDIX C

Representative MAFF Food Codes for All Fortified Food-Uses of EPA and DHA in the U.K.

Representative MAFF Food Codes for All Proposed Food-Uses of EPA and DHA in the U.K.

Bars

Food Code	Food Name
2987	CHOCOLATE CHIP BAR FORTIFIED
3159	NEW YORKER BREAKFAST BAR fortified
3216	BENECOL SNACK BAR CHOCOLATE CHIP
3353	KELLOGS FROSTIES CEREAL AND MILK BAR
3745	OAT & RICE CEREAL BAR FORTIFIED KELLOG
5770	NUTRI GRAIN BARS/ NUTRI-GRAIN TWIST BARS
6310	CHOCOLATE CRISP RICE BISCUIT BAR
6655	CHEWY CEREAL BAR WITH COCONUT AND CHOC
6883	CEREAL BAR WITH FRUIT. UNFORTIFIED
7656	CHEWY CEREAL SNACK BAR
7665	CEREAL CRUNCHY BARS
7966	TRACKER BAR PEANUT
7967	TRACKER BAR CHOCOLATE CHIP

Beverage Mixes

Food Code	Food Name
2310	HORLICKS POWDER
2311	MILK SHAKE POWDER
2313	OVALTINE DRY WEIGHT NOT INSTANT NOT LOW FAT
2635	HORLICKS LOW FAT INSTANT DRY WEIGHT
2670	OVALTINE LIGHT INSTANT LOW FAT DRY WEIGHT
7053	BARLEY CUP DRY WEIGHT
8957	BAMBU CHICORY DRINK - COFFEE SUBSTITUTE
9367	MALTED DRINKS DRY WEIGHT OWN BRAND
9368	INSTANT MALTED DRINKS DRY WEIGHT

Bread

Food Code	Food Name
102	BROWN BREAD NO ADDED BRAN
107	BROWN BREAD TOASTED
110	WHEATGERM BREAD EG HOVIS WHEATGERM BREAD
111	WHEATGERM BREAD TOASTED
112	BREAD GRANARY
113	GRANARY BREAD TOASTED
114	BREAD RYE
115	RYE BREAD TOASTED
118	BREAD VIT-BE
119	VITBE BREAD TOASTED NOT VITBE HI BRAN
120	BREAD WHITE SLICED
121	BREAD WHITE CRUSTY
126	BREAD WHITE TOASTED
128	MILK BREAD WHITE
129	BREAD WHITE SLIMMERS
130	BREAD WHITE SCOTTISH BATCH LOAF
133	BREAD WHOLEMEAL
138	BREAD WHOLEMEAL TOASTED
157	ROLLS HAMBURGER BUNS

158	ROLLS WHITE CRUSTY
159	ROLLS WHITE SOFT
160	ROLLS WHITE STARCH REDUCED
161	ROLLS WHOLEMEAL
169	ROLL GRANARY BROWN WHEATGERM TOASTED
170	HAMBURGER ROLLS TOASTED
171	ROLLS WHITE TOASTED
172	ROLLS WHOLEMEAL TOASTED
3172	WHOLEMEAL BREAD SLIMMERS TOASTED
5851	REDUCED CALORIE WHOLEMEAL TOAST
6463	WHOLEMEAL BREAD SESAME SEEDS SUNFLOWER
7604	SOFTGRAIN BREAD NOT FORTIFIED WITH FOLATE
7605	BREAD SOFTGRAIN TOASTED
7609	BREAD HIGH FIBRE WHITE
7610	BREAD HIGH FIBRE WHITE TOASTED
7614	BREAD WHOLEMEAL SLIMMERS ONLY
7618	BREAD OATMEAL TOASTED
7619	SOFTGRAIN ROLLS
7620	ROLLS BROWN GRANARY WHEATGERM CRUSTY
7621	BROWN GRANARY WHEATGERM ROLLS SOFT
8073	MILK LOAF TOASTED
8177	HI BRAN BREAD
8178	HIBRAN BREAD TOASTED
8179	SOFTGRAIN BREAD FORTIFIED WITH FOLATE
8180	SOFTGRAIN BREAD FORTIFIED TOASTED
8700	BROWN BREAD WITH ADDED VITAMINS + CALCIUM
8804	BROWN BREAD WITH ADDED VITAMINS CA & FE
9129	BRIOCHE
9373	BAGELS PLAIN ONLY
9466	BREAD WHOLEMEAL FORTIFIED EG. TESCO
9467	BREAD WHITE FORTIFIED NOT SOFTGRAIN
9929	WHITE TOAST FORTIFIED WITH VITS AND MINERALS
9928	W/MEAL TOAST FORTIFIED WITH VITS AND MINERALS

Breads – Recipe fraction approx 20 to 95%

Food Code	Food Name
103	BR. BREAD FRIED BLEND OIL
104	BROWN BREAD FRIED IN PUFA OIL
106	BROWN BREAD FRIED IN LARD
122	BREAD WHITE ANY FRIED IN BLENDED VEG OIL
124	BREAD WHITE FRIED IN DRIPPING
125	BREAD WHITE FRIED IN LARD
135	WHO. BREAD FRIED PUFA OIL
136	WHO. BREAD FRIED IN DRIPPING
162	BREAD VITBE FRIED BLENDED OIL
163	BREAD VITBE FRIED DRIPPING
165	VITBE HOVIS FRIED IN PUFA OIL
7607	SOFT GRAIN BREAD FRIED IN LARD
7608	SOFT GRAIN BREAD FRIED IN PUFA
7612	BREAD HIGH FIBRE FRIED IN LARD
7613	BREAD HIGH FIBRE FRIED IN PUFA
8363	SOFT GRAIN BREAD FRIED IN BLENDED VEG OIL

8522	HGH FIBRE WHITE BREAD FRIED IN BLENDED
9310	SOFTGRAIN BREAD FRIED IN OLIVE OIL
9682	FRIED WHITE BREAD PALM OIL
105	BROWN BREAD FRIED IN DRIPPING
123	BREAD WHITE FRIED IN PUFA OIL
134	WHO. BREAD FRIED BLENDED OIL
137	BREAD WHOLEMEAL FRIED IN LARD
164	BREAD VITBE FRIED IN LARD
7606	SOFTGRAIN BREAD FRIED IN DRIPPING
7611	BREAD HIGH FIBRE FRIED IN DRIPPING
9640	WHOLEMEAL BREAD FRIED IN BUTTER
4843	EGGY BREAD FRIED IN BLENDED
6486	EGGY BREAD WITH SKIM MILK FRIED IN PUFA
3624	BREAD WITH EGGS AND OLIVE OIL
7769	EGGY BREAD W/M MILK BLEND OIL
9081	EGGY BREAD BROWN WITH CHEESE & PUFA OIL
505	BREAD PUDDING
2746	Wholemeal bread pudding
3122	BREAD & BUTTER PUDDING MADE WITH BRIOCHE
3534	BREAD AND BUTTER PUDDING WITH APRICOTS
3562	BREAD AND BUTTER PUDDING WITH PURCHASED
5418	BREAD PUDDING MADE WITH WHOLE MILK
6214	BREAD PUDDING WITH OLIVIO RUM NO MILK
6407	SUMMER PUDDING MADE WITH WHOLEMEAL BREAD
6592	BREAD BUTTER PUD. SEMI SKI MILK W.BREAD
6926	Chocolate bread pudding with rum
6939	Bread and butter pudding
9520	BREAD & BUTTER PUD MADE W REDCD FAT SPR
9623	BREAD AND BUTTER PUDDING WMEAL BREAD
9625	BREAD AND BUTTER PUDDING S/SKIM MILK
9718	BREAD PUDDING WITH MARMALADE
9919	BREAD & BUTTER PUDDING FORTIFIED BREAD
507	BREAD AND BUTTER PUDDING
3245	BREAD & BUTTER PUDDING WITH CREAM
6186	BREAD PUDDING WITH WATER AND PUFA SPREAD
6474	BREAD BUTTER PUDDING HOMEMADE FLORA LIGHT
6676	BREAD & BUTTER PUD WITH UTT BUT DATES
9621	BREAD & BUTTER PUDDING MADE W WHOLEMEAL
9887	BREAD & BUTTER PUDDING WITH ARTIFICIAL SWEET

Canned Pasta and Beans

Food Code	Food Name
38	PASTA MACARONI CANNED IN CHEESE SAUCE
39	PASTA RAVIOLI CANNED IN TOMATO SAUCE
40	PASTA SPAGHETTI CANNED IN BOLOGNAISE SAUCE
41	PASTA-SPAGHETTI CANNED IN TOMATO SAUCE
1240	BAKED BEANS IN TOMATO SAUCE WITH PORK SAUCE
1662	BEANS BAKED CANNED
2646	BEANS BAKED CANNED LOW SUGAR/ NO ADDED SUG
3174	SPAGHETTI WHOLEMEAL CANNED TOMATO SAUCE
3207	PASTA & VEGETABLES IN TOMATO SAUCE CANNED
3760	SPAGHETTI WHOLEMEAL CANNED IN TOMATO SAUCE

6255	FORTIFIED PASTA SHAPES WITH MINI SAUSAGE
6366	CHEESE RAVOLI IN TOMATO SAUCE CANNED
7602	SPAGHETTI CANNED IN TOMATO SCE REDUCED
7781	BEANS BAKED WITH ADDITIONS (BURGERS)
8611	PASTA SHAPES IN TOMATO SAUCE FORT.
8871	GLUTEN FREE WHOLEMEAL SPAGHETTI CANNED
9102	TUNA RAVIOLI IN SPICY TOMATO SAUCE - CANNED
9172	VEGETABLE RAVIOLI CANNED IN TOMATO SAUCE
9273	PASTA WITH SAUSAGES CANNED IN TOM SAUCE

Canned pasta and beans – Recipe fraction approx 10 to 30%

Food Code	Food Name
2787	Corned beef hash with baked beans
3684	CORNED BEEF HASH WITH BAKED BEANS
5693	BAKED BEANS AND POTATO COATED IN BREAD
5877	CORNED BEEF HASH WITH BAKED BEANS ONIONS
5913	CORNED BEEF HASH WITH BAKED BEANS
7839	BAKED BEANS LOW FAT SAUSAGE
7840	BAKED BEANS WITH PASTA
3616	BOLOGNESE SAUCE WTH BAKED BEANS TOMATOES
3707	CHILLI WITH BAKED BEANS CARROTS AND PEPPER
5413	BAKED BEANS WITH SAUSAGE BACON EGG & MUSHROOM
8685	OMELETTE WITH SAUSAGES & BAKED BEANS
2937	Bolognese sauce with bacon baked beans
3001	Lamb with potatoes baked beans tomatoes
3044	MINCE LAMB CASSEROLE WITH BAKED BEANS
3397	COTTAGE PIE WITH BAKED BEANS AND CHEESE
3453	BOLOGNESE SAUCE WITH BAKED BEANS
3512	CORNED BEEF PIE WITH BAKED BEANS FLORA
3600	LASAGNE WITH BEEF MINCE BAKED BEANS
3642	MINCED BEEF CASSEROLE WITH BAKED BEANS
3643	SAUSAGE CASSEROLE WITH BAKED BEANS CARROT
3758	BEEF COBBLER WITH BAKED BEANS AND CARROT
3759	SHEPHERDS PIE WITH BAKED BEANS
5159	MINCE BEEF STEW WITH BAKED BEANS ONION
5187	LASAGNA WITH BAKED BEANS MUSHROOMS
5356	SHEPHERDS PIE WITH BAKED BEANS IN DOLMIO
5547	PORK MINCE WITH BAKED BEANS AND TOMATO
5772	COTTAGE PIE WITH BAKED BEANS TINNED CARROT
5777	BOLOGNESE SAUCE WITH BAKED BEANS ONIONS
5778	BEEF CURRY WITH BAKED BEANS
5857	PORK CASS WITH BAKED BEANS CHOP HAM
6141	CHILLI WITH MINCED BEEF BAKED BEANS
6195	SAUSAGE STEW WITH BAKED BEANS AND CANNED
6408	BEEF CURRY WITH POTS ONIONS BAKED BEANS
6417	SHEPHERDS PIE W LAMB MINCE BAKED BEANS
6523	CHILLI CON CARNE MINCED BEEF BAKED BEANS
6734	COTTAGE PIE W BAKED BEANS FLORA & SK MILK
8668	SHEPHERDS PIE WITH BAKED BEANS
8991	SHEPHERDS PIE LEAN BAKED BEANS CARROTS
9136	CHILLI WITH BAKED BEANS

Chocolate Bars

Food Code	Food Name
2252	BOUNTY BAR BOOST BAR CABANA COCONUT ICE
2254	MILK CHOCOLATE BAR
2255	DARK CHOCOLATE NO ADDITIONS EG BOURNVILLE
2258	CHOCOLATE BAR WITH NUTS
2265	MARS BAR
2273	TURKISH DELIGHT
2276	TWIX/DRIFTER MUNCHIES
2277	KIT KAT
2278	WISPA
7954	BALISTO LION BAR PICNIC CRISPY CARAMEL
7955	FRUIT AND NUT MILK CHOCOLATE
7959	MILKY WAY
7960	WHITE CHOCOLATE BUTTONS MICE
7962	CREAM EGG/MINTOLAI
7963	CRUNCHIE BAR
7964	TOPIC/MARATHON (SNICKERS)
7971	APPLAUSE
7972	BITZ BAR (PLAIN & MILK) MATCHMAKER
7973	BITZ BAR MILK CHOC BAR WITH ORANGE/CHERR
7974	DAIRY CRUNCH MILK CHOCOLATE NOT WHITE DARK
7975	DAIRY CRUNCH WHITE CHOCOLATE
7978	DOUBLE DECKER
8302	FRUIT AND NUT CHOCOLATE BAR
8521	MILKY BAR WITH RAISINS
8612	CADBURYS NUT CRISP BAR
9616	HALO REDUCED CALORIE AND FAT CHOCOLATE BAR

Cookies

Food Code	Food Name
251	BISCUITS CHEESE FLAVOURED
252	CHEESE SANDWICH BISCUITS
253	FULLY COATED CHOCOLATE BISCUITS BISCUIT
254	CHOCOLATE SHORT OR SWEET BISCUITS HALF COAT
259	DIGESTIVE PLAIN
260	DIGESTIVES HALF COATED CHOCOLATE
262	FRUIT BISCUITS NOT WHOLEMEAL
263	GINGERNUTS
265	JAM FILLED BISCUITS EG JAMMIE DODGERS
266	MATZOS
268	CREAM SANDWICH BISCUITS
269	SEMI-SWEET BISCUIT
270	SHORT SWEET BISCUITS
272	BISCUITS WAFER SANDWICH CREAM FILLED
276	WHO.BISC.PLAIN OR FLAVOURED
277	WHO. BISC. FRUIT OR NUT
278	WHO. CREAM FILLED BISCUITS
281	FRUIT AND NUT BISCUITS
412	SLIMMING BISCUITS
3783	Iced gem biscuits fortified
3802	BRANDY SNAPS

4103	SAINSBURY W/M SHORTBREAD
5441	CHOCOLATE BRICK BISCUIT
5594	MCVITIES GO AHEAD FRUIT
5653	WHOLEMEAL AND OAT BISCUITS
5970	SHORT SWEET BISCUITS WITH JAM AND CREAM
5974	SULTANA COOKIES WITH OATS
6022	NUT COOKIES
6252	COCONUT SLICES
6400	CHOCOINIS MCVITIES GO AHEAD 85% FAT FREE
7651	COCONUT COOKIES
7657	DIGESTIVES WITH OATS PLAIN EG HOB NOBS
7658	DIGESTIVES WITH OATS CHOC. 1/2 COATED
7659	DIGESTIVES WITH OAT & FRUIT
7660	DIGESTIVES (OAT FRUIT & CHOCO)
7661	JAFFA CAKES ANY FLAVOUR
7662	CHOCOLATE CHIP COOKIES
7663	CHOCOLATE CHIP COOKIES WITH NUTS
7664	FIG ROLLS
8162	SHORTBREAD PURCHASED
8166	MALLOW BISCUITS NO CHOCOLATE
8191	ALL BUTTER BISCUITS
8192	CAROB HALF COATED BISCUITS
8193	CHOCOLATE BISCUITS FULLY COATED
8194	CHOCOLATE BISCUIT FULLY COATED
8195	CHOCOLATE COATED BISCUITS WITH MARSHMALLOW
8196	CRUNCH BISCUITS
8197	CRUNCH BISCUITS HALF COATED WITH CHOCOLATE
8198	CRUNCH BISCUIT WITH CREAM FILLING
8199	DIGESTIVE REDUCED SUGAR
8200	HONEY BISCUITS
8201	ICED BISCUITS
8202	CHOCOLATE COATED BISCUITS WITH MARSHMALLOW
8203	OSTLERS
8204	SEMI-SWEET BISCUITS HALF COATED WITH CHOC
8484	GARIBALDI
8541	BISCUITS WITH CREAM AND JAM
8989	MCVITIES LIGHT DIGESTIVES 25 % LESS FAT
9472	DIGESTIVES HALF COATED IN CHOC REDUCED FAT
9473	SHORT SWEET BISCUITS REDUCED FAT
9770	OATMEAL COOKIES
9907	ALL BUTTER GINGER BISCUITS

Cream

Food Code	Food Name
634	CREAM DOUBLE
636	CREAM HALF PASTEURISED
644	CREAM WHIPPING FRESH
2681	EMLEA IMITATION DOUBLE CREAM
4328	EMLEA IMMITATION CREAM SINGLE
5335	DELIGHT DOUBLE IMITATION CREAM
5336	DELIGHT SINGLE IMITATION CREAM
5337	DELIGHT IMITATION WHIPPING CREAM
6828	Elmlea light single cream

6984	Cream dairy extra thick 24% fat
7718	ELMLEA WHIPPING CREAM
9112	BIRDS EYE SUPER WHIP LOW FAT CREAM

Cream – Recipe fraction approx 5 to 60%

Food Code	Food Name
351	MERINGUE +ARTIFICIAL CREAM
352	MERINGUES FILLED WITH WHIPPED CREAM
5581	PAVLOVA / MERINGUE WITH FRUIT AND CREAM
336	FRESH CREAM GATEAU HOMEMADE
8551	CHOCOLATE GATEAU WITH FRESH CREAM HOMEMADE
8552	SPONGE CAKE NO FAT WITH FRESH CREAM HOME
8553	CHOCOLATE CAKE NO FAT WITH CREAM FILLING
2780	mussels in cider & cream sauce
9833	PEACH & CREAM TART ON A DIGESTIVE BASE
2766	Salmon tagliatelle with single cream
2798	Macaroni cheese with single cream bacon
2813	Cheesecake chocolate with cream
3126	CHICKEN MEATBALLS WITH DOUBLE CREAM
3162	ARTICHOKE & OLIVE & CREAM PASTA SAUCE
3225	Chicken Bacon Mushroom & Cream Pie
3245	BREAD & BUTTER PUDDING WITH CREAM
3284	CHICKEN BREASTS IN TOMATO AND CREAM
3316	SPAGHETTI CARBONARA WITH SINGLE CREAM
3324	CHICKEN CURRY WITH YOGHURT AND CREAM
3368	CHICKEN IN RED WINE WITH CREAM AND SPINACH
3433	TURKEY BACON AND CREAM WITH A LEEK
3442	PASTA SAUCE WITH BROCCOLI CREAM MUSHROOM
3537	SALMON AND POTATO BAKE WITH SINGLE CREAM
3541	BRIE QUICHE WITH DOUBLE CREAM
3635	MUSHROOM SOUP WITH BUTTER CREAM
3640	BEEF STROGANOFF WITH DOUBLE CREAM WINE
3679	LEEK AND POTATO SOUP WITH CREAM AND BUTTER
3687	CHEESECAKE NO FRUIT WITH CREAM
5226	PASTA WITH TOMATO SAUCE CREAM AND BACON
5737	MASHED POTATO WITH CHEESE BUTTER & CREAM
5971	PINEAPPLE TART WITH CREAM
6174	TUNA SAUCE WITH ONION MUSH CREAM & TOMATO
6412	PASTA SCE W BACON LEEKS MUSHROOM CREAM
6536	DATE AND SOUR CREAM PIE
6672	CHICKEN WITH ONION CIDER CREAM AND MUSTARD
6736	PUMPKIN SOUP WITH ONION AND CREAM
6880	Tomato soup with cream home-made
6882	White wine sauce with cream & chicken
6899	Tuna capers and cream sauce
6912	Potatoes baked in the oven with cream
6988	Chicken curry korma style with cream
8883	MACARONI CHEESE WITH BACON CREAM AND TOMATO
8884	FISH PIE WITH PEAS SWEETCORN AND CREAM
9033	CHICKEN CURRY WITH DOUBLE CREAM
9089	HADDOCK WITH POTATO MUSHROOM CREAM
9742	TAGLIATELLE WITH SALMON AND CREAM SAUCE
9802	CHEESE QUICHE MADE WITH SINGLE CREAM
581	TRIFLE HOMEMADE WITH ARTIFICIAL CREAM

Eggs

Food Code	Food Name
751	EGG WHOLE RAW
753	EGG YOLK RAW
754	EGG WHITE RAW
755	EGGS BOILED
762	EGG POACHED
783	EGG BOILED WEIGHED WITH SHELL
785	EGG YOLK ONLY BOILED
786	EGG WHITE ONLY BOILED
2611	EGG AFTER BAKING/BOILING
7763	EGG FRIED WITHOUT FAT

Eggs – Recipe fraction approx 10 to 95%

Food Code	Food Name
756	EGG FRIED IN BLENDED OIL
757	EGG FRIED IN BUTTER
758	EGG FRIED IN DRIPPING
759	EGG FRIED IN LARD
760	EGG FRIED IN MARGARINE
761	EGG FRIED IN PUFA
763	OMELETTE COOKED IN BLENDED OIL
764	OMELETTE COOKED IN BUTTER
765	OMELETTE COOKED IN MARGARINE
766	OMELETTE COOKED IN PUFA
767	OMELETTE SWEET FRIED BLENDED
768	OMELETTE SWEET COOKED IN BUTTER
769	OMELETTE SWEET FRIED MARG
770	OMELETTE SWEET FRIED PUFA
2840	Egg yolk fried in lard
3734	EGG YOLK FRIED IN BUTTER
5591	EGG FRIED IN LOW FAT SPREAD NOT PUFA
6187	PLAIN OMELETTE FRIED IN REDUCED FAT SPREAD
8598	EGG POACHED IN WATER WITH ADDED FAT
8732	EGG FRIED IN OLIVE OIL
8761	EGG FRIED IN RAPESEED OIL
9090	OMELETTE-FRIED IN LARD
9111	EGG WHITE FRIED IN VEGETABLE OIL
9332	EGG FRIED IN SOLID SUNFLOWER OIL
9334	OMELETTE (PLAIN) FRIED IN OLIVE OIL
9355	OMELETTE PLAIN COOKED IN DRIPPING
9356	EGG FRIED IN COMPOUND COOKING FAT
9639	OMELETTE PLAIN FRIED IN LARD
9683	EGG FRIED IN PALM OIL
9845	EGG FRIED IN CCF
9930	OMELETTE FRIED IN CCF
2610	EGG & CRUMB AFTER FRYING LOSS
7765	SCRAMBLED EGG WITHOUT MILK
7766	CURRIED OMELETTE /EGG MASALA
771	OMELETTE CHEESE FRIED BLENDED
772	OMELETTE CHEESE COOKED IN BUTTER
773	OMELETTE CHEESE FRIED MARG
774	OMELETTE CHEESE FRIED PUFA

775	OMELETTE HAM FRIED IN BLENDED
776	OMELETTE HAM FRIED IN BUTTER
777	OMELETTE HAM FRIED IN MARG
778	OMELETTE HAM FRIED IN PUFA
6509	CHEESE OMELETTE FRIED IN FLORA
2720	Mushroom and onion omelette
2753	omelette with potato bacon and cheese
3095	EGG FLORINTINE WITH SPINACH AND CHEESE
3135	CHEESE OMELETTE WITH GREEN PEPPER AND MUSH
3139	OMELETTE WITH POTATOES TOMATO & OLIVE OIL
3141	PRAWN OMELETTE MADE WITH WHOLE MILK NO FAT
5388	OMELETTE PEPPERONI
5788	EGGS MORNAY MADE WITH S/S MILK AND MARGARINE
6112	OMELETTE CHEESE & ONION FRIED IN BLENDED OIL
6121	SPANISH OMELETTE POTATO ONION CARROT
6172	OMELETTE WITH POTATOES CHEESE AND ONION
6450	OMELETTE WITH ONION MIXED VEG HAM GARLIC
6520	OMELETTE SEMI-SKIM MILK CHEESE BACON
6856	Omelette with courgette tomato & onion
6857	Omelette ham & onion fried in butter
6953	Egg fu yung and chicken
7767	EGG FU YUNG
8817	OMELETTE PORK & SWEETCORN FRIED BLENDED
9018	CHEESE & TOMATO OMELETTE COOKED IN OLIVE OIL
9890	BACON & VEGETABLE OMELETTE
779	SCRAMBLED EGG WITH WHOLE MILK
780	SCRAMBLED EGG MARG & MILK
781	SCRAMBLED EGG PUFA& MILK
782	SCRAMBLED EGG MILK NO FAT
2721	Scrambled eggs with skimmed milk
2841	Scrambled eggs with reduced MUFA spread
3741	SCRAMBLED EGG WITH SEMI-SKIMMED MILK
6021	SCRAMBLED EGG WITH SUGAR
6555	SCRAMB EGGS WITH REDUCED FAT SPREAD
8638	SCRAMBLED EGG WITH SKIMMED MILK AND PUFA
8711	SCRAMBLED EGG NO FAT SEMI SKIMMED MILK
8727	SCRAMBLED EGG WITH SEMI SKIMMED MILK
8735	SCRAMBLED EGGS WITH SEMI SKIMMED MILK
9303	SCRAMBLED EGG WITH SEMI-SKIMMED MILK
3654	KEDGEREE WITH COD PEPPERS EGGS AND OLIVE
803	CURRIED EGG & POTATO
1296	BACON AND EGG PIE
1303	PORK AND EGG PIE
3516	BACON CHEESE AND EGG PIE 2 CRUSTS
3519	FISH PIE WITH COD EGGS GRUYERE CHEESE
3590	SOYA BREAD WITH EGGS CHEESE AND OLIVE OIL
3624	BREAD WITH EGGS AND OLIVE OIL
5176	EGG PASTA BAKE WITH MUSH PEPPERS B/BEANS
5185	PASTA BAKE WITH EGGS BROCCOLI & CHEESE
5360	BEEF AND EGG PIE H/M 2 CRUSTS
5413	BAKED BEANS WITH SAUSAGE BACON EGG & MUSH
5444	EGG AND VEG CURRY MADE WITH OLIVE OIL
5484	CHIC & BAC PIE WITH HARD BOILED EGG

5576	POTATO AND CHEESE PIE WITH BAKED EGGS
5577	SPINACH QUARK ONION AND EGG BAKED
6062	POTATO HASH POTATOES & EGG
6083	VEGETABLE PIE WITH CHEESE & EGGS
6084	CHEESE EGG AND ONION PIE
6129	PASTA WITH HAM & EGG
6155	TURKEY BREAST STEAKS WITH EGG & TOMATOES
6530	AUBERGINE MASALA WITH EGGS CANNED TOMS
6653	PORK CHOP IN EGG & BREADCRUMB BAKED HOMEMADE
6708	CORNED BEEF PASTIE WITH EGG IN PASTRY
6791	POTATO AND PEPPER BAKE WITH EGGS
8658	MUSHROOM BAKE MIX MADE UP WITH EGG VEG OIL
8932	EGG & CAULIFLOWER CURRY HOMEMADE
8945	BEANS POTATO TOMATO & EGGS STIR FRIED
8998	MINCED LAMB WITH EGGS
9086	EGG CURRY
9194	BACON & EGG PIE - MADE WITH ALL BUTTER
9706	BACON EGG & BROCCOLI QUICHE
9736	BACON & EGG QUICHE MADE WITH JUS-ROL
801	CHEESE AND EGG FLAN
2930	Potatoes mashed with egg onion
3140	RICE WITH EGG CARROTS PINE NUTS AND RAISIN
3256	LEMON CHICKEN & RICE WITH CARROTS EGG
3533	CHICKEN WITH RICE YOGURT AND EGG
6176	PANCAKES WITH EGGS AND SEMI-SKIMMED MILK
8914	FISH CREAM (WHITING AND EGGS) OVEN BAKED

Fruit Juice Drinks

Food Code	Food Name
2347	RIBENA BLACKCURRANT JUICE DRINK. READY TO DRINK
2358	MIXED FRUTI JUICE DRINK RTD NOT LOW CALORIE
3217	BLACKCURRANT & BLACKBERRY DRINK WITH ZINC
3257	SUNNY DELIGHT LIGHT FRUIT JUICE DRINK
3362	WOLFRA MULTIVITAMIN FRUIT JUICE DRINK
3548	FRUIT JUICE DRINK WITH VIT A C & E
3556	Vitofit Vitamin drink
3806	FRUIT DRINK WITH CREAM AND VIT E
5112	FRUIT FLAVOUR DRINK NO JUICE RTD
5113	RTD FRUIT FLAVOUR LOW CAL DRINK
5114	RIBENA NO ADDED SUGAR RTD
5501	RIBENA BCURRANT JUICE DRINK RTD NOT LIGHT
5502	RIBENA JUICE DRINK RTD ORANGE&APRICOT
5503	RIBENA JUICE DRINK RTD APPLE FOREST
5504	RIBENA LIGHT RTD BLACKCURRANT LOW SUGAR
5505	RIBENA NO ADDED SUG BLCURR RTD LOW CALORIE
6402	SANATOGEN START-UP FRUIT JUICE DRINK
6827	SUNNY DELIGHT FRUIT JUICE DRINK
6957	ROBINSONS FRUIT SHOOT NOT NAS RTD
6959	ROBINSONS FRUIT SHOOT NAS RTD
7905	RIBENA LIGHT BLACKCURRANT JUICE DRINK RTD
7908	RIBENA JUICE DRINK RTD APPLE FOREST FRUIT
7909	RIBENA JUICE DRINK RTD ORANGE & APRICOT

7912	HIGH JUICE RTD NOT BLACKCURRANT OR LOW CAL
7914	HIGH HUICE RTD BLACKCURRANT NOT LOW CAL
7918	C-VIT RTD ANY NOT BLACKCURRANT
8029	MIXED / SUMMER FRUIT JUICE DRINK RTD LOW CAL
8453	CITRUS/PINEAPPLE DRINK RTD NOT LOW CALORIE
8455	BLACKCURRANT JUICE DRINK RTD NOT LOW CAL
8472	CITRUS/PINEAPPLE JUICE DRINK RTD LOW CAL
8474	BLACKCURRANT JUICE DRINK RTD LOW CALORIE
8691	APPLE JUICE DRINK RTD NOT LOW CALORIE
8888	LUCOZADE SPORT ISOTONIC DRINK NOT CARBONATED
9137	BOOTS LEMON & LIME DRINK RTD FORTIFIED
9157	RUBICON MANGO JUICE DRINK RTD
9966	RIBENA JUICE & FIBRE BCURRANT RTD

Infant/Toddler Milk

Food Code	Food Name
7930	APTAMIL DRY WEIGHT
7931	PREMIUM (COW & GATE) DRY WEIGHT
7932	OSTERMILK (FARLEYS) DRY WEIGHT
7933	GOLD CAP SMA DRY WEIGHT
7934	GOLD CAP SMA READY TO FEED CARTON MADE UP
7935	PLUS (COW AND GATE) DRY WEIGHT
7936	OSTERMILK TWO (FARLEYS) DRY WEIGHT
7937	MILUMIL DRY WEIGHT
7938	WHITE CAP SMA DRY WEIGHT
7939	WHITE CAP SMA READY TO FEED CARTON MADE
7940	OSTER SOY (FARLEYS) DRY WEIGHT
7941	FORMULA S SOYA FOOD (COW & GATE) DRY WEIGHT
7942	PROSOBEE DRY WEIGHT
7943	WYSOY DRY WEIGHT
7944	JUNIOR MILK (FARLEYS) DRY WEIGHT
7945	PROGRESS (WYETH) DRY WEIGHT
7984	BOOTS FOLLOW ON MILK DRY WEIGHT
8031	MILUPA INFANT DRINK DRY
8737	COW AND GATE NUTRILON SOYA MADE UP
8936	GALACTOMIN 17 LOW LACTOSE INFANT FORMULA
9182	BOOTS FOLLOW ON MILK DRINK-BANANA/STRAWB

Margarine/Spreads

Food Code	Food Name
859	LOW FAT SPREAD (40%) NOT PUFA
860	HARD BLOCK MARGARINE
862	HARD MARGARINE UNSPECIFIED/RECIPES
864	SOFT MARGARINE NOT PUFA NOT LOW FAT
865	SOFT MARGARINE POLYUNSATURATED NOT LOW FAT
866	REDUCED FAT SPREADS (70-80%) NOT POLYUNSAT
7774	LOW FAT SPREAD (40%) PUFA NOT LOW IN TRANS
7775	REDUCED FAT SPREAD (60%) NOT PUFA
7776	VERY LOW FAT SPREAD (20-25%) NOT PUFA
8230	REDUCED FAT SPREAD (60%) WITH OLIVE OIL
8480	REDUCED FAT SPREAD POLYUNSATURATED (70-80%)

8487	VERY VERY LOW FAT SPREAD (5%)
8509	REDUCED FAT SPREAD (60%) PUFA NOT LOW TRANS
8510	VERY LOW FAT SPREAD (20-25%) PUFA
8511	LOW FAT SPREAD (40%) WITH OLIVE OIL
9408	REDUCED FAT SPREAD 70-80% FAT MUFA
9409	REDUCED FAT SPREAD 70-80% FAT NO HYDROG
9510	REDUCED FAT SPREAD (70-80%) PUFA
9511	LOW FAT SPREAD (40%) PUFA LOW IN TRANS
9827	UTTERLY BUTTERLY (ST IVEL) REDUCED FAT
9985	RED FAT SPREAD 60% FAT WITH OLIVE OIL
9986	VERY LOW FAT SPREAD (20-25%) NOT PUFA
9987	RED FAT SPREAD 60% FAT + FISH OIL
9988	LOW FAT SPREAD (40%) NOT PUFA LOW IN TRANS
9989	LOW FAT SPREAD (40%) WITH OLIVE OIL
9990	REDUCED FAT SPREAD (60%) PUFA LOW IN TRANS

Meal Replacement Drinks

Food Code	Food Name
2739	SLIMFAST RTD MEAL REPLACEMENT DRINK
3028	BUILD UP DRINK MADE WITH EGG BANANA
3785	Ensure Liquid vitamin + mineral supplement
3807	Fortisip protein nourishment drink
8621	NOURISHMENT MILK DRINK
9637	FORTISIP NUTRITIONALLY COMPLETE SUPPLEMENT
9799	ENSURE LIQUID
9980	PROVIDE LIQUID PROTEIN SUPPLEMENT APPLE
9981	FRESUBIN LIQUID SUPPLEMENT

Meal Replacement Drinks – Powdered form

Food Code	Food Name
649	BUILDUP SLENDER SLIMMING DRINK POWDER
3220	SLIMFAST DRINK (POWDER ONLY)
2305	COMPLAN

Milk

Food Code	Food Name
602	MILK WHOLE SUMMER PASTEURISED
603	MILK WHOLE PASTEURISED WINTER
606	MILK WHOLE CHANNEL ISLAND PASTEURISED SUMMER
607	MILK WHOLE CHANNEL ISLAND PASTERIZED WINTER
613	MILK SKIMMED PASTEURISED SUMMER
614	MILK SKIMMED WITH ADDED VITAMINS AND MILK
628	MILK SHAKE WHOLE MILK WITH ICECREAM
698	MILK AFTER BOILING
700	MILK SKIMMED AFTER BOILING
7714	MARS BAR MILK
8217	CADBURYS CHOCOLATE MILK DRINK-LOW FAT
8544	MILK SKIMMED PASTEURISED WINTER
8723	TODDLERS BANANA MILK DRINK WITH CALCIUM
9248	MILK WHOLE HEATED

Milk – Recipe fraction approx 5 to 90%

Food Code	Food Name
547	CUSTARD WITH POWDER WHOLE MILK AND SUGAR
548	Custard made with semi-skimmed milk
549	CUSTARD WITH POWDER SKIMMED MILK AND SUGAR
3554	MILKSHAKE WITH SKIMMED MILK + ARTIFICIALSWEET
5139	CUSTARD SEMI-SKIMMED MILK AND HERMESETAS
5858	CUSTARD MADE WITH WHOLE MILK AND SACCHARINE
8649	CUSTARD MADE WITH SEMI SKIMMED MILK
9061	CUSTARD WITH SEMI-SK MILK AND SWEETENER
9349	CUSTARD MADE WITH SKIMMED MILK
9674	CUSTARD WHOLE MILK NO SUGAR
9775	CUSTARD WITH WHOLE MILK & ARTIFICIAL SWEET
9835	CUSTARD (WITH SKIMMED MILK & ARTIFICIAL SWEET
216	PORRIDGE MADE WITH WHOLE MILK
3797	PORRIDGE MADE SEMISKIMMED MILK
3925	PORRIDGE SKIMM MILK NO SUGAR
7644	PORRIDGE BRAN WHOLE MILK
7646	PORRIDGE BRAN SKIM MILK
9555	PORRIDGE MADE W BRAN & SEMI SKIMMED MILK
556	MILK PUDDINGS MADE WITH WHOLE MILK
557	MILK PUDDING MADE WITH SEMI-SKIMMED MILK
558	MILK PUDDING MADE WITH SKIMMED MILK
3421	READY BREK WITH SKIMMED MILK
5330	READY BREK FRUIT & NUTS WITH WHOLE MILK
5332	READY BREK FRUIT & NUTS ALL SKIMMED MILK
7640	R.BREK SEMI SKIMMED MILK PLAIN
7641	R.BREK FLAV. WHOLE MILK
7643	R.BREK FLAV. SKIM MILK
587	ANGELDELIGHT SUG FREE WHOLEMILK
630	DREAM TOPPING MADE UP WITH WHOLE MILK
2411	BREAD SAUCE MADE WITH WHOLE MILK
2413	CHEESE SAUCE MADE WITH WHOLE MILK
2437	ONION SAUCE MADE WITH WHOLE MILK
2451	SAVOURY WHITE SAUCE MADE WITH WHOLE MILK
2452	WHITE SAUCE SWEET (WHOLE MILK)
2750	Onion sauce made with skimmed milk
3026	WHITE SAUCE SEMI SKIMMED MILK
3179	ANGEL DELIGHT SEMI SKIMMED MILK
3622	WHITE SAUCE WITH SEMI SKIMMED MILK CREAM
4209	DREAM TOPPING SKIMMED MILK
4319	INSTANT WHIP SKIMMED MILK
5420	CHEESE SAUCE MADE WITH SEMISKIMMED MILK
5833	VANILLA SAUCE MADE WITH WHOLE MILK
6161	MUSHROOM SAUCE MADE WITH YOGHURT MILK
7922	WHITE SAUCE SKIMMED MILK
8629	CHEESE SAUCE WITH SEMI SKIMMED MILK
8664	CHEESE SAUCE MADE WITH SKIMMED MILK
8746	MUSHROOM SAUCE WITH OLIVE OIL WHOLE MILK
9063	CHEESE SAUCE WITH S/SKIMMED MILK
9203	CHEESE SAUCE (MADE WITH WHOLE MILK
9479	CHEESE SAUCE MADE UP WITH WHOLE MILK
9480	CHEESE SAUCE MADE WITH S/SKIMMED MILK
9481	CHEESE SAUCE MADE WITH SKIMMED MILK

9628	SWEET WHITE SCE MADE W WHOLE MILK & CORN
554	JELLY MADE WITH WHOLE MILK
7702	JELLY MADE WITH SEMI-SKIMMED MILK
7703	JELLY MADE WITH SKIMMED MILK
7705	JELLY LOW SUGAR MADE WITH WHOLE MILK
7707	JELLY LOW SUGAR MADE WITH SKIMMED MILK
1899	POT INSTANT RECONST. WITH MILK
5418	BREAD PUDDING MADE WITH WHOLE MILK
6592	BREAD BUTTER PUD. SEMI SKI MILK W.BREAD
9625	BREAD AND BUTTER PUDDING S/SKIM MILK
63	RICE WHITE BOILED IN MILK
64	RICE WHITE MILK AND SUGAR
65	RICE WHITE IN SEMI SKIM
66	WHITE RICE SEMI SKIM MILK SUGA
67	RICE WHITE BOILED IN SKIM MILK
68	RICE WHITE SKIM MILK AND SUGAR
75	RICE MILK SUGAR AND BUTTER
506	BLANCMANGE MADE WITH WHOLE MILK
576	YORKSHIRE PUDDING MADE WITH WHOLE MILK
2836	Yorkshire pudding made with skimmed milk
3585	RICE PUDDING WITH EGG YOLKS AND SEMI SKIM
3606	BLANCMANGE WITH EGG AND SEMI-SKIMMED MILK
4112	YORKSHIRE PUDDING MADE WITH SKIMMED MILK
5215	YORKSHIRE PUDDING MADE WITH S SKIM MILK
5859	SEMOLINA MADE WITH WHOLE MILK JAM SACCHARINE
5879	RICE PUDDING WITH SEMI SKIM MILK EVAPORATED
6223	YORKSHIRE PUDD WITH S/S MILK NO FAT
6819	SEMOLINA WITH WHOLE MILK AND NO SUGAR
9337	RICE PUDDING MADE WITH SEMI SKIMMED MILK
9636	BLANCMANGE MADE W S/SKIMMED MILK
9829	RICE PUDDING WITH S/SMILK & ARTIFICIAL SWEET
563	SWEET PANCAKES MADE WITH WHOLE MILK
2487	SOUP CONDENSED (MILK ONLY)
6176	PANCAKES WITH EGGS AND SEMI-SKIMMED MILK
6229	CHEESE SAUCE WITH BACON WHOLE MILK
8215	MILKSHAKE PURCHASED MADE WITH SEMI-SKIMMED
8627	PANCAKES MADE WITH SEMI SKIMMED MILK
9038	PANCAKES MADE WITH SKIMMED MILK
9545	HAM & MUSHROOM SAUCE (SKIMMED MILK
6204	MACARONI CHEESE WITH HAM AND WHOLE MILK
9926	CUSTARD MADE WITH W/MILK AND WATER
217	PORRIDGE MADE WITH WHOLE MILK & WATER
8756	PORRIDGE MADE 1/2 SEMI-SKIM MILK 1/2 WATER
9055	CORNMEAL PORRIDGE HALF MILK HALF WATER
9549	PORRIDGE MADE WITH 1/2 SKIMMED MILK
1898	POTS. INSTANT RECON MILK&WATER
6358	CHEESE SOUFFLE WITH SKIMMED MILK & FLORA
6377	LAMB MACARONI SKM MILK LAMB ONIONS TOMATO
6785	MACARONI CHEESE SEMI SKIM MILK
9627	CREME CARAMEL MADE W S/SKIMMED MILK
9908	QUEEN OF PUDDINGS WITH SEMI SKIM MILK
5449	CHOCOLATE SAUCE MADE WITH WHOLE MILK
9559	RICE PUDDING MADE W 1/2 SS MILK 1/2 WATER

2486	SOUP CONDENSED (MILK&WATER)
1722	CAULIFLOWER CHEESE (WHOLE MILK)
3104	LASAGNE WITH OLIVE OIL SEMI-SKIMMED MILK
5345	CAULIFLOWER CHEESE WITH S/S MILK
5619	AUBERGINE LASAGNE MADE WITH SKIM MILK CH
5788	EGGS MORNAY MADE WITH S/S MILK AND MARGARINE
6143	LASAGNE W/MILK CHEESE SAUCE LEAN MINCE
6303	FISH PIE WITH CHEESE & SEMI-SKIMMED MILK
6343	CAULIFLOWER CHEESE WTIH SKIMMED MILK
6445	LASAGNE SOYA MINCE MUSHROOMS WHOLE MILK
6456	LASAGNE WITH MINCED BEEF TOMS WHOLE MILK
6586	FISH PIE COD IN BUTTER SAU. WH.MILK MUSH
6888	Cauliflower cheese made with s/s milk
9087	MUSHROOM SOUP MADE WITH GOLD TOP MILK
9116	CHEESE PUDDING WITH S/SKIMMED MILK
9135	LASAGNE WITH OLIVE OIL & SKIMMED MILK
779	SCRAMBLED EGG WITH WHOLE MILK
780	SCRAMBLED EGG MARG & MILK
781	SCRAMBLED EGG PUFA& MILK
782	SCRAMBLED EGG MILK NO FAT
2721	Scrambled eggs with skimmed milk
3141	PRAWN OMELETTE MADE WITH WHOLE MILK
3377	MUSHROOM SOUP WITH SEMI SKIMMED MILK
3528	VEGETABLE CURRY NO POTATO WITH MILK
3620	GAMMON QUICHE WITH SEMI SKIMMED MILK TOMATO
3741	SCRAMBLED EGG WITH SEMI-SKIMMED MILK
5475	CHEESE FLAN WITH S/S MILK FAT CHEESE
5840	TUNA PASTA BAKE WITH SKIMMED MILK CHEDDAR
6173	COTTAGE PIE WITH SUNFLOWER SPREAD & MILK
6283	TUNA & PASTA BAKE WITH FC MILK SWEETCORN
6486	EGGY BREAD WITH SKIM MILK FRIED IN PUFA
6520	OMELETTE SEMI-SKIM MILK CHEESE BACON
6621	SHEPHERDS PIE NO VEG SEMI-SKIM MILK
6724	COTTAGE PIE WITH CARROTS & S/SKIMM MILK
7769	EGGY BREAD W/M MILK BLEND OIL
8638	SCRAMBLED EGG WITH SKIMMED MILK AND PUFA
8711	SCRAMBLED EGG NO FAT SEMI SKIMMED MILK
8727	SCRAMBLED EGG WITH SEMI SKIMMED MILK
8735	SCRAMBLED EGGS WITH SEMI SKIMMED MILK
8874	CHIX CASSEROLE WITH WHOLE MILK & COOK-IN
9015	TRIFLE WITH WHIPPED DESSERT & WHOLE MILK
9303	SCRAMBLED EGG WITH SEMI-SKIMMED MILK
6198	FRUIT CAKE: VITALITE SEMI SKIMMED MILK
8773	MALT LOAF WITH ALL BRAN SEMI-SKIM MILK

Oils

Food Code	Food Name
867	RED PALM OIL
870	VEGETABLE OIL CORN OIL/GROUNDNUT
871	BLENDED VEGETABLE OIL
872	BLENDED VEGETABLE OIL KRISP N DRY
873	VEGETABLE OIL POLYUNSATURATED EG SUNFLOWER

874	OLIVE OIL
7990	RAPESEED OIL

Olives

Food Code	Food Name
2090	OLIVES IN BRINE FLESH & SKIN ONLY
2091	OLIVES IN BRINE WEIGHED WITH STONES

Olives – Recipe fraction approx 10%

Food Code	Food Name
2927	Savoury rice with bacon olives cheese
2945	Tuna and pasta bake with tomatoes olives
3162	ARTICHOKE & OLIVE & CREAM PASTA SAUCE

Processed cheese

Food Code	Food Name
684	CHEESE SPREAD TRIANGLES FLAVOURED
685	CHEESE SPREADS TRIANGLES PLAIN
686	Cottage cheese not low fat with additions
687	COTTAGE CHEESE PLAIN
689	LACTIC CHEESE SPREAD
3781	FROMAGE FRAIS BASED DIP LOW FAT
4414	PROCESSED CHEESE SPREAD LOW FAT
5254	FROMAGE FRAIS LOW FAT OR UNSPECIFIED
5255	FROMAGE FRAIS FULL FAT FRUIT FORTIFIED
5256	FROMAGE FRAIS FRUIT FORTIFIED WITH IRON
7725	COTTAGE CHEESE LOW FAT PLAIN
7726	cottage cheese low fat with additions
7730	COT. CHEESE SNACK POTS
7733	CHEESE SPREAD WITH SUNFLOWER OIL
7735	FROMAGE FRAIS FULL FAT NATURAL UNSWEETENED
7736	FROMAGE FRAIS FULL FAT FRUIT
7737	FROMAGE FRAIS FRUIT FORTIFIED WITH VITS
7738	FROMAGE FRAIS VIRTUALLY FAT FREE NATURAL
7739	FROMAGE FRAIS VIRTUALLY FAT FREE FRUIT
7985	FROMAGE FRAIS VIRT FAT FREE FRUIT
8740	M&S BUGS BUNNY STRAWBERRY FROMAGE FRAIS

Processed cheese – Recipe fraction approx 10 to 50%

Food Code	Food Name
3434	MIXED FRUIT BRULEE WITH FROMAGE FRAIS
2939	Cottage pie with tomatoes and fromage frais
3261	PASTA WITH QUORN FROMAGE FRAIS PESTO
6169	SARDINE & COTTAGE CHEESE PIE DOUBLE CRUST
3597	CHICKEN WITH FROMAGE FRAIS WINE TOMATO
3708	CHICKEN AND MUSHROOMS IN FROMAGE FRAIS
3739	CHICKEN WITH BACON FROMAGE FRAIS
9117	HOMEMADE VEG SOUP WITH FROMAGE FRAIS)
9192	CELERY AND COTTAGE CHEESE SOUP

Processed fish

Food Code	Food Name
1533	TUNA CANNED IN OIL FISH ONLY
1534	TUNA CANNED IN BRINE FISH ONLY
1615	FISH FINGERS GRILLED
1649	FISH FINGERS FROZEN UNCOOKED
7832	FISH FINGERS ECONOMY BATTER/BREADCRUMB G
7833	FISH FINGERS ECONOMY BATTER/BREADCRUMB V
7834	FISH FINGERS ECONOMY BATTER/BREADCRUMB D
7835	FISH FINGERS ECONOMY BATTER/BREADCRUMB L
7836	FISH FINGERS ECONOMY BATTER/BREADCRUMB P
8002	FISH FINGERS ECONOMY RAW
9003	FISH FINGERS COATED BATTER/BREADCRUMBS F

Processed fish – Recipe fraction approx 20 to 95%

Food Code	Food Name
1616	FISH FINGERS FRY BLENDED OIL
1617	FISH FINGERS FRY IN DRIPPING
1618	FISH FINGERS FRIED IN LARD
1619	FISH FINGERS FRIED IN PUFA OIL
8751	FISH FINGERS NOT ECONOMY FRIED IN OLIVE OIL
8774	TUNA SWEETCORN TOMATO SAUCE
2809	Tuna Pasta
2876	Tuna and pasta with sweetcorn and breadcrumb
2877	Tuna and pasta bake with tomato sauce
2878	Tuna and pasta bake with sweetcorn tomato
2945	Tuna and pasta bake with tomatoes olives
3108	TUNA PASTA BAKE WITH CHEESE BROCILLI
3118	TUNA PASTA WITH SWEETCORN AND TOAST TOPPING
3332	TUNA AND VEG CASSEROLE WITH PULSES
3441	PASTA SAUCE WITH TUNA AND PEPPERS
3617	TUNA PASTA WITH SOUP CARROTS BROCCOLI
3673	TUNA AND PASTA BAKE WITH PEPPER CONDENS
5196	TUNA AND PASTA BAKE CODE 5196
5477	TUNA & PASTA BAKE WITH SWEETCORN AND ONION
5787	TUNA BAKED WITH WHITE SAUCE AND PASTA
5789	TUNA AND PASTA BAKE
5840	TUNA PASTA BAKE WITH SKIMMED MILK CHEDDAR
5870	TUNA AND PASTA BAKE WITH PACKET MIX
5911	TUNA AND PASTA BAKE WITH HALF FAT CONDEN SED
6024	TUNA BAKE WITH VEGETABLES AND CRISPS
6032	TUNA WITH SWEETCORN ONIONS PEPPERS & OLIVE
6199	TUNA NAPOLITANA
6220	TUNA & PASTA BAKE WITH CANNED TOMS
6283	TUNA & PASTA BAKE WITH FC MILK SWEETCORN
6372	TUNA & PASTA BAKE WITH SWEETCORN & CHEESE
6628	TUNA PASTA BAKE ONION TIN TOMATOES TOMATO
6776	TUNA PASTA BAKE TOMS CRISPS CHEESE & MUSH
6852	Tuna pasta with sweetcorn cheese
9143	TUNA BAKE
6107	TUNA MAYONNAISE AND VEGETABLES SANDWICH

Processed Meat

Food Code	Food Name
1039	HAM NOT SMOKED
1040	HAM SMOKED
1125	CHICKEN SPREAD CHICKEN PASTE NOT CANNED
1126	CHICKEN ROLL CANNED
1127	CHICKEN ROLL NOT CANNED
1168	CHICKEN SPREAD CHICKEN PASTE CANNED
1169	CHICKEN FINGERS RAW
1236	HAM IN NATURAL JUICE CANNED
1237	HAM AND PORK CHOPPED CANNED
1239	LUNCHEON MEAT PORK CANNED
1256	LIVER PATE CANNED
1257	LIVER PATE DELI
1258	LIVER PATE PLASTIC WRAPPED
1264	BEEFBURGERS IN GRAVY CANNED
1265	BEEFBURGERS 100% BEEF FROZEN RAW
1266	BEEFBURGERS 100% FRIED
1267	BEEFBURGERS WITH ONION FROZEN RAW
1269	BEEFBURGERS ECONOMY FROZEN RAW
1271	FRANKFURTER
1275	SAUSAGES BEEF RAW
1277	SAUSAGES BEEF GRILLED
1278	SAUSAGES PORK RAW
1280	SAUSAGES PORK GRILLED
1281	SAUSAGES PORK AND BEEF RAW
1282	SAUSAGES PORK AND BEEF GRILLED FRIED
1283	SAUSAGES LOW-FAT GRILLED
1338	LUNCHEON MEAT NOT CANNED
1382	LOW FAT BEEFBURGERS GRILLED
2672	CHIC BURG COAT GRILLED
2706	Chicken escalope with coronation sauce
3180	BBQ SIZZLERS e.g Iceland
3334	LOW-FAT LIVER PATE
3680	CHICK KIEV NOT MINI OVEN BAKED
3686	MEATBALLS IN TOMATO SAUCE
3784	Pork sausages very low fat grilled
4771	HAM PATE LOW FAT PURCHASED
5217	LAMB BURGER
5219	CHICKEN BREAST STUFFED WITH CHEESE
5263	CHICK GOUJONS PIECES IN BCRUMBS F/C GRILL
5264	CHICK BREAD & CHEESE VEG FILL. C/FR OVEN
5284	CHICK SLICE WAFER THIN NOT SMOKED
5285	CHICK SLICES SMOKE PRE OR DELI INCL WAFER
5291	TURK FINGERS/PIECES COATED IN CRUMBS
5303	TURKEY SLICES UNSMOKE PREPACK OR DELI
5323	PORK ROAST SLICES
5382	TURKEY ROLL NO STUFFING FROM DELI
5466	CHICKEN MEATBALLS IN TOMATO SAUCE
5523	CHICK NOT BREAST NO SKIN COATED E+C GRILL
5589	HAM AND CHOPPED PORK CROQUETTES FRIED
6164	CHICKEN WAFFLES GRILLED

6168	PORK MEATBALLS IN TOMATO SAUCE
6797	CHICKEN BREAST COATED WITH YOGURT & CRUMB
7783	MICROWAVE SAUSAGES WALLS PORK AND BEEF
7784	SAUSAGES ECONOMY FRIED
7785	SAUSAGES ECONOMY GRILLED
7786	SAUSAGES PORK SKINLESS FRIED
7787	SAUSAGES PORK SKINLESS GRILLED
7788	SAUSAGES PORK AND BEEF FRIED
7789	SAUSAGES PORK & BEEF SKINLESS GRILLED
7791	SAUSAGES BEEF SKINLESS GRILLED
7793	SAUSAGES PREMIUM PORK GRILLED
8052	MEAT BALLS IN BARBECUE SAUCE
8235	HAM SMOKED DELI OR BUTCHERS
8236	HAM SMOKED VACUUM PACKED
8249	PORK ROAST ROLL COOKED BERNARD MATTHEWS
8258	CHICKEN FINGERS COATED GRILLED
8259	CHICKEN KIEV MINI GRILLED
8261	TURKEY RST ROLL T BRST ROAST
8262	TURKEY SLICES SMOKE PRE OR DELI INCL WAFER
8264	BEEFBURGER 100% GRILLED
8265	BEEFBURGER AND ONION GRILLED
8266	BEEFBURGER ECONOMY GRILLED
8269	PORK SAUSAGE SMOKED GRILLED
8694	TURKEY AND PORK LUNCHEON MEAT
8697	HAM LOW FAT EG. DELIGHT
8728	TURKEY KEBAB GRILLED
8903	CHICKEN MEATBALLS IN GRAVY CANNED
9051	MEAT BALLS IN ONION GRAVY
9285	BREADED CHICKEN BREAST RAW
9287	CHICKEN BREAST COATED GRILLED
9381	HAM WITH ADDED WATER NOT SMOKED
9382	HAM NO ADDED WATER NOT SMOKED
9383	SMOKED HAM WITH ADDED WATER ANY CUT
9384	SMOKED HAM NO ADDED WATER ANY CUT
9508	HAM UNSPECIFIED NOT SMOKED NOT CANNED
9509	HAM UNSPECIFIED SMOKED
9719	DUCK AND ORANGE PATE PURCHASED
9785	ICELAND SAUSAGE BURGER
9875	TURKEY & HAM CRISPBAKES (EG TESCO)

Processed meat – Recipe fraction approx 20 to 95%

Food Code	Food Name
1051	VEAL FILLET ESCALOPE SCHNITZEL FRIED LEAN
1078	CHICKEN COATED E&C FRY BLENDED
1079	CHICKEN COATED WITH BONE FRIED IN BLENDED
1080	CHICKEN COAT E&C FRY DRIPPING
1081	CHICKEN COATED FRIED IN DRIPPING WITH BONE
1082	CHICKEN COATED E&C FRIED LARD
1083	CHICKEN COATED FRIED IN LARD WEIGHED
1085	CHICKEN COATED FRIED IN P/S OIL WEIGHED
1109	CHICK.BURGER COATED FRIED VEG OIL FROZEN
1110	CHICKEN BURGERS FRIED IN DRIPPING
1111	CHICKEN BURGERS FRIED IN LARD

1112	CHICKEN BURGERS FRIED IN P/S OIL
1268	BEEFBURGER & ONION FRIED NOT 100% MEAT
1270	BEEFBURGER HAMBURG ECONOMY FRIED NOT CANNED
1276	SAUSAGES BEEF FRIED
1279	SAUSAGES PORK FRIED
5735	PORK ESCALOPE PORK IN E&C FRIED IN VEG OIL
6018	CHICKEN WAFFLES FRIED IN PUFA OIL
7792	SAUSAGES PREMIUM PORK FRIED
8250	CHICKEN BREAST COATED FRIED IN BLENDED
8251	CHICKEN BREAST COATED FRIED IN DRIPPING
8252	CHICKEN BREAST COATED FRIED IN LARD
8253	CHICKEN BREAST COATED FRIED IN P/S OIL
8254	CHICKEN FINGERS COATED FRIED IN BLENDED
8255	CHICKEN FINGERS COATED FRIED IN DRIPPING
8256	CHICKEN FINGERS COATED FRIED IN LARD
8257	CHICKEN FINGERS COATED FRIED IN P/S OIL
8263	BEEFBURGERS LOW-FAT FRIED
8268	PORK SAUSAGE SMOKED FRIED
9360	CHICKEN BURGER FRIED IN SOLID SUNFLOWER
3126	CHICKEN MEATBALLS WITH DOUBLE CREAM
5308	FRANKFURTER IN A BUN WITH KETCHUP ONIONS
6434	SAUSAGES IN TOMATO SAUCE WITH ONIONS
5699	TURKEY HASH WITH LEEKS AND POTATO
6221	PASTA SCE: HAM FRANKFURTERS CHSE
5326	TOAD-IN-THE-HOLE MADE WITH PORK SAUSAGES
775	OMELETTE HAM FRIED IN BLENDED
776	OMELETTE HAM FRIED IN BUTTER
777	OMELETTE HAM FRIED IN MARG
778	OMELETTE HAM FRIED IN PUFA
2779	Sausage casserole with peppers
2799	Sausage casserole with green pepper
2931	Beef and sausage casserole with tomatoes
2946	Sausage and mixed bean casserole
2999	Sausage carrot and green bean pasta
3032	SAUSAGE CASSEROLE WITH WINE BROCCOLI TOMATO
3060	PORK SAUSAGE CASSEROLE WITH TINNED TOMAT
3074	SAUSAGE LIVER AND BACON CASSEROLE
3089	SAUSAGE CASSEROLE WITH CANNED TOMATOES
3310	CHICKEN RISOTTO WITH SAUSAGE TOMATOES
3331	SAUSAGE CASSEROLE WITH POTATOES
3483	PORK SAUSAGE CASSEROLE WITH TOMATO
3638	SAUSAGE AND BACON CASSEROLE WITH TOMATOES
3643	SAUSAGE CASSEROLE WITH BAKED BEANS CARROTS
3713	SAUSAGE CASSEROLE WITH LOW FAT SAUSAGES
5227	SAUSAGE CASS WITH POTS CARROTS PEAS
5325	SAUSAGE CASSEROLE MADE WITH PORK BACON
5413	BAKED BEANS WITH SAUSAGE BACON EGG & MUSH
5602	TURKEY/PORK SAUSAGE PASTA BAKE TOMS MUSH
5622	RISOTTO WITH BACON SAUSAGES TOMS & ONION
5713	SAUSAGE & BAKED BEAN CASSEROLE
5726	SAUSAGE CASSEROLE BEEF STEAK CARROTS
5758	LIVER AND SAUSAGE PIE
5882	SAUSAGE CASSEROLE WITH COURGETTE CANNED

5901	SAUSAGE CASSEROLE TURKEY AND BEEF SAUSAGE
5976	STEAK AND SAUSAGE CASSEROLE AND ONIONS
5987	SAUSAGE CASSEROLE PORK SAUSAGE HAM BAKED
6089	SAUSAGE CASSEROLE WITH CANNED TOMS CARRO
6184	STIR-FRIED BROCCOLI NOODLES FRANKFURTER
6195	SAUSAGE STEW WITH BAKED BEANS AND CANNED
6251	SAUSAGE CASSEROLE WITH PORK SAUSAGES TOMATO
6362	SAUSAGE CASSEROLE WITH CARROTS AND POTATO
6450	OMELETTE WITH ONION MIXED VEG HAM GARLIC
6468	SAUSAGE STEW AND DUMPLINGS
6495	SAUSAGE CASS CARROTS MUSHROOMS G.BEANS
6561	PASTA WITH SAUSAGES BACON AND VEGETABLES
6568	SAUSAGE PORK CASSEROLE WITH MUSHROOMS
6713	CHICKEN & TURKEY SAUSAGE CASSEROLE
6717	SAUSAGE CASSEROLE W CARROTS POTS & TOMATO
6857	Omelette ham & onion fried in butter
6864	Sausage casserole with mushrooms carrots
6913	Sausage casserole
6938	Chicken Basque with peppers sausages
8685	OMELETTE WITH SAUSAGES & BAKED BEANS
8922	PORK SAUSAGE POTATO TOMATO CASSEROLE
8940	SAUSAGE CASSEROLE
8946	SAUSAGE WITH PASTA AND VEGETABLES
9127	SAUSAGE & CARROT SAUCE (CASSEROLE)
9164	SAUSAGE A LA MOUTARDE
9888	SAUSAGE CASSEROLE WITH CARROTS & PEAS

Processed Potatoes

Food Code	Food Name
2653	POTATO WAFFLES FRITTERS ALPHABITES HASH
2654	POTATO CROQUETTES GRILLED
6062	POTATO HASH POTATOES & EGG
6386	POTATO WAFFLES/HASHBROWNS/ALPHABITES
8295	POTATO CRUNCHIES
8782	LATTICE POTATO SLICES

Processed potatoes– Recipe fraction approx 95%

Food Code	Food Name
1879	POTATO WAFFLES FRIED BLENDED
1880	POTATO WAFFLE FRIED DRIPPING
1881	POTATO WAFFLE FRIED LARD
1882	POTATO WAFFLE FRIED PUFA
1883	POTATO WAFFLES FRITTERS HASH BROWNS
1884	POTATO SLICES BATTERED FR
1885	POT. SLICES BATTERED IN DRIPPING
1886	POT SLICES BATTERED (LARD)
1887	POT SLICES BATTERED (IN PUFA)
1901	POTATO CROQUETTES FRIED IN BLENDED OIL
1902	POTATO CROQUETTES COATED BCRUMBS FRIED
1903	POTATO CROQUETTES COATED BCRUMBS FRIED
1904	POTATO CROQUETTES COATED BCRUMBS FRIED
3307	HASH BROWNS/ WAFFLES IN BUTTER

9002	POTATO WAFFLES/FRITTERS/ALPHABITES FRIED
9345	POTATO WAFFLES FRIED IN OLIVE OIL

Quorn

Food Code	Food Name
5447	QUORN QUARTER POUNDER GRILLED NO BUN
5677	QUORN BURGER FRIED IN SUNFLOWER OIL
7103	SAINSBURYS QUORN PIE
7189	QUORN MYCOPROTEIN

Quorn – Recipe fraction approx 40 to 75%

Food Code	Food Name
6830	Quorn fillets in roasted red pepper sauce
2869	Quorn risotto with olive oil peas
3098	QUORN MINCE BOLOGNESE WITH CANNED TOMS
3124	CHILLI WITH QUORN CARROTS PEPPER KIDNEY
3261	PASTA WITH QUORN FROMAGE FRAIS PESTO
3327	BOLOGNESE SAUCE WITH QUORN TOMATO & PASTA
3382	QUORN AND SPINACH PASTY WITH CREME FRAICHE
3400	FAJITA FILLING WITH QUORN AND PACKET MIX
3408	BOLOGNESE SAUCE WITH QUORN CARROTS
3454	PIZZA WITH QUORN CANNED TOMATOES
3559	CHILLI WITH QUORN CARROTS SWEETCORN
3560	QUORN STEW WITH CARROTS PEPPERS POTATO
5154	QUORN CASSEROLE WITH VEGES AND BEANS
5212	BOLOGNESE SAUCE WITH QUORN AND RED KIDNEY
5786	LASAGNE WITH QUORN AND KIDNEY BEANS
5887	CHILI MADE WITH QUORN CANNED TOMATOES
5895	QUORN CASSEROLE WITH ONIONS AND MIXED VEG
5906	LASAGNE WITH QUORN LEAN MINCED BEEF
5964	BOLGN. SAUCE WITH QUORN AND FLAGEOLET
6090	QUORN IN COOK-IN MUSHROOM SAUCE
6094	QUORN TIKKA MASALA READY MEAL
6126	COTTAGE PIE WITH QUORN ONION & TOMATO
6286	QUORN RISOTTO
6323	QUORN VEGETARIAN LASAGNE FROZEN/CHILLED
6334	QUORN AND VEGETABLE STIR FRY
6446	QUORN STIR FRIED IN OLIVE OIL
6493	BOLGN. SAUCE WITH QUORN MUSH ONIONS CARROT
6524	TESCO QUORN MUSHROOM PIE TWO CRUSTS BAKE
6525	QUORN STIR FRY R.PEPPER CARROT S&S SAUCE
6712	CHILLI WITH QUORN TOMS KIDNEY BEANS PEAS
6714	SHEPHERDS PIE W QUORN MINCE MASH POTATO
6910	Quorn stir fry
8285	QUORN STIR FRIED IN BLENDED VEGETABLE OIL
9190	QUORN CASSEROLE

Ready Meals

Food Code	Food Name
1250	FAGGOTS IN GRAVEY READY MEAL
1321	ROAST BEEF IN GRAVY PURCHASED READY MEAL
1352	PORK ROAST DINNER FROZEN READY MEAL

1353	ROAST PORK IN GRAVY FROZEN READY MEAL
1356	SHEPHERDS PIE FROZEN PURCHASED READY MEAL
2661	CHICK STIR FRY WITH RICE R MEAL
2714	Chicken Ariabiatta ready meal
2734	Sweet and sour chicken low fat ready meal
2736	Roasted duck in plum sauce ready meal e
3171	FISH IN BROCCOLI & CHEESE SAUCE READY MEAL
3253	CHICKEN PAELLA LOW FAT READY MEAL
3731	BEEF ENCHILLADAS READY MEAL *E.G.* MORRISO
3757	CHICKEN PIZZA FOR MICROWAVE *E.G.* MCCAIN
5279	CHICK CASS R MEAL CHICK IN TOM/GRAVY/SAUCE
5311	BEEF CASSEROLE READY MEAL IN GRAVY
5312	BEEF CURRY FROZEN/CHILLED READY MEAL
5313	BEEF HOT POT WITH POTS READY MEAL
5315	CHILLI CON CARNE.NO RICE READY MEAL
5319	LAMB HOT POT WITH POTS READY MEAL
5320	MOUSSAKA READY MEAL CHILL/FROZEN/LONG LIFE
5321	SHEPHERDS PIE FROZEN/CHILLED LAMB READY MEAL
5471	DONER KEBAB WITH PITTA READY PURCHASED
5626	TOASTER POCKETS FLAKY PASTRY TOASTER
5832	CHICKEN & BACON LASAGNE PURCHASED READY MEAL
5898	TUNA AND PASTA BAKE READY MEAL
6092	VEGETABLE BAKE PURCHASED READY MEAL.
6153	CHICKEN AND HAM CHILLED MEAL *E.G.* TESCO
6423	CHICKEN AND PASTA BAKE READY MEAL
6431	BIRDS EYE FISH STACKER READY MEAL
6588	SEAFOOD PAELLA READY MEAL EG. M&S
8286	VEGETABLE CURRY WITH RICE READY MEAL
8287	VEGETABLE CHILLI READY MEAL COOKED
8290	VEGETABLE MOUSSAKA READY MEAL COOKED
8359	TODDLERS SAVOURY MEALS
8666	TAGLITELLE CARBONARA READY MEAL EG. TESCO
8671	COW & GATE STAGE 2 SAVOURY BABY MEALS
9173	BOOTS TODDLERS READY MEAL FORTIFIED
9244	CHILLI CON CARNE WITH RICE READY MEAL
9245	SPAGHETTI BOLOGNAISE READY MEAL
9318	BEEF CURRY WITH RICE READY MEAL
9328	PRAWN CURRY WITH RICE READY MEAL EG ICELAND
9386	CHICKEN CURRY TIKKA MASALA READY MEAL
9387	CHICKEN CURRY READY MEAL FROZEN CHILLED
9700	READY MEAL-STEAK IN RED WINE + VEG
9702	GLAZED CHICKEN MEAL (+ POTATOES BROCCOLI
9720	SALMON CRUMBLE FROZEN READY MEAL EG ICELAND
9763	SWEET AND SOUR PORK FROZEN READY MEAL
9812	SALMON MORNAY WITH BROCCOLI READY MEAL
9815	MACARONI CHICKEN AND BACON READY MEAL

Ready-To-Eat Breakfast Cereals

Food Code	Food Name
202	BRANFLAKES KELLOGGS ONLY
203	SULTANA BRAN KELLOGGS ONLY
205	CORN FLAKES KELLOGGS ONLY

206	CORNFLAKES OWN BRAND NOT KELLOGGS
220	RICE KRISPIES KELLOGGS ONLY
223	SPECIAL K KELLOGGS
226	WHEAT FLAKES WITH SULTANAS OR RAISINS
228	MULTIGRAIN START KELLOGGS
229	FRUIT AND FIBRE KELLOGGS ONLY
231	OAT KRUNCHIES QUAKER
232	CRUNCHY NUT CORNFLAKES KELLOGGS & OWN BRAND
2970	SPECIAL K WITH RED BERRIES
3008	HONEY & NUT BRAN FLAKES OWN BRAND.
3226	GET UP & GO OATWHEAT & CORNFLAKE CEREAL
3546	CRUNCHY RICE AND WHEAT FLAKES CEREAL
3762	QUAKER OAT BRAN CRISPIES
3778	WHOLEWHEAT CORN & RICE CEREAL WITH RAISINS
3800	FLAKES AND GRAINS CEREAL WITH TROPICAL FRUIT
4084	OAT AND BRAN FLAKES NO ADDITIONS OWN BRAND
4289	CORNFLAKES-HIGH FIBRE EG RYVITA
4741	TEAM
5207	FEAST OF FLAKES QUAKER
5327	FRUIT AND FIBRE OWN BRAND NOT KELLOGGS
5333	SUSTAIN KELLOGGS
5363	KELLOGGS STRIKE
6043	JORDANS BRAN CRISP CEREAL
6159	APRICOT CRUNCHIES TESCO ONLY
6209	TESCO STRAWBERRY CRISP
6302	SAFEWAY CRISPY MALTY FLAKES
6452	SAINSBURYS STRAWBERRY CRISP CEREAL
6544	OAT BRAN FLAKES WITH RAISINS AND APPLE
6822	JUST RIGHT KELLOGGS (1/2 FAT MUESLI)
6823	WHEATFLAKES ON SULTANAS WHOLEWHEAT FLAKE
7051	RAISIN WHEATS-KELLOGGS
7623	BRAN FLAKES WITHOUT SULTANAS OWN BRAND
7624	BRANFLAKES WITH SULTANAS OWN BRAND
7630	RICE KRISPIES OWN BRAND NOT KELLOGGS
7637	CHEERIOS MULTI
7647	KELLOGGS COMMON SENSE OAT BRAN FLAKES
7648	KELLOGGS COMMON SENSE OAT BRAN FLAKES
8188	OAT & WHEAT BRAN EG WEETABIX
8189	OAT CEREAL INSTANT WITH FRUIT & NUTS
9276	OAT BRAN FLAKES WITH RAISINS APPLE
9796	PERFECT BALANCE (HEINZ WEIGHT WATCHERS)
9818	OAT BRAN FLAKES WITH RAISINS AND APPLE

Smoothies

Food Code	Food Name
711	YOGURT DRINK
2985	FRUIT JUICES/SMOOTHIE WITH VITAMIN B
5213	RIBENA STRAWBERRY YOGHURT DRINK FORTIFED
7755	YOGURT DRINK CONTAINING FRUIT PUREE
7756	YOGHURT DRINK LITE CONTAINING FRUIT JUICE
7986	YOGHURT DRINK CONTAINING FRUIT JUICE

Turkey Meat

Food Code	Food Name
1157	TURKEY SAUSAGES GRILLED FRIED
1170	TURKEY BURGER RAW
1380	TURKEY BURGER TURKEY STEAK COATED GRILLED
3158	BACON & TURKEY IN BREADCUMBS EG DANEPAK
5300	TURKEY MINCE STEWED

Turkey meat – Recipe fraction approx 40 to 95%

Food Code	Food Name
1153	TURKEY BURGER FRIED BLENDED
1154	TURKEY BURGER FRY DRIPPING
1155	TURKEY BURGER FRIED IN LARD
1156	TURKEY BURGER FRIED PUFA OIL
9597	TURKEY ESCALOPE IN VEGE OIL (PUFA)
6798	TURKEY BURGER HOMEMADE WITH ONION OVEN
3342	TURKEY MINCE WITH PARSNIP SWEDE CASSEROLE
5175	TURKEY MINCE WITH VEG IN BOLOGNESE SAUCE
5233	BOLOGNESE SAUCE WITH TURKEY MINCE & COOK
5351	LASAGNE WITH TURKEY MINCE CARROTS & WINE
5352	BOLOGNESE SAUCE WITH TURKEY MINCE CARROT
5411	MINCED TURKEY & CHICKEN IN CHEESE FLAVOUR
5646	LASAGNE:WITH TURKEY MINCE CARROTS TOMS
5760	SHEPHERDS PIE WITH TURKEY MINCE TOMS
5775	SHEPHERDS PIE MADE WITH TURKEY MINCE
5785	TURKEY MINCE COTTAGE PIE WITH VEG OLIVE
6274	LASAGNE W TURKEY MINCE PEAS SOYA MILK
6279	BOLOGNESE SAUCE W TURKEY MINCE PUREED
6731	BOLOGNESE SCE W TURKEY MINCE CARROTS

Yogurt

Food Code	Food Name
701	YOGHURT WHOLE MILK FRUIT
702	YOGURT WHOLE MILK NATURAL UNSWEETENED
703	YOGURT LOW FAT ANY OTHER FLAVOUR
704	YOGHURT LOW FAT FRUIT
705	YOGHURT LOW FAT NATURAL UNSWEETENED
706	YOGHURT LOW FAT WITH MUESLI OR NUTS
708	YOGURT LOW FAT LONGLIFE UHT PASTEURISED
712	YOGURT LOW FAT NATURAL SWEETENED
713	DIET LOW FAT YOGURT
2700	Yogurt virtually fat free natural
2701	Yogurt virtually fat free fruit
2702	Yogurt low fat french set fruit
2991	Curried yogurt with gram flour
3732	GREEK STYLE YOGURT LOW FAT FLAVOURED
5259	THICK & CREAMY TWIMPOT YOG FULL FAT FRUIT
5260	YOGURT WHOLE MILK FORTIFIED WITH VITAMINS
5261	YOGURT WHOLE MILK FORTIFIED WITH VITAMINS
5361	YOGHURT WHOLE MILK WITH ADDED SUGAR
5408	YOGHURT CUSTARD STYLE WITH FRUIT

5529	YOGURT WHOLE MILK FORTIFIED WITH VIT E
6997	Yogurt greek style cows with honey
7149	YOGURT LOWFAT FRUIT FORTIFIED WITH VITAMIN
7741	YOGURT GREEK STYLE COWS NATURAL
7742	GREEK YOGURT SHEEP
7748	YOGURT LF FRUIT WITH VITS A C D
7749	YOGURT LOW FAT FRUIT FORTIFIED VITAMINS
7751	YOGURT VLF WITH SWEETENER WITH VITS C
8220	CUSTARD STYLE YOGURTS
8223	YOGURT VIRTUALLY FAT FREE LONGLIFE UHT
8376	YOG VIRT FAT FREE TWIN POT FRUIT
8488	TESCOS BIO VLF YOGURT
8613	YOGURT LONG LIFE/UHT/PAST FRUIT WHOLE
8894	ST IVEL PRIZE WHIPPED YOGURT WITH CREAM
8935	YOGURT INFANTS OR TODDLERS
8990	YOGURT VIRTUALLY FAT FREE FRUIT
9142	YOGURT GREEK STYLE COWS WITH FRUIT
9272	YOG VIRT FAT FREE ANY OTH FLAVOUR
9881	YOGURT FULL FAT TWINPOT WITH CEREAL/CR

Yogurt – Recipe fraction approx 5 to 30%

Food Code	Food Name
9139	FRUIT IN CREAMY YOGURT SAUCE
3694	SALMON PASTA SAUCE WITH YOGURT PEPPER
6797	CHICKEN BREAST COATED WITH YOGURT & CRUMB
8997	CHICKEN WITH YOGURT AND TOMATO
9031	WHEAT AND YOGURT SOUP
9150	ASEEDA (PORRIDGE WITH YOGURT)
9151	MULAH (MINCED LAMB WITH YOGURT)
9760	AUBERGINE AND TOMATOES WITH GREEK YOGURT
3393	LAMB CURRY WITH SPINACH YOGURT GHEE
3467	CHICKEN CURRY WITH YOGURT AND CASHEW NUT
3533	CHICKEN WITH RICE YOGURT AND EGG
3660	CHICKEN STOGANOFF WITH WINE YOGURT
3692	LAMB CURRY WITH YOGURT BUTTER NO TOMATO
5756	LAMB CURRY WITH TOMATOES & YOGURT
6409	CHICKEN CURRY WITH CHICKEN BREAST YOGURT