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Methodological characteristics of the national dietary surveys carried out in the European Union as included in the EFSA Comprehensive European food consumption database

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Abstract:	In 2009 competent organisations in the European Union (EU) provided the European Food Safety Authority (EFSA) with data from the most recent national dietary survey, at the level of individuals' consumption. Twenty different Member States (MS) provided EFSA with data from 22 different national dietary surveys, with consumption figures for adults and, when available, for children. MSs' dietary data were assembled into the EFSA Comprehensive European Food Consumption Database (Comprehensive Database).

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	<p>In this paper an overview of the methodologies and protocols employed in the different national dietary surveys is provided. Specifically, details about dietary assessment methods, interview administration, sampling design, portion size estimation, dietary software, evaluation of under-reporting and non dietary information collected are described. This information is crucial to evaluate the level of accuracy of food consumption data and to anticipate and acknowledge utmost important sources of heterogeneity of national databases included in the Comprehensive database. The Comprehensive database constitutes a unique resource for the estimation of consumption figures across the EU and represents a useful tool to assess dietary exposure to hazardous substances and nutrient intake in Europe. Nevertheless, the many substantial methodological differences that characterise the Comprehensive database are acknowledged and critically discussed.</p>

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1 **Methodological characteristics of the national dietary surveys carried out**
2 **in the EU as included in the EFSA Comprehensive European Food**
3 **Consumption Database.**

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3 33 **KEYWORDS:** Dietary survey, exposure assessment, food consumption, 24-hour recall,
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5 34 food records.

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7 35 **RUNNING TITLE:** Comprehensive European Food Consumption Database.
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12 38 **LIST OF ABBREVIATIONS**

13
14 39 BMR: Basal Metabolic Rate
15
16 40 Comprehensive Database: EFSA Comprehensive European Food Consumption Database
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18 41 DCF: Data Collection Framework
19
20 42 EGFCF: Expert Group on Food Consumption Data
21
22 43 EI: Energy Intake
23
24 44 EU: European Union
25
26 45 FFQ: Food Frequency Questionnaire
27
28 46 FPQ: Food Propensity Questionnaire
29
30 47 HBS: Household Budget Surveys
31
32 48 MS: Member State
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34 49 PSMA: Portion Size Measurement Aids
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36 50 WHO: World Health Organization
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51 ABSTRACT

52 In 2009 competent organisations in the EU provided the European Food Safety Authority
53 (EFSA) with data from the most recent national dietary survey, at the level of individuals'
54 consumption. Twenty different Member States (MS) provided EFSA with data from 22
55 different national dietary surveys, with consumption figures for adults and, when available,
56 for children. MSs' dietary data were assembled into the EFSA Comprehensive European
57 Food Consumption Database (Comprehensive Database). In this paper an overview of the
58 methodologies and protocols employed in the different national dietary surveys is provided.
59 Specifically, details about dietary assessment methods, interview administration, sampling
60 design, portion size estimation, dietary software, evaluation of under-reporting and non
61 dietary information collected are described. This information is crucial to evaluate the level
62 of accuracy of food consumption data and to anticipate and acknowledge utmost important
63 sources of heterogeneity of national databases included in the Comprehensive database. The
64 Comprehensive database constitutes a unique resource for the estimation of consumption
65 figures across the EU and represents a useful tool to assess dietary exposure to hazardous
66 substances and nutrient intake in Europe. Nevertheless, the many substantial methodological
67 differences that characterise the Comprehensive database are acknowledged and critically
68 discussed.

70 Introduction

71 Food consumption data reflect what individuals or population groups consume in terms of
72 foods, beverages, including drinking water, and supplements. Food consumption in a
73 population can be estimated through surveys at individual level (Individual dietary surveys)
74 or household level (Household budget surveys). Alternatively, consumption figures might be
75 approximated through food supply data derived from food balance sheets. Individual dietary
76 surveys are the only surveys that provide information on the distribution of food consumption
77 in well-defined groups of individuals and are therefore preferred for the assessment of dietary
78 exposure within the risk assessment process. Data from individual dietary surveys are also
79 assumed to more closely reflect actual consumption (Kroes et al., 2002). National dietary
80 surveys are presently carried out in many European countries and provide valuable
81 information to be used in national policy and in nutritional surveillance.

1
2
3 83 In 2007, the European Food Safety Authority (EFSA) established the “Expert Group On Food
4 Consumption Data” (EGFCD), an EFSA network with representatives from each EU Member
5 84 State (MS) to provide a platform for discussion to ultimately define practical guideline steps
6 85 for the collection and collation of food consumption data. At the end of 2008, EFSA started a
7 86 project aimed at establishing the EFSA Comprehensive European Food Consumption
8 87 Database (Comprehensive Database). Within this project, competent organisations,
9 88 nominated in each MS by the Permanent Representative to the European Union, were
10 89 requested to provide EFSA with data from the most recent national dietary survey in their
11 90 country.
12 91
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14 93 In October 2009, the EGFCD endorsed the Guideline of EFSA on “Methods and protocols
15 94 for the collection of national food consumption data in the view of a pan-European dietary
16 95 survey” (EFSA, 2009). The main objective of this Guideline is to recommend general
17 96 principles for the collection of dietary information to estimate the intake of foods and
18 97 nutrients to perform risk assessment for a variety of biological agents and chemical
19 98 substances evaluated by EFSA Scientific Panels.
20 99

21 100 The aim of this paper is to give an overview of the different methodologies used for the
22 101 collection of food consumption and related data included in the Comprehensive Database.
23 102 This information is crucial to evaluate the level of accuracy of food consumption data and to
24 103 anticipate and acknowledge utmost important sources of heterogeneity for the comparison of
25 104 this data at European level. Such knowledge will assist with realising estimates of uncertainty
26 105 when assessing exposure to hazardous substances.
27 106

28 107 **Materials and methods**

29 108 Twenty MSs signed a collaboration agreement with EFSA for the provision and processing of
30 109 dietary data collected through national surveys. The information provided made the
31 110 establishment of the Comprehensive database possible. In order to be included in the
32 111 database, the dietary data had to be collected at individual level by means of (replicates of)
33 112 24-hour dietary recalls or dietary records. Dietary surveys were requested to be representative
34 113 at national level, at least for the adult population. The consumption data should be provided
35 114 at the most disaggregated level recorded. All participating institutions provided EFSA with a
36 115 database schema describing their food consumption and related data tables. Based on this
37 116 information a common data model was developed for the transmission of the food

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3 117 consumption data. Data providers coded all food descriptors present in the food consumption
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5 118 database according to a unique classification system developed by EFSA (EFSA, 2010). Data
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7 119 providers were also asked to disaggregate industrially produced composite foods or home-
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9 120 made dishes, such as a ready-made frozen pizza or a home cooked beef stew, into their main
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11 121 raw ingredients. The transmission of food consumption data was accomplished through an
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122 application designed by EFSA, called Data Collection Framework (DCF).
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16 124 Data providers systematically compiled a report describing in detail the methodology
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18 125 employed in the dietary survey, according to an agreed protocol with the objective of
19
20 126 providing detailed information on each of these sections: dietary method, administration of
21
22 127 the interview, sampling design, portion size estimation, dietary software, food coding,
23
24 128 evaluation of under-reporting and non dietary information.

25 129 All information contained in the reports was checked for completeness and consistency.
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27 130 When necessary, clarifications were requested to the data providers. Where applicable,
28
29 131 information reported was verified against the related food consumption data provided to
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31 132 EFSA.
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33 133

34 134 **Results**

35 135 Twenty different MSs provided food consumption data to EFSA at individual level collected
36
37 136 in 22 different national dietary surveys. Table 1 shows the MS institutions that implemented
38
39 137 the food consumption survey in their respective country. The methodological characteristics
40
41 138 of the surveys are presented in Table 2. Five different types of survey methodologies were
42
43 139 conducted: 7-day food records were carried out in five surveys, 3-day food records in three
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45 140 surveys, one-day 24-hour dietary recalls in six surveys and 2-day 24-hours dietary recalls in
46
47 141 seven surveys. In Finland a 48 hours dietary recall method was used.
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49 142

50 143 All countries which used 2-day 24-hour dietary recalls conducted the interview on two non-
51
52 144 consecutive days with the exception of the most recent survey in Spain (Spain II) where
53
54 145 about 35% of the interviews were conducted on consecutive days. The average length
55
56 146 between non-consecutive days ranged from 3 (Spain II) to 79 days (Czech Republic). The
57
58 147 food record surveys were consistently conducted on consecutive days.
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149 The methodology used within the studies conducted in Denmark (Groth and Fagt, 1997) and
150 France (Lafay et al., 2002) have been reported as validated. In the United Kingdom, a doubly

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3 151 labelled water validation study was carried out as part of the feasibility study prior to the
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5 152 main survey.
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9 154 Fourteen surveys also included the administration of a Food Frequency Questionnaire (FFQ)
10 155 or of a Food Propensity Questionnaire (FPQ) whereas in Germany a diet history was
11 156 administered to the same study subjects that completed 24-hour dietary recalls. In addition,
12 157 Germany and Finland collected further dietary information, by means of food records, in a
13 158 sub-sample of the study population, whereas an additional 24-hour recall was administered to
14 159 all subjects within the Spain I survey. This information was not transmitted to EFSA.

15
16 160 The methods used for the administration of the interview are presented in Table 3. The
17
18 161 number of face-to-face meetings between interviewer and subjects to collect food
19 162 consumption information varied from none up to four meetings. In 15 surveys, at least one
20 163 face-to face interview took place at the study subject's home. In Ireland, subjects were
21 164 interviewed either at home or at their working place. In Slovakia, Bulgaria II and Finland the
22 165 interviews were conducted at a medical centre, whereas in Spain II subjects were interviewed
23 166 either at the university campus, health centres and pharmacies where the subjects were also
24 167 recruited for the study. In the Netherlands the interviews were conducted by phone without
25 168 any prior physical contact. In the German study there was only one face-to-face meeting with
26 169 the subject which aimed at collecting information on the socio demographic status, along
27 170 with information on nutritional and purchase behaviour, health aspects and anthropometric
28 171 measures. The 24-hours recalls were both conducted by phone a few weeks later. In Austria
29 172 no verbal contact with the study subjects was established. The subjects completed a 24-hour
30 173 dietary recall according to documented guidelines and returned it by mail to the study centre
31 174 (postal survey method). In thirteen surveys interviewers had a background in nutrition and in
32 175 the remaining surveys interviewers were trained staff without a nutrition related background.
33 176 The survey period, sampling strategy and response rate are shown in Table 4. In three surveys
34 177 (Estonia, Ireland and Sweden) the food consumption data were collected prior to the year
35 178 2000. In 16 surveys the study population was sampled at individual level whereas in the
36 179 remaining 6 surveys, it was sampled at household level. Sample units were selected randomly
37 180 in all surveys but different sampling frames were used. The national population register was
38 181 the most used sampling frame (in 8 surveys). In Spain, participants were randomly selected
39 182 from universities, health centres and pharmacies, whereas in Slovakia subjects were sampled
40 183 from lists of employees of confectionary and bakery manufactures. The response rate varied
41 184 from 27% (Hungary) to 96 % (Slovakia and Poland).

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3 185 In six surveys the target population included children below 10 years old and in about half of
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5 186 the surveys the target population included adolescents from 10 to 17 years (Table 5). In all
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7 187 surveys, with the exception of Bulgaria II, which focused on children, surveys included the
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9 188 age range of 18 to 64 years. In nine surveys elderly people from 64 to 74 years were also
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11 189 included. In the Dutch dietary survey only young adults, from 19 to 30 years of age, were
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13 190 included.

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16 192 The sample size, the stratification variables and the distribution by gender are shown in Table
17
18 193 6. The sample size across the surveys varied between 410 (Slovenia) and 13,926 (Germany)
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20 194 subjects. The vast majority of the surveys were nationally representative for gender (in 20
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22 195 surveys), age groups (in 19) and geographical areas (in 15). Six surveys were also
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24 196 representative for urban and rural areas. In addition, the Dutch and Irish data were
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26 197 representative for education level. Austria was only representative according to the
27
28 198 employment status. In six countries weighting factors were used to make the sample
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30 199 representative at national level for at least age groups, gender and regions.

31 200 The weekday and seasonal representativeness of the surveys are shown in Table 7. In six
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33 201 surveys record or recall days did not evenly cover week and weekend days. For example, in
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35 202 Slovakia only 5% of the records for which the consumption date was known related to
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37 203 weekend days. Twelve surveys captured consumption figures across all seasons. In the
38
39 204 remaining surveys the seasonality was not fully covered, with only one season represented in
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41 205 Bulgaria I (Spring), Estonia (Summer), Hungary (Winter) and The Netherlands (Fall).

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43 207 The applied exclusion criteria are shown in Table 8. The majority of MSs (in 17 surveys)
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45 208 excluded institutionalised persons, such as elderly in retirement homes or people residing in
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47 209 hospitals, prisons or military barracks. In seven surveys pregnant and breastfeeding women
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49 210 were excluded. Information on the diet of pregnant and breastfeeding women were available
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51 211 only from nine different surveys. In three surveys, specific population groups were purposely
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53 212 over represented, notably children aged 3–17 years in France, teenagers aged 15-18 years and
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55 213 people aged >75 years in Belgium, and subjects with lower education level in The
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57 214 Netherlands.

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59 216 The methods used to estimate portion size are shown in Table 9. Three surveys were
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217 conducted using the weighing method, either as the sole method (United Kingdom for food
218 consumed inside the home) or combined with other measurement tools (Ireland and Spain I),

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3 219 to estimate the amount of food consumed. In the British survey, for food eaten outside of
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5 220 home, a ruler and information on household measures and known packaging size were used.
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7 221 In the majority of surveys (19) a combination of 2 or more measurement tools were used and
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9 222 in 16 studies the picture book was used as one of these tools. In all but four (Ireland, Latvia,
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11 223 Slovenia, Estonia) of these 16 surveys a validated or tested picture book was used. EPIC-soft
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13 224 picture book was used in four surveys (Belgium, Germany, The Netherlands and Italy). Out
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15 225 of the six surveys in which no picture book was used, two were weighed surveys (United
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17 226 Kingdom and Spain I), Austria relied on household measurements only, Spain II was
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19 227 conducted using household measurements and packaging size, while in the Slovakian survey
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21 228 the interviewer estimated portion sizes without any tool but relied only on the subject's
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23 229 description. In Hungary, subjects used "reference tables" to estimate and fill in the portion
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25 230 sizes in the record. Three out of the six dietary surveys including children <10 years of age
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27 231 (Bulgaria II, Denmark and Italy) reported the use of a picture book with small portion sizes
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29 232 appropriate for children. The remaining three (Poland, Latvia and France) did not use specific
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31 233 tools for children.

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34 235 Details of the dietary software and related databases used in the different surveys are
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36 236 presented in Table 10. In Belgium, Germany, and the Netherlands EPIC SOFT (Slimani et
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38 237 al., 1999) was used, in Austria and France an *ad hoc* software using MS Access was
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40 238 developed and used. In all other surveys different software were used. Most countries used
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42 239 integrated portion size databases (in 17 surveys) and integrated standard recipe databases (in
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44 240 20 surveys). In 10 surveys no yield factors were used when breaking down recipes and/or
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46 241 composite dishes into the main raw ingredients. Only Sweden did not disaggregate recipes
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48 242 and/or composite dishes into the main ingredients. In 19 surveys, the software links the food
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50 243 consumption databases to food composition databases. With this respect, the EPIC SOFT
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52 244 program is an exception since it does include food composition information only on
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54 245 macronutrients. The availability of brand name, household processing and packaging
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56 246 information in each survey per food record are presented in Table 11. Brand information was
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58 247 available only in nine surveys for a percentage of records varying from 1% to 29%. In
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60 248 Germany only a flag variable indicating the availability of the brand name was provided
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250 because, at the time of the data transmission, data concerning brand name were still in the
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252 cleaning phase. The description of the food incorporated information on brand, household
processing and packaging in Ireland and, for some of the food items, in UK. In these
circumstances it was not possible to calculate the percentage of food records including this

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3 253 information. In Finland the brand information is also incorporated directly in the food name.
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5 254 Household processing information was available in 14 surveys for a percentage of records
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7 255 varying from 1% to 45% with the number of different processing methods reported in the
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9 256 various surveys varying from 1 to 24. Packaging information is available from three surveys
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11 257 for a percentage of records varying from 1% to 24%. In Belgium and Spain II the packaging
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13 258 information differentiates between physical characteristic such as carton or metal, whereas in
14
15 259 Germany packaging information is available only for two food groups (fat and sauces).
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17 261 The technique used in the various surveys to identify under-reporters is described in table 12.
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19 262 In eleven surveys, individual level under-reporters were identified among adults, by
20
21 263 comparing the ratio of Energy Intake (EI) to Basal Metabolic Rate (BMR) to Goldberg cut
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23 264 off points (Goldberg 1991), showing frequency of under-reporters ranging from 11.7% (in
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25 265 Hungary) to 37.3% (in Finland). The cut-off was corrected on the basis of the physical
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27 266 activity level, as suggested by Black (2000a and 2000b) only in the survey from France. In
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29 267 Italy and in the Netherlands under-reporting among adults was assessed at the population
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31 268 level. Under reporting among children was only assessed in France, by comparing the
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33 269 logarithm of energy intake with the mean minus three standard deviations, and in Italy, by
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35 270 examining the means of the ratio of energy intake on estimated energy expenditure
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37 271 distributions. Under-reporters were excluded before transmitting data to EFSA only in the
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39 272 Austrian survey where subjects with a ratio of EI/BMR below 0.65 were excluded.
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41 274 Information on specific study subjects' long term dietary pattern (e.g. vegetarian, health
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43 275 related or slimming) had been collected in half of the surveys (Table 13). In Germany
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45 276 information on further special diets like Halal was collected. Non dietary information
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47 277 collected within the survey is presented in Table 14. Data on body weight and height were
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49 278 consistently available. In nine surveys direct measurements were taken, while in the
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51 279 remaining, self reported measures were used. In 12 and eight surveys information on study
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53 280 subjects' physical activity level, self-reported by means of questionnaires, and ethnicity were
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55 281 collected, respectively.
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283 **Discussion**

284 *Dietary method*

285 Only data collected through dietary records and 24-hours dietary recalls have been accepted
286 to be included in the Comprehensive Database. The EGFCF considered both methods

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3 287 suitable for the requirements of providing data at a sufficiently detailed level for the purposes
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5 288 of exposure assessment (EFSA, 2009) but differences exist between these two methods. The
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7 289 dietary record method might be a more suitable tool for the elicitation of a greater level of
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9 290 detail but, among others, a potential drawback might be the selection bias due to high
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11 291 illiteracy levels in some minority groups across Europe (Biró et al., 2002). On the other hand,
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13 292 an accurate memorisation of food consumed the preceding day is required for the 24-hours
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15 293 dietary recalls method. This might represent a difficult cognitive task for the respondent, in
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17 294 particular, for the very young or very old study subjects, and could affect the precision in the
18
19 295 quantification of the foods consumed (Thompson and Subar, 2001). Six of the countries
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21 296 providing data into the Comprehensive Database collected dietary data on children younger
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23 297 than 10 years. Half of these countries used the 24-hour recall method and the other half used
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25 298 the dietary record method.

26
27 300 Food consumption data collected on more than one day per subject are required to assess
28
29 301 chronic exposure. At least two independent short-term assessments days are needed to apply
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31 302 statistical modelling to estimate habitual intake (Dodd et al., 2006). The EGFC (EFSA,
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33 303 2009) recommends the collection of dietary information for two non-consecutive days for
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35 304 both the 24-hour recall and the dietary record methods. Recording days are here considered
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37 305 as non-consecutive if there is an interval of at least two weeks between them. Collecting data
38
39 306 on non-consecutive days has the potential advantage of making dietary measurements less
40
41 307 prone to correlation between errors in dietary assessments (Kipnis et al., 2003, Day et al.,
42
43 308 2004). However, in half of the surveys where 24-hour dietary recalls were used, information
44
45 309 on only one single day was collected per subject. Such data can nevertheless be useful to
46
47 310 estimate acute exposure. The seven surveys that used 2-day 24-hour recall method were
48
49 311 conducted on non-consecutive days, with the exception of Finland where a 48-hour dietary
50
51 312 recall method was used. In three of these seven surveys the average distance between two
52
53 313 interview days is below the recommended two weeks interval.

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56
57 315 It has been argued that, accuracy of self-reported dietary information may decrease as the
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59 316 number of days increases (Biro et al., 2002, Gersovitz et al., 1978, Moreno et al. 2005,
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317 Whybrow et al., 2008). On the other hand, increasing the number of assessment days of a
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319 survey affects the distribution of consumption, particularly at the upper tails (EFSA, 2006). In
particular, increasing the number of survey days (for both recalls and records) has the

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3 320 advantage of reducing the effect of study subjects' day-to-day variation, thus leading to an
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5 321 improved estimation of consumption variability (Willett, 1989). As survey duration increases,
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7 322 also the observed percentage of subjects reporting non zero consumption for commonly and
8
9 323 rarely eaten foods becomes larger (Nusser et al., 1995), whereas the observed mean and high
10
11 324 percentiles consumption, in consumers only, decreases, as also illustrated by Lambe et al.
12
13 325 (2000). Half of the surveys using the record methodology in the Comprehensive Database
14
15 326 (Denmark, France, Ireland and United Kingdom) collected information for more than three
16
17 327 days per subject.
18

19 329 Some episodically consumed foods may become of public health concern, as a result of high
20
21 330 level contamination with a given hazardous substance. In order to accurately estimate the
22
23 331 usual intake of these foods, additional information on their frequency of consumption could
24
25 332 complement 24-hour dietary recalls or dietary records (Tooze et al., 2006; Kipnis et al.,
26
27 333 2009), as emphasised in the EGFCD (2009) guideline. Twelve countries reported using a
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29 334 FFQ or a FPQ along with a 24 h recall or dietary record method. In one country (Ireland), the
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31 335 FFQ focused solely on the intake of meat. Data from FFQ or FPQ may be used in acute
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33 336 exposure assessments to assess the proportion of consumers of a given food, and in chronic
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35 337 exposure assessments to determine the frequency distribution of the consumption of rarely
36
37 338 consumed foods. Data from FFQ or FPQ was, however, not transmitted to EFSA.
38

39 340 *Administration of the interview*

40
41 341 The vast majority of surveys in the Comprehensive Database used the face-to-face interview
42
43 342 method, mainly at the respondent's home. There were also two surveys conducting 24-hour
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45 343 dietary recalls by phone (Germany and the Netherlands), while in Austria one self-
46
47 344 administered 24-hour dietary recall was collected via postal mail. Numerous studies (Derr et
48
49 345 al., 1992; Lyu et al., 1998; Casey et al., 1999; Tran et al., 2000; Bogle et al., 2001) concluded
50
51 346 that the telephone 24-hour dietary recall interview method provides a reliable and cost-
52
53 347 effective alternative to a face-to-face method, with similar response rates being observed for
54
55 348 both methods whereas there are not as many studies in the literature that have examined
56
57 349 postal questionnaires as a method of obtaining dietary information. In general it seems that
58
59 350 both face-to-face and telephone interviews are more suitable for collecting dietary and health
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351 data compared to postal questionnaires (Sibbaldi et al., 1994). The effect of the number of
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face-to-face meetings is likely to improve the accuracy of dietary estimates as the number of

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3 353 contacts with the study subjects increases and especially if conducted by personnel with a
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5 354 nutritional background.
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9 356 The home visit is considered the most appropriate location to conduct dietary interviews
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11 357 since it offers the advantage of collecting additional information on foods consumed, such as
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13 358 brand level data and food packaging, and could allow for direct weighing of some dietary
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15 359 items (De Henauw et al., 2002). On the other hand, other locations like medical centres are
16
17 360 likely to offer better conditions for the collection of additional information, such as biological
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19 361 samples (Riboli et al., 1997).
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21 362
22 363 Dietary interviews should be ideally conducted by nutritionists or dieticians. In alternative
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24 364 adequately trained staff could be employed. In the Comprehensive Database, over half of the
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26 365 surveys were conducted by an interviewer with a nutritional background.
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28 366
29 367 *Sampling design*

30 368 The Comprehensive Database includes data from the most recent national dietary surveys
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32 369 carried out in 20 MSs of the European Union. Some surveys (Estonia, Ireland, Spain and
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34 370 Sweden) started before 2000, thus limiting the accuracy of consumption estimates of dietary
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36 371 items recently introduced into the market.
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38 372
39 373 Sample representativeness is a crucial aspect for the evaluation of the food consumption data
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41 374 gathered in the Comprehensive Database. Representativeness is a qualitative parameter
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43 375 related to the sampling design of a dietary survey. Significant biases can arise from a survey
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45 376 sample that does not represent the population at national level.
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48 378 Sample units (individuals or households) were selected randomly in all dietary surveys, but
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50 379 differences in the sampling design are observed. Concerning the sampling frames used,
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52 380 National population registers, address registers, postcode address files, general population
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54 381 census, consumer panels and electoral lists (only for the adult population) can all be
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56 382 considered as optimal sampling frames as far as these lists are regularly updated and each
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58 383 subject within the national population register is likely to be selected. The national register of
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60 384 the general practitioner's practices used in Bulgaria seems to be a good sampling frame for
385 children since, due to the national legislation, all children must be listed there. In Italy the use
386 of telephone books has the potential of introducing unwanted bias, as non-telephone

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3 387 households, telephone numbers issued after the publication of the telephone directory, and
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5 388 unlisted numbers will be automatically excluded. In Spain, the use of universities, health
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7 389 centres and pharmacies to randomly recruit subjects is likely to constitute a potential source
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9 390 of bias. In Slovakia, the study population cannot be considered representative of the general
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11 391 population since subjects were only selected among employees of confectionary and bakery
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13 392 manufactures.

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16 394 On the other hand, the use of the household as a sampling unit seems to be a convenient
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18 395 choice since an interviewer could collect information from more subjects during the same
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20 396 visit. However, food consumption estimates are likely to be mutually dependent when
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22 397 subjects from the same household are interviewed, thus leading to a reduced variability in
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24 398 terms of dietary pattern observed. In France and UK, only one respondent per household was
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26 399 included in the study. The random selection of subjects from households sampled within the
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28 400 national household budget survey in Poland seems to offer a good choice since it allows the
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30 401 comparability between the two sets of data. A cost reduction of the survey can be obtained by
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32 402 the use of a multistage sampling design where, for example, a random choice of cities, as
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34 403 primary units, of households, as secondary units, and finally individuals within households is
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36 404 adopted. This method can be combined with a stratification for instance on regions or
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38 405 rural/urban areas to reduce sampling bias because the part of the variability of the studied
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40 406 indicator explained by the strata is controlled (Cochran, 1977). All surveys in the
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42 407 Comprehensive Database were stratified for gender and age groups with the exception of
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44 408 Austria. The number of subjects participating in the dietary survey varied sizeably from
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46 409 survey to survey. The adult population group (from 18 to 64 years of age) was the only
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48 410 represented age group in all 20 MSs with a number of study subjects varying from 400
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50 411 (Slovenia) to 10,419 (Germany) where the study population was sampled at a very fine
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52 412 geographical level (Federal State level). A large sample gives the opportunity to collect more
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54 413 information on rarely consumed foods.

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57 415 The target population of a national dietary survey includes all people living in the country at
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59 416 the time of the study. However, institutionalised subjects, such as the elderly in retirement
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417 homes or people residing in hospitals, prisons or military barracks, have not been included in
418 the large majority of dietary surveys. Their exclusion is often considered necessary to
419 simplify sampling procedures, as outlined in the recommendation of the EGFC (EFSA,
420 2009) for a future pan-European dietary survey.

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3 421 Despite pregnant and breastfeeding women being specifically excluded only in 7 surveys,
4 422 where included their number is overall rather low, i.e. from 0 (Spain I) to 59 (Denmark)
5 423 breastfeeding women and from 0 (Spain II) to 52 (Germany) pregnant women. Therefore
6 424 dietary estimates of these important subgroups should be treated cautiously.
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12 426 One important aspect of food consumption data is their representativeness over the different
13 427 seasons. Ideally, 24-hours dietary recalls and dietary records should be collected uniformly
14 428 over the four seasons. This was achieved in the majority of surveys in the Comprehensive
15 429 Database, with the exception of Bulgaria I, Bulgaria II, Estonia, Finland, Hungary, Latvia,
16 430 Netherlands, Poland and Spain II where an uneven distribution of recording days over
17 431 seasons was reported. This issue is particularly relevant when using food consumption data to
18 432 assess exposure to hazardous chemicals mainly present in seasonal foods. In addition, it has
19 433 been suggested that a proportionate collection of dietary estimates in week versus weekend
20 434 days should be adopted, at population level, in the sampling phase (Lyhne et al., 2005).
21 435 Weekend days were particularly under represented in Austria, Bulgaria and Slovakia and
22 436 over represented in Bulgaria II. The effects of uneven sampling fractions over days of the
23 437 week are potentially relevant for foods that exhibit specific consumption patterns related to
24 438 weekend consumption, e.g. alcoholic drinks.
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30 439
31 440 It has been argued that the response rates of dietary surveys should be high enough to ensure
32 441 that individual dietary estimates can be generalised to the general population, thus avoiding
33 442 under-sampling of specific population subgroups. Response rates were relatively low in
34 443 Hungary (27%), Spain II (28%), Italy (33%), Belgium (41%), Netherlands (42%) and
35 444 Germany (42% for the total study). The high response rate in Slovakia (98%) is likely due to
36 445 the very convenient sampling frame used. No information was collected on type of incentives
37 446 for the study subjects. The use of incentives is a common method for increasing survey
38 447 response but can also introduce bias in dietary estimates by inadvertently drawing individuals
39 448 from selected population subgroups or by influencing respondents' responses (Singer &
40 449 Kulka, 2002).
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56 451 *Portion size estimation*

57 452 Systematic bias and large random error may occur while quantifying foods and no gold
58 453 standard exists for estimation of portion size (Wrieden et al., 2009). The use of different aids
59 454 will depend on survey methodology, target population (Foster et al., 2009) and the level of

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3 455 accuracy required. Weighing is considered to be the most precise method for measuring food
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5 456 intake, however it is time-consuming, costly and disruptive (Wolper et al., 1995). It was used,
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7 457 alone or in combination with other methods, in the United Kingdom, Ireland and Spain only.
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9 458 As an alternative to weighing all food items eaten, consumption can be measured based on
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11 459 the subjects' estimates of portion size. The parallel use of different Portion Size Measurement
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13 460 Aids (PSMAs), such as photographs, household measures, rulers etc, was considered the most
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15 461 convenient option by the EGFCD (EFSA, 2009) in order to obtain best estimates for different
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17 462 foods. Indeed the majority of surveys (in 19) used a combination of two or more
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19 463 measurement tools, with 16 using the picture book as one of the tools and all but four of these
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21 464 used a validated or tested picture book. Measuring children's dietary intake is challenging.
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23 465 Foster et al. (2009) investigated whether the estimate of portion sizes for children would
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25 466 improve if they were provided with age appropriate tools. They concluded that providing
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27 467 children with food photographs depicting age-appropriate portion sizes increased accuracy of
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29 468 estimates compared with estimates using photographs designed for use with adults. The
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31 469 EGFCD also stressed the importance of using age-appropriate tools and portion size aids
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33 470 which are representative of the food available on the market and of the food portions actually
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35 471 consumed. Six of the 22 surveys included children <10 years of age. Bulgaria II, Denmark
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37 472 and Italy reported the use of the same picture book as for the adults but with special sets of
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39 473 smaller portion sizes for children.

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475 It might be advisable to more closely examine estimated food portion quantities in those
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477 surveys' data using only household measurement tools (Austria), household measurement
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479 tools in combination with packaging size (Spain II) and, in particular, in those two countries
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481 reporting no use of any PSMAs to quantify portion sizes. This latest case is related to the
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483 dietary surveys carried out in Slovakia, where the interviewer estimated portions relying only
484
485 on the subject's description, and in Hungary, where "reference tables" were used by all the
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487 study subjects.

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483 *Dietary software and database*

484 Different software (and associated databases) for the collection and/or processing of food
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486 consumption data were used in the 22 surveys, thus introducing extra complexity for the
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488 comparability of dietary information across surveys. Only three surveys (Belgium, Germany
and the Netherlands) used the EPIC SOFT program (Slimani et al., 1999), thus making these
three surveys more comparable.

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3 489 Cautious interpretation of consumption data is advisable in almost half of the surveys which
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5 490 did not use yield factors to disaggregate composite foods from cooked into their raw
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7 491 ingredients. Hence, the cooked foods are considered as consumed as such and consumption
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9 492 estimates of these particular food groups might differ from those in countries where yield
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11 493 factors were used to disaggregate the recipes into the ingredients as purchased.
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13 494 Overestimation of exposure might result from these five surveys in certain foods such as
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15 495 pasta or rice (the cooked weight of one portion is far higher than its raw weight) whereas
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17 496 underestimation may result in other foods such as meat or fish (their weight decrease when
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19 497 cooked since they lose water).

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21 499 In Sweden recipes were not disaggregated into ingredients. As a result, an underestimation of
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23 500 the foods used regularly as ingredients in recipes e.g. cheese or tomato can be expected in the
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25 501 Swedish data. For some exposure assessments within the focus of EFSA, additional
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27 502 information to the food name might be needed. For example, the concentration of heat-
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29 503 generated food toxicants, food additives and substances migrating from packaging materials
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31 504 in foods can differ by household processing method, by brand names, or kind of packaging,
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33 505 respectively. It was requested that national data providers provide available information on
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35 506 brand, household processing and packaging, additionally to the food name information. The
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37 507 available information on brand was very limited at country level. Concerning the information
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39 508 on household processing, in about two third of surveys different information on household
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41 509 processing for varying percentages of food records was collected. Information on baking,
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43 510 frying and grilling of food was available in the vast majority of the surveys where household
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45 511 processing information was collected. Information on packaging material was only available
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47 512 in Belgium (24% of food records), Germany (5%) and Spain II (1%) and its use for exposure
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49 513 assessment purpose is likely to be very limited.

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51 515 Available brand and household processing information might differ throughout the surveys
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53 516 since different survey objectives might result in the collection of different information on the
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55 517 foods consumed. Similar to the brand names, information on household processing is
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57 518 sometimes only available as a part of the food description, instead of than as a separate
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59 519 variable, and this cannot easily be extracted. It should be noted that for the brand names, and
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520 partly also for the packaging information, the level of detail related to all food items might
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522 521 not be sufficient for a complete exposure assessment. If brand level information is available,
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523 522 it will further need to be linked to chemical occurrence data specific for that branded food

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3 523 (e.g. food additives). The use of this information for exposure assessment must be decided
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5 524 case by case, based on the availability of information for the food categories of interest.
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7 525 Information on brand name, food packaging and household processing is available for some
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9 526 of the countries that have used a 24 hour recall as well as for some countries that have used
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11 527 food records. This confirmed that this information can be collected by both protocols.
12
13 528 However, the three surveys using the 24 hour dietary recall by means of EPIC SOFT program
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15 529 provided a higher number of different descriptors of household processing information.
16
17 530 In summary, the use of brand information is limited to certain foods and only available in a
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19 531 restricted number of surveys, information on household processing might be useful in a larger
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21 532 number of countries whereas the available packaging information appears to be of poor use
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23 533 for exposure assessment. In this respect, the EGFC (EFSA, 2009) recommended the
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25 534 collection of information on brand name, physical characteristics of the packaging and
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27 535 household cooking procedures. However, other data sources, like market share data from
28
29 536 marketing research studies, could be linked to the food consumption data in order to fill the
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31 537 information gap for exposure assessments.
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539 *Under-reporting*

540 Under-reporting was assessed in a number, but not all, surveys by comparison of individual
541 energy intake estimates with Goldberg cut-off points. In the evaluated surveys a varying
542 proportion of under-reporters was identified, i.e. between 12% to 37%. It was assessed that
543 the Goldberg's cut-offs have moderately low sensitivity in identifying under-reporters (Black,
544 2000b), thus suggesting that, although most study participants identified as extreme under-
545 reporters are likely to have truly underestimated energy intake, a proportion of study-subjects
546 identified as normal-reporters are likely to be under-reporters. One effective way to improve
547 the identification of under-reporters is to use complementary information on individuals'
548 physical activity levels. This strategy was followed in France, where the cut-off points were
549 corrected on the basis of physical activity levels (Black, 2000b). However, this approach
550 finds a natural limitation in the fact that the assessments of physical activity are also prone to
551 measurement errors (Ferrari et al., 2007).

552

553 In the guidance document of the EGFC (EFSA, 2009) it was suggested that individual
554 measurements should not be excluded on the basis of estimated under- or over-reporting
555 assessed with short-term dietary assessment methods. Rather, dietary measurements
556 considered unreliable by the interviewers should be removed from the database.

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3 557 The inclusion in the database of surveys with high frequency of under-reporters may lead to
4
5 558 an underestimation of mean dietary exposure and of the percentage of consumers of some
6
7 559 particular foods, e.g. foods with high fat or sugar content, whose estimation is more prone to
8
9 560 under-reporting (Becker, 1999). On the other hand, under-reporting is likely to have less
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11 561 impact on the assessment of high percentiles of consumption.

12 562

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14 563 An extensive review from Gorber et al. (2007), evaluating the relationship between self-
15
16 564 reported and directly measured height and weight, showed trends of under-reporting for
17
18 565 weight (ranging from -0.1 kg to -6.5 kg in women and from -0.1 kg to -3.2 kg in men) and
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20 566 over-reporting for height (ranging from +0.6 cm to +7.5 cm. A slight over-estimation of
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22 567 exposure expressed per kg body weight is therefore expected when using data from the 13
23
24 568 dietary surveys that collected the weight information through self reporting.

25 569

26 570 Uncertainty analysis

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28 571 The uncertainty related to exposure estimates based on the Comprehensive Database is
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30 572 presented and discussed for a number of methodological parameters characterising each
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32 573 dietary survey. It has been highlighted that different survey methodologies have a potential to
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34 574 induce uncertainties on exposure, especially for the comparison of results between countries.
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36 575 Although in some circumstances the effect and direction of potential bias in exposure
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38 576 estimates can be, to a certain extent, anticipated, this is not consistently possible. For
39
40 577 example, it is recognised that estimating high percentiles of habitual consumption, when only
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42 578 one record or recall day is available per subject, leads to overestimation of intake. In dietary
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44 579 surveys the degree of such overestimation is often an unknown quantity in the absence of
45
46 580 accurate information on true variability of a given food. Similarly, the effect of a non-random
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48 581 selection of survey participants might be difficult to predict in magnitude and direction. The
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50 582 effects of an uneven sampling over days of the week can be, for example, particularly
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52 583 relevant for the consumption of alcoholic drinks and not for bread, whereas the reported
53
54 584 consumption of soft drinks and certain types of fruits and vegetables can be significantly
55
56 585 affected if the survey design does not capture consumption patterns evenly across the four
57
58 586 seasons. With these examples it is intended to stresses the fact that uncertainty is likely to be
59
60 587 specific (i) to food or food groups, (ii) to the characteristic of populations in terms of dietary
588 habits, and possibly (iii) to subgroups within a population.

589 Existing guidance documents on uncertainty refer to the uncertainty in exposure assessment
590 (EFSA, 2006 and WHO, 2008) but not to uncertainty of data inputs. Because the uncertainty

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3 591 of a database can be evaluated only by considering the objective of the assessment, it is
4
5 592 therefore deemed extremely difficult to quantitatively anticipate an overall level of
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7 593 uncertainty for each dietary survey. The description of the surveys given in the present paper
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9 594 will enable the risk assessor to perform a qualitative uncertainty analysis and, to a limited
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11 595 extend, also a quantitative analysis when using the Comprehensive Database to assess
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13 596 exposure. The qualitative evaluation of uncertainty represents a valuable option by
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15 597 considering, if possible, the effect of a given parameter on the estimation of the consumption
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17 598 of specific food or food groups. This qualitative approach is in accordance with an EFSA
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19 599 guidance related to uncertainty in dietary exposure assessment (EFSA, 2006). Nevertheless it
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21 600 is recognized that in some circumstances qualitative evaluations can be complemented by
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23 601 methods for quantitative uncertainty analysis of inputs to models for exposure, such as
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25 602 intervals and probability bounds, fuzzy methods, probabilistic methods and sensitivity
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27 603 analysis, as recently summarised in a WHO (2008) monograph. These methods, requiring
28
29 604 careful consideration, could be used to evaluate the uncertainty related to specific
30
31 605 methodological parameters characterising the Comprehensive Database.

606

607 **Conclusions**

608 The food consumption data gathered at EFSA to be part of the Comprehensive European food
609 consumption database offers a unique resource for risk assessment activities routinely carried
610 out by EFSA. However, dietary data collected at national level cannot be directly compared
611 due to the different study designs, methodologies and protocols adopted in the different MSs.
612 In particular, differences existed with respect to a number of parameters affecting the level of
613 detail and the accuracy of the collected data, such as: the dietary assessment method used, the
614 description and codification of the food consumed, the number of days per subject, the
615 sampling design, the quantification of portion sizes, the software applications used and non-
616 dietary information collected. Furthermore, in three countries, data provided to EFSA came
617 from national dietary surveys carried out more than ten years ago.

618

619 The collection of accurate food consumption data at a European level following a harmonized
620 methodology and protocols is a primary long term objective for EFSA, and it has been
621 recognised as a top priority for collaboration with the EU MSs.

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Table 1 – Basic information on the dietary surveys included in the “Comprehensive European Food Consumption Database”

Country	Name of the dietary survey (Acronym)	Institution providing the data	Reference publication
Austria	Austrian Study On Nutritional Status (ASNS)	Institute of Nutritional Sciences - University of Vienna	Elmadfa <i>et al.</i> , 2009.
Belgium	Diet National 2004	Scientific Institute of Public Health	De Vriese <i>et al.</i> , 2005.
Bulgaria I	National Survey Of Food Intake And Nutritional Status	National Centre of Public Health Protection	Petrova & Angelova, 2006.
Bulgaria II	NUTRICHILD	National Centre of Public Health Protection	Petrova <i>et al.</i> , 2009.
Czech Republic	SISP04	National Institute of Public Health	Ruprich <i>et al.</i> , 2006..
Denmark	Danish National Survey of Dietary Habits and Physical Activity	National Food Institute, Technical University of Denmark	Lyhne <i>et al.</i> 2005.
Estonia	NDS 1997	National Institute for Health Development	Pomerleau <i>et al.</i> , 1999.
Finland	FINDIET 2007	National Public Health Institute - Nutrition Unit [§]	Paturi <i>et al.</i> , 2008. Reinivuo <i>et al.</i> , 2010. Pietinen <i>et al.</i> , 2010.
France	INCA2	French Food Safety Authority (AFSSA) ^{§§}	AFSSA,2009, Lioret <i>et al.</i> 2010. Dubuisson <i>et al.</i> 2010.
Germany	German National Nutrition Survey II (NVS II)	Max Rubner-Institut (Bundesforschungsinstitut für Ernährung und Lebensmittel)	MRI, 2008; Krems <i>et al.</i> , 2006.
Hungary	National Repr Surv	Hungarian Food Safety Office	Rodler <i>et al.</i> , 2005.
Ireland	NSIFCS	Food Safety Authority of Ireland	Kiely <i>et al.</i> , 2001. Harrington <i>et al.</i> , 2001.
Italy	INRAN-SCAI 2005–06	National Research Institute for Food and Nutrition (INRAN)	Leclercq <i>et al.</i> , 2009.
Latvia	EFSA_TEST	Food Centre Food and Veterinary Service of Latvia	Šantare <i>et al.</i> , 2008.
Netherlands	VCP2003	National institute of public health and the environment, TNO Quality of Life	Ocké <i>et al.</i> , 2005.
Poland	IZZ-FAO-2000	National Food and Nutrition Institute	Sekula <i>et al.</i> , 2004. Szponar <i>et al.</i> , 2001 and 2003.
Slovakia	SK MON 2008	Food Research Institute	Not available.
Slovenia	CRP-2008	National Institute of Public Health of Slovenia	Gabrijelčič Blenkuš <i>et al.</i> 2009.
Spain I	AESAN -FIAB	Universidad Complutense de Madrid	Requejo <i>et al.</i> , 2002.
Spain II	AESAN	Universidad Complutense de Madrid	Ortega <i>et al.</i> , 2010.
Sweden	RIKSMATEN 1997-98	Swedish National Food Administration	Becker and Pearson, 2002.
United Kingdom	National Diet & Nutrition Survey (NDNS)	Food Standards Agency (FSA)	.Henderson <i>et al.</i> 2002.

[§] currently National Institute for Health and Welfare, ^{§§} currently French agency for food, environmental and occupational health safety

Table 2 – Information on the dietary method used within the dietary surveys

Country	Method	Number of replicates	Days between non consecutive replicates* Mean (5 th – 95 th percentile)	Additional food frequency (FFQ) or propensity (FPQ) questionnaire^
Austria	24 h dietary recall	1	Not applicable	No
Belgium	24 h dietary recall	2	23 (12 – 42)	Yes
Bulgaria I	24 h dietary recall	1	Not applicable	Yes
Bulgaria II	24 h dietary recall	2	3 (2 – 5)	Yes
Czech Republic	24 h dietary recall	2	79 (43 – 141)	Yes
Denmark	Food record	7	Consecutive days	No
Estonia	24 h dietary recall	1	Not applicable	Yes
Finland	48 h dietary recall	1	Not applicable	Yes
France	Food record	7	Consecutive days	No
Germany	24 h dietary recall	2	16 (7 – 39)	Diet history
Hungary	Food record	3	2 consecutive days and 1 non consecutive day [§]	No
Ireland	Food record	7	Consecutive days	Yes, only focused on meat
Italy	Food record	3	Consecutive days	No
Latvia	24 h dietary recall	2	68 (27 – 106)	Yes
Netherlands	24 h dietary recall	2	11 (8 – 17)	Yes
Poland	24 h dietary recall	1	Not applicable	No
Slovakia	24 h dietary recall	1	Not applicable	No
Slovenia	24 h dietary recall	1	Not applicable	Yes
Spain I	Food record	3	Consecutive days	Yes
Spain II	24 h dietary recall	2	3 (1 – 16)	Yes
Sweden	Food record	7	Consecutive days	No
United Kingdom	Food record	7	Consecutive days	Yes

* Information extracted from the "Comprehensive European Food Consumption Database".

^ Information collected by means of FFQ or FPQ was not transmitted to EFSA

§ 2 consecutive weekdays and one weekend day

Table 3 – Administration of the interview

Country	Number of meetings	Method of administration	Place of interview	Interviewer with nutritional background
Austria	0	Post	Not applicable	Not applicable
Belgium	2	Face to face	Home	Yes
Bulgaria I	1	Face to face	Home	Yes
Bulgaria II	2	Face to face	Medical centre	Yes
Czech Republic	2	Face to face	Home	No
Denmark	1	Face to face	Home	No
Estonia	1	Face to face	Home	No
Finland	1	Face to face	Study centre	Yes
France	2	Face to face	Home	Yes
Germany	1 [§]	Telephone	Not applicable	No
Hungary	1	Face to face	Home	Yes
Ireland	4	Face to face	Home or work place	Yes
Italy	3	Face to face	Home	No
Latvia	2	Face to face	Home	No
Netherlands	0	Telephone	Not applicable	Yes
Poland	1	Face to face	Home	No
Slovakia	1	Face to face	Medical centre	Yes
Slovenia	1	Face to face	Home	Yes
Spain I	2	Face to face	Universities, health centre, pharmacies	Yes
Spain II	3	Face to face	Home, universities, health centre, pharmacies	Yes
Sweden	1	Face to face	Home	No
United Kingdom	4	Face to face	Home	No

[§]The meeting was not used for 24h dietary recall administration

Table 4 – Survey period, sampling design and response rate

Country	Survey period	Sampling method and sampling frame	Sample unit	Response rate (%)
Austria	May '05 - February '06	Random from telephone book, Job centres, gynaecologists, university	Individual	48
Belgium	February '04 - February '05	Random from the national population register	Individual	41
Bulgaria I	March '04 - August '04	Random from the national population register	Individual	85
Bulgaria II	April '07 - August '07	Random from the register of general practitioner's practices	Individual	78
Czech Republic	November '03 - November '04	Random from the address register	Household	54
Denmark	June '00 - December '02	Random from the national population register	Individual	53
Estonia	July 1997 - August 1997	Random from the national population register	Individual	67
Finland	January '07 - March '07	Random from the national population register	Individual	62
France	December '05 - April '07	Random from the general population census	Household	60
Germany	November '05 - January '07	Random from the national population register	Individual	42 [§]
Hungary	October '03 - December '03	Random from the general population census	Individual	27
Ireland	October 1997 - October 1999	Random from the electoral list	Individual	63
Italy	October '05 - December '06	Random from the telephone book	Household	33
Latvia	June '08 - November '08	Random from a consumer panel	Individual	56
Netherlands	October '03 - December '03	Random from a consumer panel	Individual	42
Poland	September '00 - November '00	Random from the sample of the household budget survey	Household	96
Slovakia	January '08 - December '08	Random among employees of confectionary and bakery manufactures and canteen	Individual	96
Slovenia	September '07 - April '08	Random from the national population register	Individual	52
Spain I	January 1999 - November '01	Random from the university, health centre, pharmacies	Individual	71
Spain II	January '09 - September '09	Random from the university, health centre, pharmacies	Individual	28
Sweden	January 1997 - January 1998	Random from the national population register	Household	60
United Kingdom	July '00 - June '01	Random from the postcode address file	Household	47

[§] For the total study

Table 5 – Number of subjects according to age group and gender

Country	From 0* to 1# years old [§]		From 1* to 3# years old		From 3* to 6# years old [§]		From 6* to 10# years old [§]		From 10* to 18# years old		From 18* to 64# years old		From 64* to 74# years old		Older than 74* years	
	Total	% Males	Total	% Males	Total	% Males	Total	% Males	Total	% Males	Total	% Mal	Total	% Male	Total	% Males
Austria	2123	37	.	.	.	.
Belgium	611	48	1356	50	502	49	776	52
Bulgaria I	162	50	691	48	130	55	221	46
Bulgaria II	861	50	428	51	434	51	.	.	.	.	.	.	.	.	.	.
Czech Republic	85	51	1666	48	.	.	.	.
Denmark	159	52	331	53	479	48	2821	46	283	50	45	51
Estonia	1858	45	8	13	.	.
Finland	1575	46	463	49	.	.
France	163	49	319	50	973	46	2276	41	240	42	108	46
Germany	1011	49	10419	44	190	47	588	45
Hungary	1074	41	188	39	98	35
Ireland	952	50	6	50	.	.
Italy	16	56	36	56	67	49	126	48	247	44	2277	46	302	46	252	31
Latvia	190	50	496	50	1382	50	2	0	.	.
Netherlands	750	47	.	.	.	.
Poland	.	.	79	59	137	48	272	51	666	50	2527	45	316	40	137	37
Slovakia^{&}	1	100	2756	50	2	50	.	.
Slovenia^{&}	400	49	7	57	.	.
Spain I	86	55	982	48	.	.	.	.
Spain II	418	47	.	.	.	.
Sweden	7	57	1081	48	112	54	10	50
United Kingdom	1724	44	.	.	.	.

[§] Information extracted from the Comprehensive European Food Consumption Database;

*included in the age range;

excluded from the age range

& subjects missing because no gender or age information available

Table 6 – Stratification of the sample and gender distribution

Country	Age range* (years)	Number of subjects*	Sample stratification variables				Weighting factors to normalise the sample	Gender [§]	
			Gender	Age groups	Geographic al areas	Others		Females (%)	Males (%)
Austria	19 - 64	2123	No	No	No	Employment status	Yes	63	37
Belgium	14 - 105	3245	Yes	Yes	Yes		Yes	50	50
Bulgaria I	16 - 95	1204	Yes	Yes	Yes	Urban vs. rural residence	No	51	49
Bulgaria II	0.1 - 5	1723	Yes	Yes	Yes	Urban vs. rural residence	No	49	51
Czech Republic	16 - 64	1751	Yes	Yes	Yes	Urban vs. rural residence	No	52	48
Denmark	4 - 75	4118	Yes	Yes	No		No	53	47
Estonia	19 - 65	1866	Yes	Yes	No	Urban vs. rural residence	No	55	45
Finland	25 - 74	2038	Yes	Yes	Yes		No	53	47
France	3 - 79	4079	Yes	Yes	Yes	Size of urban area	Yes	56	44
Germany	14 - 80	13926	Yes	Yes	Yes		Yes	55	45
Hungary	18 - 96	1360	Yes	Yes	No		No	60	40
Ireland	20 - 65	958	Yes	Yes	Yes	Education level Urban vs. rural residence, Social status, Employment status	No	50	50
Italy	0.1 - 98	3323	No	No	Yes	Household structure	No	45	55
Latvia	7 - 66	2070	Yes	No	Yes		No	50	50
Netherlands	19 - 30	750	Yes	Yes	Yes	Education level	Yes	53	47
Poland	1 - 96	4134	Yes	Yes	No		No	54	46
Slovakia	17 - 68	2761	Yes	Yes	Yes		No	50	50
Slovenia	18 - 65	410	Yes	Yes	No		No	51	49
Spain I	17 - 60	1068	Yes	Yes	Yes		No	51	49
Spain II	18 - 60	418	Yes	Yes	Yes	Urban vs. rural residence	No	53	47
Sweden	17 - 79	1210	Yes	Yes	Yes		No	52	48
United Kingdom	19 - 64	1724	No	No	Yes	Population density and socio-economic status	Yes	56	44

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* Information extracted from the "Comprehensive European Food Consumption Database".

§ Weighting factors to normalise the sample not used to calculate these percentages.

Table 7 – Percentage of record or recall days according to the day of the week and season

Country	% of record or recall days according to the day of the week*			% of record or recall days according to the season*				
	Week days	Week end days	Unclassified	Spring 21.03-21.06	Summer 22.06-22.09	Fall 23.09-22.12	Winter 23.12-20.03	Unclassified
Austria	49	14	37	21	26	25	27	1
Belgium	76	24	0	26	25	27	23	0
Bulgaria I	92	8	0	100	0	0	0	0
Bulgaria II	54	46	0	60	40	0	0	0
Czech Republic	74	26	0	34	23	12	31	0
Denmark	72	28	0	25	26	39	10	0
Estonia	73	27	0	0	100	0	0	0
Finland	67	33	0	9	0	0	91	0
France	71	29	0	20	17	24	39	0
Germany	75	25	0	20	27	40	13	0
Hungary	67 [§]	33 [§]	0	0	0	0	100	0
Ireland	71	29	0	26	28	27	18	0
Italy	78	22	0	26	24	25	25	0
Latvia	72	28	0	0	49	50	0	0
Netherlands	71	29	0	0	0	100	0	0
Poland	77	23	0	0	31	69	0	0
Slovakia	78	5	17	23	19	29	7	23
Slovenia	76	24	0	11	14	56	19	0
Spain I	43	30	27	28	7	25	22	17
Spain II	73	26	0	75	19	0	6	0
Sweden	71	29	0	0	0	0	0	100
United Kingdom	71	29	0	31	24	22	23	0

* Information extracted from the "Comprehensive European Food Consumption Database".

§ Percentages reported by the national data provider.

Table 8 – Exclusion criteria

Country	Institutionalised subjects excluded	Pregnant and breastfeeding women excluded	Number of breastfeeding women*	Number of pregnant women*	Over sampled population groups
Austria	Yes	No	Not available	Not available	
Belgium	Yes	No	7	9	Subjects from 15 to 18 and older than 75 years
Bulgaria I	Yes	Yes	Not applicable	Not applicable	No
Bulgaria II	Yes	NA	Not applicable	Not applicable	No
Czech Republic	Yes	No	Not available	Not available	No
Denmark	Yes	No	59	50	No
Estonia	No	Yes	Not applicable	Not applicable	No
Finland	No	No	Not available	22	No
France	Yes	No	20	27	Children
Germany	Yes	No	36	52	No
Hungary	No	No	Not available	Not available	No
Ireland	Yes	Yes	Not applicable	3	No
Italy	Yes	No	10	19	No
Latvia	Yes	Yes	Not applicable	Not applicable	No
Netherlands	Yes	Yes	Not applicable	Not applicable	Males with low education level group
Poland	Yes	No	26	23	No
Slovakia	No	No	Not available	Not available	No
Slovenia	Yes	Yes	Not applicable	Not applicable	No
Spain I	Yes	No	0	3	No
Spain II	Yes	No	Not available	0	No
Sweden	Yes	No	16	11	No
United Kingdom	Yes	Yes	Not applicable	Not applicable	No

* Information extracted from the "Comprehensive European Food Consumption Database".

Table 9 – Portion sizes estimation

Country	Portion sizes estimated by				
	Weighing	Picture book	Household measures	Known packaging size	Ruler
Austria	No	No	Yes	No	No
Belgium	No	Yes, based on EPIC-soft	Yes	No	No
Bulgaria I	No	Yes, validated	Yes	Yes	No
Bulgaria II	No	Yes, validated	Yes	Yes	No
Czech Republic	No	Yes, tested in a convenient sample	Yes	No	Yes
Denmark	No	Yes, validated	Yes	No	No
Estonia	No	Yes, not validated	Yes	No	No
Finland	No	Yes, validated (Ovaskainen et al., 2008)	Yes	Yes	Yes
France	No	Yes, validated (Le Moullec et al., 1996)	Yes	Yes	No
Germany	No	Yes, based on EPIC-soft	Yes	No	No
Hungary	No	No	No	No	No
Ireland	Yes	Yes, not validated	Yes	Yes	No
Italy	No	Yes, based on EPIC-soft	Yes	Yes	No
Latvia	No	Yes, not validated	Yes	No	No
Netherlands	No	Yes, based on EPIC-soft	Yes	No	Yes
Poland	No	Yes, tested in a convenient sample	Yes	Yes	No
Slovakia	No	No	No	No	No
Slovenia	No	Yes, not validated	Yes	No	No
Spain I	Yes	No	Yes	Yes	No
Spain II	No	No	Yes	Yes	No
Sweden	No	Yes, validated (Becker et al., 1998)	Yes	No	No
United Kingdom	Yes	No	<u>Yes</u>	Yes	Yes

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Table 10 – Dietary software and database used

Country	Dietary software	Database used before providing the data to EFSA:			
		Portion size	Standard recipe	Yield factors	Food composition
Austria	MS Access 2003 based on German nutrient data base BLS II.3	Yes	Yes	Yes, from raw to cooked foods	Yes
Belgium	EPIC SOFT Program	Yes	Yes	Yes, from raw to cooked foods*	No
Bulgaria I	NUTRICALC	Yes	Yes	Yes, from cooked to raw foods*	Yes
Bulgaria II	NUTRICALC	Yes	Yes	Yes, from cooked to raw foods*	Yes
Czech Republic	Paradox for Windows	Yes	Yes	Yes, from cooked to raw foods*	Yes
Denmark	GIES	Yes	Yes	Yes, from cooked to raw foods*	Yes
Estonia	Finnish micro nutritica nutritional analysis program	Yes	Yes	Yes, from cooked to raw foods* [§]	Yes
Finland	Finessi	Yes	Yes	Yes, from cooked to raw foods* [§]	Yes
France	MS Access	Yes	Yes	No	Yes
Germany	EPIC SOFT Program	Yes	Yes	Yes, from raw to cooked foods*	Yes
Hungary	NutriCompEtrend	Yes	Yes	Yes, from cooked to raw foods	Yes
Ireland	WISP-DES	Yes	Yes	Yes, from cooked to raw foods*	Yes
Italy	INRAN-DIARIO 3.1	Yes	Yes	Yes, from cooked to raw foods* [§]	Yes
Latvia	PGAIS	No	Yes	Yes, from raw to cooked foods	Yes
Netherlands	EPIC SOFT Program	Yes	Yes	Yes, from cooked to raw foods*	No
Poland	Dieta FAO	Yes	Yes	Yes, from cooked to raw foods*	Yes
Slovakia	Alimenta 4.3	No	Yes	Yes, from cooked to raw foods [§]	Yes
Slovenia	Blaise 4.7	No	Yes	Yes, from raw to cooked foods [§]	Yes
Spain I	DIAL software	Yes	Yes	No	Yes
Spain II	DIAL software	Yes	Yes	No	Yes
Sweden [^]	MATs version 4.03	No	No	No	Yes
United Kingdom	Intake 2	No	No	No	Yes

* Yield factors included in the recipe database.

[§] only for some foods

[^] Sweden did not disaggregate their recipes

Table 11 – Additional information on food coding

Country	Specific information collected on:		
	Brand* (% of food records)	Household processing* (% of food records)	Packaging* (% of food records)
Austria	3	1	0
Belgium	19	22	24
Bulgaria I	0	25	0
Bulgaria II	0	57	0
Czech Republic	0	0	0
Denmark	0	32	0
Estonia	0	0	0
Finland	0	75	0
France	29	18	0
Germany	13	14	5
Hungary	0	40	0
Ireland ^o	0	0	0
Italy	27	0	0
Latvia	12	26	0
Netherlands	21	20	0
Poland	0	45	0
Slovakia	0	0	0
Slovenia	1	1	0
Spain I	0	41	0
Spain II	4	18	1
Sweden	0	0	0
United Kingdom	0	0	0

* Information extracted from the "Comprehensive European Food Consumption Database".

Table 12 – Method of identification of under-reporters, cut-off values and percentage of under-reporters

Country	Method	Cut off value	Under-reporters excluded	Under-reporters (%)
Austria	Individual level	0.65 (Goldberg et al., 1991) for adults	Yes	12%
Belgium	Individual level	0.965 (Black, 2000a) for adults	No	NR [^]
Bulgaria I	Individual level	0.9 (Goldberg et al., 1991) for adults	No	NR [^]
Bulgaria II	None	-	-	-
Czech Republic	Individual level	0.96 (Black, 2000a) for adults	No	12.8
Denmark	Individual level	1.1 (Goldberg et al., 1991) for adults	No	NR [^]
Estonia	None	-	-	-
Finland	Individual level	1 (Goldberg et al., 1991) for adults	No	37.3
France	Individual level	1.01-1.27 (Black, 2000b)* for adults	No	26.9
Germany	Individual level	-	No	-
Hungary	Individual level	1.1 (Goldberg et al., 1991) for adults	Yes	11.7
Ireland	Individual level	1.1 (Goldberg et al., 1991) for adults	No	18.0
Italy	Population level	1.55 (Goldberg et al., 1991) for adults	No	-
Latvia	None	-	-	-
Netherlands	Population level	1.53 (Goldberg et al., 1991) for adults	No	-
Poland	None	-	-	-
Slovakia	None	-	-	-
Slovenia	None	-	-	-
Spain I	None	-	-	-
Spain II	None	-	-	-
Sweden	Individual level	1.1 (Goldberg et al., 1991) for adults	No	24.7
United Kingdom	None	-	-	-

* Cut-off values defined by Black (2000a) vary according to age and sex, taking into account the specific intra and inter individual variability of Physical Activity Levels (PAL)

[^] NR: Not reported;

Table 13 – Number of subjects according to the different self-reported eating patterns.

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Country	Normal diet*	Vegetarian diet*	Diet related to health condition*	Slimming diet*	Vegetarian and slimming diet*	Unspecified*
Austria	2123					0
Belgium	2642	1	331			271
Bulgaria I	863	1	70	116		154
Bulgaria II						1723
Czech Republic	1572	9	86	66		18
Denmark						4118
Estonia						1866
Finland	1377	29	584	26	22	0
France	3167	19	314	181	1	397
Germany	10839	287	2106	141	1	552**
Hungary	1360					0
Ireland	764	9	77	70		38
Italy	3124		80	76		43
Latvia						2070
Netherlands	691	12	8	24		15
Poland						4134
Slovakia	83					2678
Slovenia	410					0
Spain I	1051		10	1		6
Spain II	398		4	16		0
Sweden	1188	18	2			2
United Kingdom	1333	66		314	11	0

* Information extracted from the "Comprehensive European Food Consumption Database"

** In Germany information on further special diets, like halal, was also collected but here these are considered as unspecified.

Table 14 – Non dietary information

Country	Body weight and height	Information available on		
		Physical activity* [§] (% of subjects)	Education level* (% of subjects)	Ethnicity* (% of subjects)
Austria	Estimated	100	100	14
Belgium	Estimated	100	100	0
Bulgaria I	Measured	0	100	100
Bulgaria II	Measured	0	100	100
Czech Republic	Estimated	100	100	0
Denmark	Estimated	0	0	0
Estonia	Estimated	100	100	100
Finland	Measured	0	99	0
France	Measured	74 [^]	100	0
Germany	Measured	0	100	0
Hungary	Estimated	0	0	0
Ireland	Measured	100	100	100
Italy	Estimated	0 ^{**}	83	0
Latvia	Estimated	0	100	0
Netherlands	Estimated	100	100	100
Poland	Measured	0	100	0
Slovakia	Estimated	3	3	6
Slovenia	Estimated	100	99	0
Spain I	Estimated	80	28	0
Spain II	Measured	100	99	0
Sweden	Estimated	0	100	0
United Kingdom	Measured	96	100	100

* Information extracted from the "Comprehensive European Food Consumption Database"

** Data not transmitted to EFSA

[^] Questionnaire administered only to subjects between 15 and 79 years old

[§] Information on physical activity collected by means of questionnaires within all surveys.

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