

## How does the quality of surveys for nutrient intake adequacy assessment compare across Europe? A scoring system to rate the quality of data in such surveys

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Research was conducted within the EUROpean micronutrient RECommendations Aligned (EURRECA) Network of Excellence, to find the best practice in assessing nutrient intakes. Objectives include: to search for and use data on individual nutrient intake adequacy (NIA) assessment collected in twenty-eight European countries and the four European Free Trade Association countries; to design and test innovative tools for data quality analysis. The information was obtained using the method described by Blanquer *et al.* in the present issue. The best-practice criteria were devised to select the most appropriate survey in each country. Then a survey quality scoring system was developed in consultation with experts and tested on these surveys. Weights were allocated according to a variable priority order agreed by consultation. The thirty-two countries yielded twenty-four national surveys (eight countries excluded). Data collection techniques: eleven countries/surveys used personal interviews only; six used combinations of techniques. Dietary assessment methods: two used repeated 24 h recalls only; eleven used combinations. NIA assessment methods: two used probabilistic approach and SD/Z-scores only; eleven used comparison with estimated average requirements/RDA only. Countries were ranked according to the survey quality scoring, but careful interpretation is needed because of incomplete data from some surveys; bearing this in mind, the information quality is high in 37.5 % countries, medium in 50.0 % and low in 12.5 %. Although there is room for improvement and caution should be taken when drawing conclusions and recommendations from these results, the lessons learned and tools developed at this first attempt form the basis for future work within the EURRECA framework for aligning European micronutrient recommendations.

### Nutrient intake adequacy: Assessment methods: Best practice: European survey quality

Several studies have recently compared or are presently in the process of comparing dietary intake at the European level (Data Food NETworking (DAFNE)<sup>(1,2)</sup>, European Food Consumption Survey Method (EFCOSUM)<sup>(3)</sup>, European Food Consumption Validation (EFCOVAL)<sup>(4)</sup>, European Prospective Investigation into Cancer and Nutrition (EPIC)<sup>(5)</sup>, Europe Alimentation (EPIC)<sup>(6)</sup>, European Nutrition and Health

Report 2004 and 2009 ((EURALIM) ENHR I and II)<sup>(7,8)</sup>, each having different objectives and focusing on different aspects of the dietary information available. For instance, the EURALIM sought to improve ways of comparing European data on health-related risk factors from projects carried out in six European countries (in subjects aged 40–59 years as common age in all projects)<sup>(9)</sup>.

**Abbreviations:** EFCOSUM, European Food Consumption Survey Method; ENHR I and II, European Nutrition and Health Report 2004 and 2009; EURRECA, EUROpean micronutrient RECommendations Aligned; NIA, Nutrient Intake Adequacy.

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The EFCOSUM project aimed at finding a new method for collecting comparable food intake data in Europe, considering both pre- and post-harmonisation, i.e. collecting the raw data to later compare it or otherwise making existing data comparable<sup>(3)</sup>. Nowadays, food availability data from household budget surveys (e.g. the DAFNE project) are already comparable across countries<sup>(1,2)</sup>. In addition, the methods developed by the EPIC study<sup>(5)</sup> allowed the collection of comparable individual intake data, but its focus was only on cancer and adults. Therefore, it is necessary that European countries harmonise intake data at the individual level that can be compared within a wider context. In this direction, the European Food Safety Authority (EFSA) has developed the Concise European Food Consumption database<sup>(10)</sup> with the intention to provide a valuable first screening tool (to EFSA, its scientific panels and potentially to other scientists in Member States) to help carry out preliminary exposure assessments. EFSA seeks to use this concise database as the starting point of a more comprehensive database, with information on more refined food categories and specific population groups. In order to meet the aim of aligning micronutrient recommendations across Europe as part of the EUROpean micronutrient RECommendations Aligned (EURRECA) Network of Excellence, some EURRECA partners have already produced one study, whose objective was to understand the differences and similarities of the present micronutrient recommendations in Europe<sup>(11)</sup> and another one to produce an evidence-based toolkit to support nutrition and food policy<sup>(12)</sup>. The objective of the present paper is to give an overall picture of the present European situation with regard to the methods used for evaluating nutrient intake. This is achieved by comparing the information available on nutrient intake adequacy (NIA) assessment and dietary collection methods in national nutrition/health surveys/studies on healthy adults of twenty-eight European countries and the four European Free Trade Association countries (Iceland, Liechtenstein, Norway, Switzerland). This comparison will help identify the information gaps as a starting point for future European micronutrient recommendations on the best practice regarding intake methods. For this purpose, identified information as described by Blanquer *et al.*<sup>(13)</sup> is analysed and the response to their questionnaire for data collection used as a databank for obtaining quantitative results. A best-practice guide and a survey/study quality scoring system have also been developed for qualitative analyses and proposed as tools to be used by future EURRECA research activities.

### Methodology

The step-wise methodological process followed to obtain the information used in the present paper has been thoroughly described by Blanquer *et al.*<sup>(13)</sup>, who presented an overview of the methodological framework in Fig. 1. A brief summary of Blanquer's methodological framework is described herein.

#### *The 'Country information found' table and the pan-European questionnaire*

A literature search and review was carried out. The sources of information were PubMed MEDLINE, EURRECA partners

and selected stakeholders, and websites of country-specific ministries of agriculture or health. All the results obtained were screened using the exclusion criteria<sup>(13)</sup> on two consecutive occasions, until final results were obtained and entered into an Excel databank: the 'Country information found' table.

Parallel to the literature reviews, a questionnaire was designed and a country-specific list of experts compiled; the preliminary version of the questionnaire was circulated for its review among EURRECA's research activity 1.1 members, all EURRECA members and experts of the ENHR I<sup>(7)</sup>. The final version of the questionnaire incorporated the feedback from all three groups and, together with a summary table containing country-specific information found, it was sent to an average of two to five food consumption experts per country. A total of three reminder follow-ups were sent to non-respondents.

The present paper is based on data extracted from the questionnaire completed by country experts, whose response has been analysed for obtaining quantitative results. The rest of the information found by Blanquer *et al.*<sup>(13)</sup> was used to complete relevant information gaps of the questionnaires when necessary.

#### *How to select 'the best' dietary survey/study per country: the best-practice guide for future activities within EURRECA*

The concept of 'toolkit' developed within the EURRECA framework<sup>(12)</sup>, and in the context of the present paper, denotes a step-by-step guidance diagram summarising the process followed to select the 'best' or the 'highest quality' dietary survey/study in each country considered; this toolkit was developed to facilitate the best practice for future EURRECA's research activities. A set of guidelines was formulated to increase comparability of the data obtained (Fig. 1), some of them in accordance with EFCOSUM's recommendations<sup>(3)</sup>:

1. standardise data presentation through a same questionnaire sent to experts for completion;
2. only one survey/study per country can be considered; thus, in the present paper, the words 'survey/study' and 'country' will have the same meaning when it comes to results;
3. surveys/studies of cross-sectional nature;
4. the most representative survey/study of the country's population (to maximise external validity) – ideally at the national level (otherwise regional or, lastly, local levels);
5. the most recent surveys/studies (only include those conducted after 1990);
6. surveys/studies with the best methodology in accordance to their objectives (to maximise internal validity)

The type of survey/study was also an important element, ideally selecting those focused on nutrition firstly, health surveys with nutritional data secondly, or household budget surveys with nutritional data in third place. Combinations of regional or local levels with health or household budget surveys/studies were excluded (Fig. 1).

Finally, only surveys/studies on the adult population (defined as 18–65 years) were considered, since a first

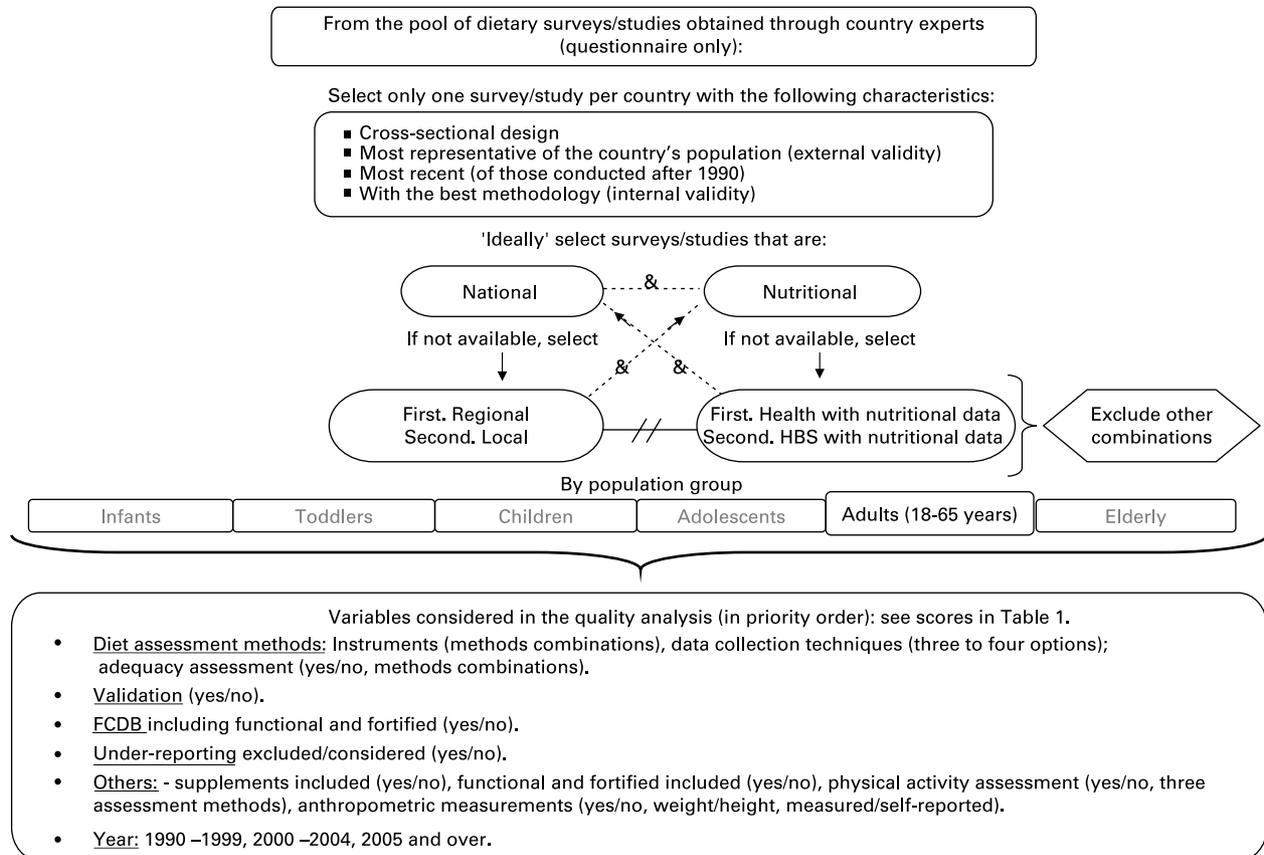


Fig. 1. The best-practice guide: how to select 'the best' dietary survey/study per country. HBS, Household Budget Survey, FCDB, Food Composition Database.

screening of the obtained information revealed that most countries (twenty-four out of thirty-two) had carried out surveys/studies on this population group and this age range was the widest, covering the majority of the population.

Once the best dietary surveys/studies per country were selected, they underwent a quality scoring test, whose results allowed us to rank the countries by the level of quality their surveys/studies obtained: high; medium; low. Fig. 1 shows the six variables and their subcategories that were considered for analysis in the scoring test, all extracted from the questionnaire's relevant questions. Pertinent variables and their scores in the scoring system were derived following consultation with EURRECA and external experts (Table 1).

It is worth mentioning that readers should be aware about the way these surveys/studies were referenced, since the references included might not respond to the 'official/definite' references. For example, in five cases, the respondent wrote: the survey/study 'has not been published yet' (Germany) or 'is in press' (Bulgaria) or 'its publication is in progress' (Austria) or 'no publication available as yet' (Lithuania). Such non-definite references were included in Table 2 as 'in the press' publications with one author only (facilitated by the questionnaire respondent), but they were excluded from the final reference section. The survey/study references of the final reference list have been written as provided by the respondent which, in some cases, included a web link.

### The 'quality scoring system'

For the qualitative analysis, a 'quality scoring system' was developed using the answers to fifteen questions of the questionnaire completed by the country experts. Answers to these fifteen questions contained the information for creating the six quality variables and had been previously chosen upon consultation with EURRECA experts. Table 1 shows the variables or factors included, displayed into levels and sublevels, as well as their weights and scores/points distribution. Weights were allocated according to a variable priority order also agreed upon in consultation with EURRECA and external experts. Each answer regarding a survey/study characteristic was given a score, all scores were summed up and total scores (150 being the minimum and 1000 the maximum possible total values) compared across countries. Total scores (of three digits) were divided by 100, rounded up and truncated to one decimal for a clearer presentation. Unanswered questions were initially given the minimum score value possible – which was zero in many cases; however, at a second stage of the analysis (see 'Qualitative results') and in order to ameliorate misclassification and close the gaps between countries with complete and those with incomplete questionnaires, unanswered questions were given the maximum score value. This helped to simulate the maximum score that would have been reached by the country if all questions had been answered, which allowed the opportunity of a more realistic comparison subsequently carried out.

**Table 1.** Quality scoring system: factors (F; with levels (L) and sublevels (S)), their weights and scores, by country survey/study

Factors displaying levels and sublevels	Weights 100 % divided by six factors	Scores (points) 100 % = 1000 points	Country 1, 2, ..., X
F1. Scope and type of surveys	20 %	200 points/by five levels = 40	
L5. National and nutritional (the highest)		40 × 5 = 200 (max)	
L4. Regional and nutritional		40 × 4 = 160	
L3. Local and nutritional		40 × 3 = 120	
L2. National and health with nut. info.		40 × 2 = 80	
L1. National and HBS with nut. info. (the lowest)		40 × 1 = 40 (min)	
F2. Dietary assessment methods	25%/5 levels = 5 %	250/five sublevels = 50	
L1. Instruments	5 %	50/four sublevels = 12.5	
S4. R24 hr Rcl		10 × 4 = 40 (max)	
S3. S24 hr Rcl		10 × 3 = 37.5	
S2. EFR or WFR		10 × 2 = 25	
S1. FFQ		10 × 1 = 12.5 (min)	
S2/3/4. Recall and record combinations		10 × 2/3/4 (choose the highest used)	
S1/4. FFQ and R24 hr Rcl		10 × 1/4 (choose the highest used)	
S1/3. FFQ and S24 hr Rcl		10 × 1/3 (choose the highest used)	
S1/2/3/4. FFQ and recall and record combinations		10 × 1/2/3/4 (choose the highest used)	
L2. Data collection techniques	5 %	50/3 sublevels = 16.66	
S3. Personal interview		16.66 × 3 = 50 (max)	
S2. Telephone interview		16.66 × 2 = 33.20	
S1. Self-administered questionnaire		16.66 × 1 = 16.66 (min)	
Combinations (choose the highest) S1/2/3		16.66 × 1/2/3	
L3. Nutrient Intake Adequacy (NIA) assessment	5 %	50/four sublevels = 12.5	
Yes – methods			
S4. PA, or PA and biomarkers or PA and others		12.5 × 4 = 50 (max)	
S3. Biomarkers and others		12.5 × 3 = 37.5	
S2. EAR/RDA and others		12.5 × 2 = 25	
S1. Others		12.5 × 1 = 12.5	
S0. No		8.33 × 0 = 0 (min)	
L4. Could NIA be assessed?	5 %	50	
S1. Yes		50 × 1 = 50 (max)	
S0. No		0 (min)	
L5. Validation	5 %	50	
S1. Yes		50 (max)	
S0. No		0 (min)	
F3. Food composition database	20 %	200	
L1. Include functional and fortified foods			
S1. Yes		200 (max)	
S0. No		0 (min)	
F4. Mis-reporting	15 %	150/2 = 75	
L1. Under-reporting			
S2. Excluded		75 × 2 = 150 (max)	
S1. Considered		75 × 1 = 75 (min)	
F5. Others	5 %	50/4 = 12.5	
L1. Supplements included	1.25%/2 = 0.625 %	12.5/2 = 6.25	
S1. Vits and mins – yes and/or dietary supplements – yes		6.25 × 1 or 6.25 × 2 (if both 'yes')	
S0. No		0 (min)	
L2. Functional and fortified included (in the survey)	1.25 %	12.5	
S1. Yes		12.5 (max)	
S0. No		0 (min)	
L3. Physical activity assessed	1.25 %	12.5/5 = 2.5	
Yes – methods			
S5. Accelerometer and questionnaire		2.5 × 5 = 12.5 (max)	
S4. Accelerometer		2.5 × 4 = 10	
S3. Questionnaire and pedometer		2.5 × 3 = 7.5	
S2. Questionnaire		2.5 × 2 = 5	
S1. Pedometer and other		2.5 × 1 = 2.5	
No		0 (min)	
L4. Anthropometric measurements included	1.25 %	12.5/2 = 6.25	
Yes – specify			
S2. Body weight and height – measured		6.25 × 2 = 12.5 (max)	
S1. Body weight and height – self-reported		6.5 × 1 = 6.25	
No		0 (min)	
F6. Year	5 %	50/2 = 25	
L1. Last year of conduction period	2.5 %	25/3 = 8.33	

Table 1. Continued

Factors displaying levels and sublevels	Weights 100 % divided by six factors	Scores (points) 100 % = 1000 points	Country 1, 2, ..., X
S3. 2005 and over		$8.33 \times 3 = 25$ (max)	
S2. 2000–4		$8.33 \times 2 = 16.66$	
S1. 1990–9		$8.33 \times 1 = 8.33$ (min)	
L2. Publication	2.5 %	$25/2 = 12.5$	
S2. Published		$12.5 \times 2 = 25$ (max)	
S1. In press		$12.5 \times 1 = 12.5$	
S0. Not published		0 (min)	
Total score			

HBS, Household Budget Survey; R-24-hr Rcl, repeated 24-hr recall; S-24-hr Rcl, single 24-hr recall; EFR, estimated food records; WFR, weighed food records; FFQ, food frequency questionnaire; PA, probabilistic approach; EARs/RDAs, Estimated Average Requirement/Recommended Dietary Allowances.

In this line, the higher the number of unanswered questions from a country, the greater the increase in its simulated scoring. Finally, the chosen best survey/study in each country was always the one scoring the highest. An index was used to classify countries into those having 'high' (score > 7), 'medium' (score 4–7) and 'low' (score < 4) information quality.

## Results

Twenty-nine out of thirty-two countries responded to the questionnaire (response rate 92.2 %), sending a total of seventy-eight completed questionnaires (no questionnaires were received from Liechtenstein, Luxembourg or Slovakia, despite the three request reminders). The surveys/studies contained in the 'Country information found' table were then compared with those received as completed questionnaires and duplicates were eliminated. A final table containing 118 surveys/studies (forty plus seventy-eight) from all thirty-two countries was compiled, which was used for the counting and analysis of the results and for obtaining quantitative and qualitative results. As mentioned earlier, for the purpose of the present paper, only national cross-sectional surveys/studies on the adult population were considered in the analysis, representing a total of twenty-four.

### Quantitative results

Experts from twenty-nine countries completed and sent their questionnaires; however, no national cross-sectional nutritional/health/household budget surveys/studies on adults were obtained from the following five countries: Cyprus – the experts sent completed questionnaires on two national surveys on children; Greece – sent questionnaires on one national survey on adults, but it was of 'cross-sectional within a cohort' design (European Prospective Investigation into Cancer and Nutrition – Greek component, 1994–9)<sup>(14)</sup>; Latvia – sent a questionnaire on one survey that was planned to be conducted in 2008, 'under national discussion' (First National Food Consumption Survey (7–64 years); Romania – sent one questionnaire on a national survey on the elderly ('Aging and Nutrition Project, Nutritional status in elderly-Romania' 2003 – official reference omitted by the expert); Switzerland – the expert sent a questionnaire on a local nutritional survey on adults from Geneva<sup>(15,16)</sup>. These five countries were therefore excluded from Table 2 'Methodological aspects of the twenty-four surveys/studies included in the analysis'. Table 2 shows that twenty-two out of twenty-four countries had carried out nutritional surveys/

studies at a national level, while two countries (Malta and Portugal) had national health surveys with nutritional data. Fifteen countries had conducted their surveys/studies since 2000 (five since 2005). The samples of all surveys/studies were representative of their countries' population, and only four out of twenty-four had a sample size below 900 subjects (Table 2). In terms of the methods for data collection, eleven countries used only personal interviews, one only telephone interviews, six only self-administered questionnaires, and six used combinations of two or three of the dietary techniques (Fig. 2). Regarding dietary instruments, two countries used only repeated 24 h recalls, three countries used only a single 24 h recall, eight used only estimated and/or weighed food records (one used dietary history), three used only FFQ (one used only specific questions – Portugal), eight used combinations of recalls, records and FFQ (two also used dietary histories) (Fig. 3). As per the NIA method, twelve countries used only comparison with estimated average requirements/RDA, two used only the probabilistic approach and standard deviation/Z-scores, five used combinations of comparisons to estimated average requirements/RDA and other methods: one with probabilistic approach, one with nutrition quality index, one with biomarkers of status, one with Mediterranean adequacy index, and one with probabilistic approach, nutrition quality index and nutrition adequacy ratio; in addition, three surveys/studies did not assess NIA and two left this question unanswered (Fig. 4).

### Qualitative results: country ranking

Fig. 5 shows that nine out of twenty-four countries (37.5 %) have surveys/studies with high information quality, twelve (50.0 %) have medium information quality surveys/studies, and three (12.5 %) have low information quality. It can also be observed that, considering the answers by the experts to all relevant questions, the country that obtains the highest score is France (8.1), closely followed by Finland, Lithuania and Spain (8.0).

Fig. 5 also shows six countries whose questionnaires were incomplete, which brought their scoring down to unrealistic figures in some cases (unanswered questions scored the minimum score value). However, Fig. 6 shows that, through the simulated scoring, countries like The Netherlands, Germany and the United Kingdom can substantially increase their scores to a more realistic present picture of the quality of existing/available/accessible information. Nevertheless, the results from these three countries do reflect the lower level of involvement from the experts to whom the questionnaire was sent.

**Table 2.** Methodological aspects of the twenty-four surveys/studies included in the analysis, according to questionnaire answers by country experts

No.	Country*	Fieldwork	Age (years), sample size (n) and sex (M-F)	Dietary data collection techniques	Dietary instruments	Nutrient intake adequacy assessment methods	Reference (Study Director and survey name)
1	Austria	2005–6	18–65 ( <i>n</i> 1103 M and 1655 F)	SAQ	S24 hr Rcl	Comparison with EAR/RDA	Elmadfa <i>et al.</i> Austrian Study on Nutritional Status (ASNS) (In the Press).
2	Belgium	2004–5	15–18, 19–29, 30–59, 60–74, 75 + ( <i>n</i> 1546 M and 1537 F)	PI	R24 hr Rcl	Comparison with EAR/RDA	De Vriese <i>et al.</i> <sup>(29)</sup> Belgian national food consumption survey in the adult population (15 years and older).
3	Bulgaria	March–April 2004	1–2, 3–6, 7–9, 10–13, 14–18, 19–29, 30–59, 60–74, 75 + ( <i>n</i> 1113 and 1142 F)	PI	S24 hr Rcl and FFQ	PA and standard deviation/ Z-scores	Baykova <i>et al.</i> <sup>(30)</sup> National monitoring of dietary intake and nutritional status of Bulgaria population 2004.
4	Czech Republic	2003–4	4–6, 7–10, 11–14, 15–17, 18–59, 60 + ( <i>n</i> 1235 M and 1365 F)	PI	R24 hr Rcl and FFQ	Usual intake with probabilistic uncertainty analysis	Ruprich <i>et al.</i> <sup>(31)</sup> Study of individual food consumption (SISP04).
5	Denmark	2000–2	4–5, 6–9, 10–17, 18–24, 25–34, 35–44, 45–54, 55–64, 66–75 ( <i>n</i> 1954 M and 2166 F)	PI and SAQ	EFR	Comparison with Nordic nutrition recommendations	Lyhne <i>et al.</i> <sup>(32)</sup> The Danish National Survey of Dietary Habits and Physical Activity. (Dietary Habits in Denmark 2000–2).
6	Estonia	1997–7	19–34, 35–49, 50 + ( <i>n</i> 902 M and 1115 F)	PI	S24 hr Rcl and FFQ	Comparison with EAR/RDA	Pomerleau <i>et al.</i> <sup>(33,34)</sup> Estonian Adults Nutrition Survey.
7	Finland	January–April 2002	25–34, 35–44, 45–54, 55–64, 65–74 (in two areas) ( <i>n</i> 915 M and 1095 F)	PI and SAQ	R24 hr Rcl and EFR	PA and comparison with EAR/RDA (comparison with the Finnish nutrition recommendations)	Männistö <i>et al.</i> <sup>(35)</sup> The National FINDIET 2002 Study ('carried out in a subsample of the National FINRISK 2002 Study', by Laatikainen <i>et al.</i> ).
8	France	2006–7	3–10, 11–14, 15–17, 18–29, 30–54, 55–74 ( <i>n</i> 1959 M and 2830 F)	PI and TI	R24 hr Rcl	Comparison with EAR/RDA and NQI	Castetbon & Hercberg <sup>(36)</sup> . Etude Nationale Nutrition Santé (ENNS).
9	Germany	2005–7	14–80 ( <i>n</i> about 20 000)	PI, TI and SAQ	R24 hr Rcl, WFR and DH	Left 'blank'	Brombach <i>et al.</i> <sup>(37)</sup> National Nutrition Survey II.
10	Hungary	November–December 2003	19–34, 35–59, 60 + ( <i>n</i> 473 M and 706 F)	PI and SAQ	EFR	Comparison with EAR/RDA (comparison with Hungarian RDI)	Biró <i>et al.</i> <sup>(38)</sup> Third National Nutrition Survey ('a part of the National Health Survey of the Population – OLEF 2003', by Stehle <i>et al.</i> ).
11	Iceland	May–November 2002	15–19, 20–39, 40–59, 60–80 ( <i>n</i> 580 M and 662 F)	TI	S24 hr Rcl	Comparison with EAR/RDA (comparison with RDA)	Steingrimsdóttir <i>et al.</i> <sup>(39)</sup> The Diet of Icelanders, Dietary Survey of The Icelandic Nutrition Council 2002, Main Findings.
12	Ireland	1997–9	18–35, 36–50, 51–64 ( <i>n</i> 662 M and 717 F)	SAQ	WFR or EFR (7-d food diary)	Biomarkers of status and comparison with EAR/RDA	Kiely <sup>(40)</sup> North/South Ireland Food Consumption Survey 2001 – by IUNA (Irish Universities Nutrition Alliance).
13	Italy	2005–6	All members in each selected household (cluster): 0–2.9; 3–9.9; 10–17.9; 18–64.9; 65 + ( <i>n</i> 1501 M and 1821 F)	PI	EFR	Comparison with EAR/RDA and Mediterranean adequacy index	Turrini & Leclercq <sup>(41)</sup> Food Consumption Survey INRAN-SCAI 2005–6.
14	Lithuania	April–June 2007	16–64, 19–34, 35–49, 50–64 (initial <i>n</i> 5000, between Lithuanians, Russians and Polish)	PI	S24 hr Rcl and FFQ	Left 'blank'	Barzda <i>et al.</i> Macronutrient, Food Intake and Health Behavior in the Lithuanian Population (In the Press).
15	Malta	2002–3	15–24, 25–44, 45–64, 65–74, + 75 ( <i>n</i> 5510, 46.88% M and 52.84% F)	PI and SAQ	FFQ	Not assessed	Pace Asciak <i>et al.</i> <sup>(42)</sup> The First, National Health Interview Survey (HIS Malta 2002).
16	The Netherlands	1997–8	1–97 ( <i>n</i> 6250)	SAQ	WFR and DH	Comparison with EAR/RDA	Anonymous <sup>(43)</sup> . Netherlands Nutrition Centre. The third Dutch National Food Consumption Survey (DNFCS-3).

Table 2. Continued

No.	Country*	Fieldwork	Age (years), sample size (n) and sex (M–F)	Dietary data collection techniques	Dietary instruments	Nutrient intake adequacy assessment methods	Reference (Study Director and survey name)
17	Norway	March, June, September and November – 1997	16–19, 20–29, 30–39, 40–49, 50–59, 60–69, 70–79 (n 1298 M and 1374 F)	SAQ	FFQ	Not assessed	Johansson & Solvol <sup>(44)</sup> . NORKOST 2.
18	Poland	September–November 2000	1–3, 4–6, 7–9, 10–12, 13–15, 16–18, 19–25, 26–60, 60+ (n 1911 M and 2223 F)	PI	S24 hr Rcl	Comparison with EAR/RDA (% RDA)	Szponar <i>et al.</i> <sup>(45)</sup> ‘Household food consumption and anthropometric survey’.
19	Portugal	1998–9	0–4, 5–14, 15–24, 25–34, 35–44, 45–54 (n 22 408 M and 24 771 F)	PI	FFQ with ‘Especially questions’	Not assessed	Graça <i>et al.</i> <sup>(46)</sup> Inquérito Nacional de Saúde.
20	Serbia	1997–8 (ten cities)	19–65 (n 1475 M and 1632F)	SAQ	EFR and WFR	Comparison with EAR/RDA	Pavlović <i>et al.</i> <sup>(47,48)</sup> Nutrition as the potential risk factor of atherosclerosis (YUSAD study).
21	Slovenia	1995	18–25, 26–45, 46–65 (n 954 M and 1229 F)	PI	S24 hr Rcl and FFQ	Comparison with EAR/RDA	Koch & Pokorn <sup>(49,50)</sup> Nutritional habits of Slovenian adults in health protection aspect.
22	Spain	1998–2000	2–5, 6–9, 10–13, 14–17, 18–24 (n 1629 M and 1905 F)	PI	R24 hr Rcl and FFQ	Comparison with EAR/RDA (< 1/3, < 2/3, < RNI), PA, NQI and nutrition adequacy ratio	Serra Majem <i>et al.</i> <sup>(51)</sup> EnKid Study.
23	Sweden	1997–8	18–24, 25–34, 35–44, 45–54, 55–64, 65–74 (n 589 M and 625F)	SAQ	EFR	Comparison with EAR/RDA	Becker & Pearson <sup>(52)</sup> Riksmaten 1997–8.
24	United Kingdom	2000–1	19–24, 25–34, 35–39, 50–64 (n approximately 2000)	PI	WFR	Comparison with EAR/RDA and RNV	Henderson <i>et al.</i> <sup>(53–55)</sup> , Ruston <i>et al.</i> <sup>(56)</sup> and Hoare <i>et al.</i> <sup>(57)</sup> National Dietary and Nutritional Survey (NDNS) adults aged 19–64.

SAQ, self-administered questionnaires; S24 hr Rcl, single 24 h recall; EAR, estimated average requirements; PI, personal interview; R24 hr Rcl, repeated 24 h recall; PA, probabilistic approach; EFR, estimated food records; TI, telephone interview; NQI, nutrition quality index; WFR, weighed food records; DH, dietary history; RDI, recommended daily intake; RNI, recommended nutrient intake; RNV, relative nutritional values.

\* Countries that had expert response for which no national cross-sectional nutritional/health/HBS, household budget surveys/studies on adults were obtained: Cyprus; Greece; Latvia; Romania; Switzerland.

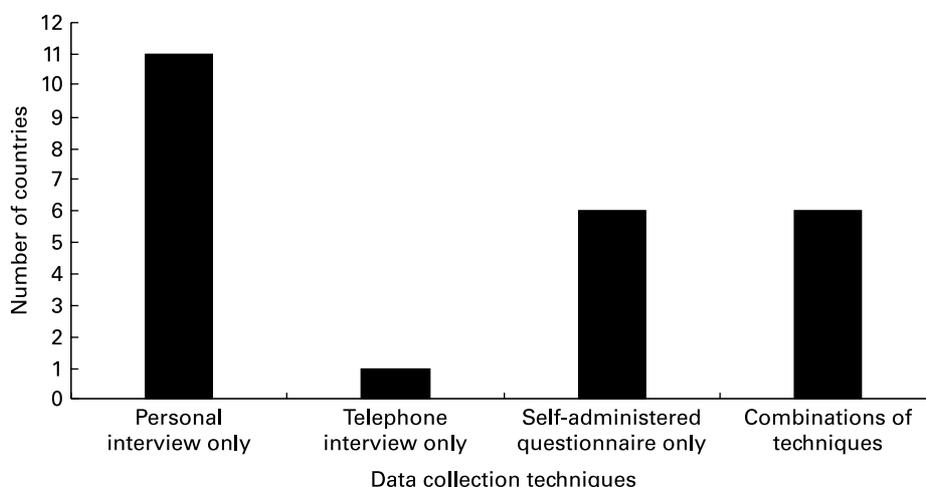


Fig. 2. Number of countries using the different data collection techniques.

Fig. 7 shows the rearrangement of scores including the simulated ones for the six countries previously discussed. A new country ranking can thus be observed: Lithuania and Spain reach the leading positions; The Netherlands, the United Kingdom and Germany are included in the high category; and Poland upgrades positions within the same category. Needless to say, the 'real' score of all these countries would be somewhere between the 'present' and the 'simulated' scores. The national health surveys from Malta and Portugal remain in the low category scoring <4.

### Discussion

The format of the quantitative results on dietary data collection instruments allows comparison with those of the latest ENHR II<sup>(8)</sup>, and it can be observed that the surveys/studies from the present work not only employed instruments separately (e.g. single 24 h recall only), but also combinations of different instruments (e.g. single 24 h recall and FFQ). We believe that analysing the methods employed in combination as opposed to separately gives a better reflection of reality, since that is how methods are usually found in studies. In addition, the number of 'partners' or 'countries' included

in the analysis is also different, fifty-three 'partners' from the ENHR II as compared with the present study's twenty-four. It is interesting to point out that twelve out of fifty-three partners (22.6%) of the ENHR II use single 24 h recalls as compared with the three in the present study (12.5%); moreover, the highest difference is observed in FFQ use: seventeen ENHR II partners (32.1%) and three identified by the present study (12.5%). Expert consultation through a questionnaire yields comparable results across partners or countries, and using similar formats as those found in different European projects/studies facilitates comparison across them at a European level. Another relevant point is the fact that the ENHR II includes data on adults and children, which reinforces the possibility of carrying out the analysis on other population groups.

When comparing the results from Table 1 with those found by EFCOSUM<sup>(3)</sup>, it can be observed that, for Slovakia, the EFCOSUM publication shows the study 'Assessment of food habits and nutritional status<sup>(17,18)</sup>' on the population ranging 11–88 years; the present study could not be obtained through the country experts; hence, the country was not included in the analysis. On the contrary, Serbia was not included in the EFCOSUM review, while the national study

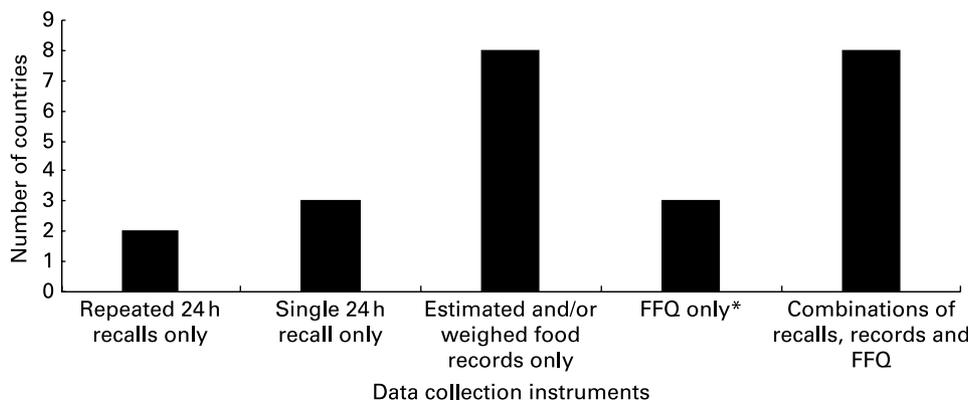


Fig. 3. Number of countries using the different data collection instruments. \* One food frequency questionnaire of 'specific questions'.

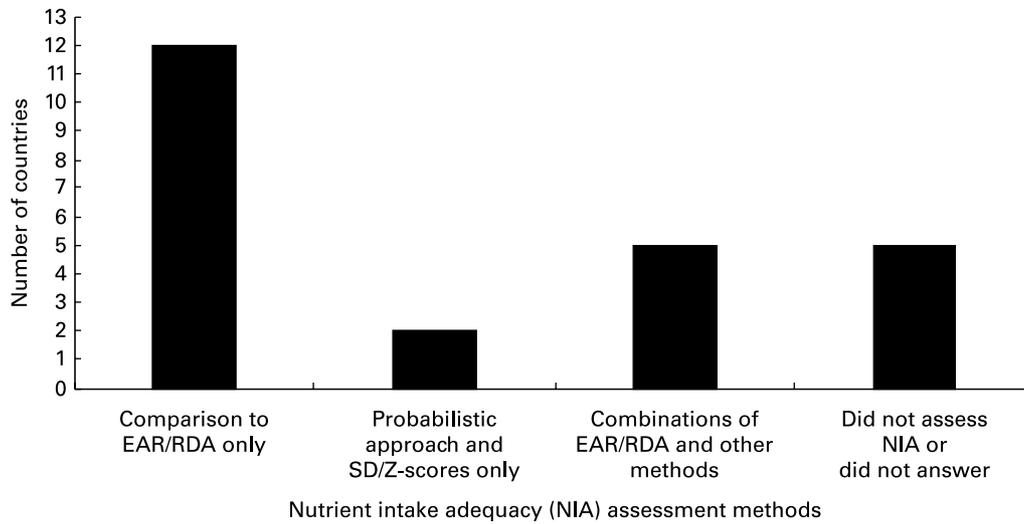


Fig. 4. Number of countries using the different NIA assessment methods. EAR, estimated average requirements; NIA, nutrient intake adequacy.

‘Nutrition as the risk factor for atherosclerosis’ has been included in the present analysis. In the case of Croatia, it was included in the EFCOSUM review but not in the present analysis. Finally, Liechtenstein and Luxembourg were not included either in the EFCOSUM review or in the present analysis; therefore, their nutrition information status in terms of intake methods remains unknown to us. Country inclusion/exclusion criteria should be further justified in future work within Europe, so that wider comparisons can be made.

The present study also includes national health surveys that contain nutritional data from Malta and Portugal. Although comparison of nutritional and health surveys is not ideal, because their methodology differs in concordance to their objectives, we believe that including national health surveys containing nutritional information from a given country not only allows the increase of knowledge about the information

available, but also gives recognition to the work carried out in the country and the opportunity to be included in comparative descriptive studies within European projects such as EURRECA. Nevertheless, defining the criteria for the type and scope of studies to be included is also important.

We would also like to acknowledge the countries that were not included in the analysis because no national nutritional survey/study was obtained through the questionnaire, but whose experts did send questionnaires on adult studies of regional or local scope. This is the case for regional surveys from Greece – the ‘Nutritional survey of the province of Attica (The ATTICA Study 2001–2002)<sup>(19)</sup>’, and Romania – the ‘Nutritional survey of Transylvania (2002–2004)<sup>(20)</sup>’. At the local level, Portugal has the ‘Health study considering food habits in Porto (The EPIPorto Study 1999–2003)<sup>(21)</sup>’ and Switzerland the ‘Nutritional and physical health survey, Geneva (The Bus Santé Study 1993–2008, every

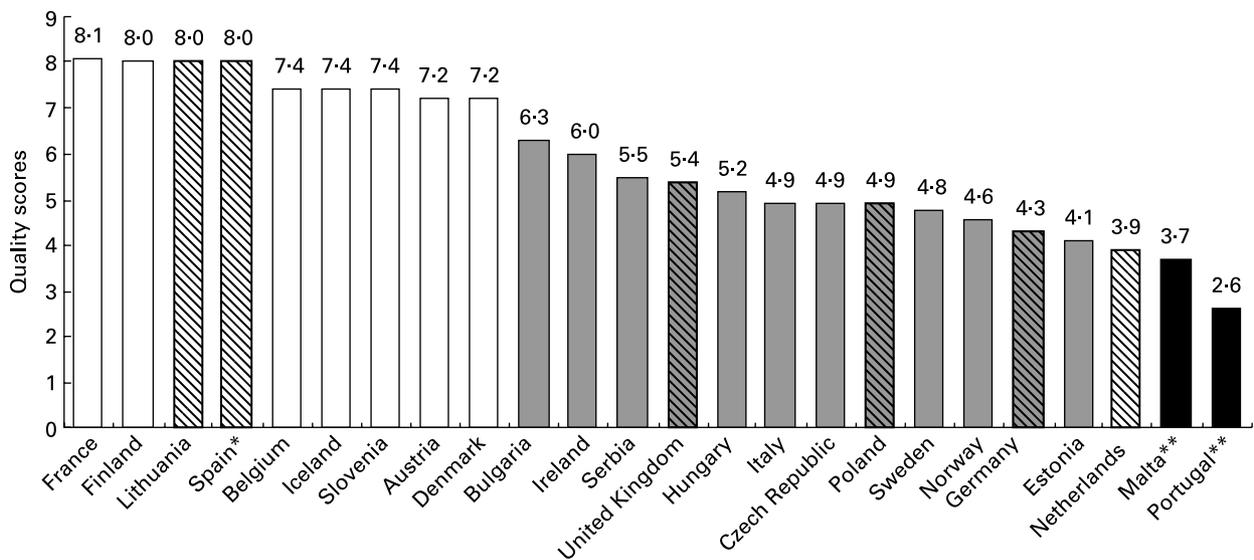
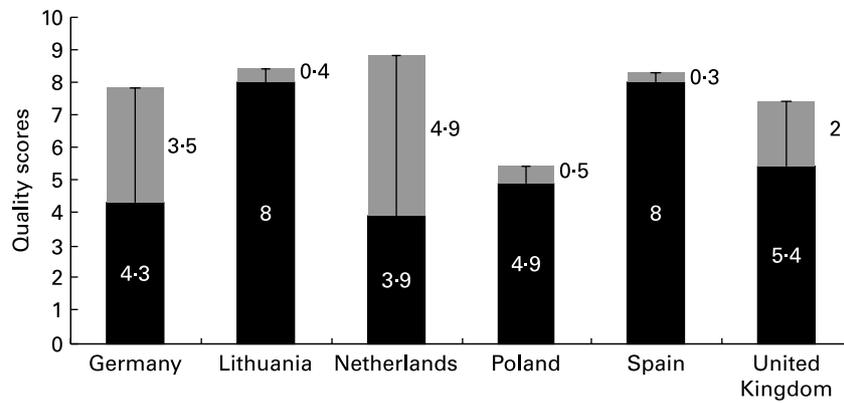


Fig. 5. Countries with ‘high’, ‘medium’ and ‘low’ information quality from their national surveys/studies on adults (18–65 years) – present scores showing countries with complete and incomplete questionnaires. □, ‘high’ information quality (score >7); ■, medium information quality (scores 4–7); ■, low information quality (score <4); ▨, countries with incomplete questionnaires. \* The survey includes young adults only (18–24 years). \*\* National health surveys containing nutritional data.

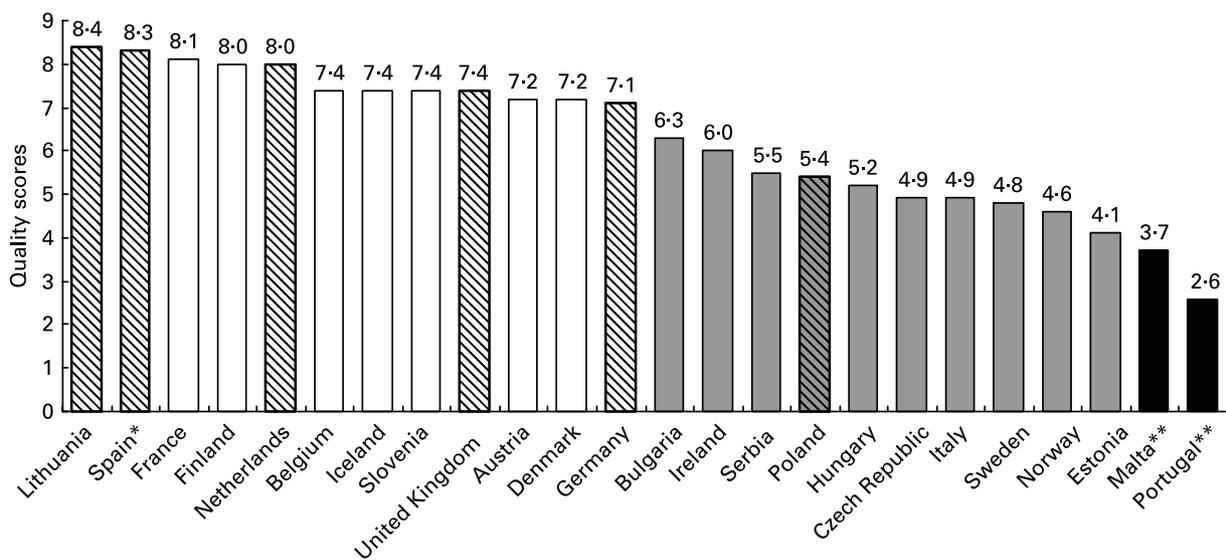


**Fig. 6.** The present and simulated scores of countries with incomplete questionnaires. ■, simulated score: current score + maximum score from unanswered questions; ■, current score: missing scores from unanswered questions.

year)<sup>(15,16)</sup>. Had the inclusion criteria been different, emphasising other aspects of the surveys different from their national scope, these countries probably would have been included. On the contrary, in the case of Spain whose score was high, its survey benefited from the national scope criterion. However, if the objective had been to cover as much of the population as possible, this survey would have been in a weaker position, as it only included the youngest adult population (aged 18–24 years). There were several Spanish regional nutritional surveys that covered the adult population range (18–65 years) that had been excluded and for which experts had also sent questionnaires ('Evaluation of the Nutritional Status of the Catalan Population' – ENCAT survey 2002–3)<sup>(22)</sup>, ('Nutritional Survey of The Canary Islands' – ENCA 1997–8)<sup>(23,24)</sup>, ('Nutritional Survey of The Balearic Islands' – ENIB 1999–2000)<sup>(25)</sup>, 'Nutrition and Health Survey of the Community of Valencia 1994')<sup>(26)</sup>. Finally, it must be taken into account that in the case of The Netherlands and the United Kingdom, with present scores of 3.9 and 5.4, respectively, the questionnaire was completed by the authors of

the present study using the information found in the different literature searches, as no questionnaire was completed by any expert on these national nutritional surveys on adults (Table 1). As such, we emphasise the relevance of selecting adequate experts when results depend on their response.

The results presented earlier meet the objective of applying an information search strategy that combines internet and available written literature with the collection of existing data by means of a designed questionnaire<sup>(13)</sup>. However, there are several points that should be further discussed before drawing conclusions and recommendations based on the results obtained. Blanquer *et al.* have recommended a combination of both approaches of the strategy to obtain information in order to derive more complete results. Nevertheless, the questionnaire was chosen for the present paper's analysis because it was thought that using a specific format would restrict the possibilities of data presentation, which would then ease subsequent comparison of the information. Having gone through the experience, we can now identify the advantages and limitations of the procedures followed:



**Fig. 7.** Countries with 'high', 'medium' and 'low' information quality including simulated scores of countries with incomplete questionnaires: national surveys/studies on adults (18–65 years). □, 'high' information quality (score >7); ■, medium information quality (scores 4–7); ■, low information quality (score <4); ▨, adjusted by simulation. \* The survey includes young adults only (18–24 years). \*\* National health surveys containing nutritional data.

1. Countries varied in their definitions of age groups, and hence we had great difficulty when classifying the surveys/studies by population group, before limiting the analysis only to adults. A clear definition of age ranges at early stages of EURRECA would have been time-saving and would have reinforced objectivity and consistency of results. Potential misclassification could therefore be reduced.
2. Using expert knowledge to complete questionnaires can expedite the information collecting process, but it can also introduce bias if the experts have not thoroughly completed the questions, due to a diverse spectrum of reasons: under-reporting as a result of lack of time; knowledge ('indirect or not real experts'); interest or understanding of the question; over-reporting due to, e.g. excessive interest for their country/study to perform well. Taking this into account, some questions of the questionnaire used could be identified as 'problematic' because of the low response rate, seen in particular with those addressing nutrients considered in the survey/study (but not included in the present analysis), those related to NIA assessment methods or those that asked for a survey/study reference. Regarding NIA assessment methods in particular, and based on the experience from this work, we would like to recommend future researchers to separate questions on estimated average requirements from questions on RDA or from questions on any other reference value e.g. Lower Nutrient Reference Level, etc. This will allow for the identification of the exact reference value used by each survey/study and whether or not it is appropriate, according to present recommendations<sup>(27,28)</sup>.

All these, among other issues, can distort the final results and make us draw an unrealistic picture of the situation. We therefore recommend that the data collection strategy be as objective as possible to assure that the results obtained are the most reliable.

We conclude that the present research, performed as part of the EURRECA Network of Excellence, represents an attempt at designing a strategy for identifying cross-sectional nutritional data at the individual level and testing developed innovative tools for data quality analysis. Although there is room for improvement and caution should be taken when drawing conclusions and recommendations from these results, the lessons learned and tools developed help set the context for future analysis and evaluation within the EURRECA framework for aligning European micronutrient recommendations.

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