Misreporting in nutritional surveys: methodological implications

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Abstract

The reliability of the information collected in dietary assessment can be affected by different factors. One of the main sources of error in dietary assessment is misreporting which encompass under- and overreporting. Underreporting of food intake is one of the major problems in the assessment of habitual dietary intake. Physical and psychosocial characteristics that are related to energy underreporting include sex, age, weight, BMI, fear of negative evaluation and dieting among others. At present, diverse reference methods are employed to verify the results of dietary assessment and double labelled water is used as the gold standard method. Underreporting affects the estimation of nutrient intake and also alters associations between diet and disease assessed in epidemiological studies. Therefore, underreporting has to be considered and addressed by researchers through development and improvement of dietary intake adjustment methods, and taking advantage of the new technologies for assessing dietary intake in order to minimize underreporting bias.

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Key words: Underreporting. Nutritional surveys. Dietary intake. Methodology.

INFRADECLARACIÓN EN LAS ENCUESTAS ALIMENTARIAS: IMPLICACIONES METODOLÓGICAS

Resumen

La fiabilidad de la información recogida en la evaluación dietética puede verse afectada por diferentes factores. Una de las principales fuentes de error en la evaluación de la dieta es la declaración errónea de consumo de alimentos, que abarca la infradeclaración y sobredeclaración de la dieta. La infradeclaración de la ingesta de alimentos es uno de los principales problemas en la evaluación de la ingesta dietética habitual. Las características físicas y psicosociales que están relacionadas con la infradeclaración de energía incluyen el sexo, edad, peso, índice de masa corporal, el miedo a la evaluación negativa y estar bajo un régimen de dieta, entre otros. En la actualidad, se emplean diversos métodos de referencia para verificar los resultados de la evaluación dietética, no obstante, el método estándar es el agua doblemente marcada. La infradeclaración afecta a la estimación de la ingesta de nutrientes y también altera las asociaciones entre dieta y enfermedades en estudios epidemiológicos. Por lo tanto, la infradeclaración tiene que ser considerada y abordada por los investigadores a través del desarrollo y la mejora de los métodos de ajuste dietético y el aprovechamiento de las nuevas tecnologías para la evaluación de la ingesta dietética con el fin de minimizar el sesgo ocasionado por la infradeclaración.

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Abbreviations

ANR: Average nutrient requirement.
BMI: Body mass index.
BMR: Basal Metabolic Rate.
DLW: Doubly Labelled Water.
EPIC: European Prospective Investigation Into Cancer and Nutrition.
FFQ: Food Frequency Questionnaire.
IDEFICS: Identification and prevention of Dietary- and lifestyle-induced health Effects In Children and infants.
ICT: Information and communication technologies.
PDA: Personal digital assistants.
pTEE: Predicted total energy expenditure equations.

Background

In nutritional assessment, diverse methods are used to evaluate food and nutrient intake. It can be done via questionnaires (i.e. Food records, Dietary recalls, Food frequency questionnaires, Short questionnaires) or through biochemical methods. The selection of the appropriate method should consider the level of evaluation according to the target population, either individuals or groups. When nutrient intake is estimated, it can be compared to the nutrient requirement of the individual or population and therefore the probability of adequacy can be estimated. Nutritional adequacy enables to identify if there is sufficient intake of essential nutrients, needed to fulfill nutritional requirements for optimal health. Therefore, to assess dietary intake correctly is crucial to enhance the effectiveness of interventions and policies both at the individual and population level.

However, dietary intake assessment is a difficult task and different factors can affect the accuracy of the information collected. The reliability of dietary assessment can be affected by intra-individual variability, seasonal variability or misreporting. One of the main sources of error in dietary assessment is misreporting, comprising both under and overreporting. Underreporting of food intake is one of the major obstacles preventing the collection of accurate habitual dietary intake data (Figure 1). Although less frequent, overreporting is also a problem, and is related to certain individual characteristics, for instance in eating behaviors it is common to alter the consumption report of fruits and vegetables.

A recent study conducted in European countries, assessed the prevalence of low micronutrient intakes and the presence of underreporting by using nationally representative dietary survey data from Belgium, Denmark, France, Germany, The Netherlands, Poland, Spain and the United Kingdom. The proportion of possible underreporters in children aged 1–3 years ranged from 0.6% in Belgium to 1.7% in The Netherlands. For those aged 4–10 years, it varied from 0.5% in Denmark to about 5% of the German girls. For participants aged from 11 to 17 years, the underreporting values ranged from 0.6% of the Dutch boys to 34% of the Danish boys. For women aged 14–50 years, it ranged from 1.1% in The Netherlands to 14% in Germany. For elderly subjects aged 60 years of age, it ranged from about zero in the Dutch men to 26% in women from France. For elderly subjects over 60 years of age, it ranged from about zero in the Dutch men to 26% in women from France. For elderly subjects over 60 years of age, it ranged from about zero in the Dutch men to 26% in women from France. For elderly subjects aged 18–60 years, it ranged from about zero in the Dutch men to 26% in women from France. For elderly subjects over 60 years of age, it ranged from about zero in the Dutch men to 26% in women from France.

Misreporting affects not only the estimation of energy intake, but also in other nutrients. Therefore, misreporting of food intake is a major challenge for nutrition research when evaluating the relationship between diet and health outcomes.

Characteristics of low energy reporters

In 2003, Livingston & Black reviewed the characteristics of low energy reporters in 25 adult studies. Age and sex have been associated with energy underreporting. Some studies have found that women and elderly subjects are more likely to underreport energy intake. However, these associations are inconsistent and further investigation is needed in representative population samples that have identified underreporters at all levels of energy requirement. Another characteristic identified is weight status. Low-energy reporting has been associated with a high body mass index (BMI), and the probability that an individual will underreport rise as BMI increases. Education and socioeconomic status are less predictable characteristics in low energy reporters; however, in some studies underreporting has been associated with low education or socioeconomic status. Subjects with lower levels of education and consequently reduced literacy skills might be expected
misreporting include dieting, efforts to maintain weight stability, attempt to lose weight, self-perception of high weight and weight change over 5 years.

Children and adolescents also tend to underreport energy intake. Higher weight, BMI and adiposity have been consistently associated with underreported energy intake. In Spain, a study conducted in children and adolescents, the ENKID study (1998-2000) compared the psychosocial characteristics between underreporters and plausible reporters in children and youth aged 2-24 years. A higher probability to underreport was found for female group and for adolescents and young adults (14-24 years). According to geographical region, individuals from Canary Islands had higher odds to underreport, while children living in the Northern region had lower odds to underreport. Misreporting was also associated with skipping breakfast and having a high BMI or weight (over percentile 85). Another study conducted in adolescents has shown that obese participants were 5.0 times more likely to underreport energy intake than subjects with normal weight.

Some psychosocial characteristics have also been associated to low energy reporting such as eating restraint, social desirability, depression, anxiety and fear of negative evaluation. For instance, higher social desirability, known as the tendency to respond to questions in a socially appropriate and accepted manner, has been related with a higher incidence of energy underreporting, especially in women.

Energy misreporting, specifically underreporting, also results from incomplete recordkeeping on the part of the subject due to one or many established factors, for example: recording fatigue, memory disturbances, misrepresentation of portion size consumed and “unconscious” omission of certain eating occasion or item. In order to improve the estimation of portion size, some tools are used, for instance, the use of household measures, drawings and photographs or food models.

Since the characteristics of low energy reporters and associated physical and psychosocial factors play an important role in the observed reporting bias, further investigation is needed in order to properly account for such factors in future studies.

Reference Methods to identify energy misreporting

Nowadays there are a number of reference methods to verify the results of dietary assessment. Reference methods include urine nitrogen, total energy expenditure, resting metabolic rate and physical activity, and total water loss. The gold standard reference method for assessing total energy expenditure is doubly labelled water (DLW). This accurate and noninvasive method is used for validation of reported energy intake by subjects in free living situations.

In the DLW, subjects receive a loading dose of water labeled with the stable isotopes $^1$H and $^{18}$O, and these isotopes mix with the hydrogen and oxygen in body water within a few hours. As energy is expended, CO$_2$ and water are excreted. Urine samples are collected at baseline before administration of the dose and subsequently either daily or at the beginning and end of the measurement period. The urine samples are analyzed to determine the rate of disappearance of each isotope from the body. Usually, the measurement period in adults is 14 days. The energy expenditure calculated is then compared with the reported energy intake and the deviation is expressed as magnitude of misreporting (as a percentage of energy expenditure or as an absolute deviation in kJ or kcal). However, DLW cannot be widely used as validating method for energy intake, due to the high costs since it needs a sophisticated laboratory and analytical back-up.

Urinary nitrogen loss is used to validate reported protein intake. Healthy adults are in nitrogen balance, and nitrogen loss in urine was found to be 81±5% of total nitrogen loss per 24 hours. However, within-subject variation in daily nitrogen excretion of individuals may be large, and repeat collections of consecutive 24 hour urine samples are necessary if the method is going to be used to validate the protein intakes of individuals.

To assess the dietary intake of other nutrients (i.e. Na or K), the urinary excretion of such nutrients for which urine is the major excretory route has also been used as a biomarker. To measure dietary Na intake, Na excretion can be used, however, the day-to-day fluctuations in Na excretion are larger than those for nitrogen. Therefore more collections are needed to correctly characterize Na excretion in an individual.

The Goldberg cut-off method reports energy intake as a multiple of basal metabolic rate (BMR), and using this index (Energy intake/BMR) in comparison to expected energy expenditure as a validity check for negative bias in energy intake. The Goldberg equation calculates the confidence limits (cut-offs) that evaluate if mean reported energy intake is plausible as a valid measure of food intake even if chance has produced a dataset with a high proportion of genuinely low (or high) intake. Sensitivity of the Goldberg cut-off was improved when subjects were assigned to low, medium and high activity levels and different physical activity levels and cut-off values were applied to each level. BMR for the calculation of the Goldberg cut-off can be either measured or estimated from predictive equations specific for age and sex, such as the Schofield equations. In the method of indirect calorimetry that measures BMR, the subject must be in a fasting state and with minimal physical disturbance.

Finally, another method to validate reported dietary intake is to compare it with the actual intake of subjects. Actual intake is obtained by direct observation of people eating during the study period. This method attempts to measure absolute validity, but it is very time-consuming.
Underreporting represents a problem for the estimation of nutrient intake in epidemiological studies since underreporting of energy intake usually is related with underreporting of some nutrients.

A study of Mexican-American women showed that estimated energy, protein, cholesterol, dietary fiber, and vitamin E intakes were significantly higher among the plausible reporters compared with the implausible energy intake reporters group. Most implausible reporters underreported energy intake (86%). There was a significant difference between the proportions of plausible versus implausible reporters meeting recommendations for several nutrients, with a larger proportion of plausible reporters meeting recommendations.

In children and adolescents, the ENKID study has also evaluated the differences in nutrient intake between plausible reporters and low energy reporters (Table I). Higher intakes were observed among plausible reporters for energy, carbohydrates, total fat intake, cholesterol, sodium, phosphorus and calcium when compared to estimated intakes including underreporters in the sample. Similar results were observed in 96 adolescents from Brazil, where energy intake misreporting (under or overreporting) was identified in 65.6% of adolescents. Underreporters also showed higher rates of insufficient intake of carbohydrate, lipids and cholesterol intake than plausible reporters. Another survey conducted in Australian children aged 2-16 years, revealed, that those classified as underreporters had significantly higher intakes of protein and starch but lower intakes of sugar and fat, as percentage from energy, than plausible reporters, whereas overreporters had higher fat and lower carbohydrate intakes.

In the analyses of the ENCAT and ENCA previously cited, the nutritional adequacy of Vitamin A, Vitamin C, Vitamin E, Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Fe, Mg, P and Zn intake was estimated for the entire sample and excluding underreporters (defined by the Goldberg cut-off method) (Table II). The exclusion of underreporters substantially reduced inadequacy of intake for all vitamins assessed by daily methods (one 24 hour recall and a mean of two non-consecutive 24 hour recalls) and FFQ. Data from daily methods adjusted for intra-individual variability were the least modified by underreporters. The highest reduction of inadequacy (above 10%) was found for thiamin, Mg, Zn and vitamin E (except in 24 hour recall adjusted by intra-individual variability).

Implications of underreporting

The implications of underreporting are that they may alter diet and disease associations. Underreporting is a problem that has to be considered in nutritional studies, especially in some cases such as the evaluation of the relationship of dietary intake and obesity or studies examining the nutritional adequacy of the diet. Furthermore, it is important for the creation and evaluation of dietary guidelines and nutrition policies.
### Table I

Energy and nutrient intake (percentile 95th) from the ENKID (n=1857) and ENCAT (n=1840) studies, in total sample, excluding underreporters, and difference between them*

<table>
<thead>
<tr>
<th>Age group</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Without underreporter</td>
<td>Difference</td>
</tr>
<tr>
<td></td>
<td>P 95</td>
<td>P 95</td>
<td>All-Without under.</td>
</tr>
<tr>
<td>4-10 y ENKID</td>
<td>Energy (kcal)</td>
<td>2382.3</td>
<td>2388.8</td>
</tr>
<tr>
<td></td>
<td>Calcium (mg)</td>
<td>1197.0</td>
<td>1197.4</td>
</tr>
<tr>
<td></td>
<td>Magnesium (mg)</td>
<td>326.0</td>
<td>327.3</td>
</tr>
<tr>
<td></td>
<td>Iron (mg)</td>
<td>16.1</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td>Phosphorus (mg)</td>
<td>1675.4</td>
<td>1677.5</td>
</tr>
<tr>
<td></td>
<td>Total Vitamin A (µg)</td>
<td>705.5</td>
<td>702.9</td>
</tr>
<tr>
<td></td>
<td>Vitamin B6 (mg)</td>
<td>2.3</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>Niacin (mg)</td>
<td>26.3</td>
<td>26.4</td>
</tr>
<tr>
<td></td>
<td>Vitamin E (mg)</td>
<td>8.6</td>
<td>8.7</td>
</tr>
<tr>
<td>11-17 y ENKID</td>
<td>Energy (kcal)</td>
<td>3026.7</td>
<td>3125.8</td>
</tr>
<tr>
<td></td>
<td>Calcium (mg)</td>
<td>1356.5</td>
<td>1386.0</td>
</tr>
<tr>
<td></td>
<td>Magnesium (mg)</td>
<td>379.0</td>
<td>382.8</td>
</tr>
<tr>
<td></td>
<td>Iron (mg)</td>
<td>20.4</td>
<td>20.7</td>
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<tr>
<td></td>
<td>Phosphorus (mg)</td>
<td>2001.7</td>
<td>2027.5</td>
</tr>
<tr>
<td></td>
<td>Total Vitamin A (µg)</td>
<td>766.4</td>
<td>774.9</td>
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<tr>
<td></td>
<td>Vitamin B6 (mg)</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>Niacin (mg)</td>
<td>30.7</td>
<td>30.8</td>
</tr>
<tr>
<td></td>
<td>Vitamin E (mg)</td>
<td>10.3</td>
<td>10.3</td>
</tr>
<tr>
<td>18-80 y ENCAT</td>
<td>Energy (kcal)</td>
<td>2874.3</td>
<td>3001.0</td>
</tr>
<tr>
<td></td>
<td>Calcium (mg)</td>
<td>1201.6</td>
<td>1278.3</td>
</tr>
<tr>
<td></td>
<td>Magnesium (mg)</td>
<td>395.8</td>
<td>410.0</td>
</tr>
<tr>
<td></td>
<td>Iron (mg)</td>
<td>12.0</td>
<td>12.7</td>
</tr>
<tr>
<td></td>
<td>Phosphorus (mg)</td>
<td>15.7</td>
<td>16.3</td>
</tr>
</tbody>
</table>
Table II

Analysis of Spanish Population aged 12–80 years (n= 2615) with intakes below average nutrient requirement (ANR) cut point in the entire sample and excluding underreporters.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>One 24 Hour Recall (%)</th>
<th>Two 24 Hour Recall (%)</th>
<th>24HR adjusted for intra-individual variability (%)</th>
<th>FFQ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Without underreporters</td>
<td>Difference</td>
<td>All Without underreporters</td>
<td>Difference</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>52.1</td>
<td>41.7</td>
<td>10.4</td>
<td>47.9</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>39.1</td>
<td>32.8</td>
<td>6.3</td>
<td>33.0</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>78.8</td>
<td>66.2</td>
<td>12.6</td>
<td>80.6</td>
</tr>
<tr>
<td>Thiamin</td>
<td>35.4</td>
<td>14.1</td>
<td>21.3</td>
<td>30.7</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>16.0</td>
<td>4.6</td>
<td>11.4</td>
<td>12.5</td>
</tr>
<tr>
<td>Niacin</td>
<td>15.7</td>
<td>6.0</td>
<td>9.7</td>
<td>9.8</td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>20.4</td>
<td>6.5</td>
<td>13.9</td>
<td>16.7</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>13.9</td>
<td>5.3</td>
<td>8.6</td>
<td>6.7</td>
</tr>
<tr>
<td>Mg</td>
<td>59.3</td>
<td>37.5</td>
<td>21.8</td>
<td>61.0</td>
</tr>
<tr>
<td>Zn</td>
<td>43.1</td>
<td>23.5</td>
<td>19.6</td>
<td>41.7</td>
</tr>
</tbody>
</table>
A recent investigation within the frame of the European Prospective Investigation Into Cancer and Nutrition-Spain (EPIC) has evaluated the effect of accounting for misreporters in the associations between some dietary factors and BMI. Misreporters were identified by comparing reported energy intakes with estimated energy requirements obtained by three methods: 1) the original Goldberg method, 2) using basal metabolic rate equations that are more valid at higher BMIs, and 3) doubly labeled water-predicted total energy expenditure equations (pTEE). The results indicate that after excluding implausible reporters using each approach, coefficients for several diet-BMI associations changed in magnitude or direction. The consideration for misreporters yielded associations between diet and BMI that were more consistent with previous findings. For example, among women, initially negative associations between BMI and energy intake became positive (Figure 2), a neutral association with fruit became negative and a positive association with vegetables became negative. Although all methods had consistent effects on estimates, the magnitude of these diet-BMI associations was generally stronger when we used the pTEE and revised Goldberg methods than when the standard Goldberg method was used. In contrast, excluding subjects with extreme energy intakes by using recommended cutoffs had no meaningful effect.

Similar results were observed in 5357 European children aged 2–9 years. The IDEFICS study (Identification and prevention of Dietary- and lifestyle-induced health Effects In Children and infants) investigated the effect of handling implausible reporters in the association between dietary intakes (total energy, soft drinks, fruits/vegetables) and overweight/obesity. In the basic model, no significant association was found for energy intake and soft drink intake with overweight/obesity and a significant positive association between overweight/obesity and fruit/vegetable intake was found. However, when underreporters and overreporters were excluded, a positive association between energy intake and overweight/obesity was observed. This finding was also observed when models were adjusted for misreporting, energy intake and overweight/obesity were associated and even more pronounced compared with the model excluding misreporters. Moreover, after adjustment for the propensity score, which combined various indicators for misreporting into one summary measure, Authors found a positive association between soft drinks and overweight/obesity and a negative association was found for fruit/vegetable intakes. The adjustment for propensity score is an alternative that could be useful to minimize misreporting error. Nevertheless, Börnhorst et al. recommend that future studies have to be careful when applying the propensity score approach, which requires the identification of the relevant determinants of misreporting according to the study population. Therefore, the effectiveness of the propensity score adjustment in adolescent and adult populations is a task for future research.

**SOLUTION: New technologies for assessing intake?**

Given all the previously recognised limitations, research has focused on refining assessment methods to more accurately evaluate food intake. What could be the solution? The possibilities of developing new applications of information and communication technologies (ICT) to improve dietary as well as physical activity assessment have been explored. Adaptations of technology have led to extensive changes in how dietary assessment is performed. The most common objective has been to reduce the costs of both the collection and processing of dietary intake information due to the amounts and complexity of data usually involved. The early Framingham and Tecumseh community studies were the first to establish cohorts for the express purpose of examining diet and

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**Fig. 2.**—Associations between energy intakes and body mass index among women, determined using alternative adjustments for estimated under- and overreporting in the Spanish cohort of the European Investigation Into Cancer and Nutrition. Coefficients from multivariable linear regression models were adjusted for age, center, height, activity, educational level, smoking status, season, alcohol intakes, parity, diabetes, and use of special diets. Abbreviations: SE, standard error; GB 1.5, Goldberg method with 1.5-standard-deviation cutoffs; GB 2.0, Goldberg method with 2.0-standard-deviation cutoffs; GB-R 2.0, revised Goldberg methods with 2.0-standard-deviation cutoffs; pTEE 2.0, pTEE method with 2.0-standard-deviation cutoffs.
Old methods done in new ways:

ICT was applied in FFQ, 24HR and diet histories. Self-administered computerised assessment makes it possible for participants to register and assess their dietary intake at their own pace and convenience. Furthermore, computerised assessment tools can directly calculate nutrient intake and energy expenditure, which makes it possible for immediate feedback. However, some subjects may need more instructions before or during completion of the questionnaire. Applying alerts to warn subjects of improbable answers could also decrease the problem of overreporting as well as reduce the amount of data cleaning by researchers. These types of questionnaires may be useful for web-based data collection and could be applied as an alternative to in-person or self-administered questionnaires in studies where participants attend a central study visit site, as well as for questions on sensitive topics. When using computerised self-assessment questions about risky or sensitive behaviours may be answered more truthfully. A disadvantage of self-administered computerised assessment is that it requires the user to have a minimum level of knowledge about computer use. Certain population groups may have difficulty using a computerised assessment tool, for example, older and less educated individuals. This is less problematic in interviewer-administered computerised assessment tools.

Personal digital assistants PDA

A PDA is a handheld computer that can be used for various purposes. This technology has been applied for data collection in medical settings for over 15 years. PDA with specifically designed dietary software program can be used to register and self-monitor dietary intake. Subjects are required to record their food intake immediately after consumption by scrolling through a list of foods or by selecting a food group and then a specific food item. After food item selection, portion sizes are entered.

PDA-based food records have several advantages as individuals can be provided with immediate feedback and data stored on the PDA can be reviewed at any point in time. Although the advantages of PDA show their potential to improve data quality, there are several limitations. The use of PDA-based food records increases the respondent burden compared with paper diaries. Studies report subjects having difficulty using the search function and experienced inability to find certain foods. Furthermore, like paper diaries, PDA-based food records require participants to be literate. As such, older or less educated individuals might have difficulty using a PDA for recording food intake.

Digital photography

The main advantage of digital photography is the possibility to collect dietary intake data from large groups relatively quickly, with minimal disruption and impact on the eating behaviour of participants. Because data are immediately stored on the computer, the researchers have more time to analyse and process the obtained data. Furthermore, the participants’ identities can be kept anonymous, which can be seen as an advantage. Studies show that digital photography is a reliable and valid tool to measure food intake in dining facilities both in adult- and school-age populations.

New measurement methods:
Barcode scanner/ Smart card

An advantage of using the smart card system to measure food choice is that it can collect long-term data from large groups on individual food behaviour. Furthermore, the costs are relatively low as smart cards are inexpensive and fewer researchers are needed since data are stored when the diner uses the smart card to pay for the meal. More research is needed to determine whether this tool can be applied to measure food intake in a variety of population groups.

Summarizing, several dietary-assessment tools applying ICT have been developed and some have shown to be valid and reliable for diverse purposes and target groups. Recently, results from the European Commission project, Innovative Dietary Assessment Methods in Epidemiological Studies and Public Health (IDAMES), concluded that web-based approach in adult study populations it might take...
more time to have participation rates similar to paper versions. In terms of feasibility, more than two contacts (24-hour recalls) will result in a drop of participation, favouring a non-linear calibration approach and that it is still unclear whether web based or other new technologies can provide ranking instruments better than FFQs in respect to ranking and feasibility. In general, which tool is the most suitable to collect dietary data depends on the objectives of the study and the target group. Before selecting a given tool, it is important to review the advantages and disadvantages of each method.27

References