

24-hour dietary recalls

Dietary Assessment

Introduction

- > Nutrients, foods, and diets
- > Dietary adequacy and nutritional requirements
- > Diet variation, quantification, and misreporting
- > Weighed food diaries
- > Food composition
- > Data processing

Subjective Methods

- > Introduction
- > Estimated food diaries
- > Weighed food diaries
- > **24-hour dietary recalls**
- > Food frequency questionnaires
- > Diet checklists
- > Diet histories
- > Technology assisted dietary assessment

Objective Methods

- > Introduction
- > Direct observation
- > Duplicate diets
- > Nutritional biomarkers

Video Resources

- > 24 hour diet recall
- > Food frequency questionnaire
- > Measuring blood pressure

Method selector

Harmonisation

What is assessed?

The method assesses food and beverage consumption during the previous day or the preceding 24 hours. The variety of outcomes assessed by 24-hour dietary recall is shown in Figure D.2.9.

To capture habitual consumption of foods, multiple recalls are essential. The more days of recall, the better capture of between-day variability, seasonal variability, and foods episodically consumed. In a preliminary study to decide the method for the UK Low Income Diet and Nutrition Survey (LIDNS), four repeat 24-hour recalls were recommended as the most appropriate method of dietary assessment [11]. In an Australian study in adults, eight repeat 24-hour recalls were recommended to capture the variation in macronutrient intake [12]. The number of recalls needed to assess individuals' exposure to nutrient intake can be statistically calculated, ranging from 3 days for major macronutrients to weeks for micronutrients.

By contrast, if the research aim is to identify average consumption in a population, a single 24-hour recall for individuals from a target population is sufficient. However, to identify population-level statistics of variations and prevalence of individuals meeting certain consumption levels (recommended levels of intakes), multiple 24-hour recalls are necessary.

Table D.2.9 Dietary outcomes assessed by multiple 24-hr dietary recall.

Dietary outcome	Possible to assess?
Energy and nutrient intake of total diet	Yes
Intake of specific nutrients or food	Yes
Infrequently consumed foods	Maybe
Dietary pattern	Yes
Habitual diet	Yes
Within-individual comparison	Yes
Between-individual comparison	Yes
Meal composition	Yes
Frequency of eating/meal occasions	Yes
Eating environment	Yes
Adult report of diet at younger age	

How is the measurement conducted?

Protocol

The 24-hour dietary recall is a retrospective assessment method carried out by a trained interviewer. This method can also be self-administered with no interviewer. The 24-hour recall is normally undertaken in chronological order of consumption (i.e. from morning to night). The multiple pass approach has been often used as described below.

Multiple pass approach

The multiple pass recall is a staged approach to the dietary recall thought to be more tailored to human cognition than the chronological approach. Multiple pass has been widely used in national surveys and research [17]. The following is an example of the 5-step approach. The exact stages or passes may vary between protocols.

- Quick list, to collect a list of foods and beverages consumed during the previous day (i.e., over past 24 hours)
- Forgotten foods, to probe for foods forgotten during the quick list
- Time and occasion, to record time and eating occasion for each food
- Detail cycle, to record detailed description, amount, use of condiments, cooking methods, brands of foods if purchased, and other information as review of 24-hour day
- Final probe, to probe anything else consumed

An example of a 24-hour dietary recall entry sheet used by an interviewer is displayed in Figure D.2.4. Note that entry can include 'food code', which can later facilitate data entry.

Figure D.2.4 Example of 24-hour dietary recall entry sheets. Source: Kings College London.

Ideally, on the day previous to the 24-hour recall assessment, the respondent needs to be uninformed about its implementation, so that dietary behaviour is not affected. For example, in the US national survey [1], two 24-hour recalls are conducted. The first one is through a face-to-face interview. The second one is conducted by an assessor over the phone. The respondent is informed that a phone contact is attempted approximately two weeks after the first 24-hour recall, but not informed which day is selected to avoid a respondent changing his/her dietary habit.

In an interview, aids to recall occasions during the previous day can be provided, including information on the weather, local news, local events, etc. It is also useful to undertake a short questionnaire to supplement the recall data. The questionnaire may ask about the type of staple foods usually used e.g. bread, milk, margarine, breakfast cereal to save time recording this information each time it appears in the recall.

As a part of the 5-step approach, a participant should be guided to recall dietary items often forgotten. Those include ingredients used in cooking and during consumption, snacks between mealtimes, and dietary supplements. A participant should also be guided to answer whether the day they reported was a usual day, whether they follow a special diet or not (e.g. vegetarian diet, dieting to lose/gain weight, for a disease or for lactose intolerance).

Whether foods were purchased outside or cooked at home, brands of purchased foods, and how much money was spent may also be answered. What variables are to be captured in the 24-hour assessment should be confirmed before its implementation.

Time interval between multiple recalls

The time interval(s) between multiple 24-hour recalls should be considered depending on the purpose of the study. If the purpose of the study includes the habitual intake over a year, then 24-hour recalls should be administered across all seasons within the year to account for seasonal variation. In some cases, it is considered useful to use a hybrid between a 24-hour recall and an FFC. These hybrids (for examples see below section) cover the intake over the previous day, but include questions of specific food items with frequencies (usually semi-quantitative). These tools are especially useful in large-scale studies, where the use of interviewers is not practical, but a higher amount of precision is desired compared to classical FFCs.

Interview mode

The interview can be carried out in person, by telephone or increasingly via the Internet. In the Norwegian arm of the EPIC study, no significant differences in the dietary data obtained were found when face-to-face 24-hour recalls were compared to telephone 24-hour recalls [8].

Computer-based 24-hour recall, including that via the Internet, has the following advantages:

- Standardise recalling steps
- Show typical serving sizes of any foods by displaying photos
- Record brands and specific foods by showing photos
- Enter data into an electronic format and do further processing
- Requires a program and a database of typical serving sizes and photos are required

Examples of this approach include INTAKE24 and WebQ, as described in section 9 below.

Estimation of portion size

The estimation of portion size in the 24-hour recall usually requires the use of aids such as:

- Food photographs
- Household measures
- Two-dimensional grid
- Food models

If none of these methods apply to a certain food item that a participant consumed, the participant might refer to the size of the item e.g. small, medium, big, and then depending on the specific item, the size can be converted to an approximation of the weight.

When is this method used?

- Recalls are suitable for nutritional surveys and intervention studies and could be used in prospective cohort studies
- Useful for studies requiring a measure of average levels of dietary consumption in a given population
- Several national surveys use the 24-hour recall method because of its high response rate and its ability to obtain detailed information, for example in the United States, an interviewer administered automated multiple pass recall (AMPR) is the dietary assessment method used in national surveys
- Often used as a reference method to assess validity other methods including food-frequency questionnaires and diet history
- Often used as a measure of adherence to a dietary intervention, coupled with a short dietary checklist or a questionnaire

How are estimates of diet derived?

As a 24-hour recall has an open-ended format, outcomes from 24-hour recalls can be diverse, including consumption of specific food groups, cooking at home, eating meals with family members or alone, use of table salt or dietary supplements, whether breakfast, takeaway foods or snacks between meals, was consumed.

Estimates of nutrient intakes follow a general procedure common with food records and food-frequency questionnaires. The following steps to estimate nutrient intakes are undertaken:

- De-compose records of mixed meals quantitatively to individual foods and ingredients (if a food composition table has a mixed meal which is comparable to that in the recall's output, de-composition is not necessary)
- Convert portion size to gram amounts or amounts in a standard unit (ml for liquids) of each dietary consumption
- Match all foods and ingredients with items in a food composition table
- Obtain nutrient intakes from each food, by calculating a product of an amount of each item consumed and nutrients contents per amount of each item
- Obtain nutrient intakes per day per individual by calculating a sum of intakes of the nutrient per day per individual. This calculation can be specific to intakes in breakfast or different settings in a day.

Nutrition experts often ask the question, "How much of vitamin A intake come from vegetable consumption in the population?" This can be readily calculated by the ratio of the two estimates: a total vitamin A intake from vegetables of all individuals to a total vitamin A intake from all the foods of all individuals. This calculation is important to identify major food sources for a particular nutrient in a population.

Strengths and limitations

Key characteristics of single and multiple 24-hour recall are described in Table D.2.10.

Strengths

- Theoretically unlimited level of specificity for the foods consumed
- Respondent burden is relatively low
- Procedure does not alter food intake patterns
- Literacy not required
- Interview relatively quick (e.g. 20-30 minutes)
- Sensitive to ethnicity-specific differences

Limitations

- Method dependent on respondent's ability to recall intake accurately
- Possibility of recall bias where the individual may selectively recall food items, as with all self-report methods
- Expensive to administer due to high interviewer burden but telephone 24-hour recalls can reduce cost
- It can be expensive to enter data if a paper-based 24-hour recall is implemented because the process is labour-intensive and requires dietetics knowledge
- Repeat 24-hour recalls increase time and cost of analysis
- The process of coding and conversion of data to nutrients is time consuming and labour intensive and requires trained diet coders and a nutrient database and analysis program

Table D.2.10 Characteristics of 24-hour dietary recall.

Characteristic	Single recall	Multiple recall
Number of participants	Up to ~5000	Up to ~1000
Cost of development	Low	Low
Cost of use	Medium	High
Participant burden	Low	very High
Researcher burden of data collection	High	High
Researcher burden of coding and data analysis	Medium	High
Risk of reactivity bias	No	No
Risk of recall bias	Yes	Yes
Risk of social desirability bias	Yes	Yes
Risk of observer bias	Yes	Yes
Participant literacy required	Maybe	Maybe
Suitable for use in free living	Yes	Yes
Requires individual portion size estimation	Yes	Yes

Populations

Considerations relating to the use of 24-hour dietary recall for assessing diet in specific populations are described in Table D.2.11.

The use of 24-hour recalls is particularly challenging in young children and the elderly. The ability of a child to provide a dietary recall increases markedly after the age of 8 years [14], and it has been demonstrated that the ability of younger children (aged 5-7 years) to recall a lunch meal a short time after consumption varies widely and preference and familiarity increased recall; leftover food was not reported [22]. For these reasons, in the case of children and especially of younger children, a proxy such as the parent or someone else is used to assist the dietary reporting

The use of prompts in small numbers of children aged 10 years has been investigated. Specific prompts were found to hinder recall compared to free recall [5]; an open interview format was preferable to a meal interview format [3]. It is not clear what order of recall i.e. reverse order versus forward order, is preferable to use in children [3]. Recency was found to have a positive effect on children's recall, which may mean it is preferable to inquire about intake during the previous 24 hours rather than the previous day [4].

One study in UK pre-schoolers has shown that repeat (x3 days) automated multiple pass recall (AMPR) is not valid at an individual level to measure energy intake when compared to energy expenditure using doubly labelled water; over-reporting was apparent [19]. A similar study was repeated in young school children and although inaccuracies were reduced, intakes were still only valid at a group level [16]. This concurred with an earlier US study in young children [13]. These studies all relied on proxy-reporters, like parents and carers.

Table D.2.11 Diet assessment by 24-hour dietary recall in different populations.

Population	Comment
Pregnancy	Suitable.
Infancy and lactation	Requires proxy.
Toddlers and young children	Requires proxy.
Adolescents	Suitable.
Adults	Suitable.
Older Adults	May require proxy depending on cognitive function.
Ethnic groups	Requires language/cultural specificity.
Other	

Further considerations

Dietary recalls require a trained interviewer to undertake the dietary assessment in person or via telephone. The training of the interviewer is of utmost importance to ensure that the dietary data acquired is as reliable and valid as is possible:

- Interviewers should have knowledge of local foods (or be provided with ethnically diverse documents); this is particularly important when working with culturally diverse populations
- It is also important at a regional level that colloquial names for food and eating occasions are readily understood
- It is useful for the interviewer to be familiar with the food coding system to be used
- Coding of previously collected 24-hour recalls should be included as part of the training as this helps the interviewer to understand the questions to ask about specific foods
- The interviewer must have good inter-personnel skills and should remain non-judgemental in both verbal and non-verbal cues throughout the interview
- Questions must not lead or be directive, and judicial use of probing questions must be made
- Regular reviews of the quality of the data collected (and helps by those responsible for coding the 24-hour recalls) allows feedback to be given to the interviewers and helps maintain the quality of data collected
- A standard operating procedure of interviewing is required to reduce the likelihood of interviewer-induced bias
- A checklist of prompts is useful for the interviewer e.g. commonly forgotten foods, items eaten in combination
- 24-hour recalls via phone and via face-to-face interview can be improved by physically sending photo books and cooking utensils and by communicating with a computer as mentioned above

Resources required

- Trained interviewer
- Checklist and materials to record responses
- Trained diet coders
- Nutrient database and analysis program
- Portion estimate aid

Instrument library

A method specific instrument library is being developed for this section. In the meantime, please refer to the overall instrument library page by [clicking here](#) to open in a new page.

Development of new tool/method

As mentioned above, computer-based 24-hour recall has been developed in recent years (as of 2016). The advantages include the following:

- Display of portion sizes
- Display of often forgotten foods or condiments specifically for each food item or meals consumed. The multi-pass approach includes the step to list often-forgotten foods, but not for each food item or meal consumed. Facilitating recall of anything associated with each food is a unique strength.
- Boost data entry and estimation of nutrient intakes. As 24-hour recall has an open-ended format, data entry can be highly time-consuming. But computer-based recall can largely reduce the concern if data are directly entered.

As this example of facilitate the use of the 24-hour recall method, the development of a 24-hour method is about a system and an algorithm to automate recalls and data entry.

References

- Ahluwalia N, Dwyer J, Terry A, Moshfegh A, Johnson C. Update on NHANES Dietary Data: Focus on Collection, Release, Analytical Considerations, and Uses to Inform Public Policy. *Adv Nutr.* 2016;7(1):121-34.
- Baranowski T, Dornel SB. A cognitive model for recalling children's reporting of food intake. *Am J Clin Nutr.* 1994;59:2125-75.
- Baxter SD, Smith AF, Guinn CH, Thompson WO, Litaker MS, Baglio ML, et al. Interview format influences the accuracy of children's dietary recall validated with observations. *Nutr Res.* 2003;23(11):1537-46.
- Baxter SD, Smith AF, Litaker MS, Guinn CH, Shaffer NM, Baglio ML, et al. Recency affects reporting accuracy of children's dietary recalls. *Ann Epidemiol.* 2004;14(6):385-90.
- Baxter SD, Thompson WO, Davis HC. Prompting methods affect the accuracy of children's school lunch recalls. *J Am Diet Assoc.* 2000;100(8):911-8.
- Baxter SD, Thompson WO, Smith AF, Litaker MS, Yin Z, Frye FH, et al. Reverse versus forward order reporting and the accuracy of fourth-graders' recalls of school breakfast and school lunch. *Prev Med.* 2003;36(5):601-14.
- Blanton CA, Moshfegh AJ, Bari DJ, Kretsch MJ. The USDA Automated Multiple-Pass Method accurately estimates group total energy and nutrient intake. *J Nutr.* 2006;136(10):2594-9.
- Brustad M, Skjell G, Braaten T, Slimani N, Lund E. Comparison of telephone vs face-to-face interviews in the assessment of dietary intake by the 24 hr recall EPIC SOFT program—the Norwegian calibration study. *Eur J Clin Nutr.* 2003;57(11):107-13.
- onway JM, Ingwersen LA, Moshfegh AJ. Accuracy of dietary recall using the USDA five-step multiple-pass method in men: an observational validation study. *J Am Diet Assoc.* 2004;104(4):595-603.
- Conway JM, Ingwersen LA, Vinyard BT, Moshfegh AJ. Effectiveness of the US Department of Agriculture 5-step multiple-pass method in assessing food intake in obese and nonobese women. *Am J Clin Nutr.* 2003;77(5):1171-8.
- Holmes B, Dick K, Nelson M. A comparison of four dietary assessment methods in materially deprived households in England. *Public Health Nutr.* 2008;11(5):444-56.
- Jackson KA, Byrne NM, Magarey AM, Hills AP. Minimizing random error in dietary intakes assessed by 24-h recall, in overweight and obese adults. *Eur J Clin Nutr.* 2008;62(4):537-43.
- Johnson RK, Driscoll P, Goran MI. Comparison of multiple-pass 24-hour recall estimates of energy intake with total energy expenditure determined by the doubly labeled water method in young children. *J Am Diet Assoc.* 1996;96(11):1140-4.
- Livingstone MB, Robson PJ. Measurement of dietary intake in children. *Proc Nutr Soc.* 2000;59(2):279-93.
- McKenzie DC, Johnson RK, Harvey-Berino J, Gold BC. Impact of interviewer's body mass index on underreporting energy intake in overweight and obese women. *Obes Res.* 2002;10(6):471-7.
- Montgomery C, Reilly JJ, Jackson DM, Kelly JA, Slater C, Paton JY, et al. Validation of energy intake by 24-hour multiple pass recall: comparison with total energy expenditure in children aged 5-7 years. *Br J Nutr.* 2005;93(5):671-6.
- Moshfegh AJ, Rhodes DG, Baer DJ, Murray T, Clemens JC, Rumppler WV, et al. The US Department of Agriculture Automated Multiple-Pass Method reduces bias in the collection of energy intakes. *Am J Clin Nutr.* 2008;88(2):324-32.
- Raper N, Perloff B, Ingwersen L, Steinfeldt L, Anand J. An overview of USDA's Dietary Intake Data System. *J Food Comp Anal.* 2004;17(3-4):545-55.
- Reilly JJ, Montgomery C, Jackson D, MacRitchie J, Armstrong J. Energy intake by multiple pass 24 h recall and total energy expenditure: a comparison in a representative sample of 3-4-year-olds. *Br J Nutr.* 2001;86(5):601-5.
- Robertson C, Conway R, Dennis B, Yarnell J, Stamler J, Elliott P. Attainment of precision in implementation of 24 h dietary recalls: INTERMAP UK. *Br J Nutr.* 2005;94(4):588-94.
- Subar AF, Thompson FE, Potosichman N, Forsyth BH, Buday R, Richards D, et al. Formative research of a quick list for an automated self-administered 24-hour dietary recall. *J Am Diet Assoc.* 2007;107(6):1002-7.
- Warren JM, Henry CJ, Livingstone MB, Lightowler HJ, Bradshaw SM, Perwaiz S. How well do children aged 5-7 years recall food eaten at school lunch? *Public Health Nutr.* 2003;6(1):141-7.