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Title page

A systematic review of brief dietary questionnaires suitable for clinical use in the prevention and management of obesity, cardiovascular disease and type 2 diabetes

Running title: A systematic review of brief dietary questionnaires

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A systematic review of brief dietary questionnaires suitable for clinical use in the prevention and management of obesity, cardiovascular disease and type 2 diabetes

Abstract

The aim of this systematic review was to identify and describe brief dietary assessment tools suitable for use in clinical practice in the management of obesity, cardiovascular disease and Type 2 diabetes. Papers describing development of brief (<35 items) dietary assessment questionnaires, that were accessible, simple to score and assessed aspects of the diet of relevance to the conditions of interest were identified from electronic databases. The development of 35 tools was described in 47 papers. Ten tools assessed healthy eating or healthy dietary patterns, 2 assessed adherence to the Mediterranean diet, 18 assessed dietary fat intake and 5 assessed vegetable and/or fruit intake. Twenty tools were developed in North America. Test-retest reliability was conducted on 18 tools; correlation coefficients for total scores ranged from 0.59 to 0.95. Relative validation was conducted on 34 tools. The most common reference variable was percentage energy from fat (15 tools) and correlation coefficients ranged from 0.24, $p<0.001$ to 0.79, $p<0.002$. Tools that have been evaluated for reliability and/or relative validity are suitable for guiding clinicians when providing dietary advice. Variation in study design, settings and populations makes it difficult to recommend one tool over another, although future developers can enhance the understanding and use of tools by giving clear guidance as to the strengths and limitations of the study design. When selecting a tool, clinicians should consider whether their patient population is similar in characteristics to the evaluation sample.

Introduction

The World Health Organisation estimates that in 2008, 18.3 million deaths worldwide were due to cardiovascular disease and type 2 diabetes.[1] In 2010, unhealthy dietary habits, including low fruit and vegetable consumption, high salt intake and low wholegrain and fish consumption, combined with physical inactivity, are estimated to account for 10% of the global burden of disease. Assisting people with dietary modification is, therefore, a key challenge for health professionals.

In clinical care, dietary assessment is important for providing individualised dietary advice[2] and is essential for evaluating the success of interventions aimed at improving dietary habits, such as cardiac rehabilitation programs.[3] Dietitians typically use food diaries and take diet histories to obtain an overview of a patient's usual diet, with dietary advice then given based on this assessment. This process is time-consuming and interpretation requires specialist skills.[2] However, a highly detailed assessment of nutrient intake is not always necessary in a clinical setting. It is often enough to review an individual's dietary habits to determine the potential benefit of changing specific dietary behaviours and foods/food groups.[4]

Brief dietary screening tools have been developed to assist with dietary assessment in clinical practice. These tools take the form of a brief questionnaire that can be self-completed prior to, or administered during, a consultation. The answers allow health professionals and patients to quickly identify whether a diet is appropriate or if there are areas of concern. Dietary changes, based upon the patient's current dietary habits, can be discussed and food-based dietary goals set.[5] For dietary tools to be useful in clinical practice they need to be interpretable with minimal nutrition knowledge, quick to complete and easy to score. They must provide immediate guidance on healthy dietary changes or allow clinicians to quickly identify patients who may benefit from more intensive dietary counselling. Dietary screening tools have been designed to assess specific foods or nutrients[3, 6, 7], dietary behaviours

48 associated with obesity[8] or cardiovascular disease,[9-11] adherence to specific diets[12, 13] or as
49 specific aids in dietary counselling with a prompt sheet provided to guide discussion.[14, 15]
50 They take the form of short food frequency questionnaires (FFQs), with[16] or without[17] portion
51 estimates, behavioural questionnaires[18] or a combination of FFQ and behavioural questions.[7]
52 They are unable to give estimates of absolute intake but can classify individuals as high,
53 medium or low consumers of nutrients or foods of interest, allowing dietary advice to be
54 targeted to an individual. Questionnaires have also been developed to rapidly evaluate the
55 success of dietary interventions, for example to measure the effect of advice to increase fruit
56 and vegetable intake[19] or follow a lipid lowering diet.[20] These are responsive to change and
57 can provide outcome data to determine whether an intervention has succeeded in improving
58 dietary habits. Brief questionnaires are of interest to dietary researchers,[21] but the current
59 review focuses on instruments that might be applicable in a clinical setting to obtain a picture
60 of an individual's diet.
61 A review of brief dietary assessment tools for potential clinical use was published in 2000,[22]
62 but many additional tools have been developed since then and there is a need for an update.
63 More recently the US National Cancer Institute (NCI) published an on-line registry of
64 validated brief dietary assessment instruments.[23] Although the registry provides an overview
65 of the tools, it does not facilitate comparisons and provides no summarised information about
66 applicability to clinical practice.
67 Our aims were to: 1) identify and describe available brief dietary screening tools that can be
68 used in clinical practice for the prevention and management of obesity, cardiovascular
69 disease and type 2 diabetes in adults; 2) examine the acceptability, reliability and/or relative
70 validity of the tools; and 3) summarise the data so that clinicians can quickly assess which
71 tool is most suitable for use with their patient group. Details are also provided about the
72 availability of the tools and whether there are costs associated with their use.

Methods

Search strategy

Electronic databases MEDLINE, EMBASE, PsycINFO, AMED (Ovid versions) and CINAHL (EBSCOhost version) to June 2013 (week 26) were searched using MeSH terms and text words. Search terms were based around general terms for nutritional and dietary assessment and were designed to identify brief questionnaires. Terms included nutrition assessment, diet screen, food questionnaire, nutrient questionnaire and short, brief, rapid and adult. The full list of search terms is included in the supplementary information (appendix 1). One author (CE) screened all titles and abstracts. Full text articles were retrieved if abstracts appeared to meet the inclusion criteria. Additional studies were identified from reference lists and screened similarly. Studies were initially assessed for inclusion by one author (CE). Where it was unclear whether a study or questionnaire met the inclusion criteria a second author (JT) screened the reports.

Inclusion and exclusion criteria

Dietary habits or foods relevant to adults at risk for cardiovascular disease, overweight, obesity or type 2 diabetes were derived from national and international guidelines.[24-26] Risk increases with high consumption of energy-dense foods, trans-fats, saturated fats, sodium and alcohol and decreases with high consumption of high fibre foods, fruit and vegetables, fish and low glycaemic index foods. Dietary patterns emphasising high fibre foods, low fat dairy, poultry, fish, non-tropical vegetable oils and nuts, whilst limiting red and processed meats and high fat or sugar foods and drinks, are advised. Questionnaires assessing components of the diet that increase or decrease risk were identified.

Tools were included if they had been evaluated for reliability or relative validity against a biomarker or against another self-reported measure of dietary intake (dietary reference). In common with the previous review[22], sample size was not considered. Based on the clinical

expertise of two authors (CE, RA) tools were deemed to be practical for clinical settings if they were brief, available in paper format or freely accessible on the Internet, could be scored at administration without specialist computer software and were capable of providing immediate feedback to patients and practitioners on an individual level. Questionnaires were defined as 'brief' if they were estimated to take no more than 15 minutes to complete. Mean allocated appointment times for new patients in primary care have been reported as being between 16-32 minutes and complete physicals as 12-36 minutes.[27] Consequently, questionnaires taking more than 15 minutes to complete were judged as not feasible for use in clinical practice. However, most studies did not estimate completion time. Preliminary work, prior to conducting the full review, identified mean completion times of 15 minutes for a 25 item questionnaire,[28] 10 minutes for 31-item,[29] 20 item[9] and 16 item[10] questionnaires and 5-10 minutes for a 29 item questionnaire.[5] Taking these measures into account it was estimated that questionnaires of up to 35 items could feasibly be completed in 15 minutes. Tools designed to be administered by a practitioner or completed independently by the patient were both included.

Tools that assessed micronutrient intakes, protein intake, malnutrition screening tools or those aimed at identifying hazardous drinking were excluded. Questionnaires for single food groups, such as oily fish and pulses and fruit and vegetable questionnaires containing over 10 items, were considered to be of limited use in clinical practice and were excluded. Studies were excluded if they only reported the use of a questionnaire during an intervention or observational study, or described tools that were not tested for either reliability or relative validity. Due to the limitations of time and cost, studies not published in English were excluded. It was not possible to obtain copies of 2 tools, despite contacting the institutions where they were developed, so these tools were excluded from the review.[30, 31] A full list of inclusion and exclusion criteria is available in the supplementary information (appendix 1).

Data extraction

The data extraction form was developed by all authors and piloted with four studies. One author (CE) extracted data from all studies. Data from 25% of studies were also extracted by an independent reviewer for cross-checking.

Study characteristics

The following data were extracted: study design, study setting, sample size, population and country. Age, gender, socio-economic status (SES), education, disease state and ethnicity may all impact on the results of a relative validation study.[32] As such the sample profiles were categorised.

Questionnaire characteristics

Data were collected on the number of items, type of questions, scoring system and the language of the tool, the method of administration and whether the tool was designed for a specific population or for use in a particular setting.

Questionnaire items

Data were extracted on item generation as it is important to know whether a questionnaire has been tailored to the population of interest.[4] Data were extracted on whether a questionnaire had been tested for acceptability (face validity, ease of use or an assessment of usefulness) and readability.

Reliability and relative validity

Results were extracted from test-retest reliability studies determining whether tools were consistent over two or more administrations,[33] and from internal reliability studies determining whether items measuring the same dietary characteristic were consistent within a tool.[34] Data from relative validity studies were extracted. In true validation studies a new measure is compared with an accurate measurement of the truth, but this is very difficult for habitual diet.[35] The gold standard for dietary intake is a recovery biomarker such as doubly

148 labelled water, for energy intake, or urinary nitrogen for protein.[36] These are expensive to
149 administer, only available for a limited number of nutrients and inappropriate for brief
150 questionnaires that do not measure the whole diet. Even direct observation is unsuitable as a
151 true measure of habitual diet in free living individuals due to the need for 24 hour, possibly
152 covert, surveillance. Consequently, short dietary assessment tools are evaluated against
153 imperfect reference measures. These include self-reported dietary measures, for example food
154 diaries, a longer FFQ or 24 hour recalls; a concentration biomarker such as plasma vitamin
155 levels,[37] or biomarkers of pre-clinical disease[38] such as blood lipids or anthropometric
156 measures. None of these are true measures of habitual intake. Dietary measures are subject to
157 measurement error, which vary depending upon the method. For example, those reliant on
158 memory, such as FFQs, are subject to recall bias whereas food records can change dietary
159 behaviour.[4] The use of food tables for nutrient analysis further introduces error in both self-
160 report and direct observation of diet.[35] Furthermore, if errors in the reference measure
161 correlate with errors in the new measure, for example if both methods are subject to recall
162 bias, relative validity of the new measure could be overestimated.[35] Concentration biomarkers
163 and biomarkers of pre-clinical disease are affected by metabolic and lifestyle factors. For
164 example, levels of plasma β-carotene are determined by dietary intake but also by fat intake,
165 BMI, low density lipoprotein levels and smoking.[37] However, these biomarkers can provide
166 additional evidence of accuracy of a questionnaire when used in conjunction with other
167 reference measures.
168 Internal reliability is typically tested using Crohnbach's α which assesses how closely items
169 correlate with each other.[34] Values of >0.70 indicate high internal reliability, although strong
170 correlation between items in a dietary questionnaire may not be required if each item is
171 designed to assess different aspects of the diet.[39] Test-retest reliability and relative validity
172 are commonly tested at the individual level using correlation statistics.[35] The use of mean

values alone can only assess these at the group level.[40] Correlation coefficients of ≥ 0.4 for the nutrient of interest are considered to be adequate for food frequency questionnaires when compared with another dietary reference measure.[4] Correlations of ≤ 0.4 are more usual when FFQs are compared with a biomarker.[37] Studies calibrating long FFQs against other dietary assessment methods such as food diaries have reported coefficients between -0.16 to 0.86 for total fat in grams (mean 0.51), -0.01 to 0.71 for fruit and 0.16 to 0.72 for vegetables.[41] Test-retest reliability studies for long FFQs quote coefficients of 0.50 to 0.70 for energy, fat and selected micronutrients.[41]

The practice of only examining the correlations between scores to determine test-retest reliability or validity has been criticised and it has been recommended that the Bland Altman method is used in conjunction.[33] Details of the statistical tests used were summarised.

Results

A total of 1802 separate records were identified, 1795 via the electronic databases and a further 7 from hand searching references. One hundred and twenty two full text papers were screened and 47 met the inclusion criteria (figure 1). The development and testing of 35 tools were described in these papers, although 2, the Block Fat, Fruit and Vegetable Screeners (B-F&FV)[6] and the Hispanic Fat, Fruit and Vegetable Screeners (H-F&FV),[42] can be split into 2 distinct sets of questions which provide scores for different aspects of the diet. In addition 2 different versions of 2 tools, the Rapid Eating Assessment for Patients (REAP[29] and REAP-S[14]) and the Food Behaviour Checklist (FBC-T[10] and FBC-V[43]), are currently available and the FBC-V has been translated into Spanish (FBC-SV) and evaluated[32, 44] One, the Fat Related Diet Habits Questionnaire (FRDHQ), appears to have been used in several different versions. Papers describing relative validity testing of the 20-item and 24-item questionnaires are detailed here [21, 45-47] although 21- [48] and 23- [49] item versions have been used in interventions. The current version, available on-line, contains 25 distinct items

(http://sharedresources.fhcrc.org/documents/fat-related-questionnaire). For the purposes of this review B-F&FV and H-F&FV were regarded as single tools, REAP and REAP-S and FBC-T and FBC-V were regarded as distinct tools, with FBC-SV as a subsidiary to FBC-V. All the versions of FRDHQ were regarded as one tool.

Table 1 summarises the study and tool characteristics. Over half (n=20) were developed and tested in the USA or Canada with the remainder in European countries (n=10) and Australia or New Zealand (n=5).

Dietary assessment

Fifteen papers described 10 tools assessing healthy eating or healthy dietary patterns [8, 10, 13, 14, 28, 29, 32, 43, 44, 50-55] and 2 assessing adherence to the Mediterranean diet.[13, 56] Twenty-four papers described 18 tools providing information on the intake of dietary fats or dietary behaviours associated with fat intake. Of these, 11 were specific for dietary fats alone,[3, 12, 15, 20, 21, 39, 45-47, 57-64] 1 assessed dietary fat and free sugars,[65] 4 assessed dietary fat and fibre intakes[5, 7, 9, 18] and 2 assessed dietary fat and fruit and vegetable intake (although these can be used separately as one screener for fat and one for fruit and vegetables).[6, 42] Four tools assessed fruit and vegetable intake[16, 17, 19, 66, 67] and 1 assessed fruit intake alone.[68] With the exception of questionnaires specific for fruit and vegetable intake, no tool was designed to characterise diets by food groups, although 3 broader tools also provided a fruit and vegetable sub-score.[10, 43, 50]

Fifteen tools were short FFQs and asked questions on the frequency of consumption of specific foods.[3, 5, 6, 12, 13, 42, 58, 60, 69] All of the fruit and vegetable questionnaires were in this form.[16, 17, 19, 66, 68] Four exclusively asked about food behaviours, for example, “In the past month how often did you eat fish or chicken instead of red meat?” or, “In an average week, how often do you skip breakfast?”[14, 18, 29, 45] The remaining 16 contained a mixture of FFQ and behavioural questions.[7-10, 15, 20, 28, 39, 44, 50, 54-57, 59, 61]

All except 6[8, 10, 14, 29, 44, 52, 55] were scored numerically, with a total score or subscales for separate nutrients or fruit and vegetable intakes. The 6 that were not scored in this manner give individual guidance for each item, and 2[14, 29] also provide a prompt sheet to aid advice.

Item generation

Item generation was described for 27 tools, with 8 employing more than one method. Fourteen were adapted from longer FFQs and other questionnaires,[3, 7, 12, 14, 15, 18, 20, 39, 43, 50, 54, 56, 59, 69] of which 6 were initially based upon other tools included in this review.[14, 15, 18, 20, 43, 54] Six used national databases to identify foods most commonly consumed from a particular category, or foods that contributed most to the nutrient of interest in the population of interest.[5, 42, 54, 57, 68, 69] Seven used recommendations or clinical guidelines[5, 10, 29, 53, 55, 56, 58] and 4 were developed using an expert panel.[9, 10, 45, 53] Five were developed from data collected from participants, either quantitative in the form of dietary patterns [51] or through qualitative work.[10, 18, 42, 54]

Fourteen reported being evaluated in some way for acceptability to check that wording was clear, questions were relevant and the general lay-out of the tool was appropriate. Four employed cognitive interviewing,[29, 32, 43, 51, 68] 3 used survey methods,[7, 50, 55] 5 used unspecified qualitative interviews[10, 18, 42, 53, 58] and 2 used unspecified pilot testing.[20, 59] Only the FBC-T and the visual versions derived from it were evaluated for reading comprehension.[32, 43, 52] The FBC-T and FBC-SV were of low reading difficulty and the colour version of the FBC-SV was “very easy”.

Reliability and relative validity

Table 2 summarises the results of reliability and relative validity studies. Just over half the tools (n=18) were tested for test-retest reliability,[7, 9, 18-20, 29, 39, 42, 44, 52, 55, 57-61, 69] with 1 being tested in 3 different samples.[21, 45, 47] Test-retest time varied from several hours[7] to 1 year[18, 19, 57] and different studies employed different statistical tests, although correlations were most often used (14 tools).[7, 9, 18-20, 29, 39, 42, 44, 45, 52, 55, 57, 59] Test-retest correlation coefficients for total scores ranged from 0.59 [21] to 0.95.[7] Four studies did not calculate a total score but used individual items, group classifications or derived nutrient intakes from the screener as test-

252 retest variables.[52, 55, 58, 60] One study[61] was evaluated exclusively at the group level. Internal
253 reliability was tested in 9 tools [3, 8, 39, 44, 54, 58, 69] with 2 employing more than 1 sample.[10, 45-47,
254 [52] Values for Cronbach's α were reported from 0.47 [54] to 0.83.[47]All tools were examined for
255 relative validity at the individual level against a reference measure except 1.[42] A number of
256 different reference measures, with a range of different times between tests, different test
257 variables and different statistical tests were used to determine relative validity. No study
258 employed a recovery biomarker. Nine tools were compared with an FFQ that had previously
259 reported relative validity against food diaries or dietary recalls[6, 9, 14, 15, 18, 55, 59, 60, 66] and 13
260 were compared with food diaries[5, 16, 50, 57, 61], recalls[13, 17, 44, 54, 67] or a diet history.[58, 68] One was
261 compared with a different brief questionnaire that had been previously tested for relative
262 validity against 24 hour recalls.[39] Nine tools were compared with more than one reference
263 measure;[8, 10, 12, 20, 21, 28, 29, 45-47, 52, 53, 56, 62-64, 69] and 3 were compared with more than one dietary
264 reference.[12, 21, 29, 45-47, 62-64] Alongside a dietary reference, 4[10, 28, 56, 58] were compared with
265 biomarkers of preclinical disease, 4[28, 53, 56, 69] with anthropometric measures, and 2[10, 28] with
266 concentration biomarkers. Two did not use a dietary reference measure but compared change
267 in total score with change in BMI[3] and change in total score with change in plasma
268 carotenoids and plasma vitamin C.[19] The variation in study designs makes direct comparisons
269 between tools problematic, but total score (or fat score) from 11 tools[5, 9, 12, 15, 18, 20, 21, 29, 45-47,
270 [54, 59, 62-65] were reported to have been compared with % energy from total fat from food
271 diaries or FFQs. Correlation coefficients ranged from 0.24[46] to 0.79.[12] Total scores from 2 of
272 these tools were compared with % energy from total fat from a dietary reference in more than
273 one population: the FRDHQ reported correlation coefficients ranging from 0.24[46] to 0.60[45]
274 and MEDFICTS from 0.30[63] to 0.79.[12]
275 Table 3 gives an 'at a glance' summary of the characteristics of each tool, the evaluation
276 studies and provides information on access.

Discussion

Main findings

This systematic review identified 35 tools with potential application to dietary assessment in clinical settings. Around half assess dietary fat intake, with or without other nutrients, a third assess the overall diet for healthy eating or adherence to the Mediterranean diet, and the remainder assess fruit and vegetable intake. More tools have been developed and evaluated in the USA than in any other country.

Fewer than half the tools reported evaluations for clarity of language and acceptability with users. Due to the variation in methodology, it is not possible to determine if tools that were evaluated for acceptability show greater reliability or relative validity than those that were not. However, best practice in food frequency questionnaire design involves pre-testing.[41]

All tools, except 1, were tested for relative validity against one or more reference measures, although there was a wide variation in the design of studies, the variables used and the statistical tests employed. Three quarters were tested against a different dietary reference measure, with over a quarter using a FFQ or a different brief questionnaire. Since the majority of brief questionnaires were themselves FFQs, or included many food frequency questions, errors between the tools and the FFQs may have been correlated and the relative validity of these questionnaires overestimated. Around half were evaluated for test-retest reliability with similar variation in study design. This variation makes direct comparison between tools difficult and as a consequence it is not possible to state that one tool is superior for a particular nutrient or population. However, correlation coefficients for relative validity against food diaries and biomarkers and those for reliability studies are similar to those obtained in studies which evaluate longer FFQs against food diaries. This indicates that these brief dietary screening tools can be expected to produce a fair approximation of dietary habits and consequently could be of use in clinical practice for the dietary management of

cardiovascular disease, obesity and Type 2 diabetes. It is worth noting however, that few tools reported sensitivity, specificity or predictive values[28 55, 62-64, 66, 68] and only 6 (17%) have assessed sensitivity to change over time;[3, 18-20, 39, 54] therefore their utility in an intervention setting is unclear.

Strengths and limitations of the review

The strengths of this review are the application of a systematic search strategy and systematic data extraction techniques. Dietary assessment tools developed since Calfas et al's review in 2000[22] and validated tools that are not listed in the NIC registry have been identified and described. Tools that were not included in study reports were obtained on-line or from the original authors to ensure they met the inclusion criteria. The results are presented so that clinicians and researchers can select available tools that are most suitable for their purposes.

The review has some important limitations. The piloting and use of dietary screening tools in practice has not been examined, which means it is not possible to determine whether use of a tool has a positive effect on patient behaviour. The inclusion and exclusion criteria were developed for this review and assessment of whether a tool would be useful in clinical practice was derived from the expert opinion of only 2 clinicians. Other reviewers or clinicians may disagree with the criteria and may have included or excluded different brief tools. Calfas et al[22] judged that tools suitable for use in primary care would take 15 minutes to complete or be around 50 items long but provided no justification for this. The current review based an estimate of completion time on preliminary data obtained from brief dietary questionnaires. We excluded tools assessing single food groups since there is limited clinical benefit in a detailed assessment of one food group, with the exception of fruit and vegetable intake. However, fruit and vegetable questionnaires of greater than 10 items were excluded because increased patient burden reduces feasibility in clinical practice. Only peer-reviewed studies published in English were included. There may be evaluated tools that are used in

clinical practice in other countries, or that have not been peer-reviewed that have not been identified here. However, due to the heterogeneity of studies, this would be unlikely to change the broader conclusions of this review.

Comparison with other studies

Calfas et al's review [22] used wider inclusion criteria than this current review and did not consider whether a tool could be easily scored in practice. They identified 14 dietary assessment tools, of which 7 are included in the present review.[5, 6, 11, 12, 15, 20, 55] All measured dietary fat, making comparisons between tools more straightforward. Four were evaluated for test-retest reliability, with correlation coefficients ranging from 0.67 to 0.91. The 11 validated tools were either validated against a food diary or a longer FFQ, and correlation coefficients for % energy from fat ranged from 0.30 to 0.80. These ranges are similar to coefficients reported in the current review.

In 2003, Kim et al reviewed tools reported as validated, containing up to 16 items, and designed to assess fruit and vegetable intake.[70] They identified 10 instruments, of which 1 is included in the current review.[17] The remainder were excluded in the current review for reasons of length or because the scoring algorithms were complex and unlikely to be used in clinical practice. Tools were reported as validated against longer FFQs, food diaries or 24-hour recalls. Correlation coefficients for total fruit and vegetable intakes ranged from 0.29 to 0.80. Since the tools measured the same aspect of the diet, comparisons were possible and this review concluded that more detailed tools that asked about portion sizes and the consumption of mixed vegetable dishes showed greater relative validity. Cade et al[41] also comment that FFQs asking people to estimate their own portion sizes are more reliable. Only one tool included in the current review asks people to estimate their portion sizes by providing a multiple choice list of three different sizes.[12]

All the studies previously reviewed used correlations alone to assess reliability and relative validity. This remains the most common method and only 5 studies in the present review made use of the Bland-Altman method. Correlation coefficients are not measures of absolute agreement but are instead measures of relative agreement, assessing whether an individual has maintained their ranking relative to other participants. The intra-class correlation coefficient (ICC) was used to evaluate 4 tools, but this measure has also been criticised and data simulations have shown that high correlations can be achieved with low absolute agreement.[71] The Bland Altman method assesses limits of agreement (LOA) which define the range that 95% of the differences between the measures lie within, and may include graphical presentation of the data. Clinical knowledge must be used to decide if the LOA are acceptable.[72] Of the studies that used the Bland Altman method, one was published in 2002[7] and the remainder after 2010, with 3 studies conducted by the same team.[13, 56, 68]

Clinical implications

It is important that clinicians are clear about their purpose when selecting a tool for use. In clinical practice, dietary assessment is required to assist in the provision of dietary advice or to measure the impact of dietary intervention.[4] Brief dietary questionnaires used for the former purpose are those that give clear guidance on moving to healthier dietary habits rather than obtaining a detailed, quantitative assessment of an individual's diet. Assessment may be focussed on certain nutrients to be disease specific or may be concerned with overall diet quality. Typical questions from tools included in the current review include asking about the frequency of consumption of sweet foods or savoury snacks, with responses ranging from less than once a week to more than 3 times a day. The answers can be used to target dietary advice to the individual. Tools suitable for measuring the impact of a dietary intervention must also be able to measure change.

This review provides evidence that tools developed and tested in one population may not have the same relative validity in a different population. Equally tools developed in different countries will include different food items, also affecting relative validity. It should be noted that English translations of tools developed in Spanish, French, Norwegian or Dutch have not been validated and that older tools may no longer be appropriate due to shifts in food habits and processing.[73] In common with previous reviews[22, 70] studies with small sample sizes were not excluded. Cade et al[41] report a wide range of sample sizes for relative validation studies of long FFQs and found no difference in reported correlation coefficients between studies with large sample sizes compared to small sample sizes. However, with small sample sizes, confidence intervals are likely to be wide and consequently sample sizes of around 100 to 200 are advised.[40] Clinicians should consider the sample sizes of test-retest and relative validation studies if tools are to be used 'off the shelf'.

Developers of future tools can enhance understanding of the development, relative validity and reliability of tools by clearly describing: 1) how items were derived; 2) the population of interest; 3) the characteristics of the sample for reliability and relative validation studies; 4) the results of these studies; and 5) whether stratification by age, gender, ethnicity and socioeconomic status affected results. Tools that are most helpful for clinical use need to have a clearly described and simple scoring system, and ideally a copy presented in the paper or in an on-line appendix for evaluation with clear information about copyright. Table 4 provides a checklist to assist practitioners when choosing a brief dietary questionnaire for clinical use.

Conclusion

This review identified and summarised 35 short dietary assessment tools of potential use in clinical practice for the dietary management of cardiovascular disease, obesity and Type 2 diabetes. In general, tools demonstrated adequate reliability and/or relative validity, although

around half have been developed and evaluated exclusively in US populations. It is not possible to determine if any one tool is clearly better than another for a given population or purpose due to differences in the design of reliability and relative validity studies. If tools are to be used in different countries or populations, they need to be adapted and evaluated locally to ensure they are reliable and have acceptable levels of relative validity.

Supplementary information is available on the European Journal of Clinical Nutrition's website

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Figure Legend

Figure 1: Prisma diagram. Brief dietary questionnaires