Nutrition Research Reviews

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Examining the development of automated, personalised, dietary feedback using digital technologies: a systematic review

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Review Article

Cite this article: Legrand S, Ng H, Jenkins EL, Dordevic AL, Murakami K, Shinozaki N, Dang HMT, Bonham MP, and McCaffrey TA (2026). Examining the development of automated, personalised, dietary feedback using digital technologies: a systematic review. *Nutrition Research Reviews* **39**: e15, 1–17. doi: 10.1017/S095442242610033X

Received: 23 October 2024
Revised: 14 January 2026
Accepted: 21 January 2026

Keywords:
Dietary assessment; Dietary feedback; Digital health; Personalised feedback; Digital tools

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Abstract

Digital technologies provide a convenient and scalable approach to dietary assessment and personalised feedback, facilitating behaviour change. This is essential for reducing the prevalence of non-communicable diseases at a population level. However, the evaluation of the acceptability and feasibility of dietary feedback delivered via online platforms has not been thoroughly investigated. By utilising the term 'system architecture' to describe the essential components of the digital approach to capturing dietary feedback, this systematic review outlines the platform, dietary assessment methodology, reference values for assessing dietary intake and elements of personalised dietary feedback. When reported, the acceptability and feasibility of personalised feedback were captured. OVID Medline, OVID Embase, Scopus via Elsevier and Cinahl Plus via EBSCO identified 5839 studies. Search terms included dietary assessment, feedback and digital technologies. In total, twenty-eight studies involving 301 271 participants were included. Food frequency questionnaires were the most commonly used dietary assessment method, accessed via web-based platforms. Dietary intake was commonly assessed using a diet quality index, and feedback was provided on food groups, often combined with a diet quality score or macronutrient analysis. While participant acceptance of personalised dietary feedback was generally high, the overall completion rates for acceptability questionnaires were low, and feasibility was seldom reported. Methods used to measure acceptability and feasibility varied, preventing comparisons across studies. Study quality was high; however, future research would benefit from the involvement of stakeholders and end-users in designing feedback messages.

Introduction

Modification of dietary behaviours is fundamental to decreasing the prevalence of non-communicable diseases, which led to 11 million preventable global deaths in 2017[1]. To reduce the risk of diet-related diseases at the population level, national dietary guidelines such as the UK Eatwell Guide[2] and the Australian Dietary Guidelines[3] have been developed. These guidelines promote diets rich in fruits and vegetables while limiting alcohol consumption and foods and drinks high in energy, saturated fat, sugar and sodium. Traditionally, trained health professionals have conducted dietary assessments and provided personalised feedback[4]. This feedback, based on an individual's behaviours, preferences, goals and barriers[5], is more effective than generic population-based recommendations at encouraging sustained behaviour change[6]. While in-person counselling can provide acceptable personalised feedback, it is not feasible on a population level[7]. This highlights the need for more accessible options, such as delivery via digital technologies.

Traditional dietary assessment methods and dietary feedback have been digitised using technology, providing advantages such as convenience and scalability[8], as well as reduced researcher costs and burden after the initial development[9]. With ubiquitous internet use and mobile devices, the availability of these tools has increased; however, they often focus solely on energy reduction without providing more nuanced feedback[4,10]. For this review, personalised dietary feedback is defined as advice beyond the summation of energy and nutrients and includes the comparison of nutrient intakes to a range of reference values such as dietary guidelines, nutrient reference values, and diet quality indices (DQIs). Personalised feedback extends to statements aimed at increasing food literacy and equipping individuals with the knowledge, skills and actions to make healthier food choices[11]. In addition, it can assist in achieving goals related to the frequency or quantity of certain foods[12].

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To provide personalised feedback, an accurate measure of dietary intake is essential, although this can be challenging owing to the inherent limitations of self-reported data, including misreporting and recall bias[13]. Dietary assessment methods can be broadly categorised into prospective and retrospective approaches. Prospective methods, such as weighed or estimated food records, require participants to document their intake in real time. Retrospective methods, such as 24-h recalls (24HRs) and food frequency questionnaires (FFQs), involve recalling previously consumed foods (see Table 1 for a summary). When targeted information, such as specific nutrients (for example, sodium) or food groups (for example, fruits and vegetables) is required, screeners can provide a rapid and cost-effective method of assessment[13]. In recent years, dietary assessment methods have been digitised and made accessible through various platforms, including web-based programs, mobile applications (apps), wearable technologies and artificial intelligence (AI) systems embedded with algorithms to provide automated dietary feedback[14]. Technology-based dietary assessment methods can include food and portion size guide images to aid users in estimating their intake[15–18], and participants have reported that logging their intake using these tools is easier than traditional paper-based methods[19,20].

For automated, personalised dietary feedback to be successful, several elements specific to the collection and interpretation of data are required; however, to our knowledge, these have yet to be comprehensively summarised. For this review, the system architecture includes the technology-based platform used to collect the dietary data, the dietary assessment method, the dietary/nutrient reference values used to assess intake and the dietary elements within the feedback (Fig. 1). This systematic literature review aims to: (1) describe the system architecture of automated, personalised dietary feedback and (2) report evaluations of the acceptability and feasibility of dietary feedback provided in the studies. It was not within the scope of this literature review to describe the effectiveness of the dietary feedback or any long-term changes in health outcomes.

Methods

This review used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRIMSA 2020) guidelines[21]. On 27 February 2023, the protocol was registered with the International Prospective Register of Systematic Reviews (ID: CRD42023402250).

Search strategy

The literature search strategy was developed across four databases using medical subject headings and searching within the title and abstract for words related to dietary assessment methods, digital technologies and feedback (Supplementary File 1). Searches were conducted in OVID Medline (856 results), OVID Embase (2829 results), Scopus via Elsevier (1514 results) and CINAHL plus via EBSCO host (640 results). The search strategy was developed in collaboration with a subject librarian and peer-reviewed by subject experts with no limitations on population age, publication year, language or study design. The initial search was first conducted in March 2023 and last updated in September 2025.

Eligibility criteria and screening

Results were uploaded into Covidence Online Software[22] and duplicates were removed. Independent reviewers (S.L. and T.A.M., K.M., N.S., H.D. or H.N.) screened the title and abstract of all articles against the inclusion and exclusion criteria (Table 2) with 94% agreement. This was followed by a second pass for full texts (S.L. and H.N.) with 91% agreement. Reference lists of included studies were manually examined for relevant papers to ensure literature saturation. Two authors were contacted to clarify questions (one of which was excluded), and conflicts were discussed until a consensus was reached.

Data extraction and quality assessment

Data extraction was completed independently by S.L. using a template developed for this review (for example, author, date, platform, dietary assessment method and elements of dietary feedback), and a subset ($n = 7$) was checked by T.A.M., M.B. and A.D. for consistency. Unless stated by the authors, we have defined acceptability as participant satisfaction (that is, whether the feedback was implemented, useful and met the user's expectations), while feasibility explores whether the feedback and its delivery/implementation were practical and scalable. Quality assessment was conducted using the Quality Assessment with Diverse Studies (QuADS) appraisal tool[23]. The QuADS tool was chosen as it can be applied to a set of methodologically diverse research articles and its previous application to multiple digital and health-related systematic reviews[23–25]. The tool consists of thirteen criteria scored on a scale of 0–3 (0 = not mentioned at all, 3 = explicit or detailed description) covering four domains: research aim(s), research setting and target population, the study design and the analytic method. QuADS does not provide a summative score for each paper; therefore, the quality of the included papers is descriptively reported as the tool intended. All papers were assessed by S.L. and then by a second reviewer (E.L.J., H.N., K.M. and N.S.), and conflicts were resolved through discussion. T.A.M, K.M. and N.S. were not involved in the quality assessment of their publications[12,26].

Results

Study selection

The final search yielded 5839 articles, of which 2386 were duplicates. After screening was completed, thirty-one papers with 301 271 participants, published between 2009 and 2024, were included in the review (Fig. 2). One study was published across two papers[27,28] and another was published across three papers[29–31]; therefore, twenty-eight studies were included. Numerous papers were classified as 'near misses' during full-text screening as they met all but one criterion. For example, a study with women during pregnancy provided automated, personalised dietary feedback; however, intake of fruits, vegetables, sweets and sugary drinks was assessed by completing five questions every week (screener-style questionnaire)[32]. Of particular note were multiple publications, primarily from the discipline of computer science, describing the protocol for developing AI-enabled apps that have not yet been implemented. Other studies also provided personalised dietary feedback, although the process was not automated and was manually derived using decision trees[33–36]. An RCT to evaluate a behaviour change app for physical activity and diet provided automated dietary feedback, although this was limited to energy intake[37]. A summary of the excluded studies can be found in Supplementary File 2.

Quality assessment using the QuADS tool

Overall, the quality of the included papers was high (Table 3). The highest scoring categories across all papers were:

https://doi.org/10.1017/S095442242610033X Published online by Cambridge University Press

Table 1. Definitions, strengths and limitations of dietary assessment methods commonly adapted for use with digital technologies

Dietary assessment method	Definition	Strengths and limitations
Food frequency questionnaire	A pre-defined list of foods or food groups (20–200 items) in which the respondent retrospectively reports the usual frequency of consumption over a specified period (for example, 6 or 12 months)[92,93].	Strengths - Lower participant burden and appropriate for large sample sizes[93] - Easy and cost-efficient to administer[93] - Captures habitual diet[93] Limitations - Relies on the respondent's memory[93] - Uses a fixed list and estimated portion sizes and, therefore, may not be a precise measure for absolute intake[13,93] - Food lists are population-specific[93]
24-h recall	The respondent reports all the foods and beverages (including the amount) consumed in the preceding 24 h. The multiple pass method and prompts are used to help the respondent describe how the food was prepared, or if any additional ingredients were added[92].	Strengths - Collects very detailed information about an individual's intake[94] - Relatively low participant burden[93] - Does not alter intake patterns[93] Limitations - Multiple recalls are required to capture habitual diet[93] - Relies on the respondent's memory[93] - Requires a nutrient database and analysis program for coding and conversion of data to nutrients[93]
Estimated food record (estimated food diary)	A record of all foods and beverages (including the amount) over one or more days. Ideally, the respondent completes the record at the time of the eating occasion to avoid reliance on memory[92].	Strengths - Records are entered at the time of consumption to minimise reliance on memory[13,94] - Portion sizes are described using household measures to reduce quantification error[93] - Collects detailed information[94] - Recording is relatively easy[93] Limitations - Coding paper-based diaries into data can be time-consuming[93] - High participant burden[93] - Subjects may alter their diet[93] - May not capture episodically consumed foods[93]
Screener	A short behaviour or food frequency questionnaire about a limited number of foods and/or beverages consumed over a specified period[92].	Strengths - Captures long-term dietary habits[95] - Does not alter intake patterns[95] - Minimal time to complete[95] Limitations - Lacks detailed information[95] - Limited to a small number of dietary elements[95] - Relies on memory[95]
Image-based food record	Using a mobile device, the respondent captures images before and after all eating occasions[96].	Strengths - Provides real-time data collection[93] - Low participant burden[93] - Does not require participants to estimate portion sizes[93] Limitations - Relies on participants taking high-quality images[93] - Can encounter technical issues[93]

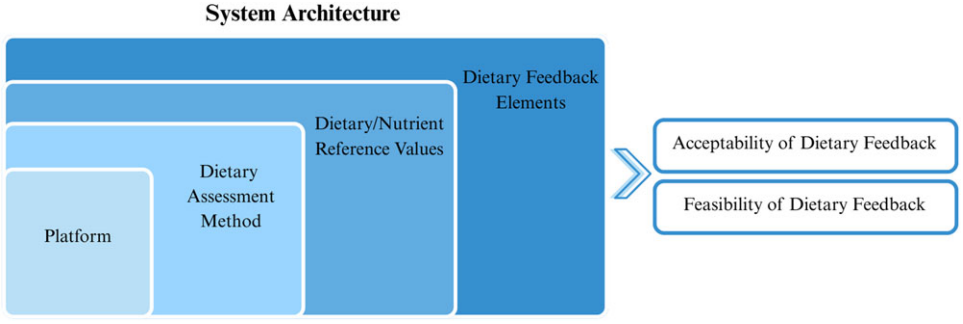


Fig. 1 Components of the system architecture of automated, personalised dietary feedback.

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Table 2. Inclusion and exclusion criteria for identifying studies

PICOS category	Criteria
Population	Adults and children
Intervention	Included: - A digital dietary assessment tool was utilised (food frequency questionnaire, 24-h recall, estimated food record or image-based) to assess the whole diet Excluded: - The dietary assessment method was not digital - The dietary assessment method only looked at part of the diet (for example, fruit and vegetable intake)
Comparison	N/A
Outcome	Included: - Automated, personalised dietary feedback was reported (for this paper, automated dietary feedback does not involve dietitians or researchers in creating information. Instead, the dietary feedback was determined by a computer algorithm) - Feedback was actionable and provided specific advice to improve diet quality Excluded: - Dietary feedback to participants was not reported - Feedback was limited to numerical energy or nutrient intake - Feedback was not automated
Study design	Excluded: - Not in English - Protocol, review paper, conference abstract or not implemented

appropriate study design (98%), appropriate format and content of data collection tools (97%), appropriate method of analysis (96%), and a clear statement of research aim/s (96%). On the basis of the information provided in the included papers, the majority performed poorly, with a 0 score across two categories: evidence of stakeholder consideration in research design and conduct ($n = 24$, 77%) and theoretical or conceptual underpinning to the research ($n = 18$, 58%).

Study characteristics

A summary of the characteristics of the included studies is presented in Table 4 and grouped by the elements included in the dietary feedback (discussed below). The majority of studies were from high-income countries ($n = 27$, 96%), with nearly half from Australia ($n = 7$, 25%)[12,29–31,38–42] and the USA ($n = 6$, 21%)[27,28,43–47]. A wide range of study designs were included, with the largest being randomised controlled trials (RCTs) ($n = 12$, 43%)[27–31,39,40,46,48–54], of which four were pilot studies[39,40,46,49], followed by non-randomised pilot studies ($n = 6$, 21%)[26,43,55–58]. Study duration ranged from a one-off measurement of diet[26,38,41,43] to a longitudinal study for 36 months[44,45]. For ease of synthesis, the reported primary outcomes were categorised across six domains. Development and user testing was the most common ($n = 9$, 32%)[40,42,43,49,53,55–57,59], followed by change in diet quality ($n = 6$, 21%)[39,48,50,51,54,60], weight change ($n = 5$, 18%)[27–30,44–46], evaluating the dietary feedback ($n = 4$, 14%)[26,52,58,61], cross-sectional descriptions of diet quality ($n = 3$, 11%)[12,38,41] and change in metabolic health ($n = 1$, 4%)[47].

System architecture of automated, personalised dietary feedback

Platform

Multiple platforms were utilised, with web-based (including web-based apps and progressive web apps) the most prevalent ($n = 14$, 50%)[12,26,29–31,38–43,49,52,58,60,61] followed by mobile apps ($n = 12$, 43%)[44,45,47,48,50,51,53–57,59], and one study each for apps for mobiles and desktops[46] and personal digital assistant ($n = 1$, 4%)[27,28].

Dietary assessment method

Dietary assessment methods varied, with the data collection ranging from a single measure of dietary intake[26,38,41,43] to daily for 24 months[27,28]. The most common method was an FFQ ($n = 14$, 50%), with 19 to 157 items[12,38–41,44,45,48–51,60,61], followed by FR ($n = 7$, 25%), with records ranging from 3 days to daily for 24 months[27–31,46,52,53,55,57]. AI-based image recognition was utilised in four studies (14%), ranging from 4 days to 13 weeks[42,56,59], with two of these incorporating text entry[42,56] and one with text, barcode and voice searching[47]. Multiple or single 24HR ($n = 2$, 7%)[43,58] and a single meal-based diet history questionnaire (MDHQ) ($n = 1$, 4%)[26] were also included. Of the included studies, fifteen (54%) sent reminders to complete the dietary assessment, with ten reminding participants before the due date[12,47–52,54,57,58], and the remainder being sent once the due date had passed[27–31,46,60,62].

Dietary/nutrient reference values

Studies analysed specific elements of the diet against dietary/nutrient reference values as per the inclusion criteria. These values included DQIs ($n = 14$, 50%)[38,40,41,44,45,48–52,54,57,60,61], a combination of a DQI and nutrient reference values ($n = 4$, 14%)[12,26,39,56], national dietary guidelines ($n = 3$, 11%)[42,53,55], national dietary guidelines combined with nutrient reference values ($n = 1$, 4%)[58] and disease-specific guidelines ($n = 1$, 4%)[43]. One study assigned recommended nutrient targets to the participants, although the reference range was unclear[29–31], and two studies used baseline weight and gender to determine energy and subsequent fat intake[27,28,46]. A study in Japan utilised an AI-based system that analysed meal images, automatically registered the food and calculated a dietary evaluation score[59], with another study incorporating AI-based recommendations[47]. Dietary/Nutrient Reference values are outlined in Table 4.

Dietary elements in personalised feedback

Personalised dietary feedback included a combination of food groups ($n = 21$, 75%)[12,26,29–31,38–42,44,45,48–51,54–58,60,61], macronutrients ($n = 19$, 68%)[12,26–31,38,39,43–46,48,49,52,53,55–58], a diet quality score ($n = 19$, 68%)[12,26,38–41,44,45,48–52,54,56,57,59–61], micronutrients ($n = 16$, 57%)[12,26–31,39,43–46,48,49,52,53,55–58,60] and energy ($n = 12$, 43%)[26–30,40,43,46,48,53,55,58,59]. Other elements included high-risk eating behaviours and non-hungry eating triggers[29–31], meal occasions[55], breakfast consumption[62], meal frequency and frequency of food items[26], and the glycaemic index of foods[47]. One study did not specify which nutrients were assessed[59], and some studies only looked at a specific macro or micronutrient, such as total fat[27,28,46], unsaturated fat[38] and sodium[48,49,53,60]. For ease of synthesis, findings were grouped into four categories: food groups plus two or more dietary elements ($n = 15$, 54%)[12,26,29–31,38,39,45,48,49,55–58,60,62,63],

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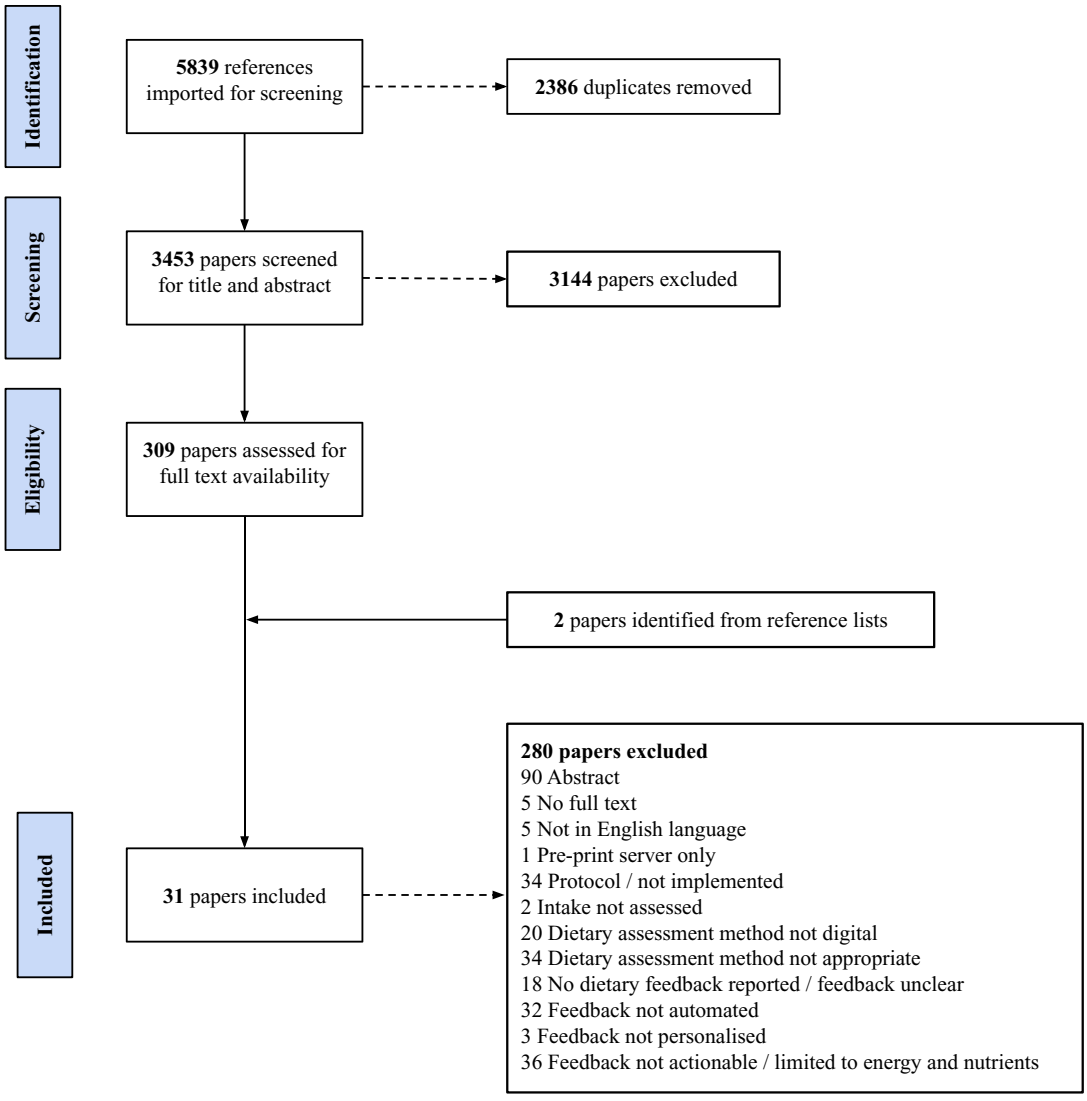


Fig. 2 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram.

food groups plus or minus diet quality ($n = 6, 21\%$)[41,42,50,51,54,61], diet quality plus nutrients ($n = 2$, 7%)[52,59] and nutrients plus or minus eating behaviours ($n = 5$, 18%)[27,28,43,46,47,53]. The majority (14/19, 74%) of the studies that provided a diet quality score utilised an FFQ for their dietary assessment method[12,38–41,44,45,48–51,54,60,61], whereas the remaining five used an FR[52,57], image-based method[56,59] or MDHQ[26].

Messaging structure of personalised dietary feedback

Dietary feedback was presented to participants using several approaches. For example, a pilot RCT using an FFQ summarised foods into the categories: 'foods to boost, foods to try, foods to reduce, foods to keep eating and foods to keep avoiding'[49], and an RCT using an FR sent daily text messages such as 'Nice job limiting fats; might want to limit sweets/candy this afternoon'[27,28]. A cohort study also using an FFQ provided a diet quality score with messaging about specific foods, such as 'You barely or do not eat nuts, there is room for improvement'[60]. Similarly, a non-randomised RCT using AI-based food recognition provided a meal balance score with information on how to increase the score, for example, 'Your meal balance score is 50. Your calorie intake is insufficient. In terms of nutritional balance, you are particularly deficient in protein and carbohydrates. For your next meal, please increase your overall food intake, focusing on meat and fish. Be sure to include 1 serving of bread or rice'[59]. Other studies using FFQs gave advice on the basis of the three lowest components of their score[38,48]. A study in Japan that piloted feedback with dietitians following the completion of an MDHQ provided a comprehensive report with personalised messages regarding meal frequency and food alternatives to improve intake based on top contributors, for example, 'Your major food source of salt is salt-based seasonings such as salt, soy sauce, and miso. Try to use smaller amounts of salt-based seasonings. Swap salt-based seasonings for lemon juice, vinegar, spices, and herbs. Select low-salt seasonings whenever possible'[26]. A summary of the dietary feedback from each study can be found in Supplementary File 3.

Dietitian/researcher input

In addition to the automated dietary feedback, eight studies (29%) involved the dietitian or researcher at various stages, including telephone 24HRs to monitor adherence[27,28,57], provision of additional annotated dietary feedback at meetings[27,28], dietetic

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Table 3. Results from the quality assessment with diverse studies (QuADS) appraisal tool for included papers[23]

						Data collection				Analysis			
Author, tear	1. Theory	2. Aim	3. Setting	4. Design	5. Sampling	6. Rationale	7. Format	8. Description	9. Recruitment	10. Justification	11. Method	12. Stakeholders	13. Strengths/ limitations
Food groups + two or more dietary elements													
Murakami *et al.*, 2021[26]	3	3	3	3	2	3	3	3	3	3	3	0	3
Zenun Franco *et al.*, 2022[48]	0	3	3	3	3	3	3	3	3	3	3	1	3
Hu *et al.*, 2020[44]	3	3	3	3	3	3	3	3	3	3	3	0	3
Hu *et al.*, 2021[45]	3	3	3	3	3	3	3	3	3	3	3	0	3
Haslam *et al.*, 2023[12]	2	3	3	3	3	3	3	3	3	3	3	0	3
Rollo *et al.*, 2020[39]	0	3	1	3	1	3	3	3	3	3	3	0	2
Mahal *et al.*, 2023[57]	0	2	0	3	1	3	2	1	0	1	3	2	3
Kong *et al.*, 2023[56]	0	3	2	3	1	3	3	3	1	3	3	3	3
Kaiser *et al.*, 2022[49]	0	3	1	3	3	3	3	3	3	3	3	0	3
Whatnall *et al.*; 2019[40]	1	3	3	3	3	3	3	2	3	3	3	0	3
Hendrie *et al.*, 2017[38]	0	3	3	3	3	3	3	3	3	3	3	0	1
Lamers *et al.*, 2023[60]	0	3	3	3	3	3	3	3	3	3	3	0	3
Collins *et al.*, 2012[29]	3	3	3	3	2	2	3	3	3	0	3	0	2
Collins *et al.*, 2013[31]	3	3	3	3	3	3	3	3	3	3	3	0	1
Hutchesson *et al.*, 2016[30]	3	3	3	3	2	3	3	3	3	3	3	0	3
Gonzalez-Ramirez *et al.*, 2022[55]	0	3	3	3	2	3	3	3	2	2	3	3	3
Vereecken *et al.*, 2012[58]	2	2	1	3	0	3	3	2	3	0	3	3	3
Food groups +/− diet quality													
Bejar *et al.*, 2022[50]	0	3	3	3	3	3	3	3	3	3	2	0	3
Bejar *et al.*, 2023[51]	0	3	3	3	3	2	3	2	3	2	2	0	2
Bejar *et al.*, 2024[54]	0	3	3	3	3	2	3	3	3	3	2	0	2
Williams *et al.*, 2017[41]	0	3	1	3	2	2	3	3	2	3	3	0	1
van der Haar *et al.*, 2021[61]	0	3	3	3	3	3	3	3	3	3	3	0	3
Guan *et al.*, 2023[42]	3	3	3	3	2	3	3	2	2	3	3	2	3
Diet quality + nutrients													
Bianchi *et al.*, 2019[52]	0	3	3	3	3	3	3	3	3	3	3	0	2
Okaniwa *et al.*, 2022[59]	0	3	1	1	1	1	2	2	2	3	3	0	3

Table 3. (*Continued*)

Nutrients +/− eating behaviours																
Murali *et al.*, 2013[43]	2	1	1	3	2	3	3	2	1	2	3	3	3	3	3	3
Threapleton *et al.*, 2022[53]	0	3	3	3	2	3	3	3	3	3	3	3	3	3	3	2
Zahedani *et. al.*, 2023[47]	0	3	1	3	2	3	2	3	3	3	2	0	3	3	3	3
Burke *et al.*, 2009[27]	2	3	3	3	3	3	3	3	3	3	3	0	3	3	3	3
Burke *et al.*, 2011[28]	0	3	1	3	2	1	3	3	3	3	3	0	3	3	3	2
Burke *et al.*, 2017[46]	1	3	1	3	2	2	3	3	3	3	3	0	3	3	3	3
Criterion total (%)	**33**	**96**	**76**	**98**	**76**	**90**	**97**	**91**	**88**	**88**	**96**	**20**	**96**	**96**	**96**	**86**

Scores range from 0 (low) to 3 (high).
Totals are calculated as a percentage of the total possible score for each criterion.
QuADS criteria.
(1) Theoretical or conceptual underpinning to the research. (2) Statement of research aim(s). (3) Clear description of research setting and target population. (4) The study design is appropriate to address the stated research aim/s. (5) Appropriate sampling to address the research aim(s). (6) Rationale for choice of data collection tool(s). (7) The format and content of data collection tool is appropriate to address the stated research aim(s). (8) Description of data collection procedure. (9) Recruitment data provided. (10) Justification for analytic method selected. (11) The method of analysis was appropriate to answer the research aim(s). (12) Evidence that the research stakeholders have been considered in research design or conduct. (13) Strengths and limitations critically discussed.

appointments or phone calls to discuss the automated feedback[52,61], providing education on the automated recommended goals[46] and phone or video calls to discuss or review goals[12,53]. Seven studies (25%) also reported the dietitian/researcher conducting quality checks of the dietary data for misreporting or implausible values[26,48–52,54] (Supplementary File 3).

Acceptability of the automated, personalised dietary feedback

The majority ($n = 17$, 61%) of the studies described an evaluation of the acceptability of the dietary feedback[12,26,39,42,48–57,60–62] (Table 5). Of the participants who completed the studies, the number who completed acceptability evaluations ranged from 26·7%[12] to 100%[26,49,52,55]. The method of measuring acceptability varied, with usability questionnaires being the most frequently used ($n = 7$, 25%)[49–51,53–56] (Supplementary File 3). Results varied across the studies, with each assessing a different aspect of acceptability. For example, an RCT of Australian young adults found that although engagement was poor and only 28% of participants visited the Australian Eating Survey feedback report, those who did found the advice motivating (70%), relevant (76%), personalised (76%) and helped them make changes to their eating habits (67%)[12]. Similarly, an RCT of adults in the UK reported that 88% of participants who completed the evaluation did not have difficulty understanding the report, 71% knew how to change their diet following the dietary feedback and 67% found the advice useful[48]. This was also the only study that reported a follow-up assessment (44% completion) in which 52% of these participants agreed the advice encouraged them to eat more healthily, 65% changed their eating/drinking habits and only 31% claimed the advice was still motivating them to improve their diet approximately 6 months after the study had ended[48]. A pilot study in Germany reported that all participants completed their evaluation and, on average, 36% would likely or highly likely recommend the app[49]. Despite this, 45% of the personalised nutrition group did not like the recommended foods, and 28% reported that the foods did not fit into their usual meal plans or recipes[49]. A formative evaluation of the feedback component of an online nutrition instrument reported that 87% of parents of school-aged children found the dietary feedback informative, comprehensible, interesting and relevant, and reported that they intended to use it[58]; however, this was defined as feasibility by the authors. Further details of each study can be found in Table 4.

Feasibility of the automated, personalised dietary feedback

Only four (14%) studies evaluated the feasibility of dietary feedback in terms of practicality and scalability[46,49,58,59], although one study used what we described as acceptability and was reported above[58]. Of the three remaining studies, the RCT of adults in the UK encountered technical difficulties in delivering dietary feedback. Initially, only 30–60% of the messages were successfully delivered, increasing to 70–80% in the latter part of the trial. Owing to these issues, participants had to uninstall and reinstall their software, which resulted in them not receiving messages for several days[46]. An intervention in Japan found that a combination of AI and human interaction had the highest retention rates and greatest weight loss, although the authors discussed the need to examine the associated time and cost of resources with human interventions[59]. A pilot study in Germany also described associated expenses, reporting that across groups, 31% would not pay anything for the eNutri app, and 56% would only pay between €0·50 and €2·50, with

https://doi.org/10.1017/S095442242610033X Published online by Cambridge University Press

https://doi.org/10.1017/S095442242610033X Published online by Cambridge University Press

Table 4. Study characteristics and system architecture of automated, personalised dietary feedback grouped by the elements of dietary feedback

Author, year, country	Study design	Study duration	Sex male/ female (%)	Sample age (mean ± SD)	Study primary outcome	Dietary assessment method	Dietary/nutrient reference values to assess intake	Dietary elements in feedback	Platform
Food groups + two or more dietary elements									
Murakami *et al.*, 2021, Japan[26]	Pilot study	Single measure	2/98	255 (48·6 ± 10·8)	Evaluation of dietary feedback	1 x MDHQ (196 items)	HEI 2015[97], The Japanese version of the US Food Patterns Equivalents Database[98] and Japanese Dietary Reference Intakes[99]	Food groups, diet quality score, macronutrients, micronutrients, energy and eating behaviours	Web-based
Zenun Franco *et al.*, 2022, UK[48]	RCT*	12 weeks	16/84	364 (43·2 ± 15·0)	Change in diet quality	3 x FFQ (157 items)	Modified HEI 2010[100]	Food groups, diet quality score, macronutrients, sodium and energy	Mobile app
Hu *et al.*, 2020, USA[44]	Longitudinal study	Up to 36 months	20/80	8977 (46·6 ± 11)	Weight change	3 x FFQ (53 items)	Nutriscore (developed by the Foodsmart research team)	Food groups, diet quality score, macronutrients and micronutrients	Mobile app
Hu *et al.*, 2021; USA[45]	Longitudinal study	Up to 36 months	16/84	1740 (48 ± 11)	Weight change	3 x FFQ (53 items)	Nutriscore (developed by the Foodsmart research team)	Food groups, diet quality score, macronutrients and micronutrients	Mobile app
Haslam *et al.*, 2023, Australia[12]	Prospective endpoint trial*	12 months	15/85	1277 (21·7 ± 2·0)	Describing diet quality	4 x FFQ (120 or 70 items)	ARFS[101] and NRVs for Australia and New Zealand[102]	Food groups, diet quality score, macronutrients and micronutrients	Web-based
Rollo *et al.*, 2020, Australia[39]	Pilot RCT*	12 weeks	14/86	50 (39·2 ± 12·5)	Change in diet quality	3 x FFQ (120 items)	ARFS[101] and NRVs for Australia and New Zealand[102]	Food groups, diet quality score, macronutrients and micronutrients	Web-based app
Mahal *et al.*, 2023, Canada[57]	Pilot study	NR	50/50	20 (NR)	Development and user testing	FR (3 days)	MDD-W[103] and HDDS[104]	Food groups, diet quality score, macronutrients and micronutrients	Mobile app
Kong *et al.*; 2023; Malaysia[56]	Pilot study	6 days	30/70†	30 (NR)	Development and user testing	AI-based food recognition and text entry (daily)	Malaysian HEI[105] and Recommended Nutrient Intakes Malaysia 2017[106]	Food groups, diet quality score, macronutrients and micronutrients	Mobile app
Kaiser *et al.*, 2022, Germany[49]	Pilot RCT*	4 weeks	13/87	167 (NR)	Development and user testing	2 x FFQ (156 items)	11-item Diet Quality Score[107]	Food groups, diet quality score, macronutrients and sodium	Web-based app
Whatnall *et al.*; 2019; Australia[40]	Pilot RCT*	3 months	27/73†	124 (22·4 ± 4·0)	Development and user testing	2 x FFQ (120 items)	ARFS[101]	Food groups, diet quality score, energy, eating behaviours	Web-based
Hendrie *et al.*, 2017, Australia[38]	Cross-sectional study	Single measure	29/71†	190 677 (NR)	Describing diet quality	1 x FFQ (38 items)	CSIRO Healthy Diet Score[108]	Food groups, diet quality score, and unsaturated fats	Web-based
Lamers *et al.*, 2023, Netherland[60]	Cohort study	4 months	40/60	195 (47, 32–57)†	Change in diet quality	3 x FFQ (16 items)	Dutch Healthy Diet 2015 index[109]	Food groups, diet quality score, and sodium	Web-based
Collins *et al.*, 2012[29], Collins *et al.*, 2013[31] Hutchesson *et al.*, 2016, Australia[30]	RCT*	24 weeks	61/59	309 (42·0 ± 10·2)	Weight change	FR (4 days/week)	Recommended nutrient targets (NR)	Food groups, macronutrients, micronutrients, energy and eating behaviours	Web-based

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Table 4. (*Continued*)

Gonzalez-Ramirez *et al.*, 2022, Spain[55]	Pilot study	1 month	23/77	39 (NR)	Development and user testing	FR (daily)	WHO dietary recommendations[110] and European Food and Safety Authority dietary recommendations[111]	Food groups, macronutrients, micronutrients, energy and eating behaviours	Mobile app
Vereecken *et al.*, 2012, Belgium[58]	Pilot study	NR	22/78†	72 (NR)	Evaluation of dietary feedback	24-HR (3 days)	Flemish food-based dietary guidelines[112], Dietary Guidelines from the Health Council Belgium[113] and nutrient recommendations from the Institute of Medicine of the National Academies[114]	Food groups, macronutrients, micronutrients and energy	Web-based
Food groups +/– diet quality									
Bejar *et al.*, 2022, Spain[50]	RCT*	28 days	26/74†	360 (NR)	Change in diet quality	Daily FFQ (19 items)	Mediterranean Diet Serving Score Index[115]	Food groups and diet quality score	Mobile app
Bejar *et al.*, 2023, Spain[51]	RCT*	28 days	23/77†	489 (20·7 ± 3·8)	Change in diet quality	Daily FFQ (19 items)	Mediterranean Diet Serving Score Index[115]	Food groups and diet quality score	Mobile app
Bejar *et al.*, 2023, Spain[54]	RCT*	28 days	62/38†	97 (43·2 ± 11·6)	Change in diet quality	Daily FFQ (19 items)	Mediterranean Diet Serving Score Index[109]	Food groups and diet quality score	Mobile app
Williams *et al.*, 2017, Australia[41]	Cross-sectional study	Single measure	24/76	93 252 (NR)	Describing diet quality	1 x FFQ (70 items)	ARFS[101]	Food groups and diet quality score	Web-based
van der Haar *et al.*, 2021, Netherlands[61]	Pretest–posttest	16 weeks	24/74§	37 (61 ± 8·2)	Evaluation of dietary feedback	3 x FFQ (16 items)	Dutch Healthy Diet Index[109]	Food groups and diet quality score	Web-based
Guan *et al.*, 2023, Australia[42]	Prototype development	NR	27/73†	15 (NR)	Development and user testing	AI-based food recognition and text entry (NR)	Australian Dietary Guidelines[3]	Food groups	Progressive web app
Diet quality + nutrients									
Bianchi *et al.*, 2019, France[52]	RCT*	12 weeks	100	80 (31·4 ± 3·64)§	Evaluation of dietary feedback	FR (3 days)	Modified PANDiet diet quality index[116]	Diet quality score, macronutrients and micronutrients	Web-based
Okaniwa *et al.*, 2022, Japan[59]	Non-randomised controlled trial	13 weeks	NR	102 (NR)	Development and user testing	AI-based food recognition (weekdays)	Automatically generated (NR)	Diet quality score, nutrients (NR) and energy	Mobile app
Nutrients +/– eating behaviours									
Murali *et al.*, 2013, USA[43]	Pilot study	Single measure	58/42†	12 (68)†	Development and user testing	24-HR (1 day)	Kidney Disease Outcomes Quality Initiative guidelines[117]	Macronutrients, micronutrients and energy	Web-based
Threapleton *et al.*, 2022, UK[53]	RCT*	8 weeks	23/77	48 (51 ± 13)	Development and user testing	FR (min. 4 days)	UK Dietary Guidelines	Macronutrients, sodium and energy	Mobile app
Zahedani *et. al.*, 2023, USA[47]	Observational	28 days (+ optional 8 weeks)	49/51	2217 (49 ± 11·5)	Metabolic health	AI-based food recognition (daily first 7 days + last 14 days)‖	AI recommendations based on input data	Macronutrients, energy and eating behaviours	Mobile app

(*Continued*)

Table 4. (*Continued*)

Author, year, country	Study design	Study duration	Sex male/ female (%)	Sample age (mean ± SD)	Study primary outcome	Dietary assessment method	Dietary/nutrient reference values to assess intake	Dietary elements in feedback	Platform
Burke *et al.*, 2009[27]; Burke *et al.*, 2011, USA[28]	RCT*	24 months	15/85†	210 (49, 13)‡	Weight change	FR (daily)	Calorie goal based on baseline weight and gender and limit fat intake to ≤25% of calories	Fat and energy	Personal digital assistant
Burke *et al.*, 2017, USA[46]	Pilot RCT*	12 weeks	13/87†	39 (44·85 ± 12·75)	Weight change	FR (daily)	Calorie goal based on baseline weight and gender and limit fat intake to ≤25% of calories	Fat and energy	App for mobiles and desktops

MDHQ, Meal-based diet history questionnaire; HEI, Healthy Eating Index; app, application; RCT, randomised controlled trial; FFQ, Food Frequency Questionnaire; ARFS, Australian Recommended Food Score; NRVs, nutrient reference values; NR, not reported; FR, food record; CSIRO, Commonwealth Scientific and Industrial Research Organisation; WHO, World Health Organisation; 24-HR, 24-h recall.
*Participants were randomised.
†Gender.
‡Median and interquartile range.
§Completers only.
‖Described as 'easy food logging with photo scan, barcode, voice, or search across a 54M+ food database' Accessed: https://www.january.ai/app.
See Supplementary File 3 for further details on the dietary feedback components.

no significant differences between the control and personalised nutrition groups[49].

Discussion

Findings from this systematic review highlight the heterogeneity of the components of the system architecture for automated, personalised dietary feedback systems. Web-based platforms were the most common, with tools predominantly utilising FFQs. Diets were commonly assessed against a DQI, and feedback was provided on food groups, often combined with a diet quality score derived from the DQI, or macronutrient analysis. Participants generally responded positively to the feedback; however, completion rates for acceptability questionnaires were low or not reported in the results, and feasibility was rarely assessed. These findings underscore the potential of digital technologies to provide personalised feedback, but also highlight critical reporting gaps in engagement, evaluation and technical implementation that must be addressed to optimise effectiveness in real-world settings.

As technology has advanced, dietary assessment has transitioned from in-person and paper-based methods to rapidly evolving digital platforms that utilise AI-based image recognition and recommendations. For example, the PDA used by Burke *et al.*[27,28] is now obsolete and has been replaced with web and mobile platforms, as seen in the subsequent study[46]. Web-based platforms were the most prevalent across studies ($n = 14$, 50%), broadening the reach and avoiding the need to install software. Mobile health apps were also commonly used across the included studies ($n = 12$, 43%), likely owing to the widespread adoption of smartphones over the past 15 years[64] with inbuilt reminders/alerts and monitoring functionalities[65]. Developing mobile apps requires substantial costs and ongoing resources for updates and maintenance[65]. In contrast, web-based platforms can now be accessed across numerous devices without requiring installation and regular updates, providing researchers with a more sustainable long-term alternative[66]. For instance, the CSIRO Healthy Diet Score survey was accessed by participants through a website and, at the time of the original publication, had provided personalised messages to over 190 000 users[38]. Although no included studies compared the use of mobile versus web apps, achieving similarly high levels of engagement through a mobile app may be more challenging, as users are unlikely to download an app unless they perceive it to offer clear advantages to existing ones in an already saturated market[65]. This review included four studies that used AI-based tools. It is worth noting that the use of AI-based image recognition and dietary recommendations predates the 2022 explosion of generative AI. Comprehensive scoping and systematic reviews highlight the use of AI to reduce participant and healthcare/researcher burden by improving data collection and processing efficiency and by supporting personalised nutrition recommendations in real time[67–69]. There are concerns about the accuracy and validity of AI-based tools, including the use of low-quality training datasets, which may result in recommendations that are not reflective of certain genders, ethnicities or socio-demographic groups[70].

Capturing detailed data through dietary assessment methods ensures the feedback is relevant and effective at guiding behaviour change[13,71]. Similar to our findings, FFQs were the most utilised dietary assessment in a systematic literature review describing digital dietary interventions to promote healthy behaviour change in adolescents[72]. This is likely because of potential lower participant burden, suitability for large sample sizes and ability to assess habitual

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Table 5. Findings on the participant acceptability of personalised dietary feedback

Author, year	**Completion *n* (%)***	Acceptability/ feasibility	Findings from participant evaluations of acceptability
Food groups + 2 or more dietary elements			
Murakami *et al.*, 2021[26]	100	Acceptability	- The report was believable (4·1/5), relevant (4·3/5), interesting (4·6/5), logical (4·3/5), understandable (4·3/5), well formulated (4·4/5), complete (4·5/5), too long (3·3/5), personal (4·4/5), correct (3·9/5) and will help me eat healthier (4·5/5) - The majority would use the report (4·3/5)
Zenun Franco *et al.*, 2022[48]	Report evaluation: 108/187 (57·8%) Follow-up questionnaire at 4·6 months: 82/187 (43·9%)	Acceptability	- After reading the report, most (71%) knew how to change their diet, did not find it difficult to understand (88%) and found the advice useful (67%) - At follow-up, around half (52%) reported that the advice encouraged them to eat healthily and change their eating/drinking habits (65%), although only 31% were still motivated by the advice
Haslam *et al.*, 2023[12]	Group 1: 102/343 (29·7%) Group 2: 111/325 (34·2%) Group 3: 90/337 (26·7%)	Acceptability (as per review definition)	- In group 1, 73% of participants were satisfied with the brief feedback from the HEQ - In groups 2 and 3, the majority were satisfied with the AES report (70%, 84%)
Rollo *et al.*, 2020[39]	NR	Acceptability	- The information was easy to understand (90·4%), helpful to identify areas to improve (57·1%) and areas doing well (61·9%) - Less than half (47·6%) found the information sufficient to enable change - More than half (66·7%) would have preferred more personalised information
Mahal *et al.*, 2023[57]	NR	Acceptability	- The majority (95%) agreed or strongly agreed the feedback was easy to understand - Nearly all (95%) frequently accessed graphic visualisations of their score and regularly accessed SAIN and LIM recommendations (80%) - Recommendations prompted diverse diets in both MDD-W (75%) and HDDS (80%) groups
Kaiser *et al.*, 2022[49]	106 (100%)	Acceptability	- The feedback changed participants' perception of a healthy diet (3/5), encouraged them to eat more healthily (4/5), try different foods (3/5), taught them how food impacts health (3/5) and increased confidence to make dietary changes (3/5) - Still following the advice and considered their diet healthier (3/5) and planned to continue (4/5) - Only 35·8% were likely or highly likely to recommend the app
Whatnall *et al.*, 2019[40]	52/62 (83·9%)	Acceptability	- Healthy eating information was useful (4·1/5), relevant (4·2/5), new (3·5/5), and motivated to eat more healthy foods (3·5/5) and less discretionary foods (3·5/5)
Lamers *et al.*, 2023[60]	180 (92·3%)	Acceptability (as per review definition)	- Nearly all (96%) knew how to eat healthier following the advice, although few (35%) had fewer symptoms after implementing the advice - To eat healthier, some participants would have liked practical advice with examples (22%), healthy recipes (65%), an explanation on why certain foods are healthy (23%) and information on portion sizes (19%)
Gonzalez-Ramirez *et al.*, 2022[55]	39/39 (100%)	Acceptability	- Around half found the messages clear (59%), useful (59%), relevant (53·8%) and thought they had potential to improve their diet (48·7%) - Participants rated the feedback messages as the most motivating/useful (59%)
Vereecken *et al.*, 2012[58]	46/72 (63·9%)	Feasibility	- The majority (87%) read all or most of the advice - Most (>81%) found the advice contained the right amount of information, was comprehensible, interesting, logical, useful, believable, well formulated, correct, personal, relevant, complete and attractive, and reported that they intended to use it as it would be helpful to improve their child's diet - The majority (>72%) preferred the information in tables, graphs, and circles, although they found circle diagrams with food groups and preference groups were too complex
Food groups +/− diet quality			
Bejar *et al.*, 2022[50]	127/385 (33·0%)	Acceptability (as per review definition)	- The majority thought the questions/feedback was understandable (90%) and would be willing to complete it again (83%)
Bejar *et al.*, 2023[51]	142/286 (49·6%)	Acceptability (as per review definition)	- The majority (85%) found the feedback understandable
Bejar *et al.*, 2023	45/71 (63·4%)	Acceptability (as per review definition)	- The majority (90%) found the feedback understandable and would be willing to complete it again (60%)

(*Continued*)

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Table 5. (*Continued*)

Author, year	**Completion *n* (%)***	Acceptability/ feasibility	Findings from participant evaluations of acceptability
van der Haar *et al.*, 2021[61]	NR	Acceptability (as per review definition)	- There were positive mean scores on the helpfulness of the personalised feedback to improve diets, and they were positive about continuing the advice after completion of the study
Guan *et al.*, 2023[42]	NR	Acceptability	- Participants highly rated the quality (4/5), quantity (4/5), visual information (4/5), and credibility (4/5) of the information, with an overall mean score of 4/5 - In subsequent interviews, almost all participants reported that the prototype was useful for increasing knowledge and awareness of healthy eating based on ADGs, although APDs suggested improvements, such as tips on food choices
Diet quality + nutrients			
Bianchi *et al.*, 2019[52]	78/78 (100%)	Acceptability	- Participants largely reported implementing the advice (5·7/9)
Nutrients +/- eating behaviours			
Threapleton *et al.*, 2022[53]	16/32 (50%)	Acceptability	- Over half wanted to discuss feedback with their healthcare practitioner - Nearly half (43%) either withdrew, never activated the app, or recorded their diet <1 day, although automated suggestions were activated on 88% of the days

NR, not reported; HEQ, Healthy Eating Quiz; AES, Australian Eating Survey; MDD-W, minimum dietary diversity for women; HDDS, Household Dietary Diversity Score; ADGs, Australian Dietary Guidelines; APDs, accredited practising dietitians.
*Participants who completed acceptability evaluations and also completed the study.

intake[13,73]. While FFQs can simplify data processing and automated feedback generation, they do not capture behavioural or contextual aspects of eating unless specific questions are asked[73]. This is particularly important as meal timing[74], portion sizes[75] and preparation methods[13] influence diet quality and can be provided as practical solutions to support dietary improvements. Among the included studies, only one using an FFQ incorporated an additional question to quantify how many days per week the participants consumed breakfast[40]. This could explain why in another study using only an FFQ, less than half of the participants found the feedback sufficient to make dietary changes, and more than half wanted more personalised information[39]. Although dietary assessment methods such as 24HR and FR are less effective at capturing episodically consumed foods, they can collect detailed contextual and behavioural information[13,76,77]. Despite nine (32%) of the included studies utilising a 24HR or FR, only two provided feedback on eating behaviours, including the frequency of eating occasions and non-hungry triggers[29–31,55]. This may have contributed to only half of the participants finding the feedback relevant and useful in a study that did not include these elements[55]. Leveraging the detailed behavioural or contextual data captured by 24HR and FR to provide feedback provides an opportunity for future research. Whilst the selection of the dietary assessment method is dependent on the study outcomes, studies may consider using multiple 24HR or FRs in conjunction with an FFQ to minimise the limitations of each instrument[78]. Where not already captured, studies may also benefit from including behavioural and contextual elements to produce nuanced feedback, ultimately increasing the potential for behaviour change.

Derived from a DQI, diet quality scores provide an overall assessment of the diet, often based on the alignment with the dietary guidelines from the country in which it was developed, with a lower score indicating an association with poorer health outcomes[79–81]. DQIs were the most commonly used dietary reference value across nineteen (68%) studies, providing a quantitative measure of diet quality. A systematic review of DQIs in RCTs found that they are effective at detecting a change in diet quality over time in interventions aimed at improving diet quality in adults with and without chronic health conditions[82]. However, another review showed that DQIs often do not accommodate vegan or vegetarian diets, highlighting the need for indices to be more inclusive of diverse cultural patterns, especially given the global focus for more plant-based diets[83]. The Australian Recommended Food Score was the most commonly used DQI in the included studies ($n = 4$) and accounts for dietary preferences by asking the user if they are vegetarian at the commencement of the dietary assessment[62]. This allows the algorithm to bypass the scoring for questions relating to meat intake and scores vegetarian alternatives higher, resulting in a score more representative of the diet[62]. Researchers should ensure the DQI is suitable for their targeted population or that it can be modified to reflect diet quality across various dietary preferences.

The structure of feedback messages plays a critical role in how participants process and act on dietary information[84]. In the included studies, feedback incorporated a combination of food groups, diet quality scores, nutrients and eating behaviours. While some messages integrated multiple elements, participants' ability to interpret and apply the feedback likely depended on their level of food literacy[85]. This was evident in one study, where participants expressed a preference for more practical advice, such as healthy recipes, explanations of the health benefits of foods and clearer portion size guidance[60]. Feedback often focused on the lowest-scoring food groups, and whilst highlighting areas for improvement is important, an exclusive focus on deficits may undermine participant engagement. Positively framed messages that recognise existing healthy behaviours have been suggested to better support motivation and encourage sustainable dietary changes[86]. Incorporating strengths-based approaches into feedback design may therefore enhance the acceptability of personalised dietary feedback delivered via digital tools.

Measuring acceptability is an important consideration in health-related interventions, as participants' perceptions of content, context and quality can influence engagement and outcomes[87]. In the context of digital tools, each component of the

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system architecture can affect the acceptability of the feedback messages delivered. However, defining acceptability remains challenging owing to the lack of a standardised definition within the literature[87]. Consistent with our findings, where both 'acceptability' and 'feasibility' were used to describe participants' responses to feedback, previous reviews of healthcare interventions have also reported considerable overlap between these constructs[88]. To address this, we broadly defined acceptability as participant satisfaction with the dietary feedback component, and feasibility as the practicality and scalability of providing feedback.

Similar to another review on feedback interventions[84], we found that completion rates for acceptability questionnaires were often low, raising concerns about the representativeness of the results. For example, although one study reported that 90% of participants accepted the feedback, only half ($n = 80$, 51%) of the participants in the intervention group completed the evaluation[50]. Assessments of acceptability in the included studies typically focused on the language and relevance of the feedback messages. In terms of feasibility, studies commonly reported the cost and technical challenges associated with automated feedback delivery[49,59]. Technical issues, such as participants not receiving feedback messages can reduce engagement and diminish the effectiveness of digital interventions. Researchers should therefore anticipate and address potential technical barriers and costs during the development of system architecture to optimise both the feasibility and impact of digital feedback tools[4].

From the quality assessment, the majority ($n = 24$, 86%) of included studies did not report the involvement of stakeholders in the design of their dietary feedback. In many cases, dietary feedback was created by dietitians and researchers drawing on their professional expertise and experience. This may reflect the focus of the studies, as only four studies reported the evaluation of dietary feedback as a primary outcome. Similarly, an umbrella review of digital health interventions highlighted inconsistent and poor reporting of co-design activities, despite the potential positive impacts on intervention acceptability and effectiveness[89]. Co-design processes, involving end-users such as patients, clinicians and healthcare decision-makers, can shape the development of feedback messages and improve their relevance, acceptability and ability to support behaviour change[90,91]. Recognising the importance of co-design can help researchers develop more practical, user-centred solutions to address health issues[91]. It is therefore suggested that future development of personalised feedback messages incorporate stakeholder input, with clear reporting of co-design processes where applicable.

Strengths and limitations

Adherence to the PRISMA guidelines and the duplicate screening of all papers are important strengths of this review. However, the included studies lacked cultural diversity, with the majority being from Australia and the USA, likely owing to the exclusion of non-English publications. In addition, several limitations emerged owing to the heterogeneity in reporting across studies. This variability led to the exclusion of numerous studies during the screening process as they failed to provide adequate detail about the dietary feedback provided to participants. The absence of this information meant we could not confirm the inclusion of these studies, possibly limiting our findings. Despite using standard definitions of acceptability and feasibility to interpret results, the comparison of studies was limited by the variation of methodologies, combined with low response rates and the potential for response bias. Consequently, the review could not determine if participants preferred a particular platform, dietary assessment method or combination of dietary feedback elements, highlighting the need for more standardised methods of assessing acceptability and feasibility across studies. We purposefully did not examine the long-term effectiveness of the dietary feedback, but focused on the system architecture to examine the development of current technology-based tools. Future studies should explore how the components of the system architecture can impact the changes in diet quality over time.

Summary

This review explored the system architecture of automated, personalised dietary feedback. Studies commonly utilised FFQs via web-based platforms, and dietary feedback was often composed of food groups combined with two or more dietary elements, with the emerging use of AI. Eating behaviours were rarely included in the dietary feedback. There was wide variability within the definitions of acceptability and feasibility; thus, a standard definition was applied. Participant completion of acceptability questionnaires was low, and feasibility was often not reported. The feedback was generally accepted when assessed, indicating that various ways of generating personalised feedback can be successful depending on the study outcomes. This review highlights the need for standardised questionnaires to assess between-study acceptability and feasibility, a lack of cultural diversity and the need to report involvement of stakeholders and end-users in future research. By understanding the development of acceptable and feasible automated, personalised dietary feedback, the impact of future digital health interventions on diet quality can be increased, ultimately leading to better health outcomes. Future research should investigate the impact of personalised dietary feedback from digital interventions on longer-term diet quality.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S095442242610033X.

Acknowledgements. The authors would like to thank Monash University Librarian Mario Sos for his assistance in developing the search strategy and Professor Sharon Kirkpatrick from the University of Waterloo for reviewing the research aims.

Financial support. Samara Legrand is supported by a Monash University Graduate Scholarship.

Competing interests. The authors declare no conflicting interests.

Authorship. Conceptualisation: S.L., T.A.M., M.B. and A.D. Methodology: S.L., T.A.M, K.M., N.S., H.D., H.N., M.B., A.D. and E.L.J. Manuscript preparation: S.L. Manuscript review and editing: S.L., T.A.M., M.B. and A.D. Supervision: T.A.M., M.B. and A.D. All authors have read and agreed to the published version of the manuscript.

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