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Review Article

A systematic review of the use of dietary self-monitoring in behavioural weight loss interventions: delivery, intensity and effectiveness

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Abstract

Objective: To identify dietary self-monitoring implementation strategies in behavioural weight loss interventions.

Design: We conducted a systematic review of eight databases and examined fifty-nine weight loss intervention studies targeting adults with overweight/obesity that used dietary self-monitoring.

Setting: NA.

Participants: NA.

Results: We identified self-monitoring implementation characteristics, effectiveness of interventions in supporting weight loss and examined weight loss outcomes among higher and lower intensity dietary self-monitoring protocols. Included studies utilised diverse self-monitoring formats (paper, website, mobile app, phone) and intensity levels (recording all intake or only certain aspects of diet). We found the majority of studies using high- and low-intensity self-monitoring strategies demonstrated statistically significant weight loss in intervention groups compared with control groups.

Conclusions: Based on our findings, lower and higher intensity dietary self-monitoring may support weight loss, but variability in adherence measures and limited analysis of weight loss relative to self-monitoring usage limits our understanding of how these methods compare with each other.

Keywords
Weight loss
Self-monitoring
Behavioural intervention

Excess adiposity is a serious global health issue, with overweight/obesity impacting over 35 percent of adult men and women worldwide[1]. These individuals are at increased risk of multiple negative physical, metabolic and psychological health outcomes, such as type II diabetes, CVD, certain types of cancers and depression[2–4]. The high prevalence and probable health consequences of excessive adiposity emphasise the need for multifaceted interventions that reduce the impact of obesity through weight loss. Self-monitoring of dietary intake is a cornerstone of behavioural obesity treatment; however, the extent of monitoring needed to produce significant intervention effects has not been well explored.

Excessive adiposity is typically the result of positive energy imbalances, and first-line treatment includes decreasing energy intake and increasing energy expenditure[5]. Lifestyle interventions targeting diet and physical activity are more effective in promoting weight loss when they encourage individuals to create and sustain behavioural modifications by employing strategies such as realistic

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goal setting and individual self-regulation skills[6,7]. One component of many behavioural weight loss interventions is dietary self-monitoring[7–9], in which individuals are responsible for logging or recording their dietary intake. The practice of dietary self-monitoring is grounded in self-regulation theory, which posits that self-evaluation and self-reinforcement necessitate behaviour change[10]. Self-monitoring requires an individual to have some level of understanding and awareness of their actions, thus supporting the development of self-regulation skills[8]. Although the theoretical basis for encouraging dietary self-monitoring is well-established, best practices for implementation are not clearly defined.

Dietary self-monitoring as a behaviour change technique evolves as weight loss intervention models modernise. In addition to conventional paper and pen methods, monitoring may now be performed on a variety of platforms including mobile apps and websites (such as CalorieKing or MyFitnessPal). Studies may also modify reporting guidelines (total intake, specific behaviours/foods) and reporting frequency (real time, once daily, five times a month) based on variations in study designs, targets or outcomes. Traditionally, dietary self-monitoring strategies involve recording of all daily food and beverage intake onto paper logs. Often, participants were required to look up the nutrient content of foods and calculate total intake by tallying points or energy content[8]. Participant's adherence to these strategies decreases over time as the practice is labor-intensive and requires substantial internal motivation[8]. A 2016 meta-analysis showed that weight loss intervention participants who had greater adherence to dietary self-monitoring lost more weight[11], thus improvement in monitoring may drive better weight loss outcomes. However, this finding may be confounded by increased individual motivation to practice self-monitoring and a coinciding motivation to utilise other self-regulatory behaviours[12,13]. That is, high adherence to dietary self-monitoring, may be an indication of a motivated participant.

Approaches to adapting traditional self-monitoring models to potentially reduce burden include digital recording options, reduction of monitoring scope or simplification of recording through smartphone photo features. Dietary monitoring smartphone applications have been created to make recording intake theoretically easier for participants to achieve and to provide richer feedback data for users[14]. Evidence has shown smartphone applications for self-monitoring dietary intake and physical activity are effective at supporting weight loss goals and promoting adherence to tracking protocols[15,16]. However, the review looking at dietary tracking only concluded that there was no significant difference in the amount of weight lost between groups who recorded their diet on paper or electronically[15].

Another way to reduce the burden of recording a full day's intake may be to decrease monitoring intensity (i.e. focusing on specific components of the diet or dietary behaviours as opposed to all food and beverage intake). For example, participants may be encouraged to monitor or track only those dietary behaviours theorised to impact weight loss success, such as drinking sugar-sweetened beverages or eating fruits and vegetables[17,18]. By decreasing the intensity of self-monitoring to only specific types of food intake, the labor associated with the task and the demand for intrinsic motivation may be reduced. However, it is unclear if this strategy is as effective in supporting weight loss as self-monitoring of the diet in its entirety. Because dietary self-monitoring remains a cornerstone of behavioural weight loss interventions, and new self-monitoring tools continue to emerge, a review of current approaches to dietary self-monitoring and their impact on weight loss is needed.

The goal of this systematic review is to examine the use of different dietary self-monitoring approaches in behavioural weight loss interventions in order to support the optimisation of these tools in future work. This review will be guided by the following research questions:

1. How is dietary self-monitoring implemented in weight loss interventions (current platforms (web, app, paper, etc.), intensity levels (all dietary intake *v.* dietary components), adherence metrics and feedback integration)?
2. How effective are interventions that use dietary self-monitoring to support weight loss among adults with overweight and obesity?
3. What are the weight loss outcomes in interventions that use higher intensity dietary self-monitoring *v.* lower intensity self-monitoring?

Methods

This systematic review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.

Search methods

We performed a systematic search in Ovid MEDLINE, Ovid EMBASE, Ovid PsycINFO, Cochrane Library, PubMed, Web of Science and EBSCOhost CINAHL, from inception to September 18, 2019 (search strategies are available as supplementary material). An update was performed using identical searches from September 18, 2019, to December 15, 2020. Results of the two searches were combined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Flow Diagram for reporting. Search structures, subject headings and keywords were tailored to each database by a medical research librarian specialising in systematic reviews. Searches were not restricted by language but were restricted to human subjects. We searched Embase for grey literature resources such as conferences, dissertations, reports and other unpublished studies in order to identify additional relevant citations. References

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Table 1 Inclusion criteria

PICOS	Inclusion criteria
Population	Adults with overweight/obesity
Intervention	Weight loss intervention that used dietary self-monitoring via paper logs, web, app, wearables, phone calls or choice of methods as a behaviour change technique
Comparators	Control group with usual care, wait list or distinct intervention or intervention delivery methods (distinct intervention or intervention strategy methods that did not incorporate identical dietary self-monitoring procedures)
Outcomes	Weight loss is primary outcome
Study design	RCT, experimental, longitudinal

in the included articles were also searched. Our findings are reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines[19].

Study selection

Behavioural weight loss intervention studies targeting adults with overweight or obesity that implemented dietary self-monitoring were included in this review. The inclusion criteria for the review are shown in Table 1. Interventions targeting people with severe mental illness or with an existing condition that would impact subsequent weight loss (such as pregnancy, post-partum, bariatric surgery) were excluded. Weight maintenance and weight gain prevention trials were also excluded. Studies using 24-h dietary recalls, food frequency questionnaires or other tools to assess diet as a study outcome, as opposed to as a behaviour change technique with a clearly defined monitoring protocol, were excluded. Trials were not limited by length of study, follow-up duration or country. Uncontrolled, pilot/feasibility, quasi-experimental or single-arm intervention studies were excluded, as were studies in which both the control and experimental groups were instructed to follow identical dietary self-monitoring procedures. The study selection process was conducted by a single reviewer (MR); a second reviewer (YL) analysed 10 % of total articles from the initial search and independently categorised them for inclusion and exclusion using an identical screening process. Agreement between the two reviewers was 98·5 %. Discrepancies were discussed among MR and YL and resolved by consensus and mediation with the senior author (KB).

Data extraction and quality assessment

The general study characteristics were extracted and are shown in Table 2. Two reviewers (MR and AR) extracted details from studies including: author, year, country, design, sample size, sampling frame, participant ages, intervention setting, study durationand main outcome measures (weight change). Dietary self-monitoring information that was extracted included: (1) platform of self-monitoring (web, app, paper, etc.); (2) dietary self-monitoring recording and submission processes (e.g. record on paper and mail in); (3) feedback messaging, if any (4) adherence; and (5) the intensity of the reported dietary intake (total diet, specific dietary components, etc.).

Data quality was assessed using a Consolidated Standards of Reporting Trials (CONSORT) statement risk of bias tool, previously adapted for weight loss intervention studies[20] (Table 3). Items were scored as present (✓), absent (✗) or 'unclear or inadequately described' (?). Some items were not applicable depending on the design of individual studies, and these were scored as N/A. Risk of bias categorization were based on total scores calculated using a previously developed system (✓ = 1 | ✗ = 0 | ? = 0 | n/a = 0); risk of bias categories included: high risk (0–3), medium risk (4–7) or low risk (8–10)[20].

Data synthesis and analysis

Studies were collectively examined with regard to study characteristics and outcomes. Weight loss was the outcome of interest in this review. Each of the included articles used weight loss as the primary study outcome. Weight change from baseline to the end of treatment was examined in each study. Mid-point and later follow-up periods were not included, as this review was focused on initial weight loss rather than weight loss maintenance. *P*-values were extracted from studies and reported whenever available. Included studies were divided into two groups based on the intensity level of monitoring that include: (i) interventions that required self-monitoring of all dietary intake and (ii) interventions that required self-monitoring of less than all dietary intake hereto referred to as 'abbreviated intake' (e.g. vegetable intake only, snack intake). A meta-analysis of weight loss data was attempted, but high clinical and methodological study heterogeneity ($I^2 > 95$ %) limited interpretability.

Results

Search/screening results

Search results and screening flow chart are shown in Fig. 1. A total of 10 441 unique study records were identified by the search. Of these, a total of fifty-nine individual interventions met the criteria for inclusion and were included in this review[17,18,21–78]. Results from studies that represented duplicate or secondary reporting of the same intervention were combined with the principal outcomes paper.

Study characteristics

General study characteristics

Study characteristics are summarized in Table 2. Of the fifty-nine studies included, thirty-eight were conducted in the USA, seven in Australia/New Zealand, four in the

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Table 2 Characteristics of included studies

First author	Year	Country	*n* (ctl)	*n* (ex)	% Female	Mean age (years)	Intervention length (weeks)	Intervention delivery method	Behavioural weight loss intervention brief description	Control group brief description
Adachi *et al.*	2006	Japan	54	46 (a) 47 (b) 58 (c)	100	46	34	Paper	(a) Materials, computer-tailored feedback, self-checks and behaviour monitoring + pedometer (b) same as (a) but no monitoring (c) materials, monitoring + pedometer but no feedback	Weight control manual
Ahn *et al.*	2020	South Korea	25	25	34	26	6	Paper (ctl) Digital (ex)	Access to diet tracking smartphone app, set up consultation with dietitian staff, real-time feedback about daily intake	Paper-based food diary, weight loss pamphlet, and goal setting instructions
Appel *et al.*	2011	USA	138	139 (a) 138 (b)	63·6	54	104	Digital and Phone (a) Combination (b)	(a) Website access, monthly feedback emails and phone calls with health coaches (weekly first 3 months then reduced) (b) Website access, monthly feedback emails, group and individual in person coaching sessions (weekly first 3 months then reduced)	Single visit with weight loss coach, brochures and recommended websites
Baer *et al.*	2020	USA	326	216 (a) 298 (b)	60	59·3	52	(a) Digital (b) Combination	(a) Adapted online weight management program including: education lessons (weekly for the first 16 weeks and then every other week), meal plans, sample menus, weight tracking, food intake tracking, and activity tracking. (b) same as (a) plus population health manager support including: additional weight-related support, monthly check-in calls, consultation with a dietitian at 6 months, log-in reminders	Single mailing with general weight management information
Becofsky *et al.*	2017	USA	20	20	46·5	50	12	Digital	Online program (diet and PA strategies)	Non-diet related weekly website lessons
Beeken *et al.*	2017	United Kingdom	270	267	65·7	59	13	Combination	Single session, Ten Top Tips (10TT) leaflets + logbooks	Usual Care
Beleigoli *et al.*	2020	Brazil	470	420 (a) 408 (b)	76·7	33·6	24	Digital	(a) Access to a weight loss program delivered through the web-based platform composed of 24 weekly sessions (12 weeks intensive and 12 weeks maintenance) and including: educational readings, videos, graphical and interactional tools, dietary monitoring, physical activity self-monitoring tasks,	Wait list plus nonpersonalised minimal intervention e-booklet on health effects of obesity and general diet/PA recommendations

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Table 2 *Continued*

First author	Year	Country	*n* (ctl)	*n* (ex)	% Female	Mean age (years)	Intervention length (weeks)	Intervention delivery method	Behavioural weight loss intervention brief description	Control group brief description
									interactive games, an embedded online social network, and personalised feedback. (b) same as (a) described above plus 12-week course of unlimited online personalised education and feedback with a dietitian.	
Bennett *et al.*	2012	USA	185	180	68·5	54	104	Combination	Website access, IVR monitoring system, counseling calls, optional group sessions, and materials	Usual Care
Bennett *et al.*	2010	USA	50	51	47·5	54	12	Combination	Website access (self-monitoring, goals, information), 2 in person motivational coaching sessions, and 2 phone motivational coaching sessions	Usual Care plus healthy lifestyle materials
Bennett *et al.*	2013	USA	94	91	100	35	52	Phone	Shape intervention including goals, materials, gym membership and phone counseling	Usual Care
Burke *et al.*, Burke *et al.*	2012, 20-11	USA	72	68 (a) 70 (b)	84·8	47	104	Digital	(a) PDA with monitoring software (b) PDA with monitoring + feedback software	Paper food diary and reference booklet
Byrne *et al.*	2006	Australia	33	41	52·7	38	32	Digital	Watch tracker and materials	Usual Care
Chambliss *et al.*	2010	USA	30	45 (a) 45 (b)	82·5	44	12	Combination	(a) Group session + email feedback (b) Same as (a) + step counter, newsletters, phone consults	Waitlist
Collins *et al.*	2012	Australia	104	99 (a) 106 (b)	58·2	42	12	Digital	(a) Web-based program access (b) Same as (a) but web program enhanced with personalised feedback	Usual Care
Crane *et al.*	2015	USA	138	139	0	44	26	Digital	2 sessions plus interactive online lessons and counseling	WaitList
Damschroder *et al.*	2014	USA	159	162 (a) 160 (b)	15	54	52	Group	(a) phone delivery of ASPIRE small changes weight loss program (b) Group delivery of ASPIRE program	VA standard weight loss program "MOVE!"
Duncan *et al.*	2020	Australia	36	41 (a) 39 (b)	70·7	44·5	52	Combination	(a) Smartphone weight management app access, online energy counter, scale, fitbit, educational materials delivered via the app, sms, printed materials and one in-person dietary counseling session, weekly summaries and self-monitoring reminders (b) Same as (a) plus access to a sleep intervention app	Wait list

Table 2 *Continued*

First author	Year	Country	*n* (ctl)	*n* (ex)	% Female	Mean age (years)	Intervention length (weeks)	Intervention delivery method	Behavioural weight loss intervention brief description	Control group brief description
Dunn *et al.*	2016	USA	38	42	84	48	15	Digital	Eat Smart, Move More, Weigh Less online program	Waitlist
Foley *et al.*, Bennet *et al.*	2016, 20-18	USA	175	176	68·1	50	52	Combination	TRACK intervention including tailored goals, interactive voice response (IVR) phone calls, text messages, materials and sessions	Usual Care
Foster-Schubert *et al.*	2012	USA	87	118 (a) 117 (b) 117 (c)	100	58	52	Combination	(a) Low energy diet + group sessions (b) PA prescription + training sessions (c) combination of (a) and (b)	Waitlist
Fukuoka *et al.*	2015	USA	31	30	77	55	21·66	Combination	DPP, mobile app/pedometer and 6 sessions	DPP
Haapala *et al.*	2009	Finland	63	62	77	38	52	Digital	Mobile app with personalised goal setting, diet tracking, text message reminders and diet/exercise information	Waitlist
Harvey-Berino	2010	USA	161	158 (a) 162 (b)	93	47	26	Combination (a) Digital (b)	(a) Group sessions (online plus monthly in person) + diet and exercise prescription (b) Same as (a) but all online	Same intervention as (a) but conducted in person
Hunter *et al.*	2008	USA	222	224	50·25	34	26	Combination	Behavioural Internet Therapy (diet and PA recommendations, lessons and feedback)	Usual Care
Jakicic *et al.*	2016	USA	233	237	77·2	31	104	Combination	Same as ctl + provided wearable tracker at 6 mos	Group counseling sessions, telephone counseling sessions, text messages, access to study website and self-monitoring of diet and physical activity (no wearable device).
Jebb *et al.*	2011	UK, Australia, Germany	395	377	87	47	52	Combination	Referral to weight watchers program including weekly meetings plus access to online food, activity, and weight monitoring, community discussion boards and information	Usual care
Jeffery *et al.*	1993	USA	40	40 (a) 40 (b) 41 (c) 41 (d)	50	40	78	Group	(a) Sessions + feedback (b) Sessions + feedback + prepackaged meals c) Sessions + weekly cash payments (d) Combination of (a), (b), and (c)	None
Johnston *et al.*	2013	USA	145	147	90	47	26	Combination	Weight Watchers program including weekly meetings, online tools and mobile application with a focus on a balanced diet plan, activity plan, group support and behaviour change skills plus food/weight/activity monitoring systems and related online content	Publically available diet and exercise materials (print and online)

Table 2 *Continued*

First author	Year	Country	*n* (ctl)	*n* (ex)	% Female	Mean age (years)	Intervention length (weeks)	Intervention delivery method	Behavioural weight loss intervention brief description	Control group brief description
Jospe *et al.*	2017	New Zealand	48	51 (a) 51 (b) 50 (c) 50 (d)		44	52	Combination (a, b, d) Digital (c)	(a) session + monthly meetings (b) session + daily self-weighing and feedback (c) session +MyFitnessPal app (d) session + hunger training and glucose testing	Single counseling session
Laing *et al.*	2014	USA	107	105	73	43	26	Digital	Instruction on using My Fitness Pal App	Usual Care
Lally *et al.*	2008	United Kingdom	35	33 (a) 36 (b)	66·3	39	8	Paper	(a) 10TT + 4xs week weighing (b) 10TT above + weekly weighing	Waitlist
Luley et al	2014	Germany	60	60 (a) 58 (b)	41	50	52	Combination	(a) 2 h diet and exercise instruction, accelerometer device with built in energetic intake tracking system and real-time energy balance gauge plus monthly feedback via mailed letters (b) same as (a) but feedback provided via phone	2 h instruction on healthy diet and physical activity
McRobbie *et al.*, Hajek *et al.*	2016, 20-16	United Kingdom	109	221	72	46	52	Group	Sessions (diet, PA)	Four one-on-one counseling sessions with a nurse + handouts
Melanson *et al.*	2012	USA	57	59 (a) 41 (b)	87·9	38	12	Group	(a) Assigned low glycemic index diet (no tracking required) (b) Assigned diet based on food-points system	Instructed to follow low energy dense diet (no tracking required)
Morgan *et al.*	2009	Australia	31	34	0	36	26	Digital	Website (diet and PA), online support and feedback	Single information session
Morgan *et al.*	2013	Australia	52	54 (a) 53 (b)	0	47	13	Paper (a) Digital (b)	(a) Materials, DVD, pedometer (b) Same as (a) + website access, user guide and personalised feedback	Waitlist
Morgan *et al.*	2012	Australia	45	65	0	44	12	Combination	Single session, website access, materials and pedometer	Waitlist
Ozaki *et al.*	2019	Japan	28	27 (a) 25 (b)	0	34	12	Combination	(a) Two group sessions (at beginning and end of program) plus online self-monitoring site and monthly emails (b) Same as (a) + 2 small group session and 4 remote, tailored counseling sessions	Waitlist
Paskett *et al.*	2016	USA	426	237	70·7	56	52	Group	Materials (print and online), sessions and regional staff meetings	Cancer education focused materials, information session, health fair, church bulletins, monthly sessions, and encouragement to complete screening tests

Table 2 *Continued*

First author	Year	Country	*n* (ctl)	*n* (ex)	% Female	Mean age (years)	Intervention length (weeks)	Intervention delivery method	Behavioural weight loss intervention brief description	Control group brief description
Patel *et al.*	2019	USA	35	35 (a) 35 (b)	84	43	12	Digital	(a) My Fitness Pal app set up, tailored feedback and materials (b) Same as (a) but no self-monitoring until week 5	Access to My fitness Pal (no feedback or support)
Rock *et al.*	2015	USA	348	344	100	56	104	Group	Sessions, booster calls and newsletters	2 individualised weight management sessions
Sherwood *et al.*	2006	USA	600	600 (a) 601 (b)	71·8	51	104	Paper (a) Phone (b)	(a) Paper materials, mailed lessons with a counselor and optional follow up (mailed lessons (b) Same as (a) but delivered by phone	Handouts
Shuger *et al.*; Barry *et al.*	2011, 20-11	USA	50	49 (a) 49 (b) 49 (c)	81·7	47	39	Group (a and b) Digital (c)	(a) Sessions + materials + phone counseling (b) Same as (a) + Sensewear armband tracker and website access (c) Armband and website access only	Weight loss manual
Spring *et al.*	2017	USA	32	32 (a) 32 (b)	84	39	26	Group (a) Digital (b)	(a) Sessions, optional walking sessions, phone calls, financial incentives (b) same as (a) but delivered via app + wireless tracking device	DVD, energy counting book and logs for monitoring
Stephens *et al.*	2017	USA	31	31	71	20	12	Digital	One time counseling session plus commercially available smartphone application with features to track diet and physical activity, network with other participants, receive text messages from health coach	One time counseling session
Svetkey *et al.*	2015	USA	123	122 (a) 120 (b)	69·6	26	108	Digital (a) One on one (b)	(a) Weight loss app with reminders and feedback (b) group and phone sessions	Handouts
Tanaka *et al.*	2018	Japan	37	75	0·9	46	8	Digital	Access to commercial mobile app with diet information, self-monitoring, and group chat with a nutritionist offering feedback and advice	Waitlist
Tate *et al.*	2001	USA	45	46	89	41	24	Digital	1 weight loss session, access to study website, weekly email lessons and feedback	1 weight loss session + access to website
Tate *et al.*	2006	USA	67	61 (a) 64 (b)	15·6	48	26	Digital	(a) Website access + automated feedback (b) website access + human counselor feedback	1 weight loss session + access to website

Table 2 *Continued*

First author	Year	Country	*n* (ctl)	*n* (ex)	% Female	Mean age (years)	Intervention length (weeks)	Intervention delivery method	Behavioural weight loss intervention brief description	Control group brief description
Teeriniemi *et al.*	2018	Finland	89	91 (a) 85 (b) 88 (c) 65 (d) 73 (e)	49	46	52	Digital (a) Combination (c and e) Group (b and d)	(a) website access (b) cognitive behavioural counseling + feedback (c) same as (b) + website access (d) self-help guidance + 2 face-to-face sessions (e) same as (d) + website access	Usual Care
Thomas *et al.*	2017	USA	86	94 (a) 91 (b)	77·5	55	52	Digital	(a) Weight Watchers online (b) Weight Watchers Online + ActiveLink tracking device	Online newsletters
Thomas *et al.*	2015	USA	77	77	79·9	53	12	Digital	Online intervention including videos and feedback	Online weight loss information
Thomas *et al.*; Goldstein *et al.*	2019; 20-19	USA	56	114 (a) 106 (b)	83	55	78	Digital (a) Group (b)	(a) Introductory session plus smartphone app based skills training videos, MyFitnessPal monitoring app, monthly feedback and social support (b) group-based behaviour change sessions (weekly 6 months, biweekly 6 months, then monthly 6 months) plus paper diaries for self-monitoring diet and activity with tailored feedback	Introductory session, printed information, monthly printed materials, paper diaries for self-monitoring diet and activity with written feedback
Turner-McGrievy and Tate	2011	USA	49	47	75	43	26	Digital	Weight loss podcasts (2 weekly for 3 months, then 2 mini pod casts for 3 months), Fat Secret energy counting app for diet tracking and Twitter messages	Weight loss podcasts (2 weekly for 3 months, then 2 mini pod casts for 3 months)
Wang *et al.*	2012	Taiwan	26	24	68	44	12	Paper	ctl sessions + PA and intake diaries with feedback	Six weight loss sessions
Wang *et al.*	2012	USA	72	68 (a) 70 (b)	85	46	52	Group	(a) ctl + PDA for tracking (b) same as (a) + feedback	32 weight loss sessions + paper diary to self-monitor diet
West *et al.*	2011	USA	112	116	84	71	12	Group	DPP, pedometers and diet/activity logs	Cognitive memory intervention
Whitelock *et al.*	2019	United Kingdom	54	53	74	43	8	Combination	Printed dietary advice book, text messages and a smartphone application that allows for uploading and review of all food and drink consumed and audio clips to promote attentive eating decisions	Printed dietary advice book plus text messages
Wilson *et al.*	2017	USA	1268	634	58·4	46	42	Digital	Digital DPP including small group support	None

DPP, diabetes prevention program.

Table 3 Quality assessment of included studies

Author, year	Baseline results reported for each group	Randomization described	Dropout rate < 20 % by end of intervention period	Assessor blinding	Adiposity assessed more than 6 mos after baseline	Intent to Treat Analysis	Confounders accounted for in analysis	Summary results and effect size/ significance reported	Power calculation conducted and study adequately powered	Objective weight measure was used	Total risk score	Risk of bias category
Adachi *et al.*, 2006	✓	✓	✓	x	✓	x	x	✓	x	✓	6	Medium
Ahn *et al.*, 2020	✓	✓	✓	x	x	✓	x	✓	✓	✓	7	Medium
Appel *et al.*, 2011	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	9	Low
Baer *et al.*, 2020	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	9	Low
Becofsky *et al.*, 2017	✓	✓	✓	x	x	✓	✓	✓	✓	✓	8	Low
Beeken *et al.*, 2017	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	9	Low
Beleigoli, 2020	✓	✓	x	✓	x	✓	x	✓	✓	x	6	Medium
Bennett *et al.*, 2010	✓	✓	✓	✓	x	✓	x	x	✓	✓	7	Medium
Bennett *et al.*, 2012	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	9	Low
Bennett *et al.*, 2018/Foley *et al.*, 2016	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	9	Low
Bennett *et al.*, 2013	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	9	Low
Burke *et al.*, 2011, 2012	✓	✓	✓	x	✓	✓	✓	✓	x	✓	8	Low
Byrne *et al.*, 2006	x	✓	✓	x	✓	✓	✓	x	✓	✓	7	Medium
Chambliss *et al.*, 2010	✓	✓	✓	x	x	✓	✓	✓	✓	✓	8	Low
Collins *et al.*, 2012	✓	✓	✓	✓	x	✓	x	x	x	✓	6	Medium
Crane *et al.*, 2015	✓	✓	✓	x	x	✓	x	✓	✓	✓	7	Medium
Damschroder *et al.*, 2014	✓	✓	x	x	✓	✓	✓	✓	✓	✓	8	Low
Duncan, 2020	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	9	Low
Dunn *et al.*, 2016	✓	✓	x	x	x	✓	✓	✓	✓	✓	7	Medium
Foster-Schubert *et al.*, 2012	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10	Low
Fukuoka *et al.*, 2015	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	9	Low
	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	9	Low

Table 3 *Continued*

Author, year	Baseline results reported for each group	Randomization described	Dropout rate < 20 % by end of intervention period	Assessor blinding	Adiposity assessed more than 6 mos after baseline	Intent to Treat Analysis	Confounders accounted for in analysis	Summary results and effect size/ significance reported	Power calculation conducted and study adequately powered	Objective weight measure was used	Total risk score	Risk of bias category
Haapala *et al.*, 2009	✓	✓	✓	x	x	✓	x	✓	✓	✓	7	Medium
Harvey-Berino, 2010	✓	✓	✓	x	x	✓	✓	x	x	✓	6	Medium
Hunter *et al.*, 2008	✓	✓	x	x	✓	x	x	✓	✓	✓	6	Medium
Jakicic *et al.*, 2016	✓	✓	x	x	✓	✓	✓	✓	✓	✓	8	Low
Jebb *et al.*, 2011	✓	✓	?	?	✓	x	✓	✓	x	✓	6	Medium
Jeffery *et al.*, 1993	✓	✓	✓	x	x	✓	✓	x	x	✓	6	Medium
Johnston *et al.*, 2013	✓	✓	x	x	✓	✓	✓	✓	✓	✓	8	Low
Jospe *et al.*, 2017	✓	✓	?	✓	x	x	x	✓	✓	✓	6	Medium
Laing *et al.*, 2014	✓	✓	✓	x	✓	✓	x	✓	✓	✓	8	Low
Lally *et al.*, 2008	✓	x	x	x	✓	✓	✓	✓	✓	✓	7	Medium
Luley *et al.*, 2014	✓	✓	x	x	✓	✓	✓	✓	✓	✓	8	Low
McRobbie *et al.*, 2016	✓	✓	✓	x	x	x	x	✓	✓	✓	6	Medium
Melanson *et al.*, 2012	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	9	Low
Morgan *et al.*, 2009	✓	✓	✓	✓	x	✓	✓	✓	x	✓	8	Low
Morgan *et al.*, 2013	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	9	Low
Morgan *et al.*, 2012	✓	✓	✓	✓	x	✓	✓	✓	x	✓	8	Low
Ozaki *et al.*, 2019	✓	✓	x	x	✓	✓	✓	✓	x	✓	7	Medium
Paskett *et al.*, 2016	✓	✓	x	x	x	✓	✓	✓	✓	✓	7	Medium
Patel *et al.*, 2019	✓	✓	✓	x	✓	x	✓	✓	✓	✓	8	Low
Rock *et al.*, 2015	✓	✓	x	✓	✓	✓	x	✓	✓	✓	8	Low
Sherwood *et al.*, 2006	✓	✓	x	✓	✓	x	✓	✓	✓	✓	8	Low

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Table 3 *Continued*

Author, year	Baseline results reported for each group	Randomization described	Dropout rate < 20 % by end of intervention period	Assessor blinding	Adiposity assessed more than 6 mos after baseline	Intent to Treat Analysis	Confounders accounted for in analysis	Summary results and effect size/ significance reported	Power calculation conducted and study adequately powered	Objective weight measure was used	Total risk score	Risk of bias category
Shuger *et al.*, 2011												
Spring *et al.*, 2017	✓	✓	✓	x	✓	✓	x	✓	✓	✓	8	Low
Stephens *et al.*, 2017	✓	✓	✓	x	x	x	x	✓	✓	✓	6	Medium
Svetkey *et al.*, 2015	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	9	Low
Tanaka *et al.*, 2018	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	9	Low
Tate *et al.*, 2001	✓	✓	x	x	x	✓	✓	✓	✓	✓	7	Medium
Tate *et al.*, 2006	✓	✓	✓	x	x	✓	✓	✓	✓	✓	8	Low
Teeriniemi *et al.*, 2018	✓	✓	x	x	✓	✓	x	✓	✓	✓	7	Medium
Thomas *et al.*, 2015	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	9	Low
Thomas *et al.*, 2017	✓	✓	✓	✓	✓	x	✓	✓	x	✓	8	Low
Thomas *et al.*, 2019/ Goldstein *et al.*, 2019	x	✓	x	x	✓	✓	x	x	✓	✓	5	Medium
Turner-McGrievy and Tate, 2011	✓	✓	✓	x	x	✓	?	✓	✓	✓	7	Medium
Wang *et al.*, 2012	✓	✓	✓	x	✓	x	✓	✓	✓	✓	7	Medium
Wang *et al.*, 2012	✓	✓	✓	x	✓	x	✓	✓	x	✓	8	Low
West *et al.*, 2011	✓	✓	✓	x	x	✓	✓	✓	✓	✓	8	Low
Whitelock *et al.*, 2019	✓	✓	x	x	x	x	✓	✓	✓	✓	6	Medium
Wilson *et al.*, 2017	✓	✓	x	x	✓	x	x	✓	x	✓	5	Medium

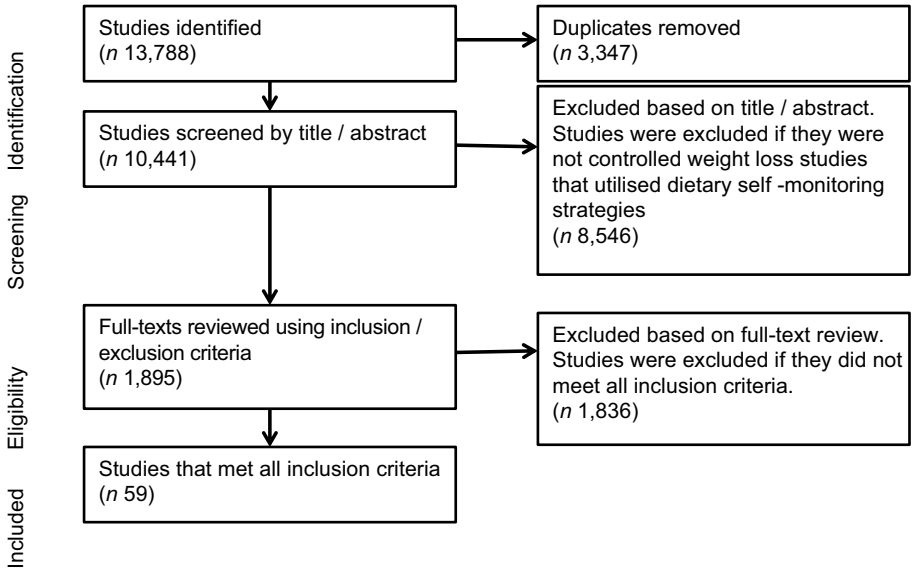

Fig. 1 PRISMA flow chart

United Kingdom, three in Japan, two in Finland and one each in Taiwan, Germany, Brazil and South Korea. One study had multiple international locations. The mean age of participants ranged from 20 to 71 years (IRQ = 10·0) with a majority of studies including participants older than 40 years (73 %, *n* 43). Five studies recruited only men and four studies recruited only women. Intervention durations varied from eight to 108 weeks (IRQ = 40·0). Based on the study selection criteria, all of the included studies had a comparison group: *n* 16 used a waitlist or a no or unrelated intervention control group; *n* 24 used a minimal intervention comparison group that typically consisted of one or two weight loss counseling sessions, handouts on healthy lifestyles, basic weight loss website access or some combination of these; and *n* 9 provided the comparison group with an alternative intervention. Alternative intervention studies were those in which two groups received substantial weight loss interventions but with variability in content, delivery or duration. Different intervention delivery methods were used to communicate weight loss content including group sessions, websites and other digital methods, one-on-one sessions, phone calls and paper materials such as books and leaflets. Studies recruiting in specialised obesity clinics or through primary care providers typically used usual care comparison groups (*n* 10).

Quality assessment

Risk of bias for each study is shown in Table 3. Quality scores indicated medium or low risk of bias for all studies. This was likely due to our inclusion criteria, which was limited to studies with comparison groups and excluded pilot studies. Forty-six out of the *n* 59 included studies (78 %) conducted some form of intent to treat analysis although different imputation methods were used. Eighteen (31 %) included assessor blinding, *n* 40 (68 %) described accounting for confounders in analysis and *n* 37 (63 %) met retention rate criteria with <20 % of the total sample dropping out before the end of the intervention.

Dietary self-monitoring methods

The methods for implementing dietary self-monitoring in the included studies are described in Table 4. This includes the scope of self-monitoring requested (all intake or abbreviated intake), platforms used, reporting and submission details, adherence metrics, adherence results and any reported relationships between self-monitoring adherence and weight loss outcomes. Several dietary self-monitoring platforms were used in the weight loss interventions including mobile phone apps (*n* 19), paper food diaries (*n* 22), wearables (*n* 2), websites (*n* 27) and personal digital assistants (PDAs) (*n* 2). Platforms were not always exclusive; some studies used different platforms for different intervention groups, or offered participants a choice of platform.

There was variability in the intensity level of dietary monitoring to be recorded. Forty-four studies (75 %) required dietary self-monitoring of all intake and *n* 15 studies required self-monitoring of abbreviated intake. Abbreviated dietary-self monitoring protocols varied among included studies. Two studies utilised the recording of meal patterns (e.g. how often one eats certain types of foods or meals), and nine focused on dietary behaviours such as eating fruit or vegetables or avoiding fast food. One study required participants to self-monitor dietary intake using a traffic light method. The traffic light method categorises foods based on nutrient and energy density into green, yellow and red. Using this method, participants were asked to report the overall number of foods consumed from each color category. Lastly, one study asked participants to estimate the portion sizes of their daily meals using

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a predefined ranking system (i.e. 'mini', 'normal' or 'maxi')[50]. Food photography was used in two studies. The first study had participants upload photos of all the foods and beverages they consumed and provide a self-review of their diet quality using a brief survey[70]. The second study had participants upload only photos of their three main meals to the study website each day. The images were later reviewed with the participant(s) during a group chat with a nutritionist on the study website. The nutritionist offered immediate (within 3 h) feedback on meal choices and responded to specific questions from participants[61].

A majority of the studies (*n* 45) provided feedback based on self-monitoring data that varied in delivery platform, frequency and timeliness. In several studies (*n* 15), feedback was delivered immediately through automated messaging or graphs; this was particularly common in studies that utilised commercial dietary tracking apps. In other instances, study personnel would review dietary inputs and offer weekly (*n* 10) or monthly (*n* 4) feedback. Six studies used a combination of these approaches, offering immediate feedback followed by additional weekly or monthly follow-ups.

Methods for assessing adherence to dietary self-monitoring and the corresponding metrics are provided in Table 4. Adherence to dietary self-monitoring was examined in thirty-three of the fofty-nine studies, although the definition of adherence was inconsistent. Metrics included the actual number of days or weeks participants completed monitoring diaries (*n* 9), the proportion of diaries completed out of the number requested (*n* 9), the proportion of participants completing a certain number of diaries (*n* 8) and the proportion or number of participants self-reporting monitoring diary use (*n* 6).

Reported relationships between adherence and weight loss are described in Table 4. Eighteen studies (all intake = 14; abbreviated intake = 4) examined adherence to self-monitoring and weight loss and 12 (all intake = 9; abbreviated intake = 3) identified significant positive relationships between adherence and weight loss while six did not (all intake = 5, abbreviated intake = 1). Twelve studies had both weight loss and adherence data but did not examine or report relationships.

Dietary self-monitoring and weight loss

The weight loss outcomes of included studies are shown in Table 5. Interventions that utilised all intake dietary self-monitoring (*n* 44) showed significant weight loss in the study group *v.* the comparison group in twenty-sevenm studies (61 %). Fifteen studies (34 %) did not report significant intervention effects between the study and comparison groups and one study reported a reverse effect[45], although that study included an active weight loss program comparison group. Among interventions that utilised all intake dietary self-monitoring and had a true (waitlist, no or unrelated intervention) control group (*n* 10), seven studies (70 %) demonstrated a significant between group intervention effect on weight loss. Of interventions that utilised abbreviated dietary self-monitoring (*n* 15), ten (67 %) reported significantly greater weight loss in intervention groups *v.* comparison groups. Five reported no significant effects. Of the interventions that used abbreviated self-monitoring methods and had true control groups (*n* 5), four studies (80 %) reported a significantly greater weight loss among the study groups compared to controls. There was no apparent pattern indicating one type of abbreviated monitoring (specific behaviours *v.* traffic light, etc.) facilitated more weight loss. Direct comparisons between paper and digital self-monitoring were examined in nine studies[24,32,43,57,58,65,67,73,78]. Among these, only one study demonstrated significantly more weight loss between in digital *v.* paper dietary self-monitoring platforms[43].

Discussion

This review, including fifty-nine intervention studies, examined: (1) the implementation of different dietary self-monitoring protocols in behavioural weight loss interventions including characteristics, adherence metrics and feedback utilisation; (2) the effectiveness of self-monitoring interventions to promote weight loss among adults with overweight/obesity and (3) differences in weight loss outcomes between interventions that use higher *v.* lower intensity dietary self-monitoring. A wide range of self-monitoring platforms and implementation protocols were identified across included studies. The majority of interventions demonstrated a significant reduction of weight compared with control groups. A similar proportion of studies that included self-monitoring of all dietary intake (61 %) and abbreviated intake (67 %) demonstrated significant intervention effects on weight loss; however, a formal meta-analysis was not conducted due to study heterogeneity.

Dietary self-monitoring was implemented in different ways across studies; digital and/or paper diaries were used to collect all intake or abbreviated intake with or without integrated feedback. Studies utilised all-dietary intake self-monitoring strategies more often than abbreviated-intake strategies. Study participants' self-monitoring behaviour wanes over time, highlighting the issue of participant burden[8]. Several included studies (*n* 15) used abbreviated self-monitoring approaches, and it is reasonable to assume that these may be less burdensome and encourage more monitoring adherence, although the adherence data are not reported with sufficient consistency to allow formal tests of the monitoring adherence by types of self-monitoring. High variability in adherence metrics obfuscates the potential relationship between dietary monitoring intensity and weight loss outcomes.

The majority of included interventions found significant weight loss in experimental groups compared with control groups (all intake monitoring (61 %) and abbreviated intake monitoring (67 %)). This finding is in line with

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Table 4 Description of dietary self-monitoring, adherence and relationship to weight loss

Author	Year	Dietary self-monitoring protocol	Monitoring platform	Recording and submitting data	Feedback	Adherence measure description	Adherence	Relationship between adherence and weight loss
Adachi *et al.*	2006	Adherence to specific behaviours (3–5 items selected by a user from a list of 13 eating habits, not specified))	Paper	Recorded on paper sheets > Mailed to study personnel (who then input on to a computer system)	Computer-tailored feedback	NR	NR	NR
Ahn *et al.*	2020	All dietary intake	Ctl) Paper Ex) Mobile App	ctl: recorded on paper ex: recorded and submitted in app	ex: real-time feedback based on user demographics, activity level and intake	Number of days participants recorded at least one food item from baseline to endpoint (6 weeks)	ctl: 15·5 ± 10·1 d ex:18·5 ± 14·1 d over 6 weeks	No significant findings
Appel *et al.*	2011	All dietary intake	Website	Recorded and submitted online	Monthly email summarising progress	NR	NR	NR
Baer *et al.*	2020	All dietary intake	Mobile App	Recorded and submitted in app	(a) Not specified (b) monthly progress calls with population health manager	NR	NR	NR
Becofsky *et al.*	2017	All dietary intake	Website	Recorded and submitted on study website	Automated feedback (weekly)	Participants that submitted monitoring data at least 5 d per week of the 12 week intervention	mean (SD) = 7·9 (4·1) weeks	NR
Beeken *et al.*	2017	Adherence to specific behaviours*	Paper Diary	NR	NR	NR	NR	NR
Beleigoli *et al.*	2020	All dietary intake	Website	Recorded and submitted online	(a) algorithm tailored messages of feedback based on data inputs over previous 4 weeks (b) algorithm tailored messages plus individualised feedback via private chat forum with dietitian	NR	NR	NR
Bennett *et al.*	2012	Adherence to specific behaviours†	Choice of Website or Phone Interactive Voice Response	Recorded and submitted on study website or via phone	Tailored feedback (immediate) and review with counselor	Percent of participants tracking behaviour change goals weekly for at least 50 % or 75 % of 104 intervention weeks	40·0 % tracked 50 % or more intervention weeksl 25·0 % tracked 75 % or more intervention weeks	NR

Table 4 *Continued*

Author	Year	Dietary self-monitoring protocol	Monitoring platform	Recording and submitting data	Feedback	Adherence measure description	Adherence	Relationship between adherence and weight loss
Bennett *et al.*	2010	Adherence to specific behaviours†	Website	Recorded and submitted online	Reviewed during in-person and phone coaching sessions	NR (website logins reported but did not specify monitoring behaviour)	NR	NR
Bennett *et al.*, Foley *et al.*	2018, 2016	Adherence to specific behaviours†	Mobile App	Recorded and submitted in app	Personalised feedback message provided in app after each self-report episode	Proportion of participants completing 80 % or more of 52 self-monitoring episodes	71·13 %	Those completing at least 80 % of expected self-monitoring episodes lost significantly more weight than those that did not meet this criteria; between group difference = –3·5 kg (–5·9, –1·2) $P = 0·004$
Bennett *et al.*	2013	Adherence to specific behaviours†	Phone Interactive Voice Response	Recorded and submitted via phone	Brief tailored feedback (immediate) and counseling calls (monthly)	Proportion of weekly calls (out of 52) resulting in the complete transmission of self-monitoring data	Range = 65·2 % to 89·5 % per week | mean (SD) = 72 % (28 %)	IVR call completion rate was significantly correlated with 12 month weight loss (Spearman $r = –0·2$; $P = 0·04$)
Burke *et al.*, Burke *et al.*	2012, 2011	All dietary intake	Paper Diary (ctl) | a) PDA: Palm pilot + self-monitoring software | b) PDA FB = palm pilot w software as well as custom feedback software	a and b recorded via PDA and submitted PDAs at group session for data upload. clt recorded using paper diaries and submitted hard copies at weekly/ biweekly sessions	ctl, a, b) written feedback from staff b) automated feedback (immediate)	Proportion of sample adherent over 6 month intervention (participant is "adherent" for a given week if the weekly record indicated participant consumed >50 % of the weekly energy goal)	ctl = 55 %, a = 80 % b = 90 % ($P < 0·01$)	a, b) Those that were adherent at least 60 % of the time lost more weight than those who were adherent less than 30 % of the time ($P < 0·001$)
Byrne *et al.*	2006	All dietary intake	Paper Diary	Recorded via paper diary, submitted online	Updates based on progress (weekly)	NR	NR	NR
Chambliss *et al.*	2010	All dietary intake	Website	Recorded and submitted online for viewing by health educator	Email reports (weekly)	Self-reported logging dietary information into software at least 5 d per week	85 % of Basic group and 70 % of the Enhanced group	NR
Collins *et al.*	2012	All dietary intake	Website	Recorded and submitted online	Automated personal feedback (weekly)	NR	NR	NR

Table 4 *Continued*

Author	Year	Dietary self-monitoring protocol	Monitoring platform	Recording and submitting data	Feedback	Adherence measure description	Adherence	Relationship between adherence and weight loss
Crane *et al.*	2015	Adherence to specific behaviours (number of daily 100-energy changes)	Paper Checklist	NR	NR	Percent of participants that self-reported using the tracking checklist | percent of participants that self-reported using the online dietary monitoring system	Checklist usage = 23·4 % | online usage = 44·7 %	NR
Damschroder *et al.*	2014	Traffic Light (log categories of foods by color: red (high-calorie/low nutrient), yellow (high-energy/ high nutrient, and green (low-energy/high nutrient)	Paper	clt given optional food intake logs | ex recorded foods eaten using traffic light guide in which Red (high-energy and least nutritional value); Yellow (high-energy and higher nutritional value); or Green (low-energy foods and high nutritional value)	Reviewed during coaching sessions	NR	NR	NR
Duncan *et al.*	2020	All dietary intake	Mobile App	Recorded and submitted in app	Emailed weekly summaries, reminders to log intake if tracking falls below 4 d per week	Mean total number of self-monitoring entries	(a) 126·9 ± 101·8 entries (b) 83·2 ± 68·4 entries over 12 months	NR
Dunn *et al.*	2016	Eating patterns (not specified)	Website	Recorded on website	NR	NR	NR	NR
Foster-Schubert *et al.*	2012	All dietary intake	Paper Diary	Recorded in paper diaries and submitted to dietitian	Dietitian feedback	NR	NR	NR
Fukuoka *et al.*	2015	All dietary intake	Mobile App	Recorded via mobile app	Automated reminders to enter data (daily)	Proportion of study days (out of 140) participants used mobile app to report caloric intake	Mean (SD) = 46·9 % (30·0 %) Range = 0 %–95 % of 140 d	NR
Haapala *et al.*	2009	All dietary intake	Mobile App	Recorded and submitted in app	NR	NR (app contacts reported but did not specify monitoring behaviour)	NR	NR
Harvey-Berino *et al.*	2010	All dietary intake	Paper Diary (ctl) or Website (a, b)	Recorded via online or paper journals and submitted weekly	NR	Percentage of study weeks that subjects submitted paper or online diaries	ctl) 63 % *v.* (a) 71 % *v.* (b) 73 %; $P = 0·13$	NR

Table 4 *Continued*

Author	Year	Dietary self-monitoring protocol	Monitoring platform	Recording and submitting data	Feedback	Adherence measure description	Adherence	Relationship between adherence and weight loss
Hunter *et al.*	2008	All dietary intake	Website	Recorded and submitted online	Counselor feedback (weekly)	Weekly website usage | Total log-ins	Weekly usage less than once (42·4 %), 1–2 times (22·6 %), 3–4 times (18·1 %), 5–7 times (9·6 %), every day (7·3 %) | total logins mean = 49·1 times, range = 1–707	Food diary review frequency was associated with 6-month weight change (Pearson $r = -0\ 464$; $P < 0{\cdot}001$)
Jakicic *et al.*	2016	All dietary intake	Website | Combination Website and Wearable Device	Months 1–6 recorded and submitted to interventionists weekly; months 7–24 recorded via website or wearable and data automatically available to study staff	Intervention staff feedback	Percentage of participants that self-reported tracking their eating behaviours at least 3 d/week	47 %	NR
Jebb *et al.*	2011	All dietary intake	Website	NR	NR	NR	NR	NR
Jeffery *et al.*	1993	All dietary intake	Paper	Recorded daily intake for first 20 weeks and then 1 week per month for the subsequent months up to 18 months via paper diaries	NR	Adherence calculated as proportion of days completed out of days assigned	NR	NR
Johnston *et al.*	2013	All dietary intake	Mobile App or Website	Recorded and submitted online/app	NR	NR (app and website usage self-reported but not specific to monitoring)	NR	NR
Jospe *et al.*	2017	All dietary intake	Choice App or Website	Recorded online daily for the first month and 1 week every subsequent month up to month 12	NR	NR	NR	NR
Laing *et al.*	2014	All dietary intake	Choice App or Website	Recorded online	Computer-generated feedback (trends and summaries – real time)	Number of logins to App/Site	Median (IQR) Month 1 = 8 (2, 24) Month 6 = 0 (0, 2)	NR
Lally *et al.*	2008	Adherence to specific behaviours*	Paper	Recorded via monitoring form	Feedback offered only if participants were consistently failing to achieve a goal	NR	NR	NR

Table 4 *Continued*

Author	Year	Dietary self-monitoring protocol	Monitoring platform	Recording and submitting data	Feedback	Adherence measure description	Adherence	Relationship between adherence and weight loss
Luley *et al.*	2014	Meals ranked by category (mini, normal, maxi)	Wearable Device	Recorded and submitted online	(a) Monthly letters (b) monthly phone calls	NR	NR	NR
McRobbie *et al.*, Hajek *et al.*	2016, 2016	All dietary intake	Paper diary	Recorded via paper diary and ticked task card once diary was complete for day for first two weeks. This was optional from week 3 onward.	NR	Self-reported diary use at session 1	77 %	NR
Melanson *et al.*	2012	Point values of foods (b)		Recorded "point values" of foods consumed (based on calories, fiber, and fat)	NR	NR	NR	NR
Morgan *et al.*	2009	All dietary intake	Website	Recorded and submitted daily online diaries to study staff for the first 4 weeks, for 2 weeks in the second month and for 1 week in the third and final month.	Individualised feedback sheets offered via email (seven occasions) Participants were also able to submit questions online (answered weekly)	Percentage of participants that submitted 7 weeks of requested daily eating and exercise diaries over the 3-month period and attended at least 12 weekly check-ins. | mean (s.D.) number of diet entries submitted	41·2 % | Mean (SD) = 38 (33)	Daily diet entry website feature usage was associated with weight change at 3 months ($r = 0{\cdot}71$; $P < 0{\cdot}001$) and 6 months ($r = 0{\cdot}72$; $P < 0{\cdot}001$)
Morgan *et al.*	2013	All dietary intake	Website	Recorded and submitted online	General feedback	NR	NR	NR
Morgan *et al.*	2012	All dietary intake	(a) Paper (b) Website	Both groups recorded and submitted diaries either online or paper for 4 d of each week (2 weekday and 2 weekend)	Feedback via email (seven occasions)	NR	NR	NR
Ozaki *et al.*	2019	Adherence to specific behaviours (e.g. eating meals regularly every day, others not specified)	Online	Recorded and submitted online	(a) graph of progress on website, generic monthly email (b) graph of progress on website, 4 tailored remote sessions	Number of days self-monitoring goals were entered on website	Mean (SD) a = 40·79 (6·15) b = 53·26 (6·28)	Frequency of self-monitoring was significantly associated with weight loss in a and b ($r = -0{\cdot}49$, $P < 0{\cdot}001$)
Paskett *et al.*	2016	All dietary intake	Paper/Online	Paper or online recording, submission type unclear	Optional short dietary survey in addition to monitoring may be submitted and tailored feedback offered on responses	NR	NR	NR

Table 4 *Continued*

Author	Year	Dietary self-monitoring protocol	Monitoring platform	Recording and submitting data	Feedback	Adherence measure description	Adherence	Relationship between adherence and weight loss
Patel *et al.*	2019	All dietary intake	Choice App or Website (a, b, ctl)	a and ctl) recorded online throughout intervention| b) recorded online only after week 5	Computerised (reminders, progress update real-time) and feedback email from staff (weekly)	Median number of d/week that participants self-monitored weight and diet (recording ≥800 kcal/d) | Percentage of days (out of days instructed (84 for ctl and group a/49 for group (b) that entries were recorded	Median (interquartile range) days tracked week 5–12 ctl) 1·44 (0 – 4·25) (a) 4·88 (0 44–6·56) (b) 1·88 (0 25–5·50) Percentage of days tracked weeks 5–12 ctl) 0 % (0–4) a) 65 % (10–89) b) 59 % (11–95) Median (interquartile range) days tracked entire intervention ctl) 2·92 (1·17–5·17) (a) 5·33 (1·83–6·67) Percentage of days tracked entire intervention ctl) 42 % (17–75) a) 77 % (27–96)	Percentage of days tracked diet was associated with weight change by month 3 for all groups (spearman rank = −.35; $P < 0·01$)
Rock *et al.*	2015	All dietary intake	Choice of Paper Diary or Website	Recorded via paper diary or online	General feedback	NR	NR	NR
Sherwood *et al.*	2006	All dietary intake	Paper Diary	Recorded via paper diary	General feedback	NR	NR	NR
Shuger *et al.*; Barry *et al.*	2011, 2011	All dietary intake	(a) Paper Diary, Website (b, c)	a) recorded via paper diary|(b, c) recorded and submitted online	b, c) computerised feedback (real-time)	NR	NR	NR
Spring *et al.*	2017	All dietary intake	(a) Paper | b) Mobile App	ctl, (a) recorded daily paper diaries b) recorded daily using app	b) computerised feedback (progress and adherence- real time) plus 2–4 personalised messages (weekly for 6 months) a, b) coaching calls (weekly)	Percent of days (out of 182) reporting > 1000 cal	Mean (SE) ctl = 18·4 % (5·3) a = 32·9 % (3·9) b = 48·0 % (4·1); $P < 0·05$	Weight loss at 6 months was associated with the amount of dietary self-monitoring (r (84) = 0·509; $P < 0·001$)
Stephens *et al.*	2017	All dietary intake	Mobile App	Recorded and submitted in app	Text message feedback from health coach based on tracking inputs	Proportion of participants logging diet data on > 50 % of the 84 study days	62 %	Increased food logging was not significantly associated with weight loss (P = 0·375)

Table 4 *Continued*

Author	Year	Dietary self-monitoring protocol	Monitoring platform	Recording and submitting data	Feedback	Adherence measure description	Adherence	Relationship between adherence and weight loss
Svetkey *et al.*	2015	All dietary intake	Mobile App (a,b)	recorded and submitted via app	(a) computerised (prompts and personalised feedback real-time) lb): coaching sessions	NR	NR	NR
Tanaka *et al.*	2018	Photos of 3 daily meals	Mobile App	Recorded and submitted in app using smartphone camera	Personalised feedback on posted images via group chat	Number of total meal photos uploaded by participant and analysed by quartile	NR	No significant effects detected
Tate *et al.*	2001	All dietary intake	Website	Recorded online (ctl and ex), ex submitted online to therapist weekly	ex) therapist email (weekly)	Number of intervention weeks (out of 24 weeks) with diaries submitted	mean (SD) = 13·65 (6·4) (24-week intervention) | First 3 months mean (SD) = 8·5 (3·6) | Last 3 months mean (SD) = 4·6 (4·4)	Overall login frequency was correlated with weight change from 0 to 6 months in ex ($r = -.43$; $P = 0·003$) and ctl ($r = -0·33$; $P = 0·03$)
Tate *et al.*	2006	All dietary intake	Website (a, b)	Recorded and submitted online	a, b) reminder email to complete diary a) computerised tailored feedback (real-time) b) email from weight loss counselor (weekly)	Number of weeks (out of 26 weeks) with diaries submitted	b) mean (SD) = 17·2 (8·7) *v.* a) mean (SD) = 11·4 (9·2); $P = 0·0001$)	Online food diary submission was significantly associated with weight loss in group a ($r = -0·56$) and b ($r = -0·69$); $P < 0·001$
Teeriniemi *et al.*	2018	Meal patterns (not specified)	Website (a, c, e) | Paper (b, d)	NR	NR	NR	NR	NR
Thomas *et al.*	2017	All dietary intake	Choice Website or Phone App (a, b)	Recorded online	Automated (real-time)	Self-reported frequency of tracking based on Likert scale from 0 (never) to 5 (multiple times a day) using either PC or App	PC Mean (95 % CI) 3 Months: (a)1·8 (95 % CI 1·4, 2·2), (b) 2·2 (95 % CI 1·8, 2·6) | PC Mean (95 % CI) 12 Months: (a) 0·8 (0·5, 1·2), b) 1·1 (0·7–1·4) App Mean (95 %) CI 3 Months: (a) 1·1 (95 % CI 0·7, 1·5), (b) 1·1 (95 % CI 0·7, 1·5) App Mean (95 % CI) 12 Months: a) 0·5 (95 % CI 0·3, 0·8), (b) 0·5 (95 % CI 0·3, 0·8)	NR

Table 4 *Continued*

Author	Year	Dietary self-monitoring protocol	Monitoring platform	Recording and submitting data	Feedback	Adherence measure description	Adherence	Relationship between adherence and weight loss
Thomas *et al.*	2015	All dietary intake	Website	Recorded and submitted online	Computerised feedback (progress, recommendations and encouragement weekly)	Number of weeks in which participants submitted daily diet, activity, and weight data on the intervention website at least 5 days out of the week.	Mean (SD) = 6·7 (4·7) of 12 intervention weeks	Frequency of reporting daily energetic intake, exercise and weight on website was associated with weight loss ($r = 0{\cdot}54$; $P < 0{\cdot}001$)
Thomas *et al.*, Goldstein *et al.*	2019, 2019	All dietary intake	(a) Mobile App, b and ctl) Paper	Recorded and submitted in app (a), record on paper and submit during group sessions (b), record on paper and mail in (ctl)	Personalised written feedback	Proportion of study days (out of 546 d) participants record either 3+ eating events or intake equaling at least 50 % of daily caloric goal	ctl = 32 % a = 37·9 % b = 27·5 %	Adherence to self-monitoring dietary intake was not significantly associated with percent weight loss overall. A significant interaction effect of condition and percent weight loss was shown for adherence to dietary self-monitoring in the subsequent month ($P < 0{\cdot}001$). Greater percent weight loss predicted more days of self-monitoring in group b (paper monitoring) only.
Turner-Mcgrievy and Tate	2011	All dietary intake	Mobile App	Recorded and submitted in app	NR	Number of days participants self-reported monitoring their diet (collected weekly)	Mean (SD) ctl: 1·3 (1·7) ex: 1·7 (2·0)	NR
Wang *et al.*	2012	All dietary intake	Paper Diary	Recorded on paper and submitted weekly	Therapist and nurse feedback in person (weekly)	NR	NR	NR
Wang *et al.*	2012	All dietary intake	Paper (ctl) | PDA (a, b)	ctl) recorded using paper diary |a, b) recorded using PDA	(b) Computerised personal feedback (daily)	Proportion of intervention weeks (out of 52 weeks) in which participants recorded at least 50 % of a daily calorie goal	% adherence (range) ctl: 34·38 (16·41, 75·00) (a) 57·81 (34·38, 87·50) (b) 71·88 (36·72, 88·28)	No significant direct effect of monitoring adherence on weight loss at 12 months detected ($P > 0{\cdot}05$); indirect effect of receiving feedback (*v.* no feedback) on weight loss through improved adherence to dietary monitoring (estimate = 1·856; $P = 0{\cdot}004$)

Table 4 *Continued*

Author	Year	Dietary self-monitoring protocol	Monitoring platform	Recording and submitting data	Feedback	Adherence measure description	Adherence	Relationship between adherence and weight loss
West *et al.*	2011	All dietary intake	Paper Diary	Recorded on paper and submit at weekly group sessions (at what frequency/duration?)	Weekly review and written feedback (at what frequency?)	Total number of diaries submitted over 12-week period	Mean (SD) = 8·3 ± 3·4	Weight loss was associated with number of submitted self-monitoring diaries ($r = -0{\cdot}46$, $P < 0{\cdot}001$)
Whitelock *et al.*	2019	All dietary intake	Mobile App	Uploaded images of all food and drink consumed	Self-given feedback regarding emotions during eating event	Proportion of participants that used the application as intended meaning they accessed the app for a majority of the 56 study days and recorded 4 + entries/d on at least 50 % of study days	51 %	No significant effects detected
Wilson *et al.*	2017	All dietary intake	Online/Mobile	NR	NR	NR	NR	NR

NR, not reported; Ctl, control group; Ex, experimental group.
*Top ten tips (10TT) dietary goals: eat at roughly the same time each day, choose reduced fat foods, eat healthy snacks, check fat and sugar content on labels, avoid sugar sweetened beverages and alcohol, focus on your food while eating, eat at least 5 portions of fruit and vegetables/d.
†Interactive obesity treatment approach (iOTA) dietary goals: avoid sugary drinks, avoid eating fast food, eat breakfast every day, eat at least 5 fruits and vegetables/d, avoid high-fat meat, avoid high-calorie snacks, have low-fat dairy 3 times/d, avoid foods made with white flour, like white bread, regular pasta and white rice.

Table 5 Weight loss outcomes of included studies

First author	*n* (ctl)	*n* (ex)	Primary out-come unit	Results (weight change from baseline) mean ± SD	Significance of change between groups (*P* value)
All intake dietary monitoring					
Ahn *et al.*	25	25	Kilograms	ctl: –1·4 ± 2·7 ex: –0·4 ± 1·6	none
Appel *et al.*	138	a: 139 b: 138	Kilograms	ctl: –0·8 ± 0·6 kg a: –4·6 ± 0·7 kg b: –5·1 ± 0·8 kg	a and b > ctl (<0·001)
Baer *et al.*	326	a: 216 b: 298	Kilograms	ctl: –1·20 ± 8·29 a:–1·9 ± 5·62 b) –3·1 ± 5·29	a + b > ctl (< 0·001) b > a (0·01)
Becofsky *et al.*	20	20	Kilograms	ctl: –1·0 ± 3·3 kg ex: –4·4 ± 5·4 kg	ex > ctl (0·021)
Beleigoli *et al.*	470	a: 420 b: 408	Kilograms	ctl: –0·7 ± 3·5 a: –1·1 ± 3·5 b: –1·57 ± 3·6	b > ctl (< 0·001)
Burke *et al.*, Burke *et al.*	72	a: 68 b: 70	Kilograms	ctl: –5·3 ± 5·9 kg a: –5·5 ± 7·0 kg b: –7·3 ± 6·6 kg	none
Byrne *et al.*	33	41	Kilograms	ctl: –2·19 ± 0 6 kg ex: –4·84 ± 0 5 kg	ex > ctl (< 0·05)
Chambliss *et al.*	30	a: 45 b: 45	Kilograms	ctl: .30 ± 2·2 kg a: –2·72 ± 3·3 kg b: –2·45 ± 3·1 kg	a and b > ctl (< 0·05)
Collins *et al.*	30	a: 45 b: 45	Kilograms	ctl: .30 ± 2·2 kg a: –2·72 ± 3·3 kg b: –2·45 ± 3·1 kg	a and b > ctl (< 0·05)
Duncan *et al.*	17	a: 23 b: 14	Kilograms	ctl: –1·46 ± 5·85 a: –3·59 ± 5·60 b: –1·91 ± 5·63	none
Foster-Schubert *et al.*	87	a: 118 b: 117 c: 117	Kilograms	ctl: –0·7 ± NR kg a: –7·1 ± NR kg b: –2·0 ± NR kg c: –8·9 ± NR kg	a > ctl (<0·0001) b > ctl (0·034) c > ctl (<0·0001) a & c > b (<0·0001)
Fukuoka *et al.*	31	30	Kilograms	ctl: 0·3 ± 2·7 kg ex: –6·2 ± 5·9 kg	ex > ctl (< 0·001)
Havapala *et al.*	62	62	Kilograms	ctl: 0·7 ± 4·7 kg ex: 3·1 ± 4·9 kg	ex > ctl (0·008)
Harvey-Berino	161	a: 158 b: 162	Kilograms	ctl: –5·5 ± 5·6 kg a: –7·6 ± 6·2 kg b: –5·7 ± 5·5 kg	a > ctl and b (< 0·01)
Hunter *et al.*	222	224	Kilograms	ctl: 0·6 ± 3·4 kg ex: –1·3 ± 4·1 kg	ex > ctl (< 0·01)
Jakicic *et al.*	233	237	Kilograms	ctl: –5·9 ± .9 kg* ex: –3·5 ± 9·5 kg	ctl > ex (0·003)
Jebb *et al.*	395	377	Kilograms	ctl: –1·8 ± 0·2 kg ex: –4·1 ± 0·3 kg	ex > ctl (< 0·001)
Jeffery *et al.*	40	a: 40 b: 40 c: 41 d: 41	Kilograms	ctl: NR kg a: –4·1 ± NR kg b: –6·4 ± NR kg c: –4·1 ± NR kg d: –6·4 ± NR kg	Not Reported
Johnston *et al.*	145	147	Kilograms	ctl: –0·6 ± (NR) kg ex: –4·6 ± (NR) kg	ex > ctl (< 0·001)
Jospe *et al.*	48	a: 51 b: 51 c: 50 d: 50	Kilograms	ctl: –2·9 ± NR kg a: 1·7 ± NR kg b: –2·7 ± NR kg c: –2·0 ± NR kg d: –6·8 ± NR kg	none
Laing *et al.*	107	105	Kilograms	ctl: .03 ± .86 kg* ex: –.03 ± 1·22 kg	none
McRobbie *et al.*, Hajek *et al.*	109	221	Kilograms	ctl: –2·3 ± 6·6 kg ex: –4·2 ± 7·3 kg	ex > ctl (0·04)
Morgan *et al.*	31	34	Kilograms	ctl: –3·0 ± 1·5 kg ex: –4·8 ± 1·6 kg	ex > ctl (< 0·001)
Morgan *et al.*	52	54 (a) 53 (b)	Kilograms	ctl: –0·5 ± 0·3 kg a: –3·0 ± 1·0 kg b: –4·4 ± 1·1 kg	a and b > ctl (< 0·0001)
Morgan *et al.*	45	65	Kilograms	ctl: 0·3 ± 0·4 kg ex: –4·0 ± 1·1 kg	ex > ctl (< 0·001)
Paskett *et al.*	426	237	Kilograms	ctl: 0·1 ± 1·35 kg* ex: –1·2 ± 1·25 kg	none
Patel *et al.*	35		Kilograms	ctl: –2·43 ± 1·26 kg* a: –2·75 ± 1·26 kg b: –2·25 ± 1·18 kg	none

Table 5 *Continued*

First author	*n* (ctl)	*n* (ex)	Primary out-come unit	Results (weight change from baseline) mean ± SD	Significance of change between groups (*P* value)
		a: 35 b: 35			
Rock *et al.*	348	344	Kilograms	ctl: –0·9 ± NR kg ex: –3·6 ± NR kg	none
Sherwood *et al.*	600	a: 600 b: 601	Kilograms	ctl: –.59 ± NR kg a: –.70 ± NR kg b: –.96 ± NR kg	none
Shuger *et al.*; Barry *et al.*	50	a: 49 b: 49 c: 49	Kilograms	ctl: –0·9 ± NR kg a: –1·86 ± NR kg b: –3·55 ± NR kg c: –6·59 ± NR kg	c > ctl (0·04)
Spring *et al.*	32	a: 32 b: 32	Kilograms	ctl: –2·7 ± 2·4 kg a: –6·6 ± 2·2 kg b: –4·7 ± 2·1 kg	a and b > ctl (< 0·05)
Stephens *et al.*	30	29	Kilograms	ctl: 0·3 ± (NR) kg ex: –1–1·8 ± (NR) kg	ex > ctl (0·026)
Svetkey *et al.*	123	a: 122 b: 120	Kilograms	ctl: –1·44 ± NR kg a: –.99 ± NR kg b: –2·45 ± NR kg	none
Tate *et al.*	45	46	Kilograms	ctl: –1·3 ± 3·0 kg ex: –2·9 ± 4·4 kg	ex > ctl (0·04)
Tate *et al.*	67	a: 61 b: 64	Kilograms	ctl: –2·4 ± 5·4 kg a: –3·9 ± 5·5 kg b: –6·4 ± 6·1 kg	b > ctl (< 0·001)
Thomas *et al.*	77	77	Kilograms	ctl: –1·3 ± 2·1 kg ex: –5·5 ± 4·4 kg	ex > ctl (< 0·001)
Thomas *et al.*; Goldstein *et al.*	56	a: 114 b: 106	Kilograms	ctl: –6·4 ± 10·5 kg a: –5·5 ± 8·7 kg b: –5·9 ± 7·6 kg	none
Thomas *et al.*	86	a: 94 b: 91	Kilograms	ctl: –1·2 ± 5·0 kg* a: –2·1 ± 4·7 kg* b: –1·6 ± 4·9 kg*	none
Turner-McGrievy and Tate	49	47	Kilograms	ctl: –2·6 ± (NR) kg ex: –2·6 ± (NR) kg	none
Wang *et al.*	26	24	Kilograms	ctl: –2·7 ± 1·4 ex: –5·6 ± 2·6	ex > ctl (< 0·001)
Wang *et al.*	72	a: 68 b: 70	Kilograms	ctl: –2·35 ± 2·2 kg* a: –1·78 ± 1·84 kg b: –2·40 ± 4·88 kg	none
West *et al.*	112	116	Kilograms	ctl: –0·3 ± 2·4 kg ex: –3·7 ± 3·7 kg	ex > ctl (< 0·001)
Whitelock *et al.*	54	53	Kilograms	ctl: – 1·1 ± 3·4 kg ex: –1·2 ± 3·1 kg	none
Wilson *et al.*	1268	634	Kilograms	ctl: –0·9 ± NR kg ex: .58 ± NR kg	ex > ctl (0·05)
Abbreviated intake dietary monitoring					
Adachi *et al.*	50	a: 46 b: 47 c: 58	Kilograms	ctl: –1·4 ± 2·4 kg a: –2·9 ± 2·7 kg b: –2·2 ± 3·0 kg c: –1·6 ± 2·1 kg	a > c and ctl (< 0·05)
Beeken *et al.*	270	267	Kilograms	ctl: –.8 ± 2·8 kg ex: –1·7 ± 3·2 kg	ex > ctl (0·004)
Bennet *et al.*	185	180	Kilograms	ctl: –.5 ± .35 kg ex: –1·53 ± .37 kg	none
Bennet *et al.*	50	51	Kilograms	ctl: 0·28 ± 1·87 kg ex: –2·28 ± 3·21 kg	none
Bennet *et al.*, Foley *et al.*	175	176	Kilograms	ctl: –0·1 ± 6·07 kg ex: –4·0 ± 6·43 kg	ex > ctl (0·001)
Bennett *et al.*	94	91	Kilograms	ctl: .5 ± .5 kg ex: –1·0 ± .5 kg	ex > ctl (0·04)
Crane *et al.*	138	139	Kilograms	ctl: –0·5 ± (NR) kg ex: –5·4 ± (NR) kg	ex > ctl (< 0·001)
Damschroder *et al.*	159	a: 162 b: 160	Kilograms	ctl: –1·4 ± .95 kg* a: –1·4 ± 95 kg b: –2·8 ± .95 kg	b > ctl ($P < 0·05$) b > a ($P < 0·05$)
Dunn *et al.*	38	42	Kilograms	ctl: –0·3 ± 2·3 kg ex: –1·9 ± 3·0 kg	ex > ctl (0·02)
Lally *et al.*	107	105	Kilograms	ctl: .03 ± .86 kg* ex: –.03 ± 1·22 kg	none
Luley *et al.*	60	a: 60 b: 58	Kilograms	ctl: –4·6 ± 7·9 kg a: –11·7 ± 6·7 kg b: –8·6 ± 7·0 kg	none

Table 5 *Continued*

First author	*n* (ctl)	*n* (ex)	Primary outcome unit	Results (weight change from baseline) mean ± SD	Significance of change between groups (*P* value)
Melanson *et al.*	57	a: 59 b: 41	Kilograms	ctl: −4·14 ± 3·64 kg a: −3·39 ± 2·76 kg b: −3·73 ± 2·84 kg	none
Ozaki *et al.*	22	a: 25 b: 24	Kilograms	ctl: 0·6 ± 0·6 kg a: −1·6 ± 0·6 kg b: −3·7 ± 0·6 kg	b > a (0·038) & ctl (< 0·001) a > ctl (0·033)
Tanaka *et al.*	37	75	Kilograms	ctl: −0·1 ± 1·6 kg ex: −1·4 ± 6·2 kg	ex > ctl (0·001)
Teeriniemi *et al.*	89	a: 91 b: 85 c: 88 d: 87 e: 92	Kilograms	ctl: −0·2 ± 0·7 kg a: −1·1 ± .55 kg b: −1·2 ± 0·9 kg c: −2·9 ± 1·1 kg d: −0·4 ± 0·6 kg e: −1·3 ± 0·9 kg	b and c > ctl (< 0·001)

*SD calculated from CI.

previous research highlighting the importance of dietary self-monitoring as a component of behavioural weight loss programmes. One meta-regression of 122 evaluations found self-monitoring in lifestyle interventions to be responsible for the greatest heterogeneity among studies and, when self-monitoring and one or more other behaviour change techniques were combined, weight loss success increased[79]. This is further supported by literature suggesting interventions that include self-monitoring are particularly effective in promoting weight loss among certain populations including post-partum women[80] and cancer survivors[81]. Similar proportions of studies using higher and lower intensity monitoring demonstrated significant impact on weight loss, suggesting abbreviated self-monitoring may be an effective approach when higher intensity self-monitoring is not possible.

It is impossible to effectively disentangle the impact of dietary self-monitoring on weight loss from the other intervention components in included studies. Although self-monitoring may be a uniquely important aspect of behavioural weight loss interventions, deeper exploration of this concept is limited by a lack of consensus on self-monitoring adherence measures. Only thirty-three of the fifty-nine included studies (all intake = 26; abbreviated intake = 7) examined self-monitoring adherence, and definitions of adherence were inconsistent across included studies. Importantly, the cut-offs used to differentiate the 'adherent' *v.* the 'non-adherent' appeared to be arbitrarily set by researchers. A priori measures of self-monitoring adherence need to be established in order to understand the relative benefits of different platforms and intensity levels of monitoring. Comparable measures would also allow for the synthesis of data across studies, thus enabling a deeper understanding of how self-monitoring impacts weight loss and participant characteristics that may moderate this relationship. This topic is under active investigation; Turner-McGrievy *et al.* suggest the reporting of two or more eating occasions per day is an optimal definition of adherence to self-monitoring in the context of weight loss interventions[82]. A narrative review of the subject concluded that until a widely agreed-upon definition of adherence was established, multiple indicators of dietary self-report adherence may be appropriate to better understand the relationship between monitoring and weight loss success[83].

Strengths of this review include utilising: eight databases including the gray literature for the search, a medical librarian to design the search strategy and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. This review is limited by the use of one reviewer in screening all articles and not conducting a meta-analysis. The extracted data were limited to information explicitly stated in the included papers, variability in article reporting made it challenging to determine what duration of time participants were requested to self-monitor (daily, weekly and monthly), and therefore this information was not included.

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Behavioural weight loss interventions among adults with overweight/obesity are an essential element in the fight against excessive adiposity and associated chronic disease. Such interventions can be effective in achieving weight loss, but intervention components must be carefully structured in order to optimise implementation. This review adds to the literature by offering an overview of existing methods for collecting different levels of dietary-intake data and weight loss success among interventions utilising diverse dietary-monitoring strategies. This is the first review to examine weight loss interventions by intensity of self-monitoring. Abbreviated dietary self-monitoring may hold promise as a way to reduce participant burden, but carefully designed studies comparing all intake and abbreviated monitoring protocols are needed.

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Supplementary material

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