Patient Preference and Adherence

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ORIGINAL RESEARCH

Weight loss intervention adherence and factors promoting adherence: a meta-analysis

This article was published in the following Dove Press journal:
Patient Preference and Adherence
12 August 2016
Number of times this article has been viewed

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Background: Adhering to weight loss interventions is difficult for many people. The majority of those who are overweight or obese and attempt to lose weight are simply not successful. The objectives of this study were 1) to quantify overall adherence rates for various weight loss interventions and 2) to provide pooled estimates for factors associated with improved adherence to weight loss interventions.

Methods: We performed a systematic literature review and meta-analysis of all studies published between January 2004 and August 2015 that reviewed weight loss intervention adherence.

Results: After applying inclusion and exclusion criteria and checking the methodological quality, 27 studies were included in the meta-analysis. The overall adherence rate was 60.5% (95% confidence interval [CI] 53.6–67.2). The following three main variables were found to impact adherence: 1) supervised attendance programs had higher adherence rates than those with no supervision (rate ratio [RR] 1.65; 95% CI 1.54–1.77); 2) interventions that offered social support had higher adherence than those without social support (RR 1.29; 95% CI 1.24–1.34); and 3) dietary intervention alone had higher adherence than exercise programs alone (RR 1.27; 95% CI 1.19–1.35).

Conclusion: A substantial proportion of people do not adhere to weight loss interventions. Programs supervising attendance, offering social support, and focusing on dietary modification have better adherence than interventions not supervising attendance, not offering social support, and focusing exclusively on exercise.

Keywords: community based, obesity, social support, program adherence

Introduction

Obesity is a common chronic condition that increases the risk of numerous health problems, including cardiovascular diseases, diabetes, cancer, and mental health issues.[1] Substantial weight loss is not required to start to see health benefits. For example, a 5% reduction in body weight is enough to improve health outcomes.[1] According to data from the 1998 National Health Interview Survey, 50% of obese men and 58% of obese women in the US are actively trying to lose weight.[2] Regrettably, despite the efforts of a large portion of the population, the prevalence of obesity has remained high.[3]

It is especially difficult to lose weight among those suffering from obesity, as it is a complex condition created by diverse genetic, environmental, cultural, and socioeconomic pathways. For example, a recent study concluded that the chances of returning to a normal weight for someone who is already obese are extremely low: one in 210 chances for men and one in 124 chances for women.[4] According to the National Health Interview Study mentioned earlier, the most commonly reported weight loss methods are as follows: 1) calorie restriction alone, 2) eating less fat, and 3) exercising more.[2]

All of that said, moderate weight loss for health reasons is possible, even among those who are obese. For example, a study of 4,034 obese adults in the US found that

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Dovepress
http://dx.doi.org/10.2147/PPA.S103649

40% lost >5% of their body weight in the past year and 20% lost >10%.[5] However, participants need to adhere to evidence-based weight loss methods to lose weight and maintain weight loss in the long term. A meta-analysis of 18 randomized controlled trials (RCTs) found that diet and exercise programs combined were clearly superior to diet programs alone or exercise programs alone.[6] A meta-analysis of 29 studies looking at long-term (5 years) weight loss maintenance among those who participated in structured weight loss programs, found that the average individual maintained at least 3 kg of weight loss and at least a 3% reduction of initial body weight. The authors found that those who lost more weight prior to starting the programs were more likely to keep weight off and those who exercised more were able to better maintain their weight loss than those who did not.[7]

Adhering to healthy weight loss behaviors is required for weight loss initially and in the long term. If participants are unable to adhere to weight loss strategies, they will not lose weight. Problems with attrition and nonadherence exist for intervention programs that are often evaluated in the short term. For example, a meta-analysis of 80 studies on weight loss interventions with a control group found a mean attrition rate of 31%.[8] In a meta-analysis of 45 RCTs of nonsurgical weight loss interventions in obese adults, it was found that 28.4% of participants dropped out of the study prior to the maintenance phase and that many of these dropouts were due to not meeting adherence criteria or weight loss criteria during the study phase.[9]

An important part of advancing weight loss interventions is to understand how to improve adherence to weight loss behaviors. In any health behavior, nonadherence is a problem. The World Health Organization has identified nonadherence as a problem, "of striking magnitude".[10] Behavior change is complex, and even in life-threatening situations, it is difficult for people to adhere to medical advice. For example, a report from Statistics Canada found that among smokers with new diagnoses of chronic diseases: 75% of patients with a recent diagnosis of heart disease, 78% of those with a new cancer diagnosis, 74% of those with stroke, and 96% of those with respiratory disease did not quit smoking.[11] Concerning weight-related health risks, more optimistic results have been reported about behavioral changes. For example, a study of 600 participants with a new diagnosis of type II diabetes found that only 20 people were able to change all their cardiovascular disease risk behaviors within 1 year, but many were able to decrease their Body Mass Index (BMI) and decrease their total daily calorie intake.[12]

In regard to weight loss interventions among those with obesity, there have been no meta-analyses investigating factors that improve adherence rates. The objective of this review and meta-analysis was to quantify adherence rates for various weight loss intervention types and to provide pooled estimates for factors associated with improved adherence to weight loss interventions.

Methods

A systematic literature review was performed, accessing the following databases: Medline, PubMed, ProQuest, CINAHL, Cochrane Central, Global Health, ISI Web of Knowledge, ProQuest, SCOPUS, and EMBASE. Search dates ranged from January 2004 to August 2015.

Subject search descriptors included terms listed in Figure 1. Search terms included relevant weight loss or reduction interventions and adherence or behavior modification (Supplementary material). Adherence was defined as completion of the weight loss program or, in certain cases, was assessed by the level of consistency with the weight loss intervention of interest. Reference sections of each article were reviewed for additional articles. Unpublished articles were not included in our search.

The following inclusion criteria were used in the search:

1. Article should clearly describe adherence to a weight loss program, and the said program should be neither pharmacological nor surgical.
2. Article should have quantifiable data describing the effect size (ie, some absolute or relative measure of program adherence).
3. Article should describe a study that is prospective in nature (ie, an RCT, a quasiexperimental, or a cohort study).
4. Article should be publicly available.
5. Article should be published in the English language.

The search strategies excluded opinion articles, letters to the editor, case reports, and case studies.

Titles were initially reviewed for relevance and to remove duplication. The articles that remained were then subjected to full abstract review in order to apply inclusion and exclusion criteria. Finally, the remaining articles were subjected to full review and methodological quality evaluation by a panel of two reviewers (CN and ML). Unanimous agreement was sought; however, when there was disagreement, a tie breaker was used with a third author (JM).

We used methodological quality checklists for experimental and quasiexperimental designs from Greenhalgh et al.[13] These checklists are a validated modification of the Cochrane Effective Practice and Organization of Care checklist and contain ten questions covering six areas of

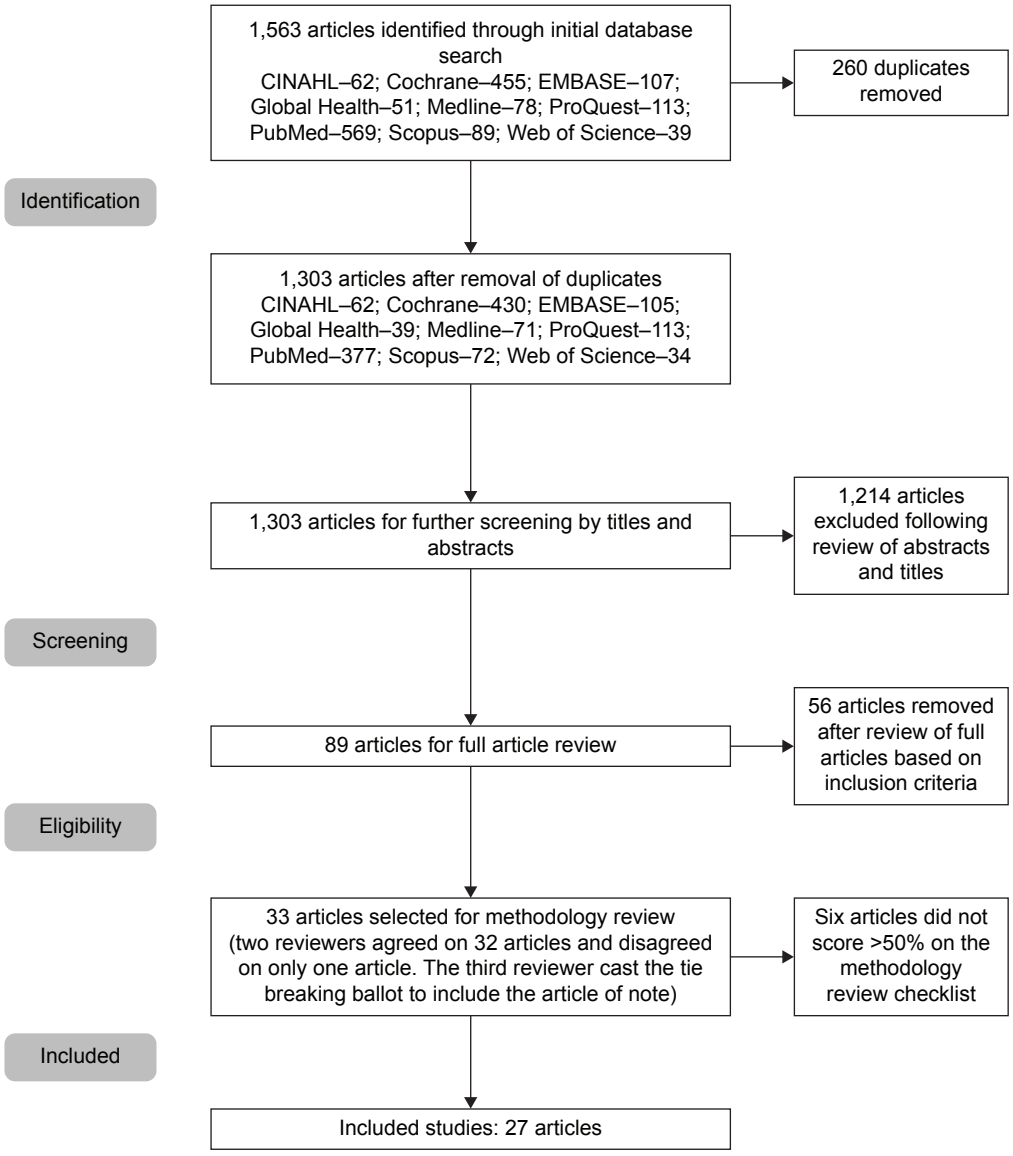

Figure 1 Flow diagram for included studies.

methodological rigor (eleven questions for quasiexperimental designs). The lists made provisions for assessing bias with the different study designs. A score of six was required in order to be accepted for review (ie, a score >50%).[14,15] The checklists are presented in Tables 1 and 2.

A computer program that utilized a random effects model, taken from Fleiss,[16] was built to take interstudy heterogeneity into account. The statistical basis and its assumptions have been previously described in detail elsewhere.[17–19] At least four articles were required for statistical pooling.

Results

Systematic review

The initial search generated 1,563 articles of which 260 articles were duplicates and removed, leaving 1,303 articles to screen abstracts. After the initial screening, 89 articles were included in the full review with 56 articles removed based on the inclusion/exclusion criteria. The remaining 33 articles were then subjected to full methodological review by two reviewers. There was disagreement on only one article that was included based on tie-breaking vote from a third reviewer. In total, six of the articles did not meet methodological requirements, leaving 27 articles for meta-analysis. Figure 1 depicts the search process. Studies included in the analysis and their detailed results are presented in Table 3.[20–46]

Operationalizing adherence

Intervention adherence ranged significantly from 10%[20] to 99.5%.[29] Adherence was operationalized in 13 studies,

Table 1 Methodology checklist for experimental designs

Authors:		
Study title:		
	Yes	**No**
A. Research question and design		
1. Was there a clear research question and was this important and sensible?		
2. If the study was nonrandomized, could a randomized controlled design have been used?		
B. Baseline comparability of groups		
3. [RCTs only]: Was allocation adequately concealed by a rigorous method (eg, random number)?		
4. Were appropriate measures of baseline characteristics taken in all groups before the intervention and were study groups shown to be comparable in all characteristics likely to influence outcome?		
C. Outcome measures		
5. Was the primary outcome measure valid (ie, do two independent raters agree that this was a sensible and reasonable measure of performance or outcome)?		
6. Was the primary outcome measure reliable (ie, do two independent raters agree on the nature and extent of change)?		
D. Protection against contamination		
7. Is it unlikely that the control unit of allocation (professional, practice, institution, and community) received the intervention through contamination?		
E. Protection against bias		
8. Were outcomes measured by "blinded" observers or were they objectively verified (eg, quantitative measures recorded prospectively and independently)?		
F. Follow-up		
9. Was there complete follow-up of participants (ideally >80%)		
10. Was follow-up continued for long enough for the primary outcome measure to show an impact and for sustainability to be demonstrated?		

Note: Passing score for experimental designs =6/10.
Abbreviation: RCT, randomized controlled trial.

Table 2 Quasiexperimental designs

Authors:		
Study title:		
	Yes	**No**
A. Research question and design		
1. Was there a clear research question, and was this important and sensible?		
2. If the study was nonrandomized, could a randomized controlled design have been used?		
B. Protection against secular changes		
3. Was the intervention independent of other changes over time?		
4. Were there sufficient data points to enable reliable statistical inference?		
5. Was a formal statistical test for trend correctly undertaken?		
C. Outcome measures		
6. Was the primary outcome measure valid (ie, do two independent raters agree that this was a sensible and reasonable measure of performance or outcome)?		
7. Was the primary outcome measure reliable (ie, do two independent raters agree on the nature and extent of change)?		
D. Protection against detection bias		
8. Was the intervention unlikely to affect data collection (eg, sources and methods of data collection were the same before and after the intervention)?		
9. Were outcomes measured by "blinded" observers or were they objectively verified (eg, quantitative measures recorded prospectively and independently)?		
F. Completeness of data set and follow-up		
10. Does the data set cover all or most of the episodes of care (or other unit of analysis) covered by the study (ideally >80%)?		
11. Was follow-up continued for long enough for the primary outcome measure to show an impact and for sustainability to be demonstrated?		

Note: Passing score for quasiexperimental designs =6/11.

Table 3 Included studies in meta-analysis

Primary authors; year, country study conducted	Study design	Study duration	Number of study participants	Type of weight loss intervention	Adherence rate	Quality scores	Baseline BMI	Predictors of adherence	Other moderators (work place intervention, social support, financial incentive, or mandatory intervention)
Acharya et al;[20] 2009, USA	RCT	12 months	127	Group sessions, energy/calorie goal, and diet	Energy/calorie goal – 10% Attendance – 44% Self-monitor – 22%	6/10 pass	–	–	–
Annunziato et al;[21] 2009, USA	RCT	12 months	42	Diet – MR	Attendance – 70% MR – 41.5%	8/10 pass	31.9	–	–
Ard et al;[22] 2008, USA	Pre/post	5 months	377	Calorie reduction, diet, and PA	Attendance – 45.6% PA goal – 36.9%	8/11 pass	35.1	–	–
Austin et al;[23] 2013, USA	Pre/post	4 months	82	LEARN	Attendance – 48.8% Calorie goals – 64.5% Step goals – 80.9%	6/11 pass	33.0	Higher adherence: older age, increasing income, and increasing education Lower adherence: more children living at home, young age, and low socioeconomic status	Financial incentive
Bartfield et al;[24] 2011, USA	RCT	18 months	507	Group session, DASH diet, and exercise	Food record – 15.7% Exercise – 14% Attendance – 53.8%	7/10 pass	33.7	–	–
Befort et al;[25] 2008, USA	RCT	4 months	34	Diet, PA, motivational interview, and health education	Attendance – 52%	6/10 pass	39.8	–	–
Burke et al;[26] 2009, USA	RCT	24 months	210	Paper record, PDA, and PDA with feedback	Attendance/retention: cohort 1 (n=73) – 90% (24 months) Cohort 2 (n=63) – 76% (18 months) Cohort 3 (n=74) – 92% (6 months)	6/10 pass	33.4	–	–
Carson et al;[27] 2013, USA	RCT	6 months	92	Self-monitoring, goal setting, stimulus control, nutrition education, and cognitive restructuring	Attendance – 64.5% Monitoring – 62.1%	6/10 pass	38.1	Higher adherence: having a social contact	Social support
Carter et al;[28] 2013, UK	RCT	6 months	128	MMM smartphone app	Attendance – 61.7% MMM app – 16% (N=43)	7/10 pass	34.0	Lower adherence: higher BMI and poorer health status	–

(*Continued*)

Table 3 (*Continued*)

Primary authors; year, country study conducted	Study design	Study duration	Number of study participants	Type of weight loss intervention	Adherence rate	Quality scores	Baseline BMI	Predictors of adherence	Other moderators (work place intervention, social support, financial incentive, or mandatory intervention)
Church et al;[29] 2009, USA	RCT	6 months	411	Exercise	4 kcal/kg/wk (N=139) – 99.5% 8 kcal/kg/wk (N=85) – 99.3% 12 kcal/kg/wk (N=93) – 99.2%	6/10 pass	31.7	–	–
Colley et al;[30] 2008, Australia	Pre/post	4 months	29	PA	PA goals – 31%	6/11 pass	36.8	Higher adherence: older age Lower adherence: higher weight	–
Das et al;[31] 2009, USA	RCT	12 months	38	Dietary ER	10% ER – 18% (N=9) 30% ER – 23% (n=29)	6/10 pass	28.8	–	–
Dutton et al;[32] 2015, USA	Pre/post	6 months	33	Primary care weight loss intervention + peer coaches	Attendance – 50% Peer calls – 40%	7/11 pass	42.9	–	Social support and financial incentive
Dutton et al;[33] 2014, USA	RCT	12 months	66	Behavioral intervention based on group sizes	Attendance: large group (n=31) – 49% Small group (n=35) – 62% Self-monitoring: large group (n=31) – 56.3% Small group (n=35) – 28.4%	6/10 pass	36.5	–	–
Greenberg et al;[34] 2009, Israel	RCT	24 months	322	Diet	Attendance – 84.5% Diet – 57%	7/10 pass	31.0	Higher adherence: low carbohydrate diet, postexercise Lower adherence: during holidays, current smoker, female sex, and less initial weight loss	–
Lemstra and Rogers;[35] 2015, Canada	Pre/post	6 months	183	Exercise, diet, and CBT	Exercise – 81% Diet – 71% CBT – 68%	8/11 pass	37.7	Higher adherence: higher education and completion of a social support contract Lower adherence: past negative experiences with physical activity, high school or less than high school education, and depressed mood	Social support
McAndrew et al;[36] 2013, USA	RCT	3 months	69	Portion controlled weight loss intervention	Dietary adherence – 87%	8/10 pass	39.0	Higher adherence: self-monitoring of blood glucose	Social support

Meffert et al;[37] 2010, Germany	Pre/post	12 months	481	Metabolic balance nutrition program	Attendance – 61.6% Program adherence – 68%	6/11 pass	30.3	Lower adherence: noncompatibility with job, dissatisfaction with program, and personal counseling, individual nutrition plans	–
Shapiro et al;[38] 2012, USA	RCT	12 months	170	Self-monitoring via daily text messaging	Daily text – 60%	8/10 pass	32.2	–	Financial incentive
Steinberg et al;[39] 2013, USA	RCT	6 months	50	Self-monitoring via daily text messaging	Attendance – 90% Daily text (n=26) – 49%	9/10 pass	35.8	–	Financial incentive
Steinberg et al;[40] 2014, USA	RCT	12 months	194	Self-monitoring via IVR	IVR – 71.6%	6/10 pass	30.2	Higher adherence: older age and increasing education	–
Theim et al;[41] 2013, USA	RCT	5 months	101	FBT	Attendance: FBT – 85% MT – 75%	7/10 pass	35.1	–	Social support
Travier et al;[42] 2014, Spain	Pre/post	3 months	42	Diet and PA	Attendance: diet (n=37) – 92% PA (n=37) – 91%	7/11 pass	30.4	–	–
Turner-McGrievy et al;[43] 2007, USA	RCT	24 months	64	Diet	Vegan (n=31) – 61.3%, NCEP (n=31) – 54.8%	8/10 pass	–	–	Social support
Unick et al;[44] 2011, USA	RCT	12 months	2,503	Intensive lifestyle/ diabetic support and education	Program adherence – 80%	6/10 pass	35.8	–	–
van Gool et al;[45] 2006, USA	RCT	18 month	238	Diet and PA	Attendance – diet (n=137) 52.3% Physical activity (n=133) 49.9%	6/10 pass	34.5	Higher adherence: Diet – low social participation and single status Exercise – exercising at home and no cardiovascular disease	–
Wang et al;[46] 2012, USA	RCT	12 months	210	Diet and PA self-monitoring	Paper record (n=72) – diet 34.4% and PA 29.7% PDA (n=68) – diet 57.8% and PA 59.4% PDA + feedback message (n=70) – diet 71.9% and PA 68.8%	6/10 pass	34.0	–	–

Abbreviations: CBT, Cognitive Behavioral Therapy; DASH, Dietary Approach to Stop Hypertension; ER, energy restriction; MMM, my meal mate; MR, meal replacement; MT, maintenance therapy; NCEP, National Cholesterol Education Program; PA, physical activity; PDA, personal digital assistant; RCT, randomized controlled trial; BMI, Body Mass Index; FBT, Family-Based Treatment; LEARN, Lifestyle, Exercise, Attitudes, Relationships, Nutrition; IVR, Interactive Voice Response.

Table 4 Adherence rate and rate ratio for multifactor subgroup analysis across baseline body mass index, study duration, financial incentive, social support, age, study design, and intervention type

Factor	Subgroup 1	N	Adherent (%)	Subgroup 2	N	Adherent (%)	Adherence rate ratio (1 vs 2)	95% CI
Baseline BMI	Overweight/moderate obesity	5,321	63.39	Severe/morbid obesity	4,598	61.56	1.03	1.00–1.06
Study duration	<12 months	2,771	69.88	≥12 months	7,591	53.01	1.32	1.28–1.36
Financial incentive	Financial incentive	538	61.79	No financial incentive	9,804	60.33	1.02	0.96–1.10
Social support	Social support	1,144	73.43	No social support	9,218	57.11	1.29	1.24–1.34
Age	Predicted by older age	469	60.97	Not predicted by older age	9,893	60.50	1.01	0.94–1.09
Study design	RCT	2,680	63.05	Pre/post	7,682	59.57	1.06	1.02–1.10
Intervention type	Supervised program	5,600	68.59	Diet	1,933	63.73	1.08	1.04–1.12
	PA	1,388	50.21	Self-monitoring	1,258	41.50	1.21	1.11–1.32
	Supervised program	5,600	68.59	Self-monitoring	1,258	41.50	1.65	1.54–1.77
	Diet	1,933	63.73	PA	1,388	50.21	1.27	1.19–1.35
	Supervised program	5,600	68.59	PA	1,388	50.21	1.37	1.29–1.44
	Diet	1,933	63.73	Self-monitoring	1,258	41.50	1.54	1.43–1.65

Notes: Potential moderators of exercise adherence were identified apriori and used as factors for a subgroup analysis. Subgroup 1 and 2 were used (for analytical purposes) to represent the sub-categories within each pre-determined factor. Adherence rates were estimated for each sub-category (subgroup) of the pre-determined factors. The adherence rates for each subgroup represents the pooled estimate for a particular sub-category of a given factor. Pairwise rate ratios were computed for all sub-categories of each factor. "Supervised program" and "Self-monitoring" as used above, refer to whether the participants were directly monitored by the investigators or not, respectively. Subgroup analysis by intervention type aims to determine which of supervised monitoring, self monitoring, diet alone, or physical activity alone had a greater effect on adherence to weight loss programs.
Abbreviations: N, number of participants in subgroup; PA, physical activity; RCT, randomized controlled trial; CI, confidence interval.

where threshold rates were given to determine adherence to particular intervention behaviors.[20,22–24,29–32,34,35,37,38,43]

Study design

Twenty of the articles were RCTs with 5,576 participants (ranging from 34 to 2,503). The remaining seven articles were observational intervention studies with 1,227 participants (ranging from 29 to 481), for a total of 6,803 participants included in the overall analysis. Among RCTs, the mean adherence was 63.1%, while the mean adherence for the observational intervention studies was 59.6%.

Study length of time and adherence

The duration of nine of the studies was 12 months, with a sample size of 3,831 participants.[20,21,31,33,37,38,40,44,46] The duration of 13 studies was <12 months with a sample size of 1,631 participants,[22,23,25,27–30,32,35,36,39,41,42] and the duration of five studies was ≥18 months with a sample size of 1,341 participants[24,26,34,43,45] (no articles had study durations between 12 months and 18 months). Interventions lasting <12 months had a mean adherence rate of 69.9%, while those lasting ≥12 months had a mean adherence rate of 53.0%.

Factors that affect adherence

Only ten of the 27 studies discussed factors that affected adherence.[23,27,28,30,34–37,40,45] One study[23] found associations between higher adherence and older age, higher income, and higher education. Older age was also associated with better adherence in two other studies,[30,40] and increasing education levels were associated with higher adherence in two other studies.[35,40] Social support contracts increased adherence rates in two studies[27,35] and six studies in total, including a social support aspect to the intervention.[27,32,35,36,41,43]

Six studies discussed factors associated with lower adherence.[23,28,30,34,35,37] These included lower socioeconomic status (education and income),[23,35] higher weight,[28,30] poor health,[28] dissatisfaction with the program or weight loss results,[34,37] smoking status,[34] and depressed mood.[35]

Subgroup analysis

Subgroup analysis is presented in Table 4. Interventions with a duration of <12 months had higher adherence rates than interventions lasting ≥12 months (RR 1.32; 95% CI 1.28–1.36). Those interventions that included social support improved adherence rates by 29% compared to those interventions that did not include social support (95% CI 1.24–1.34).

Self-monitoring programs had the lowest adherence rate (41.5%), and supervised interventions had the highest adherence rate (68.6%). When attendance was monitored (supervised) by a researcher or intervention leader, participants were more adherent compared to programs that used self-monitoring interventions (RR 1.65; 95% CI 1.54–1.77), diet interventions, or physical activity interventions without supervision or attendance tracking. Participants were more adherent to diet interventions alone than exercise interventions alone (RR 1.27; 95% CI 1.19–1.35) or self-monitoring interventions (RR 1.54; 95% CI 1.43–1.65).

Interpretation

It is not possible to lose weight without actually adhering to weight loss protocols, such as exercise and dietary

interventions. In weight loss interventions, nonadherence rates are usually high. In this article, we have included studies with interventions using methods, such as education, self-monitoring (electronic or nonelectronic), group-based or individual exercise or diet interventions, peer support, and lifestyle interventions, which included both diet and exercise. For many studies, adherence rates were low; as low as 10% in a 12-month study.[20] Different intervention strategies reported various adherence rates within different study designs. We performed a pooled subgroup analysis to determine intervention characteristics that increase the likelihood of participant adherence.

High adherence rates were observed for interventions that incorporated aspects of social support. Social support is an important determinant in overall health. The Public Health Agency of Canada has listed social support as the second most important determinant of health,[47] and the results from a number of studies indicate that those with social supports in place even have a reduced risk of premature mortality.[48–50]

Social support in the studies reviewed in this article ranged from group sessions to peer coaches to social support contracts to "buddy" programs. In the existing literature, multiple studies have indicated that social support (whether through family, friends, peers, or providers) is important for successful behavioral change. For example, one study found that those who received guided support for weight loss were 37% more likely to maintain weight loss than those who participated in self-directed strategies.[51]

Participation in weight loss interventions that allow friends or family to participate may have important implications for weight loss and weight loss maintenance. A previous study compared a weight loss intervention in which participants attended alone, with three friends, or with family members and found that at 6-month follow-up, those who attended with family or friends were more likely to maintain weight loss after program completion than those who attended alone.[52] Social support contracts also allow ongoing support outside of the program. These contracts can help maintain a stronger commitment to a weight loss plan and have been shown to also improve rates of weight loss when compared to those who try to lose weight on their own.[53] As such, it is important to incorporate aspects of social support into weight loss interventions and to provide social support when participants have none. Utilizing existing social networks may be one way to do this, while using existing technology to deliver social support via the web or smartphones is another. These social tools may also act as a motivational tool for participants to remain engaged in the weight loss intervention.[54]

Our analysis also determined that programs supervising and monitoring attendance improved adherence rates by 65% compared to self-monitoring programs and had the highest adherence rates overall. Monitoring attendance likely improves adherence rates since participants are more accountable for their behaviors. Supervision has been found to increase physical activity intervention adherence in other conditions. For example, a mixed methodology study on adherence to a physical activity program in patients with chronic obstructive pulmonary disorder found that participants felt that they would not be able to maintain the behaviors if not for the group dynamic of the classes and the required reporting to the physiotherapist.[55]

Supervised programs also allow participants to access health-care provider knowledge and feedback. Working without guidance can be discouraging and, at times, dangerous. Increasing knowledge transfer through access to an expert supervisor may help improve self-efficacy.[56] Furthermore, a good relationship between supervisors and participants can increase adherence to additional health advice.[56]

Better adherence was also seen when comparing randomized with nonrandomized studies. This result has been observed in other health intervention studies, including a meta-analysis on adherence to statin therapy, where 90% of patients in RCTs were adherent to statin therapy, while only 49% were adherent in observational studies.[57] This may be attributed in large part to the structured and specific nature of the inclusion and exclusion criteria used in RCTs. As such, participants in RCTs tend to be "less sick, younger, better educated, and of higher socioeconomic status".[58] It has been estimated that the average RCT excludes 90% of patients.[59] There are other key differences in RCTs when compared to observational studies that could improve adherence, including differences in patient populations, different intervention intensities or therapeutic regimens, control of confounding factors, potentially more rigorous follow-up, among others.[60] Additionally, due to the funding structure of RCTs and their need to evaluate efficacy instead of real-world effectiveness, these studies tend to be more heavily supervised. As such, the finding that randomized trials have higher adherence than observational studies is likely due to supervised programming and the recruitment of more "ideal" participants. For those offering clinical weight loss interventions, it is important to have participants engage in activities in which they are held accountable for their attendance or adherence to a group, a care provider, or a social support individual.

We also found better adherence to dietary interventions alone than exercise interventions alone. This could be due

to a number of reasons. First, in cases where diet adherence was captured via self-report, poor recall or false information could be a possibility.[61] Second, it may be due in part to participants seeing more weight loss from restrictive diets than from exercise interventions, which is supported by the literature.[6,62] However, it has been previously stated that dietary and exercise programming needs to be combined in order to be most effective.[6,62] Physical activity is important to overall health and overall weight loss maintenance[63] and should be encouraged as a part of a weight loss intervention along with dietary change.

Financial incentives for weight loss programs are discussed throughout the literature, and four studies were included in our analysis.[23,32,38,39] However, when comparing interventions that utilized financial incentives with those studies that did not, there were no significant differences in adherence rates. Among the studies using financial incentives, the participant pool was among the smallest in our analysis.

Future research

Weight loss intervention studies targeting obese individuals should take into account and measure factors that predict adherence. Few studies were found in this systematic review that had acceptable methodological rigor. Given the high prevalence of obesity and the importance of adherence in order to lose weight and maintain weight loss, this is an important area to continue to study.

Study limitations

Due to the variability between studies, the pooling of data, while helpful in increasing the sample size, does introduce a level of uncertainty, with regard to the study conclusion due to possible sampling errors or unmeasured covariates. Also, there were only ten studies in which the authors set out to measure factors that predict adherence to weight loss programs. Therefore, it is possible that the remaining studies may not have given proper consideration to potential confounders for adherence or made the necessary adjustment as needed.

Conclusion

It is unlikely that there is a single solution to reverse the rising prevalence of obesity observed globally. A comprehensive approach is needed to address this complex issue. Supervising weight loss programs and adding social supports help improve adherence to weight loss programs. It is expected that with better adherence, overweight or obese persons can lose more weight and help keep it off in the long term. Evaluating the views of participants and adherence rates to weight loss programs is critical as it can offer insight, expand our current knowledge, and provide evidence in support of designing and implementing more effective interventions.

Disclosure

The authors report no conflicts of interest in this work.

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Supplementary materials

Search terms

Weight loss programs
Weight loss intervention
Weight loss regimen
Weight loss plan
Weight reduction programs
Weight reduction intervention
Weight reduction regimen
Weight reduction plan
Adherence
Behavior modification

Search strategy

(((((((((Weight loss programs) OR weight loss intervention) OR weight loss regimen) OR weight loss plan) OR weight reduction programs) OR weight reduction intervention) OR weight reduction regimen) OR weight reduction plan)) AND ((adherence) OR "behavior modification").

Databases searched

Medline
PubMed
Cochrane Library
CINAHL
Global Health
ISI Web of Knowledge
ProQuest
SCOPUS
EMBASE

Inclusion criteria

1. Article should be in English language.
2. Article should have a prospective design.
3. Article should have quantifiable data describing the effect size.
4. Article should describe participation in a supervised weight loss program that is neither pharmacologic nor surgical and assess adherence to the said program.
5. Article is publicly available.