Systematic Review and Meta-Analysis: The Impact of Multicomponent Weight Management Interventions on Self-Esteem in Overweight and Obese Adolescents

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Abstract

Objective Building self-esteem in overweight adolescents is key to long-term weight management; yet, self-esteem is rarely a key outcome of adolescent weight management interventions. This systematic review investigates the impact of multicomponent weight management interventions on self-esteem in overweight and obese adolescents. Method Six databases were searched in December 2014. Eligible studies met the following criteria: (1) randomized controlled trial, (2) overweight or obese participants, (3) adolescents (10–19 years), (4) multicomponent weight management intervention, (5) reported self-esteem and weight changes. Results Thirteen studies with 1,157 overweight or obese adolescents, aged 10–19 years, were included. Meta-analyses showed no significant change in self-esteem (0.27 [-0.04, 0.59]), but body mass index z-score reduced following intervention (-0.17 [-0.22, -0.11]). Conclusion The lack of change in self-esteem suggests weight loss alone is insufficient to improve self-esteem. Multicomponent weight management interventions require a specific focus on self-esteem to improve this outcome in overweight and obese adolescents.

Key words: adolescent; at-risk youth; health promotion and prevention; meta-analysis; obesity; systematic review; weight management.

Introduction

In the United States, >20% of adolescents (12–19 years) are classified as obese (Ogden, Carroll, Kit, & Flegal, 2014) and at an increased risk of experiencing the associated physiological comorbidities. However, the psychosocial comorbidities, such as reduced self-esteem, have a more immediate impact and are often drivers for overweight or obese adolescents to seek treatment (Lobstein, Baur, & Uauy, 2004). Adolescence is a critical period of physical and psychological development that occurs between 10 and 19 years of age (World Health Organization, 2014), during which young people are at an increased risk of experiencing low self-esteem (Mission Australia, 2012). This risk is further exacerbated if they are obese (Griffiths, Parsons, & Hill, 2010; McClure, Tanksi, Kingsbury, Gerrard, & Sargent, 2010; Sanders, Han, Baker, & Cobley, 2015).

Global self-esteem is the sum of one’s perceived ability or competence, in comparison with one’s aspirations, in domains of importance (e.g., physical appearance, cognitive ability). Low self-esteem is caused when there is a discrepancy between one’s perceived level of competence and aspirations, in one or more
domains that are of importance to the individual (Harter, 1993). Self-esteem can fluctuate greatly during adolescence and there is an increased risk of self-esteem being low, particularly from the age of 13 years (French, Story, & Perry, 1995; Strauss, 2000).

During adolescence, self-esteem plays an important role in mental health and development (McClure et al., 2010). Low self-esteem in adolescents, particularly overweight adolescents, has been linked to disturbed eating and dieting behaviors, a preoccupation with body weight and shape, an inactive lifestyle, and poorer performance in education and developmental tasks (Lutzer & Stein, 2013). Low self-esteem has been hypothesized both as a contributing factor and consequence of obesity (French et al., 1995). Increased self-esteem purportedly leads to better weight outcomes in the long term (Elfhag & Rossner, 2005; French et al., 1995; Roberts, 2006). Therefore weight-management interventions for adolescents should aim to improve self-esteem.

Multicomponent weight management interventions (MWMI), with behavioral, dietary, and physical activity components, are best practice for achieving successful weight loss in overweight and obese adolescents (Kohn et al., 2006; Luttikhuis et al., 2009; National Health and Medical Research Council, 2013; National Institutes for Health and Care Excellence, 2013). However, their impact on self-esteem is still not well reported (Luttikhuis et al., 2009), despite this being a recommendation from a previous review of the effect of weight management programs on pediatric self-esteem (Lowry, Sallinen, & Janicke, 2007).

This systematic review and meta-analysis of randomized controlled trials (RCTs) examines the effect of MWMI on self-esteem in overweight and obese adolescents. A secondary outcome is the impact of MWMI on weight loss and whether this is associated with improvements in self-esteem. This review provides an update of the literature since the review by Lowry et al. (2007) and focuses specifically on (1) adolescents, an at-risk group for experiencing low self-esteem, and (2) MWMI, the most effective method for weight management in children and adolescents (Luttikhuis et al., 2009).

Methods

This review was registered with PROSPERO International prospective register of systematic reviews (registration number CRD42015016889) and is reported according to the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) Statement (see Table S1 in the supplement for PRISMA Checklist; Moher et al., 2015).

Literature Search

A literature search was conducted in December 2014 in the Scopus, MEDLINE, PsychInfo, Cochrane Library, Cumulative Index to Nursing and Allied Health Literature, and Embase databases. Search terms were used to describe the population (e.g., overweight, youth), intervention (e.g., lifestyle, health education, nutrition, physical activity), control (e.g., usual care), outcomes (e.g., esteem, body mass index), and study design (e.g., RCT, controlled trial). Studies were limited to English and humans where databases provided that option (see Table S2 in the supplement for full search strategy). The criteria for inclusion in this review were (1) RCT, (2) overweight or obese, (3) adolescent (10–19 years; World Health Organization, 2014), (4) a MWMI (behavioral, dietary, and physical activity components), (5) reported self-esteem and weight changes. Body mass index (BMI) z-score was the preferential choice for ascertaining weight status, but if not reported, other weight outcomes were collected.

Search results were imported into EndNote X7.2 Version 17.02 (Thomson Reuters, New York City, USA). Duplicate articles were manually removed by the lead author (M.M.). Throughout the title and abstract screening, two authors (M.M. and A.D.) independently excluded papers if they did not report the results of an RCT, if the intervention did not include all three behavioral, dietary, and physical activity components, or if there was no measure of self-esteem. Included papers were cross-checked, and discrepancies were resolved by the third author (M.B.). Papers that included healthy weight individuals or individuals outside the adolescent age range were included at full-paper screening, and the authors were contacted to retrieve results specific to the population of interest. These papers were subsequently excluded if authors did not respond within 1 month of initial contact or were unable to provide the requested data. All full papers were independently screened by two authors (M.M. and A.D.) and were cross-checked, with any disagreements resolved by the third author (M.B.).

Data Extraction

Data extraction was conducted using the National Health and Medical Research Council of Australia data extraction tool for RCT and cohort studies. Data were independently extracted by two researchers (M.M. and A.D.) and included outcome measures, intervention and control conditions, study design, population characteristics, and results. The two sets of extracted data were compared to ensure complete and correct interpretation. Any disagreements were settled by the M.B. Data that were missing from the included studies, such as additional results and detailed methodology, were obtained from separate publications.
than BMI
study. Studies that reported a weight outcome other
small number of studies were included and they were
analysis. Weighted mean difference was calculated for
both self-esteem and BMI change in the intervention and control groups, for
test and the coefficient of determination (R²).
results was assessed. Following tests for normality, ef-
fected sizes for self-esteem and weight changes were as-
tral difference (SMD) was calculated from the Cohen’s
meta-analysis. All meta-analyses were carried out using random effects analysis.
Sensitivity analyses were not performed, as only a
valid, and reliable outcome measures, and low risk of bias

Risk of Bias
The American Dietetic Association Quality Criteria Checklist was used to assess the quality of the papers (Academy of Nutrition and Dietetics, 2012). Criteria were independently tested by two researchers (M.M. and A.D.) to determine study quality, including randomization, research question, participant selection and comparability, blinding, outcome measures, statistical analysis, and potential for bias from funding. Studies were designated a positive, neutral, or negative rating. Publication bias was assessed through visual interpretation of funnel plots created using RevMan 5.3 (Cochrane Informatics & Knowledge Management Department, 2014; see Figure S1).

Statistical Analysis
Cohen’s $d$ effect sizes were calculated for weight and self-esteem outcomes to allow for comparison of results across studies. Positive effect sizes indicated the outcome had improved; that is, increased self-esteem, or decreased weight ($\geq 0.2 = \text{small effect, } \geq 0.5 = \text{medium effect, } \geq 0.8 = \text{large effect}$). Where an effect size could not be calculated, the reported significance of results was assessed. Following tests for normality, effect sizes for self-esteem and weight changes were assessed for correlation using the Pearson Correlation test and the coefficient of determination ($R^2$).

Meta-analyses were performed to compare the change in the intervention and control groups, for both self-esteem and BMI z-score, using Stata Statistical Software (Release 13, 2013, Texas, USA). Only studies that reported the mean (SD) change in self-esteem or BMI z-score, and compared the intervention with a no-treatment control group, were included in the meta-analyses. If data were not originally reported in this format, results were requested from the authors for inclusion in this review. To account for the different tools used to measure self-esteem outcomes, a standard mean difference (SMD) was calculated from the Cohen’s $d$ effect size for each study. Studies that reported a weight outcome other than BMI z-score were excluded from the meta-analysis. Weighted mean difference was calculated for BMI z-score for the meta-analysis. All meta-analyses were carried out using random effects analysis. Sensitivity analyses were not performed, as only a small number of studies were included and they were all of neutral or positive quality.

Results
Database searches identified 4,707 original papers. Following title and abstract screening, 115 full-text articles were retrieved and assessed for eligibility. Thirteen papers met the review criteria, including 2 studies that were reviewed by Lowry et al. (2007) and 11 studies published since. Seven studies were included in the meta-analyses (Figure 1).

Description of Included Studies
The included studies involved between 32 and 208 male and/or female participants, aged 10–19 years, who were overweight or obese (BMI $\geq 85$th percentile). Owing to the limited number of studies that exclusively examined the overweight adolescent population, studies with mixed populations were included (Croker et al., 2012; Danielsen, Nordhus, Júlíusson, Mæhle, & Pallesen, 2013; Lochrie et al., 2013; Lubans et al., 2012; Morgan, Saunders, & Lubans, 2012; Neumark-Sztainer et al., 2010; Sacher et al., 2010). However only data relating to the population of interest are reported.

Interventions ranged from seven weeks up to a year in length. Only results taken immediately postintervention were assessed in this review. For studies that included an intense treatment phase followed by a maintenance phase, the results taken immediately after the intense treatment phase have been used as the “postintervention” results (Brennan, Wilks, Walkley, Fraser, & Greenway, 2012; Daley, Copeland, Wright, Roalfe, & Wales, 2006; Neumark-Sztainer et al., 2010). One exception to this was the study by Nguyen, Shrewsbury et al. (2012) that had an additional outcome measurement at 12 months, half way through the maintenance phase. For this study, the 12-month measures have been used as the “postintervention” results, as this was the first time point that reported separate results for the intervention and control groups.

All interventions included dietary, physical activity, and behavioral strategies (Table I). For the purpose of this review, all groups that received a treatment that met the review criteria for a MWMI were considered “intervention groups”; hence, there are a greater number of intervention, than control, groups. In all studies, the intervention and control groups were considered comparable at baseline for the outcomes of interest.

Risk of Bias
Included studies were assessed against 10 criteria and study quality was generally high (Table I). Four criteria had to be met for a study to receive a positive quality rating. The remaining six criteria contributed to the overall rating, but were not compulsory for a positive rating to be assigned. All 14 studies in this review met the criteria for a clearly stated research question, clearly defined, valid, and reliable outcome measures, and low risk of bias.
owing to funding or sponsorship. Four studies were downgraded to a neutral quality rating for not meeting the criteria (1) selection of participants free from bias (Danielsen et al., 2013; Morgan et al., 2012), (2) study groups comparable at baseline (Neumark-Sztainer et al., 2010), or (3) intervention and comparison conditions described in detail (Mellin, Slinkard, & Irwin, 1987; Morgan et al., 2012). Other criteria that were not met by all studies, but did not result in the assignment of any neutral quality ratings, included appropriate statistical analysis, handling of withdrawals described, and use blinding to prevent bias. Funnel plot analysis (Figure S1) did not suggest publication bias, however should be interpreted with caution owing to the small number of studies.

The Impact of Multicomponent Weight Management Interventions on Adolescent Self-Esteem

Self-esteem effect sizes were able to be calculated for eight studies (Table II). A positive effect on adolescent
<table>
<thead>
<tr>
<th>Study (author, year, location)</th>
<th>Quality rating</th>
<th>Participants</th>
<th>Interventions</th>
<th>Focus on self-esteem</th>
<th>Duration</th>
<th>Outcome measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brennan et al., 2012, Australia&lt;sup&gt;25&lt;/sup&gt;</td>
<td>Positive</td>
<td>29 (46%) males and 34 (54%) females, 11–19 years, overweight or obese</td>
<td>I: Intervention based on cognitive-behavioral principles with a focus on making small sustainable changes in dietary intake, physical activity, and behavioral strategies. Parents involved for first half of treatment phase. C: Wait list</td>
<td>No specific mention of self-esteem, but one session on developing helpful thoughts and emotions.</td>
<td>Treatment phase—twelve 60-min sessions and one telephone call session over 16 weeks Maintenance phase—two 60-min clinic sessions and seven 15-min telephone sessions, over 6 months</td>
<td>Rosenberg Self-Esteem Scale BMI z-score</td>
</tr>
<tr>
<td>Croker et al., 2012, United Kingdom&lt;sup&gt;26&lt;/sup&gt;</td>
<td>Positive</td>
<td>13 (32%) males and 28 (68%) females, 10–12 years, overweight or obese</td>
<td>I: Family-based intervention delivered in groups with a focus on making whole-family lifestyle changes through behavior-change strategies and nutrition and physical activity goals. Parent and child sessions delivered separately. C: Wait list</td>
<td>No specific mention of self-esteem, but one session on social support and how to manage bullying.</td>
<td>Fifteen 1.5-hr sessions over 6 months Follow up 12 months from baseline.</td>
<td>Harter’s Self-Perception Profile (self-esteem) BMI SDS</td>
</tr>
<tr>
<td>Daley et al., 2006, United Kingdom&lt;sup&gt;22&lt;/sup&gt;</td>
<td>Positive</td>
<td>36 (44%) males and 45 (56%) females, 11–16 years, BMI &gt;98th percentile</td>
<td>I: Participants completed a range of aerobic activities and mini games and were provided with exercise counseling for behavior change in a one-on-one setting. Healthy eating habits were encouraged and written information was provided. Participants were given an individualized exercise program to continue after the treatment program. C: No treatment control</td>
<td>No specific mention of self-esteem, but behavioral interventions included finding social support.</td>
<td>Treatment phase—Twenty-four 1 hr sessions were held over 8 weeks Maintenance phase—home exercise program for 6 weeks, no researcher contact Follow up at 28 weeks from baseline.</td>
<td>Harter’s Self-Perception Profile for Adolescents (self-esteem) BMI z-score</td>
</tr>
<tr>
<td>Danielsen et al., 2013, Norway&lt;sup&gt;27&lt;/sup&gt;</td>
<td>Neutral</td>
<td>17 (53%) males and 15 (47%) females, 10–13 years, obese</td>
<td>I: Participants and their parents attended individual family meetings with a clinical psychologist. The intervention focused on increasing physical activity and reducing sedentary behavior, establishing a balanced diet, developing individual and family coping skills, and promoting a positive self-perception. C: Wait list</td>
<td>No specific mention of self-esteem, standard behavioral techniques used.</td>
<td>Twelve weekly 45-min sessions, with a booster session 6 months after treatment. Follow up 15 months from baseline.</td>
<td>Harter’s Self-Perception Profile for Children (self-esteem) BMI SDS</td>
</tr>
<tr>
<td>Study (author, year, location)</td>
<td>Quality rating</td>
<td>Participants</td>
<td>Interventions</td>
<td>Focus on self-esteem</td>
<td>Duration</td>
<td>Outcome measures</td>
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<tr>
<td>DeBar et al., 2012, United States</td>
<td>Positive</td>
<td>208 (100%) females, 12–17 years, BMI ≥ 90th percentile</td>
<td>I: Intervention focused on changing dietary intake and eating patterns, increasing physical activity, tackling common psychosocial issues of obesity and teaching behavioral and cognitive tools for weight management. Parent support meetings were included. C: Wait list</td>
<td>No specific focus on self-esteem, but issues such as depression and poor body image were addressed and cognitive restructuring techniques to reduce negative self-talk were used.</td>
<td>Sixteen 90-min group meetings over 5 months</td>
<td>Rosenberg Self-Esteem Scale, BMI z-score</td>
</tr>
<tr>
<td>Lochrie et al., 2013, United States</td>
<td>Positive</td>
<td>29 (43%) males and 39 (57%) females, 10–11 years, BMI ≥ 85th percentile</td>
<td>I: Participants and their parents attended group sessions led by a psychologist and registered dietitian that covered nutrition, behavior modification, exercise topics, psychosocial interventions, and medical issues associated with obesity. C: One group session for families led by a registered dietitian providing information on nutrition and physical activity.</td>
<td>Psychosocial aspects of intervention—stress management, relaxation, managing peer pressure, and teasing.</td>
<td>Fourteen sessions, lasting 60–90 min, over 6 months</td>
<td>Harter’s Self-Perception Profile for Children (self-esteem), BMI z-score</td>
</tr>
<tr>
<td>Lubans et al., 2012, Australia</td>
<td>Positive</td>
<td>152 (100%) females, 12–14 years, BMI ≥ 85th percentile</td>
<td>I: School-based intervention including enhanced sport sessions, interactive seminars, lunch-time activity sessions, pedometers for self-monitoring, parent newsletter, text messages for social support and nutrition workshops delivered by Accredited Practicing Dietitians. C: No treatment control</td>
<td>No specific mention of self-esteem.</td>
<td>Delivered over the four school terms in the year</td>
<td>Marsh’s Global Self-esteem, BMI z-score</td>
</tr>
<tr>
<td>Mellin et al., 1987, United States</td>
<td>Neutral</td>
<td>14 (21%) males and 52 (79%) females, 12–18 years, &gt;13% overweight</td>
<td>I: Intervention used cognitive, behavioral, affective, and interactive techniques to encourage sustainable modifications to diet, exercise, relationships, lifestyle, communications, and attitudes. Two-parent sessions included. C: Wait list</td>
<td>No specific mention of self-esteem, but interventions encouraged positive relationships and attitudes.</td>
<td>Fourteen 90-min sessions over 14 weeks</td>
<td>Rosenberg Self-Esteem Scale, Relative weight</td>
</tr>
<tr>
<td>Study (author, year, location)</td>
<td>Quality rating</td>
<td>Participants</td>
<td>Interventions</td>
<td>Focus on self-esteem</td>
<td>Duration</td>
<td>Outcome measures</td>
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<tr>
<td>Morgan et al., 2012, Australia</td>
<td>Neutral</td>
<td>40 (100%) males, 13–16 years, BMI ≥85th percentile</td>
<td>I: School-based intervention including enhanced sport sessions, physical activity, and nutrition handbooks with home-based challenges and interactive seminars on nutrition and physical activity behaviors and leadership. C: Wait list</td>
<td>No specific mention of self-esteem</td>
<td>3-month intervention Follow up 6 months from baseline</td>
<td>Physical Self-Perception Profile Adolescent version (self-esteem) BMI</td>
</tr>
<tr>
<td>Neumark-Sztainer et al., 2010, USA</td>
<td>Neutral</td>
<td>164 (100%) females, 13–18 years, BMI ≥85th percentile</td>
<td>I: physical activity/nutrition/social support/self-empowerment lessons at school with related letters sent home to parents, along with individual motivational interviewing sessions to encourage goal-setting. Followed by lunch time sessions during the maintenance period and a 1-day parent–daughter retreat. C: All girls physical activity class within normal school curriculum.</td>
<td>One of the program objectives was to enhance a positive self-focus, and sessions focused on self-empowerment.</td>
<td>Phase 1—daily lessons at school for 16 weeks Seven individual sessions every 3–4 weeks throughout intervention Phase 2—weekly lunch time sessions for remainder of school year (~5 months)</td>
<td>Harter’s Self-Perception Profile (self-esteem) BMI</td>
</tr>
<tr>
<td>Nguyen et al., 2013, Australia</td>
<td>Positive</td>
<td>55 (36%) males and 96 (64%) females, 13–16 years, overweight to moderately obese, BMI z-score 1.0–2.5 (BMI 84–99th percentile)</td>
<td>I: Intervention based on the social cognitive theory to modify self-efficacy, motivation, perseverance, and self-regulation. Sessions focused on physical activity, healthy eating, goal setting, stress management, and building self-esteem. Intervention group received Additional Therapeutic Contact (ATC) fortnightly throughout the maintenance period. Parent sessions included. C: As above, without the ATC</td>
<td>Building positive self-esteem was the focus of a session.</td>
<td>Phase 1—seven weekly 75-min group sessions Phase 2—from 2 to 24 months, five 60-min group sessions, held approx. every 3 months. ATC: fortnightly telephone coaching sessions and SMS/email messages.</td>
<td>Harter’s Self Perception Profile for Adolescents (self-esteem) BMI z-score</td>
</tr>
<tr>
<td>Sacher et al., 2010, United Kingdom</td>
<td>Positive</td>
<td>21 (48%) males and 23 (52%) females, 10–12 years, BMI &gt;98th percentile</td>
<td>I: Participants and their families attended group sessions focusing on behavior change, nutrition, and physical activity. Session content focused on building skills to maintain long-term behavior changes. Following treatment families were given a 12-week free family swim pass. C: Wait-list</td>
<td>No specific mention of self-esteem.</td>
<td>Eighteen 2-hr sessions over 9 weeks Follow up 12 months from baseline</td>
<td>Harter’s Self-Perception Profile for Children (self-esteem) BMI z-score</td>
</tr>
</tbody>
</table>
self-esteem was observed following four MWMIs across three studies (Croker et al., 2012; Danielsen et al., 2013; Nguyen, Shrewsbury, et al., 2012). Five studies showed no effect on adolescent self-esteem following MWMIs (Brennan et al., 2012; DeBar et al., 2012; Lochrie et al., 2013; Lubans et al., 2012; Neumark-Sztainer et al., 2010). No positive effects on self-esteem were observed in any of the control groups. One wait-listed control group (Croker et al., 2012) showed a small negative effect on self-esteem.

Mixed results were also observed in the studies for which an effect size could not be calculated. Improvements in adolescent self-esteem were observed following MWMIs by Daley et al. (2006), Mellin et al. (1987), Sacher et al. (2010), and Wadden et al. (1990). However, only Daley et al. (2006) reported that this change was different to that observed in the control group. No changes in self-esteem were detected following intervention by Morgan et al. (2012), although a significant decline in self-esteem was observed in the wait-listed control group who received the normal school curriculum throughout the study period.

Multicomponent Weight Management Interventions Improve Weight Outcomes in Adolescents

Of the 13 included studies, there were 14 groups who received a MWMI and 11 no-treatment control groups. Of these, effect sizes were able to be calculated for nine intervention groups and seven control groups (Table III). Seven intervention groups had small to medium positive effects, indicating successful weight loss (Brennan et al., 2012; Croker et al., 2012; Danielsen et al., 2013; DeBar et al., 2012; Lochrie et al., 2013; Lubans et al., 2012; Nguyen, Shrewsbury, et al., 2012), and two intervention groups had no effect (Neumark-Sztainer et al., 2010; Nguyen, Shrewsbury, et al., 2012). All seven control groups showed no effect on weight.

Of the studies for which effect size could not be calculated, the results were similar. Mellin et al. (1987), Morgan et al. (2012), Sacher et al. (2010), and Wadden et al. (1990) all observed significant weight loss following intervention. Morgan et al. (2012) and Sacher et al. (2010) also showed that these changes were significantly different to changes observed in the control groups. No studies observed significant weight change in the control groups.

Correlation Between Self-Esteem Improvement and Weight Loss Effect Sizes

There is a strong ($r = .641, R^2 = .410$) positive linear relationship between effect sizes for self-esteem improvement and weight loss across all intervention and control groups ($p = .008$).
<table>
<thead>
<tr>
<th>Author, year</th>
<th>$n$</th>
<th>Pre-mean (SD)</th>
<th>Post-mean (SD)</th>
<th>Change mean (SD)</th>
<th>Effect size</th>
<th>Control groups</th>
<th>$n$</th>
<th>Pre-mean (SD)</th>
<th>Post-mean (SD)</th>
<th>Change mean (SD)</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brennan et al., 2012</td>
<td>20</td>
<td>21.5 (5.4)$^a$</td>
<td>20.6 (6.3)$^a$</td>
<td>−2.11 (4.78)$^a$</td>
<td>−0.15</td>
<td>14</td>
<td>18.8 (4.7)$^a$</td>
<td>19.2 (4.7)$^a$</td>
<td>0.64 (3.91)$^a$</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>Croker et al., 2012</td>
<td>13</td>
<td>2.69 (0.57)$^b$</td>
<td>2.95 (0.45)$^b$</td>
<td>0.36 (0.39)$^b$</td>
<td>0.51</td>
<td>10</td>
<td>2.90 (0.61)$^b$</td>
<td>2.68 (0.52)$^b$</td>
<td>0.22 (0.59)$^b$</td>
<td>−0.39</td>
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</tr>
<tr>
<td>Daley et al., 2006</td>
<td>28</td>
<td>2.42 (0.56)$^b$</td>
<td>2.61 (0.08SE)$^b$</td>
<td>NA</td>
<td>NA</td>
<td>30</td>
<td>2.49 (0.49)$^b$</td>
<td>2.56 (0.10SE)$^b$</td>
<td>NA</td>
<td>NA</td>
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</tr>
<tr>
<td>Danielsen et al., 2013</td>
<td>16</td>
<td>2.88 (0.52)$^b$</td>
<td>3.17 (0.53)$^b$</td>
<td>0.29 (0.53)$^b$</td>
<td>0.55</td>
<td>16</td>
<td>3.11 (0.57)$^b$</td>
<td>3.06 (0.59)$^b$</td>
<td>−0.05 (0.37)$^b$</td>
<td>−0.09</td>
<td></td>
</tr>
<tr>
<td>DeBar et al., 2012</td>
<td>105</td>
<td>2.39 (0.26)$^a$</td>
<td>2.40 (0.25)$^a$</td>
<td>NA</td>
<td>0.04</td>
<td>103</td>
<td>2.41 (0.27)$^a$</td>
<td>2.39 (0.25)$^a$</td>
<td>NA</td>
<td>−0.08</td>
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<tr>
<td>Lochrie et al., 2012</td>
<td>29</td>
<td>18.3 (5.02)$^b$</td>
<td>19.1 (4.48)$^b$</td>
<td>0.73 (4.51)$^b$</td>
<td>0.17</td>
<td>18</td>
<td>19.9 (3.46)$^b$</td>
<td>19.9 (3.43)$^b$</td>
<td>0.00 (3.11)$^b$</td>
<td>0.00</td>
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<tr>
<td>Lubans et al., 2012</td>
<td>54</td>
<td>4.03 (1.12)$^c$</td>
<td>4.06 (1.32)$^c$</td>
<td>NA</td>
<td>NA</td>
<td>68</td>
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Note: Data presented as reported in original papers. SD = standard deviation; NA = data not provided/unable to be calculated; SE = Standard error not Standard Deviation; Effect size = Cohen’s $d$. Bold font indicates where effect size was small (0.20) or greater.

$^a$Rosenberg self-esteem scale (generally scored from 0 [lowest self-esteem] to 30 [highest self-esteem]).
$^b$Harter’s SPPA/SPPC (generally scored 1 [lowest self-esteem] to 4 [highest self-esteem]).
$^c$Marsh’s Physical Self-Description Questionnaire$^*$. (physical self-esteem).
$^d$Physical Self-Perception Profile for Adolescents$^*$. (physical self-esteem).
$^e$Piers-Harris Self-Concept Scale$^*$. (physical self-esteem).

*Scoring ranges unavailable, higher value equals higher self-esteem.
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<th>Post-mean (SD)</th>
<th>Change mean (SD)</th>
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**Note.** Data presented as reported in original papers. All weight outcomes reported as body mass index (BMI) z-score unless otherwise stated. SD = standard deviation; NA = data not provided/unable to be calculated; SE = Standard Error reported rather than Standard Deviation; Effect size = Cohen’s d. Bold font indicates where effect size was small (0.20) or greater.

aRelative weight.
bBMI.
Quantitative Data Analysis

Differences between intervention and control groups for change in self-esteem are presented in Figure 2a. This analysis included seven intervention groups \( (n = 191) \) and seven control groups \( (n = 132) \) with interventions, or intensive treatment phases, ranging from 9 weeks to 6 months in duration. A moderate level of the variation across studies was owing to heterogeneity \( (I^2 = 46.4\%); \) Higgins, Thompson, Deeks, & Altman, 2003). The overall summary effect showed

![Figure 2. Comparison between intervention and control groups for the change in adolescent self-esteem effect size (a) and body mass index z-score (b) following multicomponent weight management interventions. SMD = standard mean difference; WMD = weighted mean difference.](https://academic.oup.com/jpepsy/article-abstract/42/4/379/3065789)
no effect on self-esteem as a result of intervention; SMD of 0.27 (95% confidence interval: $-0.04, 0.59$), $z = 1.69$, and $p = 0.92$. However, all studies except one favored the intervention for improvements in self-esteem.

The difference between intervention and control groups for change in BMI $z$-score is illustrated in Figure 2b. This analysis included five intervention groups ($n = 135$) and five control groups ($n = 82$) with interventions ranging from 9 weeks to 6 months in duration. Heterogeneity in this sample was low ($I^2 = 17.7\%$; Higgins et al., 2003) and the overall summary effect was $-0.17 (-0.22, -0.11)$ BMI $z$-score points ($z = 6.13$ and $p < 0.001$), indicating statistically significant weight loss following MWMI.

**Discussion**

The purpose of this review was to examine the effect of MWMIs on self-esteem in overweight and obese adolescents. Increased self-esteem is proposed as a key factor for maintaining long-term weight management (Elfhag & Rossner, 2005; French et al., 1995; Roberts, 2006). A secondary outcome of this review was to examine the impact of MWMIs on weight loss and whether this was associated with improvements in self-esteem.

The meta-analysis showed no difference in self-esteem between the intervention and control groups. However, six of the seven studies in the meta-analysis favored the intervention over control for improvements in self-esteem, and four of the six studies not included in the meta-analysis found significant improvements in self-esteem following intervention. The latter of these findings are similar to those of an earlier review (Lowry et al., 2007), that showed improvements in self-esteem following weight management interventions in a pediatric population, particularly when certain intervention features were present. Similarly, a number of intervention features that contributed to an increased likelihood of improving self-esteem were identified in this review.

Improvements in self-esteem, regardless of weight loss, have been demonstrated in children who took part in weight management interventions that included a focus on building self-esteem, and it is recommended that this be a focus of all pediatric weight management interventions (Lowry et al., 2007). Yet, the majority of studies identified in this review did not include building self-esteem as a key aspect of their intervention. Nguyen, Shrewsbury et al. (2012) described the greatest focus on self-esteem (one 75-min group session focused on building self-esteem) and also resulted in the largest treatment effect (0.57) and a significant improvement in self-esteem (Nguyen, Shrewsbury, et al., 2012). A focus on similar topics such as body image, social support, and managing bullying may also contribute to improvements in self-esteem (Croker et al., 2012; Pierce & Wardle, 1997; Tiggemann, 2005); however, these findings highlight the lack of uptake of these recommendations.

Among overweight and obese youth, reductions in self-esteem are often observed in domains of physical appearance and physical ability (Franklin, Denyer, Steinbeck, Caterson, & Hill, 2006; French et al., 1995; Latzer & Stein, 2013; Lowry et al., 2007). Particularly for adolescent girls, body image is a key concern (Cave, Fildes, Luckett, & Wearing, 2015) and comprises a large portion of global self-esteem (Lowry et al., 2007; Pesa, Syre, & Jones, 2000). However, weight loss and associated changes in physical appearance do not necessarily reflect improvements in self-esteem (Lowry et al., 2007). Changes in body-esteem often occur more rapidly than changes in global self-esteem as a result of weight management (Lowry et al., 2007). This may explain the lack of change observed in global self-esteem in this meta-analysis, and highlights the need to also include body-esteem (or physical self-esteem) as a focus and outcome of weight management interventions for adolescents.

Parental involvement in adolescent weight management interventions is a critical component for successful weight loss and may also be important for improving self-esteem (Lowry et al., 2007). Weight-related teasing from family is shown to be negatively associated with self-esteem in overweight adolescents, whereas family connectedness was positively associated with adolescent self-esteem (Fulkerson, Strauss, Neumark-Sztainer, Story, & Boutelle, 2007). The inclusion of parents in weight management interventions fosters a safer and more encouraging home environment for the adolescent (Lowry et al., 2007), which is associated with increased self-esteem in nonoverweight children (Marx & Neumark-Sztainer, 2005). All studies in the present review, barring one, included parents in the intervention. Parental involvement should continue to be a key component of weight management interventions to ensure a supportive home environment for the adolescent to help foster positive self-esteem.

Weight management interventions that used a group setting to target self-esteem have shown improvements in self-esteem without significant weight change (Lowry et al., 2007; Sherman, Alexander, Gomez, Kim, & Marole, 1992). The ability of the peer group setting to provide opportunities for bonding, support, feelings of belonging, development of peer-based skills, and positive peer exchanges is key to increasing self-esteem (Lowry et al., 2007). The importance of this element is being acknowledged in the
Measure of self-esteem are self-reported and therefore subjective. Responses to questionnaires are likely to be influenced by individual (e.g., age, gender) and environmental (e.g., cultural group, socioeconomic status) factors (Khanlou, 2004). Changes following interventions may represent genuine long-term changes in self-esteem or may be due to short-term fluctuations in self-esteem in response to specific events (e.g., winning a sporting event, or performance on a test at school) (Kernis, 1993). While validated tools were used to measure self-esteem in all studies, it was difficult to conclude whether outcomes were entirely dependent on the intervention without inclusion of a no-treatment control group.

The variety of self-esteem assessment tools also adds to the difficulty of interpretation. Across the 13 studies in this review, five different tools were used, with different questions and different scales. Even within tools, there were different scales used to report the results (Rosenberg Self-esteem Scale and different versions of the same questionnaire (Harter’s Self-perception Profile for Children/Harter’s Self-perception Profile for Adolescents). Harter’s Self-Perception Profile (Harter’s Self-perception Profile for Adolescents for adolescents), which measures nine subscales of self-esteem including physical self-esteem, is suggested as the most appropriate measure for adolescent self-esteem (Lowry et al., 2007). It was also the most commonly used tool among papers included in this review. While Cohen’s $d$ effect sizes were used to standardize results in this review, the consistent use of one tool would provide the ability to compare raw self-esteem scores and create a stronger analysis in the future.

Results from this review support evidence that MWMIs induce weight loss in overweight and obese adolescents (Hoelscher, Kirk, Ritchie, & Cunningham-Saboo, 2013; Kelly & Melnyk, 2008; Luttikhuis et al., 2009). The change in BMI $z$-score in the present meta-analysis ($-0.17 [-0.22, -0.11]$) was similar to the clinically meaningful weight loss reported in the 2009 Cochrane Review in children ≥12 years at 6 months follow up from a lifestyle weight management intervention ($-0.14 [-0.17, -0.12]$) (Luttikhuis et al., 2009). Jelalian, Mehenbeck, Lloyd-Richardson, Birmaher, and Wing (2006) and Walker, Gately, Bewick, and Hill (2003) have demonstrated associations between weight loss and increased self-esteem in overweight and obese adolescents after attending a weight-management intervention. Similarly, in the present review, a strong positive relationship between treatment effects for weight loss and improvement in self-esteem was identified. However, it remains unclear whether the improvement in self-esteem was as a result of successful weight loss or whether it was a contributing factor toward successful weight loss. Nonetheless, building self-esteem should be a key focus of MWMIs, as improved self-esteem appears to be linked to enhanced weight loss.

A key strength of this review was that all included studies had strong designs and presented level II evidence (Coleman et al., 2009). However, to further elucidate the role of self-esteem in adolescent weight management, future research should consider powering studies to detect changes in psychosocial as well as physiological outcomes. Only one study in this review was powered to detect a change in psychosocial outcomes (Daley et al., 2006), which may explain the lack of significant results observed for self-esteem. Additionally, a large number of included studies did not describe their method of handling withdrawals or use blinding to prevent the introduction of bias. To improve confidence in the effectiveness of MWMIs and reduce the risk of bias, future studies should be designed with concealed allocation and document and report, in detail, the flow of participants.

Identification of intervention components that improve self-esteem is important for future weight management intervention design. Included interventions were heterogeneous, offering different levels of dietary, physical activity, and behavioral intervention, which may have collectively or individually influenced the results. Inconsistent reporting of intervention and comparator conditions make it difficult to elucidate the components that contributed to improvements in self-esteem. Future studies should report intervention and comparator procedures in adequate detail so that successful components can be identified and replicated. These limitations highlight areas for improvement to develop best-practice guidelines for undertaking and evaluating MWMIs in adolescents to enhance self-esteem.

Conclusion

Overweight and obese adolescents experience low self-esteem, largely owing to poor body image; yet, this meta-analysis found no improvement in self-esteem even with significant weight loss. Although it was noted that interventions that had larger effects on self-esteem also had larger effects on weight loss. The incorporation of intervention components that were identified to contribute to improvements in self-esteem may assist future weight management interventions to improve the self-esteem of overweight and obese adolescents. Furthermore, a consistent measure of self-esteem would enable easier interpretation of self-esteem scores and comparison of results across studies to improve our understanding of the relationship between self-esteem and weight management in adolescents.
Supplementary Data
Supplementary data can be found at: http://www.jpepsy.oxfordjournals.org/.

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Conflicts of interest: none declared.

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