

1 **Abstract**

2 **Background:** Multi-component lifestyle interventions that incorporate diet, physical activity and
3 behaviour change are effective for weight management. However, it is not clear whether delivery in
4 groups or one-to-one influences weight loss efficacy. The objective of this research was to
5 systematically review evidence of the effectiveness of group compared to one-to-one multi-component
6 lifestyle interventions for weight management.

7

8 **Methodology:** MEDLINE, EMBASE, CINAHL, CENTRAL and ISRCTN databases were searched
9 from inception up to February 2020 for randomised controlled trials (RCTs) comparing group versus
10 one-to-one multi-component lifestyle interventions for weight loss, for adults with a BMI $\geq 25\text{kg/m}^2$.
11 The primary outcome was weight loss (kg) at 12 months and the secondary outcome was attainment of
12 $\geq 5\%$ weight loss at 12 months. Risk of bias was assessed using the Cochrane Risk of Bias Tool. Meta-
13 analysis used random effects and estimated risk ratios and continuous inverse variance methods.
14 Heterogeneity was investigated using I^2 statistics and sensitivity analyses.

15

16 **Results:** Seven RCTs with 2,576 participants were included. Group interventions were favoured over
17 one-to-one interventions for weight loss at 12 months (-1.9kg, 95% CI -1.3, -2.6; I^2 99%). Participants
18 of group interventions were more likely to attain $\geq 5\%$ weight loss at 12 months relative to one-to-one
19 interventions (RR 1.58, 95% CI 1.25, 2.00; I^2 60%).

20

21 **Conclusions:** Group multi-component lifestyle interventions are superior for weight loss compared to
22 one-to-one interventions for adult weight management. Further research is required to determine
23 whether specific components of group interventions can explain the superiority of weight loss outcomes
24 in group interventions.

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29 **Tables and Figures**

30 Table 1: Study characteristics

31 Figure 1: PRISMA flowchart

32 Figure 2: Risk of bias of included studies

33 Figure 3: Forest plot of weight loss (kg)

34 Supplementary file S1: PICOS inclusion and exclusion criteria

35 Supplementary file S2: Search strategy

36 Supplementary file S3: Forest plot of attainment of 5% weight loss

37

38 **Introduction**

39 Obesity is strongly associated with co-morbidities of type 2 diabetes, cardiovascular disease and several
40 cancers ⁽¹⁾, a reduced life expectancy ⁽²⁾ and has vast economic consequences to society ^(3,4). Addressing
41 overweight and obesity poses a significant challenge, due to the complexity and interdependency of the
42 “complex web” of societal and biological influencing factors which results in excess adiposity ⁽⁵⁾.

43

44 There is strong evidence that multi-component lifestyle interventions incorporating diet, physical
45 activity and behaviour change are effective in inducing a clinically important weight loss of 5-10%,
46 which is associated with health improvements ⁽⁶⁻⁸⁾. As a result, obesity management guidelines in the
47 United Kingdom ⁽⁹⁻¹¹⁾ and internationally ⁽¹²⁻¹⁴⁾ recommend multi-component lifestyle interventions as
48 the first-line intervention for adult weight management.

49

50 In the treatment of overweight and obesity, group interventions that offer social support networks may
51 be the foundation to behaviour change for weight management. Social support is positively correlated
52 with weight maintenance after weight loss ⁽¹⁵⁾ and is an integral cognitive behavioural approach for
53 weight management ^(16,17). On the other hand, one-to-one interventions offer tailored advice that matches
54 patient characteristics and treatment needs ^(10,18). Current obesity guidelines do not specify whether
55 multi-component weight management interventions are more efficacious for weight loss when delivered
56 in groups or one-to-one.

57

58 One previous systematic review ⁽¹⁹⁾ published over a decade ago, in 2007, has synthesised direct
59 comparisons between group and one-to-one weight management interventions for adults. This previous
60 meta-analysis of randomised controlled trials (RCTs) found that group interventions led to a greater
61 mean weight loss at 1-year, compared to one-to-one interventions (-1.4kg, 95% CI -2.7kg to -0.1kg).

62

63 Hence, in the absence of any recent evidence synthesis in this area, we systematically reviewed available
64 evidence from RCTs to determine the efficacy of group versus one-to-one multi-component lifestyle
65 interventions for adult weight management.

66

67 **Methodology**

68 The present study was registered prospectively on PROSPERO (identifier CRD42017056396) and is
69 reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses
70 (PRISMA) standard ⁽²⁰⁾.

71

72 **Inclusion criteria**

73 We included RCTs that investigated the effect of multi-component lifestyle interventions for weight
74 loss delivered exclusively in groups compared to exclusively one-to-one. The PICOS criteria for
75 inclusion and exclusion of studies are shown in supplementary file S1. Studies were included if they
76 reported the primary outcome of weight change (kg). Studies that presented untransformed non-
77 parametric data for the primary outcome were excluded as it is not possible to include such studies in a
78 meta-analysis ⁽²¹⁾. Trials were excluded if follow-up data was limited to <12 months post-randomisation,
79 used non-lifestyle interventional methods (i.e. pharmacotherapy, bariatric surgery), used meal
80 replacements, included participants <18 years old or with a BMI <25kg/m². Studies focusing on
81 participants with only one type of morbidity were excluded to reflect generalisable weight management
82 interventions for a range of obesity related co-comorbidities, rather than condition-specific
83 interventions.

84

85 **Literature searching**

86 The search strategy (supplementary file S2) was tested and refined to achieve the maximum sensitivity
87 for obtaining relevant studies ⁽²¹⁾. Searches were performed on 28th February 2020 and performed via
88 EBSCO from database inception (MEDLINE (1946 to present), EMBASE (1974 to present) and
89 CINAHL (1981 to present). CENTRAL database was searched from inception via The Cochrane
90 Library. The ISRCTN database was also searched from inception to identify unpublished trials. The
91 reference lists of the included studies and the previous systematic review ⁽¹⁹⁾ were searched for
92 additional trials. Language of publication was unrestricted.

93

94 References were imported into the systematic review software EPPI-Reviewer 4 ⁽²²⁾ for de-duplication
95 and screening. Two reviewers (SA, ES) independently and in duplicate screened titles and abstracts and
96 full-text reports of all identified studies. Additional information was requested from trial authors as
97 required. Reviewers were blinded to each other's responses until each screening stage was complete.
98 Disagreement was resolved by consensus between reviewers.

99

100 **Data extraction**

101 Data was extracted in duplicate by three authors (SA, BT, DL) using an electronic data extraction form.
102 Information on study characteristics and data for the primary outcome of weight loss (kg) at 12 months
103 post-randomisation and secondary outcome of attainment of $\geq 5\%$ weight loss post-randomisation was
104 extracted. Methods were used to mitigate attrition bias, including non-responder imputations (NRI) for
105 dichotomous attainment of $\geq 5\%$ weight loss, in the assumption that non-attendance meant non-
106 achievement, and preference to baseline-observation-carried-forward (BOCF) for continuous weight
107 loss (kg), assuming that participants who dropped out of the study returned to their baseline weight ⁽²³⁾.
108 Completers-only data was extracted where BOCF data was not available.

109

110 **Quality assessment**

111 The Cochrane risk of bias tool ⁽²⁴⁾ was used to assess quality of included studies. The Cochrane risk of
112 bias tool ⁽²⁴⁾ was adapted by removing the 'blinding of participants and personnel' item to recognise the
113 impossibility of blinding participants and interventionists to the allocation of lifestyle interventions.
114 Two reviewers (SA, ES) conducted a double-blinded quality assessment of included studies. The
115 domains 'incomplete outcome data', 'random sequence generation' and 'allocation concealment' must
116 all have been judged as 'low' risk of bias for the study to be assigned overall as a 'low' risk of bias
117 study.

118

119 **Statistical analysis**

120 Meta-analysis was undertaken using RevMan 5 ⁽²⁵⁾ software to summarise the effectiveness of group
121 interventions compared with one-to-one interventions. A χ^2 based test of homogeneity was performed

122 using Cochran's Q statistic and I^2 . This describes the percentage of the variability in effect estimates
123 that is due to heterogeneity rather than sampling error ⁽²⁶⁾. Substantial heterogeneity was defined by I^2
124 $>50\%$ and a p value of <0.10 ⁽²⁶⁾. The random effects model using DerSimonian and Laird methods was
125 used due to substantial heterogeneity. Meta-analysis used estimated risk ratios for attainment of $\geq 5\%$
126 weight loss and continuous inverse variance methods for weight loss (kg). A p value of <0.05 was
127 considered statistically significant. Sensitivity analyses were performed to explore heterogeneity, by
128 (1) including only 'low' risk of bias studies and (2) excluding "outlier" studies ^(26,27). It was not possible
129 to perform meta-regression to explore between study clinical variation due to insufficient number of
130 included studies ⁽²⁶⁾. Likewise, statistical testing for publication bias using asymmetry of funnel plots
131 was not possible due to an insufficient number of included studies ⁽²⁸⁾.

132

133 **Results**

134 **Study selection**

135 The study selection process is shown in Figure 1. Our search yielded 6,794 records, of which 198 were
136 potentially eligible for inclusion after title and abstract screening. The exclusion of studies at full-text
137 review was mostly due to inappropriate comparators (minimal intervention control or including group-
138 delivery) (n=104). Other reasons for exclusion were study design, population (entry BMI unspecified
139 or including participants with a BMI $<25\text{kg}/\text{m}^2$) and the intervention group (involving meal
140 replacement, pharmacological or surgical interventions; or were not multi-component). After full-text
141 review, we included 7 studies ⁽²⁹⁻³⁵⁾ which enrolled 2,576 participants in total.

142

143 **Study characteristics**

144 The findings of this review are based upon 10 group interventions and 8 one-to-one interventions across
145 7 RCTs (Table 1). Participant numbers in each study ranged from 106 to 779. All included studies were
146 conducted in developed countries, of which half of studies were conducted within UK populations.
147 Representation of men ranged between 13 – 36%. The mean BMI of participants in the included studies
148 ranged from 31.4 to 46.2 kg/m^2 , with one study ⁽³⁵⁾ specifying a higher inclusion BMI ($>40\text{kg}/\text{m}^2$).
149 Where total contact time was reported, participants of group interventions received a greater amount of

150 contact time (range 12 – 55 hours) than participants in the one-to-one intervention (range 2.5 – 11
151 hours). Out of the 10 group interventions, 5 were commercial slimming clubs; however, these were
152 provided free of charge to all study participants. All group interventions were delivered in-person, while
153 one ⁽²⁹⁾ of the one-to-one interventions was provided remotely via telephone.

154

155 **Risk of bias**

156 The quality of the included studies is shown in Figure 2. An assessment of the overall risk of bias of
157 each study classified four studies ^(29,32–34) with a ‘low’ risk of bias, one study with an ‘unclear’ risk of
158 bias ⁽³¹⁾ and two studies with a ‘high’ risk of bias ^(30,35).

159

160 **Weight loss outcomes**

161 Group interventions were favoured over one-to-one interventions for weight loss (-1.9kg, 95% CI -1.3,
162 -2.6, $p < 0.00001$; I^2 99%), based upon data from 7 studies (Figure 3). Sensitivity analysis including
163 only ‘low’ risk of bias studies (-1.6kg, 95% CI -0.3, -2.8, $p = 0.01$, I^2 99%) and sensitivity analysis
164 removing the “outlier” study ⁽³⁵⁾ (which included patients with BMI $>40\text{kg/m}^2$) (-1.8kg, 95% CI -1.1, -
165 2.4, $p < 0.00001$; I^2 99%) did not alter the findings.

166

167 Five studies ^(29,31–34) also reported data on attainment of a 5% weight loss. Group interventions were also
168 favoured over one-to-one interventions for the attainment of a 5% weight loss. Individuals attending a
169 group intervention were 58% more likely to attain a 5% weight loss at 12 months relative to attending
170 one-to-one interventions (RR 1.58, 95% CI 1.25, 2.00, $p = 0.04$); I^2 60%) (supplementary file S3).
171 Sensitivity analysis including only ‘low’ risk of bias studies did not alter the findings (RR 1.51, 95%
172 CI 1.14, 2.00, $p = 0.03$; I^2 66%).

173

174 **Discussion**

175 This systematic review provides the first updated evidence on the comparative effectiveness of group
176 versus one-to-one lifestyle interventions for over a decade. We found that participants attending group
177 multi-component lifestyle interventions lose on average 1.9kg more (95% CI 1.3kg more to 2.6kg more)

178 weight than in one-to-one interventions, at 12 months. This is also the first time weight loss efficacy
179 of group versus one-to-one multi-component lifestyle interventions has been assessed by the attainment
180 of a 5% weight loss in a systematic review. We found that participants attending groups had a 58%
181 greater (95% CI 25% greater to 100% greater) likelihood of attaining a 5% weight loss at 12 months.
182 However, not all included studies reported on 5% weight loss and therefore these findings are based
183 upon data from five out of the seven included studies.

184

185 While in our study group interventions were superior for weight loss, compared to one-to-one
186 interventions, substantial statistical heterogeneity ($p < 0.10$, $I^2 > 50\%$) was present when measuring
187 weight loss continuously ($I^2 99\%$, $p = < 0.00001$) and dichotomously as attainment of a 5% weight loss
188 ($I^2 60\%$, $p = 0.04$). The populations across the included studies were broadly clinically homogenous.
189 One study⁽³⁵⁾, however, included patients with a higher mean BMI (46.2kg/m^2) compared to the other
190 included studies (range 31.4kg/m^2 to 36.4kg/m^2); however our sensitivity analysis showed that
191 removing this study did not influence the findings.

192

193 While our study has established that group interventions are more effective than one-to-one
194 interventions, it was beyond the scope of this systematic review to explore why. It could be hypothesised
195 that greater weight loss attained in group, compared to one-to-one interventions, is because of enhanced
196 peer support, or it could be owed to the time-efficiency of group interventions which allows for greater
197 contact time per participant and therefore a greater intervention intensity.

198

199 Social support, especially from peers, contributes to successful weight loss and long-term weight loss
200 maintenance⁽³⁶⁾. Empathy, role modelling, accountability and problem solving accompany the social
201 support offered in group settings by peers and are important factors for lifestyle change and weight loss
202^(37,38).

203

204 On the other hand, the group interventions included in our study provided more hours of contact per
205 participant (range of 12 to 55 hours) compared to one-to-one interventions (range of 2.5 to 11 hours).

206 A systematic review of reviews ⁽³⁹⁾ found that greater weight loss during lifestyle interventions was
207 associated with greater contact time and greater frequency of contact per participant. It would therefore
208 be plausible to hypothesise that group interventions could be more effective because of a greater
209 intervention intensity.

210

211 Our findings are similar to those of the previous systematic review ⁽¹⁹⁾, which also found that groups
212 attained a significantly greater weight loss compared to one-to-one, although the prior study reported a
213 lesser mean difference in weight loss and with less precision (-1.4kg, 95% CI -2.7 to -0.1; p= 0.03) than
214 our present study. The greater mean weight loss (kg) reported in our study may be explained by our
215 inclusion of only multi-component lifestyle interventions, which are known to be more effective for
216 weight management ⁽¹⁰⁾. Whereas in the previous systematic review ⁽¹⁹⁾, four out of the five studies
217 included were published in either the 1970's or 1980's, when the clinical management of obesity was
218 not multi-component. Considering it is known that the results of smaller studies are subject to greater
219 sampling variation and hence are less precise ⁽⁴⁰⁾, the greater precision of effect in our study may be
220 accounted for by our inclusion of larger studies (range 106 – 772 participants) compared to the smaller
221 studies included in the previous systematic review ⁽¹⁹⁾ (range 12 to 132 participants).

222

223 A more recent systematic review ⁽⁴¹⁾ examined the efficacy of long-term (≥ 12 months) non-surgical
224 interventions for weight loss and weight maintenance for adults with obesity (BMI ≥ 35 kg/m²),
225 exclusively within the UK context. A total of 20 studies (8,982 participants) were included, which were
226 mostly non-comparative. Findings were presented narratively, as meta-synthesis was precluded owing
227 to the heterogeneity among intervention designs. Mean weight loss reported across studies ranged from
228 -1.6kg to -18.0kg at 12 months, with higher mean weight losses reported for programmes including a
229 low energy diet (LED) meal replacement formula intervention. However, these findings represent all
230 non-surgical interventions, including pharmacotherapy, and interventions that were single component.
231 Studies delivered outside the UK setting were also excluded, and therefore their findings can only be
232 generalised to the UK setting. For these reasons, these findings are not directly comparable to the

233 findings from our study which examined international multi-component lifestyle interventions
234 (excluding meal replacement diets).

235

236 **Strengths and limitations**

237 This review has several methodological strengths including being prospectively registered on
238 PROSPERO, ensuring protocol fidelity, and employing a search strategy which was designed to have
239 maximum sensitivity ⁽²¹⁾. Screening was conducted by two blinded reviewers and data extraction was
240 peer reviewed, reducing the risk of selection bias and minimising data errors ⁽⁴²⁾. The inclusion criteria
241 ensured generalisability to adults who are overweight or have obesity across populations and the
242 dominance of large studies included in our review minimises small study effects and overestimation of
243 effect sizes ⁽²⁶⁾.

244

245 This study was limited by reliance on database searches, without handsearching relevant journals and
246 therefore source selection bias cannot be ruled out. However, several databases were searched;
247 including ISRCTN to identify un-published research. We were unable to assess publication bias through
248 funnel plot asymmetry owing to insufficient number of studies ⁽⁴³⁾. The results may also have been
249 influenced by missing data assumptions ⁽²³⁾, however this was mitigated by preference to extracting
250 baseline observation carried forward (BOCF) data. Lastly, due to an insufficient number of included
251 studies, it was not possible to conduct meta-regression to explore heterogeneity in more detail.

252

253 **Implications for practice**

254 The population sample within this review included 2,576 participants exclusively from westernised
255 populations. Therefore, these findings are widely generalisable to westernised countries. Clinicians who
256 provide support to patients who are overweight or have obesity should establish which multi-component
257 lifestyle interventions are available in their locality, as there may be a substantial geographical variation
258 in access. If there is the option for an individual seeking weight management to attend either a group or
259 a one-to-one intervention, the findings of this review suggest that attending a group over a one-to-one
260 intervention will lead to greater weight loss at 12 months. However, patients' choices should be

261 exercised to promote treatment fidelity. Group interventions may not be suited to all people seeking
262 weight management intervention, including those suffering from agoraphobia or social anxiety, or those
263 requiring translator services. The evidence presented in our study should be considered by clinicians
264 and service users in light of the wider evidence base, which shows that greater social support and greater
265 intervention intensity may lead to greater weight loss outcomes.

266

267 **Implications for future research**

268 While this study has established that group multi-component lifestyle interventions are more effective
269 than one-to-one interventions for weight loss, we were not able to explain why. It is arguable that the
270 treatment effect may be to enhanced peer support ^(37,44) or rather it may be due to intervention intensity
271 ^(39,45). Therefore, further research is warranted to examine specific components of group interventions
272 which may explain efficacy, including an RCT that compares a multi-component group versus a one-
273 to-one intervention, with equitable contact time and contact frequency. Future empirical studies should
274 consider more complete reporting on intervention characteristics, and report on the attainment of a 5%
275 weight loss, rather than only continuous weight loss in kilograms, to provide additional clinically
276 relevant outcome data.

277

278 **Conclusion**

279 The findings of this meta-analysis of seven studies conducted across westernised populations supports
280 that multi-component lifestyle interventions delivered in groups are more effective for weight loss
281 compared to one-to-one interventions among adults. Where both one-to-one and group multi-
282 component lifestyle programmes are available to adults with a BMI $\geq 25\text{kg/m}^2$, group interventions
283 should be the preferred first-line treatment option for weight management. Future research should
284 explore whether specific components of group interventions, such as intervention intensity, peer support
285 or other behavioural taxonomies, may explain why participants lose more weight in group compared to
286 one-to-one multi-component lifestyle interventions.

287

288 Transparency: The lead author affirms that this manuscript is an honest, accurate, and transparent
289 account of the study being reported. The reporting of this work is compliant with PRISMA guidelines.
290 The lead author affirms that no important aspects of the study have been omitted and that there were no
291 discrepancies from the study as planned.

292

293 Conflict of interest statement: All authors declare that there are no financial relationships with any
294 organisations that could appear to have influenced the submitted work. DL has been involved in clinical
295 trials where the treatment in the intervention arms have been provided by Slimming World and
296 Rosemary Conley Health and Fitness Clubs, but this treatment provision was, and is, of no financial
297 benefit to her or her employer.

298

299 Funding: This research was conducted by the lead author (SA) as part of a Masters in Clinical Research
300 Studentship funded by National Institute of Health Research (NIHR).

301

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