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Abstract

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

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

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

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

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

34 Supplementary file S1: PICOS inclusion and exclusion criteria

35 Supplementary file S2: Search strategy

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Introduction

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

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

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

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

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

Methodology

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

Inclusion criteria

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

Literature searching

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

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

Data extraction

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

Quality assessment

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

Statistical analysis

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

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

Results

Study selection

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

Study characteristics

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

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

Risk of bias

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

Weight loss outcomes

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

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

Discussion

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

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

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

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

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

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

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

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

A more recent systematic review ⁽⁴¹⁾ examined the efficacy of long-term (≥ 12 months) non-surgical interventions for weight loss and weight maintenance for adults with obesity (BMI $\geq 35\text{kg/m}^2$), exclusively within the UK context. A total of 20 studies (8,982 participants) were included, which were mostly non-comparative. Findings were presented narratively, as meta-synthesis was precluded owing to the heterogeneity among intervention designs. Mean weight loss reported across studies ranged from -1.6kg to -18.0kg at 12 months, with higher mean weight losses reported for programmes including a low energy diet (LED) meal replacement formula intervention. However, these findings represent all non-surgical interventions, including pharmacotherapy, and interventions that were single component. Studies delivered outside the UK setting were also excluded, and therefore their findings can only be generalised to the UK setting. For these reasons, these findings are not directly comparable to the

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

Strengths and limitations

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

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

Implications for practice

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

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

Implications for future research

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

Conclusion

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

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

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

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