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Effect of adding a Compassion-focused intervention on emotion, eating and weight outcomes in a commercial weight management programme

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Abstract

This study examined whether adding a compassion-focused light touch digital intervention into a commercial multi-component weight-management programme improved eating behaviour, self-evaluation and weight-related outcomes. The compassion intervention significantly reduced binge eating symptomology and drop-out, improved psychological adjustment, self-evaluation, but did not affect weight outcomes. Compassion, self-reassurance and reductions in shame and self-criticism mediated the effect of the intervention on reductions of binge eating symptomatology. Negative self-evaluation, binge eating symptomatology, susceptibility to hunger and eating guilt were significant predictors of drop-out. Findings suggest that compassion-based digital tools may help participants better manage binge eating symptomology and self-evaluation in weight-management interventions.

Trial registration: SRCTN16873876

Keywords: Compassion-focused therapy; Overweight; Obesity; Weight Management Programme; Light touch digital intervention

Introduction

Projected obesity trends and associated health care costs are well documented (Ng et al., 2014). The majority of Western adults are already overweight and obese, emphasising the need to provide weight-management solutions for the general population (Stubbs and Lavin, 2013b). Weight loss programmes achieve initial success but are subject to both attrition and weight regain (Dombrowski et al., 2014; Phelan et al., 2003). Avoiding weight regain requires behavioural strategies in which relapse coping and weight loss maintenance (WLM) become learned skills of self-regulation, action planning, developing self-efficacy, autonomy and motivation (Dombrowski et al., 2010; Sniehotta, 2005; Teixeira et al., 2012) as part of a longer-term process (Teixeira et al., 2012; Rössner, 2008; Silva et al., 2011). However, cognitive behaviour change techniques to self-regulate diet, physical activity and body weight do not seem to be sufficient in themselves to ensure successful longer-term WLM.

Self-evaluation and emotion regulation may impact on weight loss, behaviour change and longer-term weight management (Finlayson et al., 2007; Stubbs et al., 2012). Overweight and obese people commonly experience stigma, which enhances feelings of shame, self-criticism and feelings of inferiority in relation to others (Puhl and Heuer, 2009). This can potentially derail strategies of planned behaviour and promote weight relapse (Stubbs and Lavin, 2013b; Gilbert, 2002), because uncontrolled eating can potentially be used as a pacifier and distractor (Goss and Allan, 2009; Heatherton and Baumeister, 1991), which may undermine attempts to self-regulate eating behaviour and weight control (Stubbs and Lavin, 2013b). Studies show that shame and self-criticism are associated with binge eating symptomatology (Duarte et al., 2015a; Duarte et al., 2014), obesity (Puhl and Heuer, 2009)

(Duarte et al., 2016; Duarte et al., 2017a), and less historical weight loss during a commercial weight management programme (CWMP; Duarte et al., 2017a).

Recent studies suggest that helping individuals develop self-reassurance and self-compassionate capabilities may help buffer against the pervasive effects of shame and self-criticism in a number of physical and mental health (Kirby et al., 2017a) conditions, including eating and body image-problems (Steindl et al., 2017). Compassion focused therapy (CFT; (Gilbert, 2010a; Gilbert, 2014; Gilbert, 2010b) was developed to help individuals with high levels of shame and self-criticism. The CFT model follows a motivational approach to compassion, viewing it as a sensitivity to one's and others' suffering, developing the motivation to attend to and alleviate or prevent this suffering (Gilbert, 2010a; Gilbert, 2010b; Gilbert, 2014). CFT provides psychoeducational approaches to motivation and emotion regulation systems and the promotion of a mindful and compassionate orientation towards oneself and to others, through a series of compassionate mind training practices. There is evidence of the effectiveness of CFT in improving aspects of mental health (Kirby et al., 2017b; Leaviss and Uttley, 2014; Kirby, 2017; Kirby et al., 2017a) and alleviating binge eating symptomology (Duarte et al., 2017b; Gale et al., 2014; Kelly and Carter, 2015). In the context of weight management, compassion-based interventions may help redirect maladaptive eating behaviours (e.g., binge eating) and weight-related self-evaluation towards better coping, reduce loss of control of eating and prevent relapse.

The present study used a prospective parallel design to examine whether adding online compassion-focused exercises into a multi-component CWMP (Slimming World UK group support), affected self-evaluation, binge eating symptomatology, control of eating behaviour and weight outcomes compared to the regular programme. Outcomes were measured at baseline, 3 (post intervention), 6 and 12 months (follow-up). This study also

examined the mechanisms of change in loss of control over eating (binge eating symptomatology) at post intervention. We hypothesized that changes in binge eating symptomatology in participants in the compassion-based intervention were mediated by reductions in shame and self-criticism and improvements in self-compassion and self-reassurance, which were the main targets of this intervention. We also examined predictors of drop out from the weight management programme.

Methods

Study design

A parallel group, non-randomised, non-blinded design was used. 974 on-going participants of a commercial weight management programme (CWMP) were recruited to the trial between March 2014 and March 2015. Inclusion criteria were: adults attending CWMP group support sessions aged ≥18 years, BMI 20-70. Exclusion criteria were: inability to read and write English, BMI < 20 or > 70; inability to access the online video content. Participants were allocated to the intervention or control arms on a whole-group basis, depending on the arm to which their group leader (GL) was allocated. The commercial weight management organisation, Slimming World (www.slimmingworld.com), meets the National Institute for Health and Care Excellence (NICE) best practice criteria (NICE, 2014) to help adults adopt the lifestyle behaviour changes needed to reduce weight, prevent weight gain and support long-term weight maintenance. The organisation has an extensive community-based infrastructure of over 12,000 support groups held each week across the UK and

Ireland. Groups are convened and run by GLs, weekly meetings typically last for 1.5 hours which include a weekly weigh-in and support sessions based around the weight management programme. The programme encourages free intake of low energy density foods as well as foods high in protein, carbohydrate and fibre. It also recommends limited intake of energy dense and less satiating foods (i.e., fats and sugars; Stubbs et al., 2010). This dietary approach has been found to produce significantly greater weight loss than a low-fat diet alone (Ello-Martin et al., 2007). To support its members with making improved food choices and increases in physical activity, the programme incorporates evidence-based behaviour change techniques (e.g., goal-setting of weight and behavioural goals); action planning (e.g., meal plans, social event plans); self-monitoring (food diary, weekly weigh-in); relapse management (creating behavioural plans and strategies to address periodic increases in weight) aimed at helping members with developing self-regulation skills in the change process (Dombrowski et al., 2012; McKee et al., 2013; Ng et al., 2012; Stubbs et al., 2010; Stubbs and Lavin, 2013a; Teixeira et al., 2012). Social support is also provided to members via: group discussion to enable members to learn new strategies to support their weight loss efforts; GL support in motivation and self-efficacy for exercise and improved dietary choice; and online and social media forums (Greaves et al., 2011). The majority of participants access the groups through self-referral and pay weekly (£ 4.95) to attend their chosen group. This is an open programme, with no fixed duration of membership. Participants can join, leave and re-join as they wish for any length of time as support groups are continuously available week-by-week through the year, to maximise attendance and engagement from members of the community (Stubbs et al., 2015).

Demographic, anthropometric and body weight data were collected for participants attending groups in the UK each week through a proprietary electronic data capture system and using calibrated digital scales. At the point of enrolment each participant's gender, date of birth, weight and height were recorded and entered onto the electronic system. Each week the participant returned to group weight was measured and automatically captured on the system. Data were collected in a live database using a specifically designed data capture architecture and stored on a Microsoft Structured Query Language (SQL) server, 2008 r2. Data were collected and stored in line with the Data Protection Act and Information Governance Level 2. Six GLs were allocated to the intervention arm and 6 GLs were allocated to the control group (Figure 1).

Insert Figure 1 here

Control arm. The control arm (*n* = 426) received the regular multicomponent CWMP, which involves group support led by GLs, where motivation, self-regulation and social support strategies for healthy eating and physical activity are promoted and discussed.

Intervention arm. The intervention arm (*n* = 548) received the same CWMP, but led by GLs who received 2 days training on compassion-focused exercises by the author PG. Discussions were structured around the basic concepts of CFT and the content of the CFT online video exercises that participants would have access to during the trial. Participants in the intervention arm were given access to the videos (5.15-11.29 mins duration each) and asked to actively engage with these for 3 months. The videos remained available for the 12 months of the trial. This light touch compassion-based intervention included an introductory overview video about compassion-based approaches to weight management and 8 videos

that taught skills and techniques designed to help participants engage with and apply compassion-based skills in relation to weight management. These were (i) conscious awareness, (ii) soothing rhythm breathing, (iii) mindfulness, (iv) use of compassionate imagery, (v) developing self-compassion, (vi) practicing self-compassion, (vii) using self-compassion to counter self-criticism, and (viii) compassionate letter writing (Gilbert, 2010b; Gilbert, 2014). 'Light touch' means that the intervention provided a non-intensive, short duration (5.15-11.29 mins duration each) modular add-on to the existing programme.

Consenting members were given access to one of 2 versions of the study webpage corresponding to the control and intervention arms of the study. Both intervention and control groups continued to engage in the regular CWMP weekly groups guided by the respective GLs.

Online questionnaires were given via links embedded in the web page at baseline, 3, 6 and 12 months and participants were prompted by email reminders to complete the questionnaires at those time points (Figure 2).

Insert Figure 2 here

58.4% of participants in the intervention arm watched each video once between April and July, 38.2% watched the videos a few times and a small minority (5.1%) watched them more than 6 times or more (Figure 3).

The number of video plays declined sharply after the first month of the study (which is consistent with the video engagement data) and visits to the introduction page declined more gradually over the study period (Figure 4). Website activity particularly dropped around the time recruitment ended (August for the intervention members). There was some

continued usage as members were returning to the site at the time their subsequent questionnaires were due (3 months, 6 months and 12 months).

Insert Figure 3 and 4 here

Participants and baseline characteristics

974 participants were recruited to the study and 937 (96.2%) completed all baseline measures. At 12 months 433 completed the questionnaire measures again, giving an overall retention rate in the study of 46.2% which was comparable between the two arms ($\chi^2_{(3)}$ 5.65, $p > 0.05$). At baseline, both intervention and control groups on average tended to score higher than reference general population samples for body image shame, components of self-criticism and lower on self-reassurance. They tended to present scores for binge eating, restraint, disinhibition and perceived hunger that were similar to overweight populations seeking obesity treatment.

Table 1 compares baseline characteristics for the control and intervention groups. Compared to the control group the intervention group differed in (i) weight history: they had participated in the programme for 125 days longer, lost 1.4kg more weight but weighed ~3.1 kg more (1 BMI point higher), (ii) the intervention group presented significantly higher body shame, negative affect, feelings of inadequacy and self-hatred, and were significantly less self-compassionate and slightly less open to compassion from others, (iii) they exhibited higher binge eating symptomology, disinhibition and eating guilt.

Insert Table 1 here

Measures

Weight Focused Self-Criticism/Self-Reassuring Scale (WFSCRS)

This scale is derived from the Forms of Self-Criticising/Attacking and Self-Reassuring Scale (FSCRS), which measures how people typically respond when they face setbacks or failures. It includes three subscales: inadequate self, which measures a sense of feeling put-down and inadequate; hated self, which measures a sense of self-dislike and self-hatred with desires to hurt or persecute oneself; reassured self, involving the ability to be self-reassuring and supportive. The WFSCRS' instructions were adapted to focus on weight, body shape and eating ("When we think about our weight and body shape we can sometimes have negative and self-critical thoughts and feelings about ourselves, while at other times we can be caring and supportive of ourselves")(Duarte et al., 2018). The original scale has good reliability with Cronbach's alphas of 0.90 for inadequate self, 0.86 for hated self, and 0.86 for reassured self (Gilbert et al., 2004) and presents good test-retest reliability in clinical and nonclinical samples (Castilho, Pinto-Gouveia & Duarte, 2015). In the current study the Cronbach's alpha values were 0.89, 0.80 and 0.85 for inadequate self, hated self and reassured self, respectively.

Weight-focused External Shame Scale (WFES)

This scale was adapted from the Other as Shamer Scale, a measure of external shame (Allan et al., 1994; Goss et al., 1994). The instructions were changed to focus on perceptions of being negatively evaluated and judged by others because of one's weight, body shape or eating behaviours (e.g., "When we think about our weight and body shape we can feel that others see us negatively"). Participants are asked to rate the frequency with which they

make these evaluations about how others judge them based on their weight, body shape and eating. In the original study of the Other as Shamer Scale, the scale showed high internal consistency with a Cronbach's alpha of 0.92. The original scale also presents good test-retest reliability (Balsamo et al., 2014). The Cronbach's alpha value in the current study was 0.96.

Body Image Shame Scale (BISS)

The BISS was developed to measure body image shame. The BISS has two subscales: externalized body image shame, which involves evaluations of being negatively judged by others because of one's physical appearance, and subsequent avoidance of social situations where this scrutiny may occur; internalized body image shame, which entails negative self-evaluations based on physical appearance and body concealment behaviours. A total score of body image shame can be calculated. This scale has high internal consistency with a Cronbach's alpha of 0.92 and good test-retest reliability (Duarte et al., 2015b). The Cronbach's alpha in the current study was 0.94.

Weight-focused feelings scale (WFSS)

This 2-factor scale measures positive (e.g., "I am quite happy in myself") and negative (e.g., "I am angry that I am like this") feelings in relation to body weight, body shape, and eating. Exploratory and confirmatory factor showed that this scale shows good psychometric properties with a robust two-factor structure: negative weight-focused feelings ($\alpha = 0.93$) and positive weight-focused feelings ($\alpha = 0.88$; Duarte et al., 2017a). In the current study the Cronbach's alpha values were .91 and .82 for the negative and positive weight-focused feelings subscales, respectively.

The Three Factor Eating Questionnaire (TFEQ)

The TFEQ measures three cognitive and behavioural dimensions of eating behaviour: dietary restraint, which measures the tendency to restrict food intake to control body weight and shape; disinhibition, which assesses episodes of loss of control over eating; and susceptibility to hunger, which measures subjective perceptions of hunger and food cravings (Stunkard and Messick, 1985). In the original study the scale revealed Cronbach's values of 0.93 for dietary restraint, 0.91 for disinhibition, and 0.85 for susceptibility to hunger. The scale also presents good temporal stability (Bond et al., 2001). In the current study the Cronbach's alpha values were 0.71 for dietary restraint, 0.80 for disinhibition, and 0.82 for susceptibility to hunger.

Revised Rigid Restraint Scale (RRRS)

The RRRS was created to assess two components of rigid restrained eating: restrictive eating and perceived eating guilt. Each of the subscales showed good internal consistency (Eating Guilt subscale: $\alpha = 0.92$; Restrictive Eating subscale: $\alpha = 0.82$) (Adams and Leary, 2007). In the current study the subscales showed Cronbach's alpha values of .84 and 0.85, respectively.

Binge eating scale (BES*)*

The 16-item BES assesses severity of binge eating symptomatology (Gormally et al., 1982). Each item includes three to four statements regarding which participants are asked to choose the one that best describes their eating behaviour. Each option indicates a rating of severity that ranges from 0 (no binge eating) to 3 (severe binge eating symptomatology).

The scale has good psychometric properties with Cronbach's alpha estimates of 0.88 in community samples (Marcus et al., 1995). The scale also presents good test-retest reliability (Duarte et al., 2015). In the current study the Cronbach's alpha value was 0.90.

The Compassionate Engagement and Action Scales (CEAS)

The CEAS includes three scales that measure compassion to self, compassion to others, and experience of other people's compassion to oneself. In the original study, the CEAS showed good internal consistency (with Cronbach's alpha values that ranged from 0.74 to 0.94) (Gilbert et al., 2017). In the current study the Cronbach's alpha values were 0.81 for self-compassion, 0.75 for compassion to others and 0.81 for compassion from others.

Anthropometric data

Height was self-reported to the nearest 0.5 cm. Participants were weighed in light clothing on scales with a precision of ± 0.23 kg (SECA bespoke model). Weight data were collected as part of the CWMP's routine data acquisition and monitoring for all participants as previously described (Stubbs et al., 2015).

Power tests

Power calculations were conducted on three key primary outcomes, weight, shame and self-criticism. To detect differences of 2 kg in weight at 3 months, assuming participant variability was 4 kg required 65-85 participants to achieve 80-90% power. To detect differences in shame and self-criticism from baseline to 3 months, we chose an effect size (0.25) with a power of 0.80 and $p < 0.05$, giving a sample of $N = 119$ per study arm. We therefore aimed to recruit a minimum of 155 members per arm of the study.

Ethics, consent and permissions

All participants provided informed consent to take part in the trial and as an incentive were entered into 2 separate prize draws worth £1200 in holiday vouchers. Participants who completed the 3-month questionnaire received 1 year's subscription to the company's magazine. Those who completed the 6 month questionnaire received one of a choice of four recipe books. This study was approved by the Psychology Research Ethics Committee at the University of Derby (Ethics submission (105-13-PG)). The trial was registered on the ISRCTN registry (registration no. ISRCTN16873876).

Statistical analyses

The intervention and control arms were compared by mixed model ANOVA of differences from baseline, fitted by the REML (residual maximum likelihood) approach with fixed effects for baseline weights, variables that differed significantly at baseline (reported in Table 1; length of attendance, age when first tried to lose weight, number of weight loss attempts in the past 12 months and perceptions of success) and the first principal component of all baseline outcome values. PCA was used to avoid problems of multicollinearity if all baseline variables were included, and only the first component was found to differ between groups. The baseline value of the variable being modelled was also included as a fixed effect. The GL identification was included as a random effect. P-values were obtained by comparing log likelihoods in models with and without a group term, refitted by maximum likelihood. Least square means weighted proportionally were estimated. Adjusted and unadjusted values were included in analyses. Three, 6 and 12 month psychometric outcomes between intervention and control are presented here after adjustment for the first principle

component of baseline differences between those groups as the most conservative estimate of intervention effects. Missing data were imputed using the Baseline Observation Carried Forward approach (BOCF). A per protocol (completer) analysis was also conducted. Analyses were performed using the R statistical program (http://www.r-project.org/).

To explore whether changes produced by the compassion intervention in self-compassion and self-reassurance, self-criticism and body image and weight-related shame mediated the impact of the compassion-based active intervention (baseline to 3 months) on participants' binge eating symptomatology, mediation analyses using MEMORE for SPSS (Mediation and Moderation analysis for Repeated measures designs) were conducted in the intervention group (Montoya and Hayes, 2017). MEMORE enables estimation of total, direct, and indirect effects of an independent variable (X) on a dependent variable (Y) through mediators (M) in a two-condition within-subjects design. MEMORE considers the mediator and the dependent variable as the calculated change between baseline and post-intervention (3 months). The independent variable "X" is the passage of time from baseline to post-intervention and corresponds to the effect of the intervention. MEMORE produces 95% confidence intervals for indirect effect(s) using bootstrapping resampling (5000 bootstrap samples). An effect is significant when the interval between the lower and the upper bound of the CI does not include 0 (Montoya and Hayes, 2017).

Predictors of drop out at 12 months were modelled by logistic regression using drop out as the dependent variable and age, group, weight, self-evaluation, eating behaviour and compassion-related variables (CEAS) as independent variables and programme GLs as random effects. Predictors of drop out were modelled at 3 and 12 months respectively, comparing odds ratios. An odds ratio <1.0 indicates a lower odds ratio and >1.0 indicates higher odds.

Results

Intervention effects

Weight losses over the course of the study were slight (1.0 versus 0.8 kg), but significantly different from zero ($p < 0.010$) in the intervention and control groups respectively (BOCF). There was no significant between-group difference at 3, 6 or 12 months.

In the compassion intervention group there was a reduction in binge eating symptoms and eating guilt at 3, 6 and 12 months. Effect sizes were modest. The intervention had no effect on dietary restraint, disinhibition, susceptibility to hunger, dietary restraint and eating guilt at any time point between 3-12 months.

The intervention significantly reduced body weight-focused external shame and body image shame, at 3 and 6 months (all $p \leq 0.012$). Inadequate-self, hated-self and negative affect were slightly reduced over 12 months (all $p \leq 0.01$). Self-reassurance and weight-related positive affect were slightly increased over this time-period (all $p \leq 0.024$).

Mean differences from baseline to 3, 6 and 12 months for completers and for BOCF are presented in Table 3 and 3, respectively.

Insert Table 2 and 3 here

Mechanisms of change in the intervention group

To examine potential mediators of the effect of the compassion intervention on loss of control over eating (measured as binge eating symptomatology) and weight outcomes, mediation analyses were conducted for each mediator (self-compassion, self-reassurance, inadequate self and hated-self forms of self-criticism and shame) separately.

Results revealed significant indirect effects of the compassion intervention on reductions of binge eating symptomatology, mediated by increases in self-compassion attributes (*B* = -0.26, BootSE= 0.13, 95%CI (-0.58 to -.09)) and engagement (*B* = -0.81 , BootSE= 0.23, 95%CI (-1.30 to -0.40), reassured self (*B* = -0.78, BootSE= 0.23, 95%CI (-1.29 to -0.38)); and reductions in inadequate self (*B* = -.75 , BootSE= 0.24, 95%CI (-1.28 to -0.34)), hated self (*B* = -0.56, BootSE= 0.18, 95%CI (-0.93 to -0.2)), weight-related shame (*B* = -0.58, BootSE= 0.19, 95%CI (-1.00 to -0.27)) and body image shame (*B* = -1.17, BootSE=0.24, 95%CI (-1.68 to -0.76)).

Predictors of drop out

Dropout was defined as non-attendance for four consecutive weeks, without subsequently re-joining the programme. Drop-out rates were significantly higher in the control than intervention group. The intervention arm of the study retained 67.2% participants in the CWMP at 12 months compared to 56.4% of those in the control ($\chi^2(3, N = 985) = 13.952$; $p < 0.05$).

Table 4 shows the predictors of drop out at 3 and 12 months respectively, comparing odds ratios. The probability of drop out reduced slightly with age and was higher in the control group. Body image shame, inadequate self, negative affect, binge eating symptomatology, susceptibility to hunger and eating guilt were significantly associated with higher odds of drop-out by 3 months. Positive affect and compassion from others were associated with lower odds of drop out.

By 12-months negative aspects of self-evaluation were associated with higher odds of drop out (external and internal shame, weight focused negative affect), while positive affect was associated with lower odds of drop out. Control of eating (dietary restraint) was associated

with lower odds of drop out. Loss of control of eating (disinhibition, binge eating symptomatology, eating guilt were associated with higher odds of drop out ($p < 0.02$). Self-compassion, compassion to and from others did not predict drop out during the 12 months of the study.

Insert Table 4 here

Discussion

This is the first study to examine the effect of adding a 3-month CFT digital intervention in a CWMP. The intention was to establish whether central aspects of CFT could be delivered online, through light touch video modules made available to programme participants and whether they would affect control of eating, self-evaluation, and weight outcomes. The intervention itself was of minimal intensity, in a large sample of CWMP participants who varied considerably in both their weight loss histories, and baseline characteristics.

The compassion-based intervention had no effect on body weight. Several programme components of the CWMP programme offer approaches to self-regulation (e.g., tools for creating action plans, goal setting, establishing behavioural contracts, dietary and body weight self-monitoring; Teixeira et al., 2010; Teixeira et al., 2005; Wadden and Foster, 2000). It is perhaps not surprising therefore that adding a light touch intervention into a programme that contains tools already for this purpose is unlikely to specifically affect weight regulation.

Indeed, the compassion-focused intervention did not address aspects of self-regulation of eating or physical activity behaviours. Nonetheless, the intervention group revealed significant improvements in binge eating symptomology that lasted over 12 months. The study also had significant, modest, lasting effects of the CFT intervention on affectivity, body weight-related and body image shame, self-criticism, self-reassurance and compassion. This suggests that specific sets of tools may have value for improving emotion regulation during attempts at longer-term weight management. The NICE recommendations highlight the need for weight management programmes to attempt to address issues of psychological well-being (NICE, 2014). Moreover, improvements in compassion, self-reassurance, and reductions in shame and self-criticism (i.e., the specific targets of the compassion intervention) had a significant mediating effect in the reduction of loss of control of eating. Moreover, a major potential benefit of the compassion intervention was that it was associated with a 10% reduced drop-out from the programme. This could be important for individuals who struggle with lapses and relapses, particularly since drop-out from evidence-based behaviour change programmes is likely to be associated with weight regain.

It is likely that this type of intervention is more relevant to participants with specific emotional/behavioural needs in WMPs. It appears that the intervention content appealed to participants who may benefit more from it, creating a potential self-selection effect. In other words, participants who had a symptomology more likely to benefit from taking part in the trial appeared to be more likely to consent to joining the intervention arm, creating significant differences at baseline between this group and the control group in aspects of weight history, attendance, self-criticism, shame, self-compassion and eating behaviour. Although these differences were controlled for in the current analysis, this selection effect is

interesting because it suggests that specific tools may be of value to address individual needs of participants in CWMPs.

Key strengths with this study were the large sample size, longitudinal design and frequent collection of weight outcomes data. The study assessed the effectiveness of adding modular light touch digital compassion-focused exercises to the programme as it runs in real life, with participants that were real consumers aiming to control their weight in their everyday lives.

Limitations to this study include the non-randomised design and the confounding effect of selective participation during recruitment, due to the overt nature of the participant information materials. This design limitation needs to be balanced against the pragmatic design of the trial in relation to the development of new modular tools in an existing group-based CWMP. These preliminary results should be confirmed in a randomised controlled trial. Results were based on existing group membership, rather than intention to treat therefore those who participated cannot be considered a random sample of the overweight general population. Participants who joined the trial were not a representative sample of the whole population attending the CWMP, since on average they were long-term participants who had lost ~10% of their weight. This suggests the current study is more relevant to WLM than to weight loss per se. There were no other comparable WMPs used in this study or groups of subjects engaged in weight management efforts outside of such programmes. Generalisability of the study beyond the current programme is limited by lack of such comparative data. Participants were predominately middle-aged, Caucasian women. Only 5% of the respondents were men, which is representative of the proportion of men found in the regular membership of CWMPs. Future research should attempt to investigate the psychological processes affecting responses in men and women. As with most studies of

this type, not all of the participants in the groups from which each arm was recruited took part in the study. Differences between those who consented to take part and those who did not are limited to basic demographic and programme statistics – on average consenting participants appeared to be long-duration members. By taking part in the study they were prepared to discuss their emotions in relation to their weight control. It may well be that the variables of interest present differently in those who are less successful participants in weight management programmes. The study used a small number of intervention exercises that were fixed in content and limited in design.

In conclusion, the inclusion of light touch online digital compassion focused therapy exercises into a CWMP had a small, significant impact on loss of control of eating and aspects of self-evaluation over a period of between 3-12 months. Refinements in development and delivery of online, digital approaches offer a potential means to enhance personalised delivery of tools and solutions to those WMP participants who struggle with issues of emotional stress, binge eating symptomology and who are potentially vulnerable to drop out. Such approaches could improve the emotional and psychological well-being of participants engaged in attempts at longer term weight management.

Declarations:

Ethics approval and consent to participate

This study was approved by the Psychology Research Ethics Committee at the University of Derby (Ethics submission (105-13-PG)). The trial was registered on the ISRCTN registry (registration no. ISRCTN16873876).

Competing interests

RJS consults for Slimming World through the University of Leeds. The remaining authors declare that they have no competing interests.

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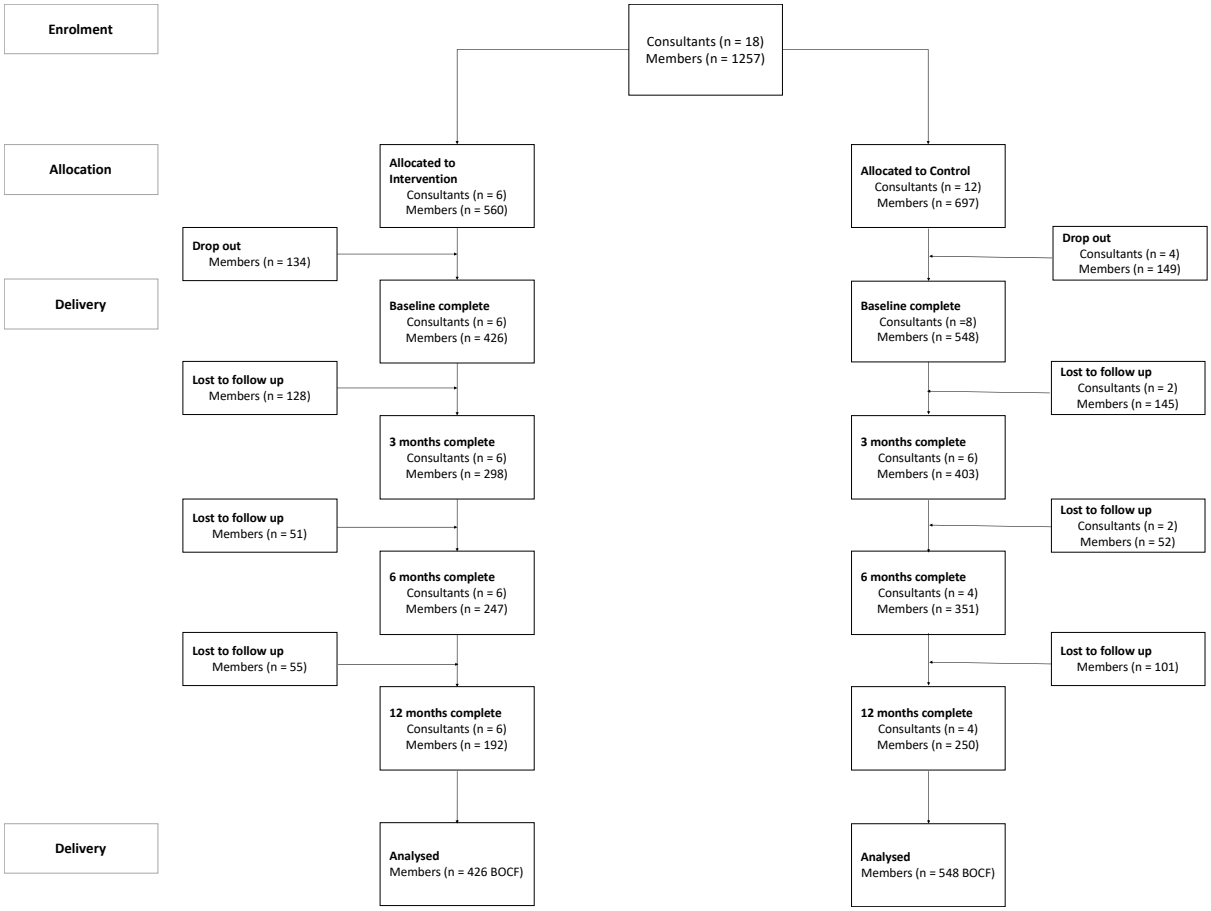
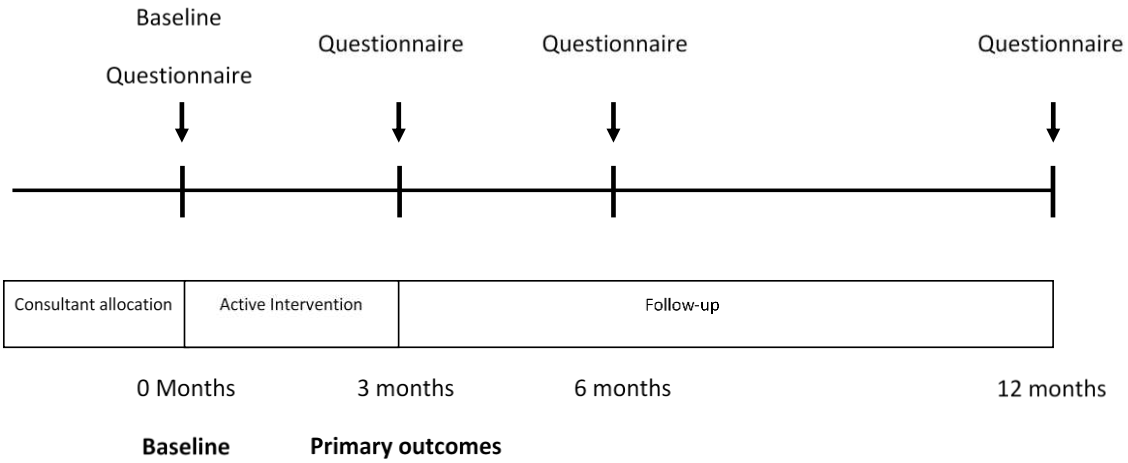


Figure 1. Consort flow diagram of the study

1



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3 **Figure 2.** Flowchart of study design

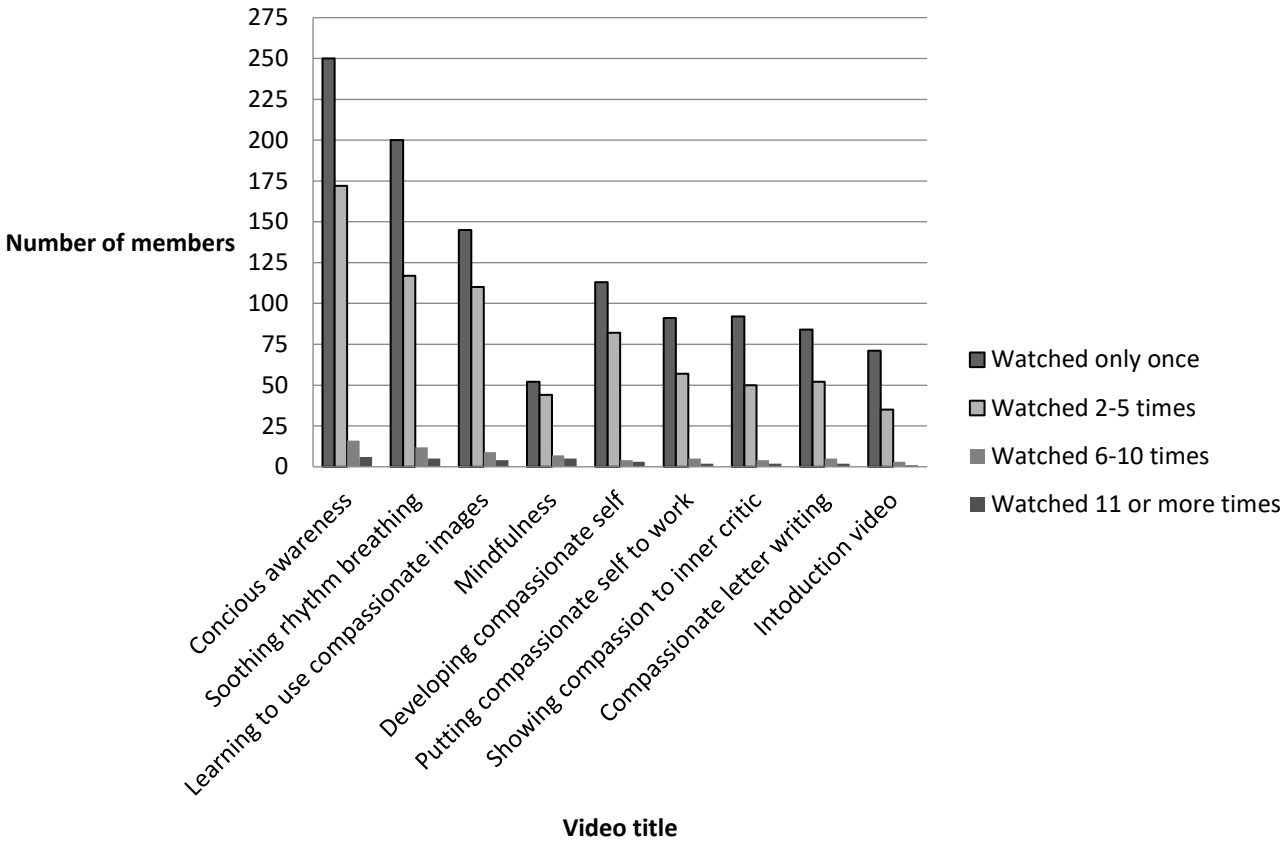

Figure 3 - The number of times recorded that individual intervention members (n = 418) watched each of the videos.

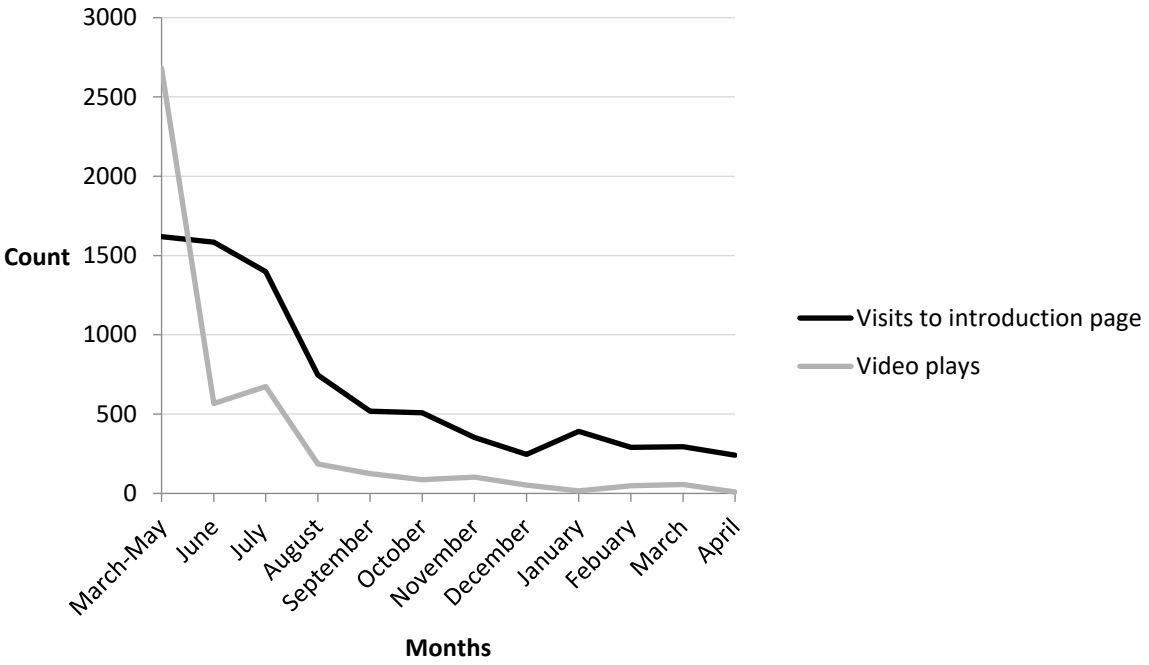

Figure 4 - Number of video plays and visits to the introduction landing page captured with Google Analytics data.

1

Table 1. Mean and standard deviation (*SD*) baseline characteristics of the intervention and control groups

	Intervention		**Control**		***t***	***p* - value**
	Mean	*SD*	Mean	*SD*		
N	426		548			
Age	46.80	12.80	47.50	12.80	0.90	.374
Females	95.60%		94.50%		0.53a	.467
Weight History						
Days in SW before study	**576**	720.70	**450.80**	666.80	2.70	**.007**
Joining weight (kgs)	**97.50**	21.40	**93.60**	19.60	2.90	**.004**
Weight loss since joining	**10.80**	10.00	**9.40**	8.90	2.20	**.026**
Weight						
Weight at Baseline	**87.40**	20.00	**84.30**	18.80	2.50	**.012**
BMI at Baseline	**32.00**	6.90	**31.00**	6.40	2.30	**.024**
Self-Evaluation						
External shame	**26.60**	15.30	**23.10**	15.10	3.60	**<.001**
Body Image Shame	**2.20**	1.00	**2.00**	1.00	3,20	**<.001**
Inadequate self	**21.30**	8.00	**18.50**	8.50	5.20	**<.001**
Hated self	**5.20**	4.60	**4.10**	4.40	4.10	**<.001**
Reassured self	**14.90**	6.00	**16.90**	6.30	5.00	**<.001**
Weight focused negative affect	**18.40**	6.20	**16.80**	6.10	4.00	**<.001**
Weight focused positive affect	**6.70**	2.30	**7.30**	2.50	3.80	**<.001**
Compassion						
Self-Compassion	**52.70**	15.40	**58.50**	15.50	5.60	**<.001**
Compassion to others	79.10	13.50	78.40	13.40	0.80	.433
Compassion from others	**58.10**	18.70	**61.20**	18.50	2.40	**.015**
Eating Behaviour						
Binge eating symptoms	**17.00**	9.30	**14.90**	8.90	3.60	**<0.001**
Disinhibition	**10.70**	3.40	**9.90**	3.60	3.40	**.001**
Susceptibility to hunger	7.30	3.80	6.90	3.60	1.70	.082
Dietary restraint	10.90	3.60	11.20	3.40	1.50	.143
Restrictive eating	17.20	4.50	17.30	4.40	0.50	.598
Eating guilt	**26.10**	5.90	**24.70**	24.70	6.00	**<.001**

a – Chi Squared

1

Table 2. Mean differences from baseline to 3, 6 and 12 months for the intervention and control groups for completers.

		Control			Intervention			p - values			Effect size (Cohen's d)		
	N	3	6	12	3	6	12	3	6	12	3	6	12
Weight	294	-1	-1.38	-1.64	-.076	-1.1	-1.5	0.255	0.550	0.859	0.04	-0.05	0.02
ES	161	-1.13	-1.68	-3.48	-4.08	-5.39	-7.19	.007	.004	0.01	0.30	0.41	0.35
BIS	156	-0.01	-0.02	-0.38	-0.25	-0.32	-0.59	.001	<.001	.072	0.45	0.48	0.30
IS	164	-0.73	-2.5	-2.53	-2.86	-3.84	-4.95	.004	.169	.016	0.34	0.20	0.37
HS	164	-0.72	-0.23	-0.78	-1.88	-0.99	-1.79	.002	.150	.060	0.37	0.23	0.29
RS	162	1.93	1.6	1.64	3.6	3.59	3.73	.036	.029	.018	0.33	-0.39	0.36
NA	167	0.12	-0.1	-0.29	-1.74	-1.57	-2.53	.006	.010	<.001	0.50	0.33	0.50
PA	168	0.31	-0.19	-0.14	1.09	0.81	0.59	.003	.001	.005	0.38	-0.47	0.32
SC	154	3.07	3.61	3.21	7.97	8.37	9.12	0.003	0.015	0.007	0.37	-0.35	0.39
CTO	158	0.56	-0.36	-3.71	0.64	-1.59	-0.76	0.949	0.414	0.077	0.01	0.12	0.23
CFO	141	1.26	0.61	1.62	3.2	1.86	4.14	0.28	0.542	0.336	0.12	-0.08	0.17
BES	162	-0.82	-0.82	-1.35	-1.86	-3.08	-2.83	.087	.002	.024	0.22	0.38	0.25
D	161	-0.85	-0.30	-0.79	-1.21	-1.02	-1.15	.219	.040	.266	0.14	0.28	0.13
SH	161	-0.23	-0.31	-0.17	-0.93	-0.77	-0.71	.059	.255	.149	0.24	0.16	0.18
DR	160	0.92	0.25	0.55	0.71	0.66	0.51	.491	.217	.893	0.08	-0.13	0.01
RE	169	0.59	-0.9	-0.73	0.07	-0.19	-0.96	.213	.097	.658	0.13	-0.17	0.05
EG	168	1	-0.14	-0.40	-1.24	-2.01	-2.44	<.001	<.001	.006	0.52	0.38	0.4

2

Note: ES - External shame; BIS - Body Image Shame; IS - Inadequate self; HS - Hated self; RS-Reassured self; NA - Negative affect; PA - Positive affect; SC - Self-Compassion; CTO - Compassion to others; CFO - Compassion from others; BES - Binge eating symptoms; D- Disinhibition; SH - Susceptibility to hunger; DR - Dietary restraint; RE - Restrictive eating; EG - Eating guilt.

1

Table 3. Mean differences from baseline to 3, 6 and 12 months for the intervention and control groups for BOCF.

		Control			Intervention			p - values			Effect size Cohen's d		
	N	3	6	12	3	6	12	3	6	12	3	6	12
Weight	547	-0.49	-1.67	-0.4	-0.49	-.59	-.065	0.876	0.292	0.516	0.01	0.06	0.04
ES	539	-0.7	-0.14	-1.13	-2.55	-2.3	-2.94	0.003	<0.001	0.003	0.23	0.31	0.24
BIS	538	-0.1	-0.05	-0.09	-0.22	-0.19	-0.17	0.005	0.002	0.108	0.27	0.29	0.16
IS	533	-0.54	-0.67	-0.75	-1.74	-1.71	-1.86	<0.001	0.013	0.01	0.23	0.21	0.23
HS	533	-0.19	-0.09	-0.29	-0.75	-0.57	-0.73	0.002	0.006	0.007	0.22	0.20	0.18
RS	533	0.64	0.25	0.42	1.7	1.08	1.42	0.006	0.018	0.008	0.25	-0.21	0.24
NA	538	-0.2	-0.24	-0.38	-1.4	-0.81	-1.03	<0.001	0.024	0.015	0.38	0.18	0.21
PA	538	0.2	-0.06	0.02	0.59	0.38	0.35	0.001	<0.001	0.004	0.24	-0.30	0.21
SC	514	1.74	1.38	1.05	3.91	3.2	3.52	0.013	0.011	0.006	0.20	-0.19	0.23
CTO	509	-0.78	-.03	-1.46	-0.13	-0.35	-0.47	0.26	0.536	0.08	0.37	0.04	0.39
CFO	499	0.78	-.01	-.66	1.76	1.32	1.88	0.24	.048	0.015	0.20	-0.13	0.23
BES	530	-0.17	-0.34	-0.54	-1.06	-1.17	-1.34	0.002	0.005	0.026	0.20	0.18	0.20
D	523	-0.35	-0.13	-0.41	- -0.51	-0.38	-0.58	0.221	. 0.18	. 0.19	0.08	0.13	0.09
SH	523	-0.2	-0.11	-0.06	-0.46	0.36	-0.29	0.146	0.1	0.099	0.12	0.12	0.12
DR	523	0.19	0.12	0.01	0.08	0.18	-0.01	. 0.524	. 0.781	. 0.9	0.05	-0.08	0.01
RE	534	-0.23	-0.17	-0.07	0.05	0.07	-0.29	0.161	0.197	0.281	0.09	-0.08	0.07
EG	534	-0.47	-0.1	-0.51	-1.41	-1.01	-1.47	<0.001	0.002	0.004	0.25	0.25	0.26

2

Note: ES - External shame; BIS - Body Image Shame; IS - Inadequate self; HS - Hated self; RS-Reassured self; NA - Negative affect; PA - Positive affect; SC - Self-Compassion; CTO - Compassion to others; CFO - Compassion from others; BES - Binge eating symptoms; D- Disinhibition; SH - Susceptibility to hunger; DR - Dietary restraint; RE - Restrictive eating; EG - Eating guilt.

Table 4. Predictors of drop-out at 3 and 12 months.

	3 months				6 momths			
	Odds ratio	L.CI	U.CI	p. Value	Odds ratio	L.CI	U.CI	p. Value
Age	0.960	0.950	0.971	0.002	1.573	1.029	2.403	0.033
Group	1.58	1.061	2.252	0.006	1.913	1.27	2.883	0.002
Weight	1.886	1.252	2.841	0.002	1.362	0.902	2.056	0.133
ES	1.465	0.804	2.668	0.203	0.87	0.577	1.31	0.495
BIS	1.811	1.046	3.135	0.03	1.473	0.846	2.566	0.162
IS	1.886	1.04	3.419	0.033	2.281	1.518	3.426	<0.001
RS	0.75	0.418	1.347	0.326	0.534	0.327	0.873	0.011
HS	1.967	0.851	4.545	0.106	1.983	1.306	3.01	0.001
NA	2.362	1.357	4.113	0.002	0.566	0.371	0.864	0.007
PA	0.501	0.249	1.009	0.048	1.354	0.871	2.106	0.169
BES	2.285	1.273	4.1	0.005	1.626	1.08	2.448	0.017
D	1.684	0.937	3.028	0.075	1.472	0.979	2.214	0.058
SH	1.867	1.015	3.437	0.041	0.65	0.442	0.956	0.025
R	0.568	0.315	1.024	0.055	0.879	0.584	1.324	0.529
RE	0.605	0.316	1.16	0.123	1.879	1.261	2.801	0.002
EG	1.884	1.09	3.255	0.021	0.713	0.465	1.095	0.115
SC	0.818	0.443	1.509	0.511	1.37	0.895	2.097	0.139
CTO	1.483	0.79	2.784	0.211	0.853	0.563	1.293	0.445
CFO	0.474	0.24	0.936	0.028	1.573	1.029	2.403	0.033

Note: ES - External shame; BIS - Body Image Shame; IS - Inadequate self; HS - Hated self; RS-Reassured self; NA - Negative affect; PA - Positive affect; SC - Self-Compassion; CTO - Compassion to others; CFO - Compassion from others; BES - Binge eating symptoms; D- Disinhibition; SH - Susceptibility to hunger; DR - Dietary restraint; RE - Restrictive eating; EG - Eating guilt.