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

3

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1 **Abstract**

2

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

14

15 **Trial registration:** SRCTN16873876

16

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

19

20

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

3 Recent studies suggest that helping individuals develop self-reassurance and self-
4 compassionate capabilities may help buffer against the pervasive effects of shame and self-
5 criticism in a number of physical and mental health (Kirby et al., 2017a) conditions, including
6 eating and body image-problems (Steindl et al., 2017). Compassion focused therapy (CFT;
7 Gilbert, 2010a; Gilbert, 2014; Gilbert, 2010b) was developed to help individuals with high
8 levels of shame and self-criticism. The CFT model follows a motivational approach to
9 compassion, viewing it as a sensitivity to one's and others' suffering, developing the
10 motivation to attend to and alleviate or prevent this suffering (Gilbert, 2010a; Gilbert,
11 2010b; Gilbert, 2014). CFT provides psychoeducational approaches to motivation and
12 emotion regulation systems and the promotion of a mindful and compassionate orientation
13 towards oneself and to others, through a series of compassionate mind training practices.

14 There is evidence of the effectiveness of CFT in improving aspects of mental health (Kirby et
15 al., 2017b; Leaviss and Uttley, 2014; Kirby, 2017; Kirby et al., 2017a) and alleviating binge
16 eating symptomology (Duarte et al., 2017b; Gale et al., 2014; Kelly and Carter, 2015). In the
17 context of weight management, compassion-based interventions may help redirect
18 maladaptive eating behaviours (e.g., binge eating) and weight-related self-evaluation
19 towards better coping, reduce loss of control of eating and prevent relapse.

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

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

7

8 **Methods**

9

10 **Study design**

11

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

1 Ireland. Groups are convened and run by GLs, weekly meetings typically last for 1.5 hours
2 which include a weekly weigh-in and support sessions based around the weight
3 management programme. The programme encourages free intake of low energy density
4 foods as well as foods high in protein, carbohydrate and fibre. It also recommends limited
5 intake of energy dense and less satiating foods (i.e., fats and sugars; Stubbs et al., 2010).
6 This dietary approach has been found to produce significantly greater weight loss than a
7 low-fat diet alone (Ello-Martin et al., 2007). To support its members with making improved
8 food choices and increases in physical activity, the programme incorporates evidence-based
9 behaviour change techniques (e.g., goal-setting of weight and behavioural goals); action
10 planning (e.g., meal plans, social event plans); self-monitoring (food diary, weekly weigh-in);
11 relapse management (creating behavioural plans and strategies to address periodic
12 increases in weight) aimed at helping members with developing self-regulation skills in the
13 change process (Dombrowski et al., 2012; McKee et al., 2013; Ng et al., 2012; Stubbs et al.,
14 2010; Stubbs and Lavin, 2013a; Teixeira et al., 2012). Social support is also provided to
15 members via: group discussion to enable members to learn new strategies to support their
16 weight loss efforts; GL support in motivation and self-efficacy for exercise and improved
17 dietary choice; and online and social media forums (Greaves et al., 2011). The majority of
18 participants access the groups through self-referral and pay weekly (£ 4.95) to attend their
19 chosen group. This is an open programme, with no fixed duration of membership.
20 Participants can join, leave and re-join as they wish for any length of time as support groups
21 are continuously available week-by-week through the year, to maximise attendance and
22 engagement from members of the community (Stubbs et al., 2015).

23

1 Demographic, anthropometric and body weight data were collected for participants
2 attending groups in the UK each week through a proprietary electronic data capture system
3 and using calibrated digital scales. At the point of enrolment each participant's gender, date
4 of birth, weight and height were recorded and entered onto the electronic system. Each
5 week the participant returned to group weight was measured and automatically captured
6 on the system. Data were collected in a live database using a specifically designed data
7 capture architecture and stored on a Microsoft Structured Query Language (SQL) server,
8 2008 r2. Data were collected and stored in line with the Data Protection Act and
9 Information Governance Level 2. Six GLs were allocated to the intervention arm and 6 GLs
10 were allocated to the control group (Figure 1).

11

12

Insert Figure 1 here

13

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

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

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

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

12 Online questionnaires were given via links embedded in the web page at baseline, 3, 6 and
13 12 months and participants were prompted by email reminders to complete the
14 questionnaires at those time points (Figure 2).

15

16 **Insert Figure 2 here**

17

18 58.4% of participants in the intervention arm watched each video once between April and
19 July, 38.2% watched the videos a few times and a small minority (5.1%) watched them more
20 than 6 times or more (Figure 3).

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

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

3

4

Insert Figure 3 and 4 here

5

6 **Participants and baseline characteristics**

7 974 participants were recruited to the study and 937 (96.2%) completed all baseline
8 measures. At 12 months 433 completed the questionnaire measures again, giving an overall
9 retention rate in the study of 46.2% which was comparable between the two arms ($\chi^2_{(3)}$
10 5.65, $p > 0.05$). At baseline, both intervention and control groups on average tended to
11 score higher than reference general population samples for body image shame, components
12 of self-criticism and lower on self-reassurance. They tended to present scores for binge
13 eating, restraint, disinhibition and perceived hunger that were similar to overweight
14 populations seeking obesity treatment.

15

16 Table 1 compares baseline characteristics for the control and intervention groups.
17 Compared to the control group the intervention group differed in (i) weight history: they
18 had participated in the programme for 125 days longer, lost 1.4kg more weight but weighed
19 ~3.1 kg more (1 BMI point higher), (ii) the intervention group presented significantly higher
20 body shame, negative affect, feelings of inadequacy and self-hatred, and were significantly
21 less self-compassionate and slightly less open to compassion from others, (iii) they exhibited
22 higher binge eating symptomology, disinhibition and eating guilt.

23

24

Insert Table 1 here

1 **Measures**

2

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

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

18

19 *Weight-focused External Shame Scale (WFES)*

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

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

6

7 *Body Image Shame Scale (BISS)*

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

16

17 *Weight-focused feelings scale (WFSS)*

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

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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).

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

4

5 *The Compassionate Engagement and Action Scales (CEAS)*

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

11

12 **Anthropometric data**

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

17

18 **Power tests**

19 Power calculations were conducted on three key primary outcomes, weight, shame and self-
20 criticism. To detect differences of 2 kg in weight at 3 months, assuming participant
21 variability was 4 kg required 65-85 participants to achieve 80-90% power. To detect
22 differences in shame and self-criticism from baseline to 3 months, we chose an effect size
23 (0.25) with a power of 0.80 and $p < 0.05$, giving a sample of $N = 119$ per study arm. We
24 therefore aimed to recruit a minimum of 155 members per arm of the study.

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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

1 component of baseline differences between those groups as the most conservative
2 estimate of intervention effects. Missing data were imputed using the Baseline Observation
3 Carried Forward approach (BOCF). A per protocol (completer) analysis was also conducted.
4 Analyses were performed using the R statistical program (<http://www.r-project.org/>).
5 To explore whether changes produced by the compassion intervention in self-compassion
6 and self-reassurance, self-criticism and body image and weight-related shame mediated the
7 impact of the compassion-based active intervention (baseline to 3 months) on participants'
8 binge eating symptomatology, mediation analyses using MEMORE for SPSS (Mediation and
9 Moderation analysis for Repeated measures designs) were conducted in the intervention
10 group (Montoya and Hayes, 2017). MEMORE enables estimation of total, direct, and indirect
11 effects of an independent variable (X) on a dependent variable (Y) through mediators (M) in
12 a two-condition within-subjects design. MEMORE considers the mediator and the
13 dependent variable as the calculated change between baseline and post-intervention (3
14 months). The independent variable "X" is the passage of time from baseline to post-
15 intervention and corresponds to the effect of the intervention. MEMORE produces 95%
16 confidence intervals for indirect effect(s) using bootstrapping resampling (5000 bootstrap
17 samples). An effect is significant when the interval between the lower and the upper bound
18 of the CI does not include 0 (Montoya and Hayes, 2017).
19 Predictors of drop out at 12 months were modelled by logistic regression using drop out as
20 the dependent variable and age, group, weight, self-evaluation, eating behaviour and
21 compassion-related variables (CEAS) as independent variables and programme GLs as
22 random effects. Predictors of drop out were modelled at 3 and 12 months respectively,
23 comparing odds ratios. An odds ratio <1.0 indicates a lower odds ratio and >1.0 indicates
24 higher odds.

1 **Results**

2

3 **Intervention effects**

4 Weight losses over the course of the study were slight (1.0 versus 0.8 kg), but significantly
5 different from zero ($p < 0.010$) in the intervention and control groups respectively (BOCF).

6 There was no significant between-group difference at 3, 6 or 12 months.

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

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

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

17

18

Insert Table 2 and 3 here

19

20 **Mechanisms of change in the intervention group**

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

1 Results revealed significant indirect effects of the compassion intervention on reductions of
2 binge eating symptomatology, mediated by increases in self-compassion attributes ($B = -$
3 0.26 , $BootSE = 0.13$, $95\%CI (-0.58 \text{ to } -0.09)$) and engagement ($B = -0.81$, $BootSE = 0.23$, $95\%CI$
4 $(-1.30 \text{ to } -0.40)$, reassured self ($B = -0.78$, $BootSE = 0.23$, $95\%CI (-1.29 \text{ to } -0.38)$); and
5 reductions in inadequate self ($B = -0.75$, $BootSE = 0.24$, $95\%CI (-1.28 \text{ to } -0.34)$), hated self (B
6 $= -0.56$, $BootSE = 0.18$, $95\%CI (-0.93 \text{ to } -0.2)$), weight-related shame ($B = -0.58$, $BootSE = 0.19$,
7 $95\%CI (-1.00 \text{ to } -0.27)$) and body image shame ($B = -1.17$, $BootSE = 0.24$, $95\%CI (-1.68 \text{ to } -$
8 $0.76)$).

9

10 **Predictors of drop out**

11 Dropout was defined as non-attendance for four consecutive weeks, without subsequently
12 re-joining the programme. Drop-out rates were significantly higher in the control than
13 intervention group. The intervention arm of the study retained 67.2% participants in the
14 CWMP at 12 months compared to 56.4% of those in the control ($\chi^2(3, N = 985) = 13.952$; $p <$
15 0.05).

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

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

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

5

6

Insert Table 4 here

7

8

9 **Discussion**

10

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

17 The compassion-based intervention had no effect on body weight. Several programme
18 components of the CWMP programme offer approaches to self-regulation (e.g., tools for
19 creating action plans, goal setting, establishing behavioural contracts, dietary and body
20 weight self-monitoring; Teixeira et al., 2010; Teixeira et al., 2005; Wadden and Foster,
21 2000). It is perhaps not surprising therefore that adding a light touch intervention into a
22 programme that contains tools already for this purpose is unlikely to specifically affect
23 weight regulation.

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

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

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

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

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

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

9

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

18

19 **Declarations:**

20 ***Ethics approval and consent to participate***

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

24

1 ***Competing interests***

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

4

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8 data extraction and collation.

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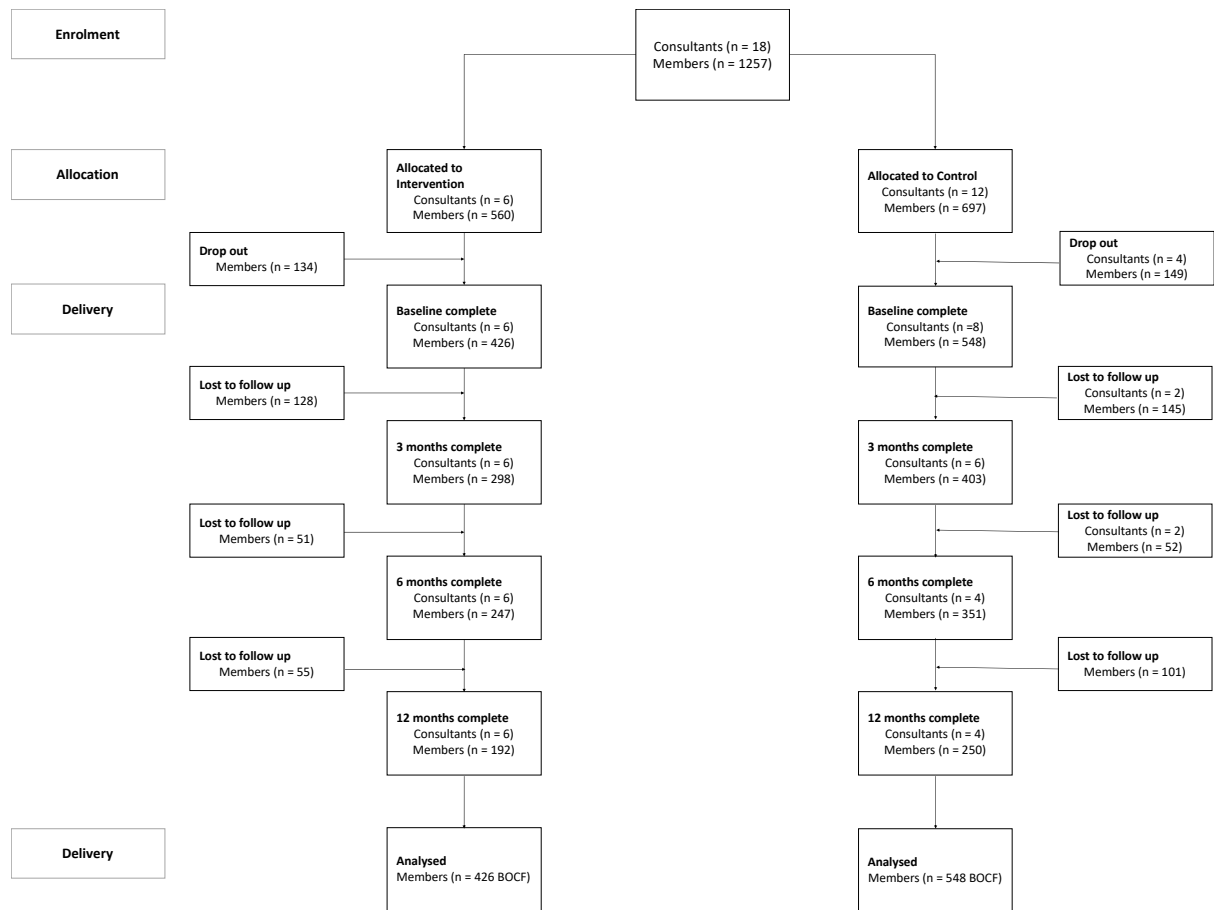
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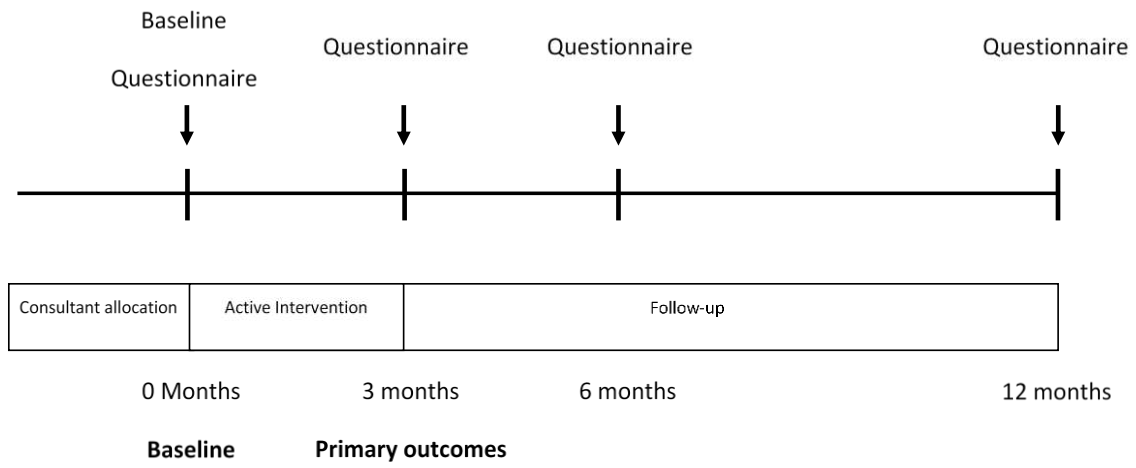
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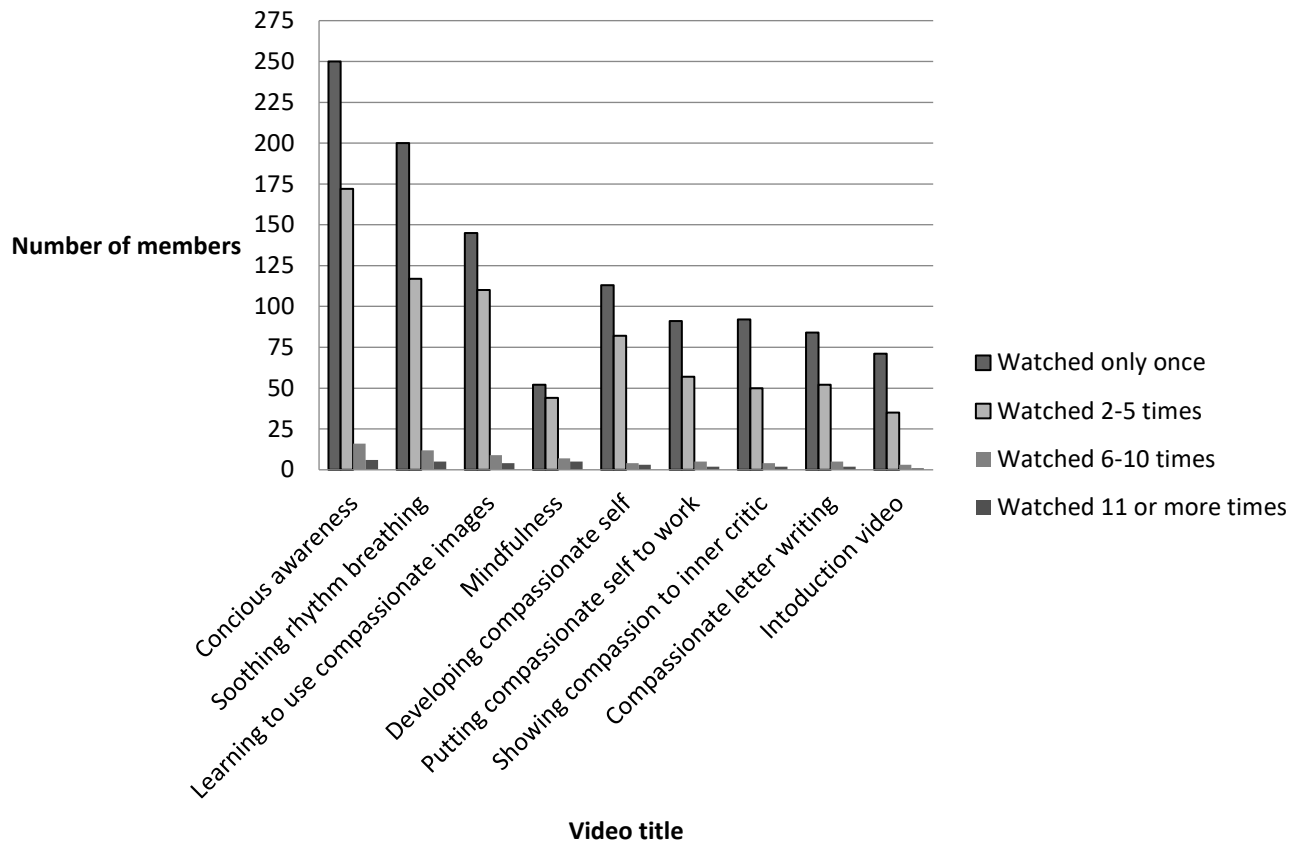
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2 **Figure 1.** Consort flow diagram of the study

1

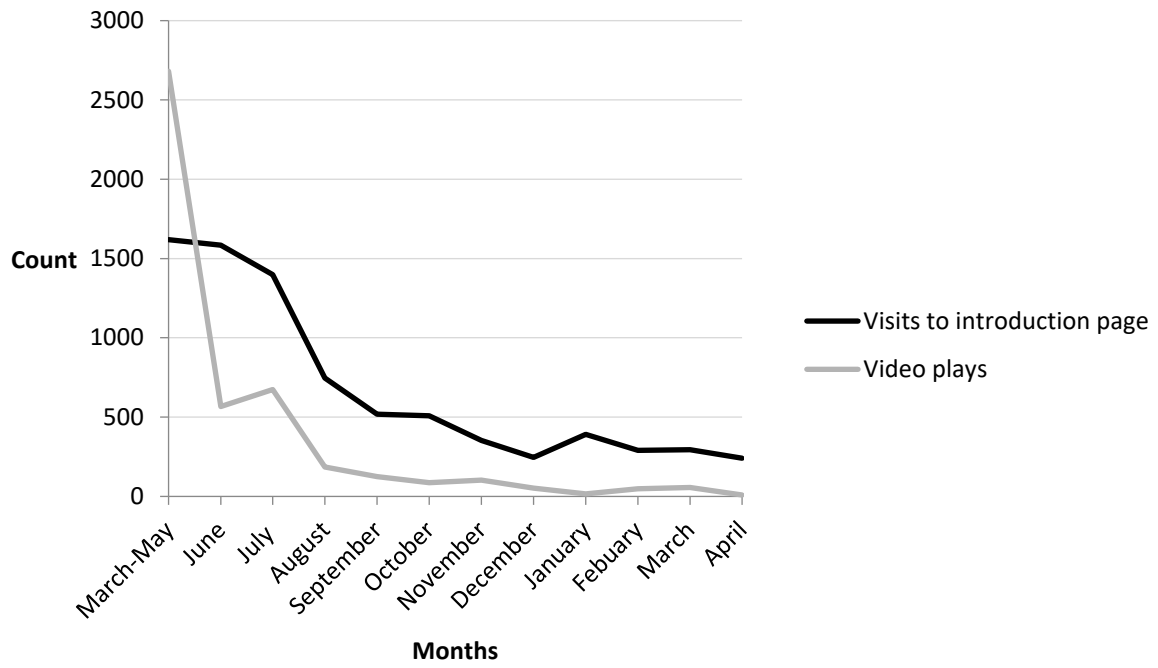


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3 **Figure 2.** Flowchart of study design



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



1

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

4

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

	Intervention		Control		<i>t</i>	<i>p</i> - value
	Mean	<i>SD</i>	Mean	<i>SD</i>		
N	426		548			
Age	46.80	12.80	47.50	12.80	0.90	.374
Females	95.60%		94.50%		0.53a	.467
<i>Weight History</i>						
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
<i>Weight</i>						
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
<i>Self-Evaluation</i>						
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
<i>Compassion</i>						
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
<i>Eating Behaviour</i>						
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

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	-	0.02
												0.05	
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	-	0.36
												0.39	
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	-	0.32
												0.47	
SC	154	3.07	3.61	3.21	7.97	8.37	9.12	0.003	0.015	0.007	0.37	-	0.39
												0.35	
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	-	0.17
												0.08	
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	-	0.01
												0.13	
RE	169	0.59	-0.9	-0.73	0.07	-0.19	-0.96	.213	.097	.658	0.13	-	0.05
												0.17	
EG	168	1	-0.14	-0.40	-1.24	-2.01	-2.44	<.001	<.001	.006	0.52	0.38	0.4

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

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

	N	Control			Intervention			p - values			Effect size Cohen's d		
		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	-.051	-0.38	-0.58	0.221	.018	.019	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

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

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

	3 months				6 months			
	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

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