Processes of change in quality-of-life, weight self-stigma, BMI and emotional eating after an acceptance, mindfulness and compassion-based group intervention (Kg-Free) for women with overweight and obesity

Lara Palmeira, Marina Cunha, &José Pinto Gouveia

2017

Journal of Health Psychology

Advance Online Publication

doi: 10.1177/1359105316686668

Processes of change in quality-of-life, weight self-stigma, BMI and emotional eating after an acceptance, mindfulness and compassion-based group intervention (Kg-Free) for women with overweight and obesity

Lara Palmeira, Marina Cunha, & José Pinto Gouveia

Abstract

This study examined the effectiveness of Kg-Free: an acceptance, mindfulness and compassion-based group intervention for women with overweight and obesity at post-treatment and 3-month follow-up and explored the psychological processes that underlie changes in quality-of-life, weight self-stigma, BMI and emotional eating at post-treatment. Overall, 53 women completed Kg-Free. At post-treatment and 3-months follow-up, participants reported increased quality-of-life, mindfulness and self-compassion abilities and decreased weight self-stigma, emotional eating, shame, weight-related experiential avoidance, self-criticism and BMI. Shame and self-criticism reductions were important mediators of changes in health-related outcomes, whereas weight-related experiential avoidance, mindfulness and self-compassion mediated changes in weight and eating-related outcomes.

Key-words: Overweight and obesity; Quality-of-life; Weight self-stigma; Kg-Free intervention; Within-group mediation analysis

Introduction

The literature suggests that traditional weight-loss treatments (that include dietary restriction and physical activity) tend to present poorer weight loss results at long-term and do not necessarily improve psychological health nor diminish weight-stigma (Lasikiewicz et al., 2014; Latner et al., 2012; Wilson and Brownell, 2002). These diet-focused interventions may also yield unwanted consequences, namely: increased body dissatisfaction, eating disordered behaviours (e.g., chronic dieting, overeating), shame and self-criticism (e.g., Bacon et al., 2002; Tylka et al., 2014). Moreover, the psychological processes (such as experiential avoidance, shame, self-criticism and weight self-stigma), known to impact negatively on health and quality-of-life are rarely targeted (Duarte et al., 2014; Latner et al., 2013; Lillis et al., 2009; Lillis et al., 2010; Luoma and Platt, 2015).

Clearly, there is still room for improvement, especially in enhancing the quality-of-life of people dealing with chronic problems such as obesity. By fostering acceptance, distress tolerance, present moment awareness and the development of a kind and caring attitude towards the self, the third wave cognitive-behavioural therapies (such as Acceptance and Commitment Therapy - ACT, Mindfulness and Compassion Focused Therapy - CFT) seem to be particularly useful in chronic conditions (e.g., Graham et al., 2016 for a review), such as obesity and weight issues (Forman et al., 2015; Gilbert et al., 2014; O' Reilly et al., 2014). Furthermore, in societies where food is easily available and where sedentary lifestyles are common, promoting willingness, acceptance and distress tolerance of internal unwanted experiences seems to be crucial for weight management (Forman et al., 2015; Forman and Butryn, 2015; Lillis et al., 2015). In addition, eating is intrinsically an automatic behaviour not only related to the fulfilment of basic bio physiological needs (suppress hunger), but also with important social and emotional regulation functions (Goss, 2011). Learning to be fully aware of the present moment in an open, accepting and non-judgmental way is required as it enhances the ability to recognize internal cues (e.g. hunger and satiety) and helps to make healthier choices (e.g., Forman and Butryn, 2015; Kristeller and Wolever, 2011).

Overall, acceptance and mindfulness-based interventions seem to be effective in reducing weight self-stigma, unhealthy eating patterns (e.g., disinhibit and emotional eating, food cravings), body image concerns and psychological distress, while increasing physical activity and health-related quality-of-life and even promoting weight loss (Forman et al., 2013; Lillis et al., 2009; Niemeier et al., 2012; O' Reilly et al., 2014). In fact, not only these interventions promote healthier behaviours and well-being, they also promote the development of a more flexible and accepting relationship with one's eating, food and weight, which seems

fundamental in weight loss (Forman, et al., 2013; 2015; Lillis et al., 2015; O'O'Reilly et al., 2014).

Although less studied, there is evidence that integrating self-compassion can bring an important contribution for people with obesity (Gilbert et al., 2014; Hilbert et al., 2015). Recently, a study with 1158 individuals with overweight and obesity found that self-compassion mediated the relationship between weight self-stigma and global health (Hilbert et al., 2015). Additionally, people trying to lose weight frequently feel inferior, flawed or a failure, become very self-critical and have difficulty to experience self-compassion (Adams and Leary, 2007; Gilbert et al., 2014). In fact, shame and self-criticism have been consistently linked to disordered eating, body dissatisfaction, and difficulties in maintaining healthy behaviours (Duarte et al., 2014; Gilbert et al., 2014; Pila et al., 2015). Contrarily, self-compassion – the ability to have a caring, accepting and comforting relationship with the self – is proving to be effective in decreasing shame and self-criticism and in improving psychological well-being (Brian et al., 2014; Gilbert, 2010; MacBeth and Gumley, 2012; Neff, 2003), particularly for people struggling with eating and weight (Adams and Leary, 2007; Gilbert et al., 2014; Goss and Allan, 2014;).

Given the fact that contextual-behavioural approaches share several common features (e.g. promote awareness and acceptance), despite targeting different yet related skills, growing interest has been raised in integrating them (e.g., Luoma and Platt, 2015; Pinto-Gouveia et al., 2016). However, integrating CFT and ACT has only been attempted in a small pilot study with people living with HIV, showing promising results (Skinta et al., 2015). Following this line, Kg-Free - an acceptance, mindfulness and compassion-based group intervention for women struggling with eating and weight - was developed. The intervention aimed to decrease weight self-stigma and unhealthy eating behaviours and promote quality-of-life (Palmeira et al., submitted-b). Results from the randomized controlled trial comparing Kg-Free with treatment as usual (TAU) supported Kg-Free efficacy in reducing weight self-stigma, weight-related experiential avoidance and self-criticism, while increasing healthy behaviours and quality-of-life (Palmeira et al., submitted-b). However, this previous study did not explore follow-up results nor the mechanisms that underlie the changes found. Still, gathering knowledge on the processes that mediate treatment-induced changes is of crucial importance in order to make interventions more effective and is usually less explored (McCracken and Martinez, 2011; Murphy et al., 2009). Particularly, several trials using ACT have found that reductions in experiential avoidance represent an important mediator of changes in binge-eating and weight loss (Lillis et al., 2011; Niemeier et al., 2012; Pinto-Gouveia et al., 2016). Also, mindfulness

and self-compassion seem to have specific and independent contributions as mediators of changes in ACT and mindfulness-based interventions (e.g., Forman et al., 2009).

Although evidence for the efficacy of Kg-Free at post-treatment has been found, the current study aimed to explore if these changes were maintained at 3-month post-intervention. Furthermore, we also aimed to explore the mechanisms of change for quality-of-life, weight self-stigma, emotional eating and BMI at post-treatment. We hypothesized that the changes that occurred after Kg-Free intervention were mediated by decreased weight-related experiential avoidance, shame and self-judgment tendencies, and increased abilities to be open, accepting and compassionate towards oneself. Lastly, and given the damaging effect of weight-related experiential avoidance and weight self-stigma on quality-of-life (e.g., Palmeira et al., 2016b), a serial mediation model was created to explore if the impact of the intervention on participants' quality-of-life was mediated by changes in weight-related experiential avoidance and weight self-stigma.

Methods

Participants

The sample comprised women, aged between 18 and 55 years old, with overweight or obesity (BMI ≥ 25) enrolled in nutritional treatment for weight loss in primary care units and Hospitals from Coimbra's district, Portugal. All participants were screened for eligibility by experienced clinical psychologists. Exclusion criteria: a) presence of Binge Eating Disorder assessed through Eating Disorders Examination interview; b) Severe psychiatric conditions (severe depressive episode, substance abuse, Bipolar disorder and Borderline Personality Disorder) assessed through SCID-I and SCID-II; c) medical conditions that affect weight; d) medication associated with significant weight or appetite changes.

From the initial 60 participants enrolled in Kg-Free, seven dropped-out after the first group sessions and did not complete any of the post-treatment assessments. From the 53 completers, at 3-month follow-up assessment, one participant was pregnant and another was admitted to the hospital due to illness. Thus, no data from the 3-month follow-up assessment was available for these two participants. At baseline, participants had a mean age of 42.55 (*SD* = 9.05), with a mean of 15.60 (*SD* = 3.21) years of education. Mean BMI was 34.09 (*SD* = 5.30). The majority of the participants were married (69.8%), 18.9% were single and 11.3% divorced. The majority (84.9%) came from low to medium socio-economic status.

Kg-Free intervention

The intervention included 10 weekly sessions plus 2 booster fortnightly sessions (2h30 hours each). It was designed upon pre-existing ACT and mindfulness-based protocols for people

with eating and weight issues (e.g., Forman et al., 2013; Kristeller & Wolever, 2011; Lillis et al., 2009), plus a self-compassion component (Gilbert, 2010; Goss, 2011). A more detailed overview of the intervention can be found elsewhere (Palmeira et al., 2016a). Overall, the intervention included several components: 1) Psychoeducation regarding eating and emotions through an evolutionary approach was introduced, in order to diminish shame and self-criticism (sessions 2 and 3); 2) Mindfulness was promoted in all sessions to enhance present moment awareness; 3) Values clarification and committed action were promoted to enhance motivation towards healthy behaviours (session 4); 4) Acceptance and defusion skills were promoted to reduce experiential avoidance and enhance distress tolerance particularly regarding weight and eating-related experiences (sessions 5 to 7); 5) Self-compassion was introduced as an antidote for shame and self-criticism (session 8) and explicitly developed through experiential exercises in sessions 9 and 10 (e.g. loving-kindness, self-compassion exercises). All sessions started with 30 minutes of shared experience, followed by a five-minute mindfulness practice. Then the session content was delivered, followed by an eating mindfulness practice and the establishment of the practices for the week (e.g., mindfulness or self-compassion exercises).

Procedures

Ethical approval was obtained from all institutions enrolled in the study. Participants were invited to take part in the study directly at the medical care units on their appointment day. All participants received information regarding the voluntary and confidential nature of the study, as well as a brief overview of the intervention. Likewise, all participants signed an informed consent. To guarantee confidentiality a unique and numerical code was assigned to each participant. Baseline assessment occurred one week before Kg-Free intervention, post-treatment assessment was obtained within the two weeks' post-intervention, and follow-up assessment occurred 3 months after the end of the intervention. All assessments were conducted by psychologists blinded to participants' condition.

Measures

Demographic Data were gathered in the initial screening interview. Participants were asked about their age, years of education, marital and socio-economic status.

Main outcome measures

BMI. Participants were weighted with their street clothes (without shoes) using a Body Composition Analyser (Tanita TBF-300) accurate to 0.1kg.

Weight self-stigma Questionnaire (WSSQ; Lillis et al., 2010; Palmeira et al., submitted-a) is a 12 items self-report measure that assesses internalized weight-stigma in people with overweight and obesity. Items are rated in a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Higher scores reflect higher levels of weight self-stigma. Both the original and Portuguese versions revealed good psychometric properties (α = .88) (Lillis et al., 2010). In this study, WSSQ presented high internal consistency at baseline (α = .89), post-treatment (α = .88) and 3-month follow-up (α = .86) assessments.

Obesity Related Well-Being Questionnaire (ORWELL-97; Mannucci et al., 1999; Silva et al., 2008) measures decreased obesity-related quality-of-life. All 18 items are rated assessing symptoms frequency and severity (occurrence subscale) and importance regarding limitations in one's life (importance subscale) using a four-point scale (0 = "not at all" to 3 = "much"). Both the original and Portuguese versions presented good internal consistency (α = .83 and α= .85 respectively). In this study ORWELL presented high internal consistency (α = .92 at baseline; α = .91 at post-treatment; and α = .90 at 3-month follow-up).

Three Factor Eating Questionnaire-21R (TFEQ-R21; Cappelleri et al., 2009; Duarte, 2016) assesses unhealthy eating behaviours: cognitive restraint, uncontrolled eating and emotional eating in a 4-point scale (1= "completely true" to 4= "completely false"). Higher scores indicate higher tendency to engage in those behaviours. The TFEQ-21 has proved to have good internal consistency (α = .76 for cognitive restraint, .85 emotional eating and .83 for uncontrolled eating), discriminant and convergent validity (Cappelleri et al., 2009). In this study, only emotional eating dimension was used and it presented very good internal consistency in all assessments (α = .93 at baseline and α = .87 at both post-treatment and 3-month follow-up).

Mediator processes

Acceptance and Action Questionnaire for Weight-Related Difficulties-Revised (AAQW-R; Palmeira et al., 2016a) includes 10 items of the AAQW. It measures weight-related experiential avoidance, i.e., the tendency to avoid, control or suppress unwanted internal experiences related to one's weight and eating. Items are rated in a 7-point scale (1 = "never true" or "not at all believable" and 7 = "always true" or "completely believable"), with higher scores reflecting higher levels of weight-related experiential avoidance. In the original study, the AAQW-R proved to be a reliable measure (Palmeira et al., 2016a). In this study, AAQW-R showed good internal consistency of α = .88 at baseline and post-treatment and α = .84 at 3-month follow-up assessment.

Other as Shamer Scale (OAS; Goss et al., 1994; Matos et al., 2016) assesses external shame. The 18 items are rated on a 5-point Likert scale (from 0 = "never" to 4 = "almost always"). Higher scores indicate more external shame. OAS consistently showed very good internal consistencies in clinical and non-clinical samples (α = .96 and .92, respectively; Goss et al., 1994). In the current study OAS internal consistency was very good in all assessments (α = .93 at baseline, α = .91 at post-treatment and α = .92 at 3-month follow-up).

Self-Compassion Scale (SCS; Neff, 2003; Castilho et al., 2015) includes 26 items and it can be divided into a positive and a negative dimension. The positive dimension – *self-compassion* (includes self-kindness, common humanity and mindfulness subscales) measures the tendency to show a caring and supportive attitude towards the self. The negative dimension – *self-judgment* (includes self-judgment, isolation and over-identification subscales) assesses the tendency to be harsh and critical towards oneself when facing setbacks. All items are rated in a 5 point Likert scale (1 = almost never; to 5 = almost always). SCS has showed very good internal consistency (α = .91 for self-compassion and α = .89 for self-judgment; Castilho et al., 2015). Similar internal consistency values were found in this study for all assessments (self-compassion: α = .85 at baseline and post-treatment and α = .89 at 3-month follow-up; self-judgment: α = .91 at baseline and post-treatment and α = .93 at 3-month follow-up)

Five Facet Mindfulness Questionnaire - 15 (FFMQ-15; Baer et al., 2006; Gregório et al., in preparation) measures the dispositional mindfulness characteristics in daily life. FFMQ-15 is a reduced version of the original FFMQ that comprises 15 items rated in a 5-point Likert scale (1 = "never or very rarely true" to 5 "very often or always true"). In this study, only FFMQ-15 global score was used and it presented an acceptable Cronbach alpha at baseline (α = .62) and good at post-treatment (α = .82) and 3-month follow-up (α = .80) assessments.

Data analysis

All data analyses were performed using SPSS Statistics 20. Power analysis was calculated for Repeated Measures Analysis of Variance (ANOVA) at post-hoc for N = 51. Using a significance level of .05, with 3 different measurement moments and an effect size of f = 0.25, the power analysis was 98%. Repeated Measures ANOVA was performed to test differences between pre-treatment, post-treatment and 3-month follow-up assessments. Whenever sphericity assumption was violated, the Greenhouse–Geisser correction was used to produce a valid F-ratio (Field, 2013). Effect sizes were calculated using partial eta square (η2) and were interpreted as follows: partial η2 values of .01 small, .06 medium and .14 large effect sizes (Tabachnick and Fidell, 2007). Post-Hoc analyses using Bonferroni adjustment for

multiple comparisons were used to explore pairwise differences (pre-to-post treatment; pre-to-3 month and post-to-3 month follow up).

To explore whether changes in shame, weight-related experiential avoidance, self-judgment, mindfulness and self-compassion mediated the impact of the Kg-Free intervention on participants' health-related (quality-of-life and weight self-stigma) and weight and eating-related outcomes (emotional eating and BMI), MEMORE (Mediation and Moderation analysis for Repeated measures designs) was used (Montoya and Hayes, 2016). MEMORE is a new SPSS macro that allows to estimate total, direct, and indirect effects of independent variable (*X*) on dependent variable (*Y*) through one or more mediators (*M)* simultaneously or in sequence in two-condition or two-occasion within-subjects design. MEMORE's approach was carefully chosen as it conceptualizes mediation analysis as a path analytic framework and not a set of discrete hypothesis tests. As such, it reduces the number of tests needed to test indirect effects, which reduces the changes of inferential errors. MEMORE computes the difference between the two mediator measurements and the difference between the two dependent variable measurements (see Montoya and Hayes, 2016 for a more detailed description). In this study, all participants experienced the same intervention (Kg-Free), hypothesized mediators and main outcomes were measured at baseline and post-intervention. Therefore, the independent variable 'X' is the passage of time that corresponds to the intervention period. Moreover, MEMORE also produces 95% confidence intervals for indirect effect(s) using bootstrapping resampling. The effect is considered statistically significant ($p < .05$) if zero is not included on the interval between the lower and the upper bound of the confidence interval (Montoya and Hayes, 2016).

Finally, a serial mediation model was conducted to test if changes from baseline to post-treatment on participants' quality-of-life were mediated by changes occurred in weight-related experiential avoidance and weight self-stigma (see figure 1 for a representative path diagram).

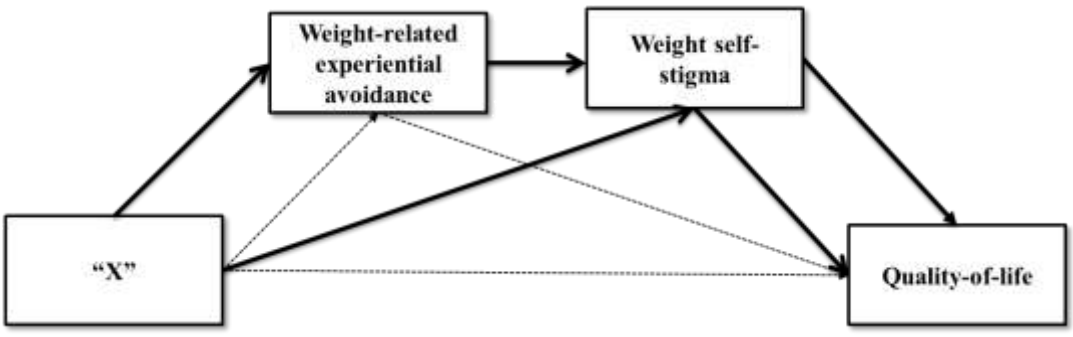

Fig. 1. Path diagram for the serial mediation model tested. Significant paths are displayed with black lines and non-significant paths are showed with doted lines.

Results

Repeated measures ANOVA

Repeated Measures ANOVAs were performed to test differences in all study's variables from baseline to post-treatment and 3-month follow-up. At post-treatment, participants presented increased quality-of-life, mindfulness and self-compassion abilities and decreased BMI, weight self-stigma, emotional eating, weight-related experiential avoidance, shame and self-judgment levels (Table 1). All differences reflected large effect sizes. Furthermore, post-hoc pairwise comparisons indicated that changes from baseline to post-treatment were maintained at 3-month follow-up. Furthermore, no significant differences were found between post-intervention and 3-month follow-up, except for emotional eating where significant differences were found between all assessments.

Kg-Free mechanisms of change

In order to explore the mechanisms of change on Kg-Free main outcomes, two-condition within-subjects' mediation analyses were performed using MEMORE. Changes from baseline to post-treatment in weight-related experiential avoidance, shame, self-judgment, self-compassion and mindfulness were hypothesized as possible mediators of changes in two main areas: 1) health-related outcomes that included weight self-stigma and quality-of-life; 2) weight and eating-related outcomes that encloses emotional eating and BMI. Changes in all outcomes were assessed from baseline to post-treatment. Table 2 displays the results found for the indirect effects of the intervention on changes in all outcome variables trough the hypothesized mediators. As we were interested in exploring the unique and specific contribution of each mediator process, all analyses were performed separately.

Table 1.

Means and SDs of the Outcome Measures at Baseline (M0), Post-treatment (M1), 3-month follow-up (M2) and Repeated Measures Analysis of Variance (N = 51) with Bonferroni Adjustment for pairwise comparisons.

	Baseline	*Post-intervention*	*3-month follow-up*	*F*	*p*	*Partial η2*	*Pairwise Comparisons*					
Outcome measures	*M (SD)*	*M (SD)*	*M (SD)*				*M0-M1*	*p*	*M0-M2*	*p*	*M1-M2*	*p*
ORWELL-97[a]	56.43 (17.13)	49.12 (14.84)	46.88 (14.68)	15.886	<.001	.25	7.31 (1.94)	.001	9.55 (2.10)	<.001	2.25 (1.11)	.147
WSSQ	38.47 (9.03)	33.04 (8.22)	33.63 (.91)	15.644	<.001	.25	5.43 (1.14)	.001	4.84 (1.11)	.001	-0.59 (.93)	1.000
BMI[a]	33.84 (5.47)	33.25 (5.36)	33.39 (5.45)	10.091	.001	.18	0.59 (.14)	.000	0.46 (.17)	.033	-0.14 (.09)	.441
TFEQ_Emotional eating[a]	2.81 (.69)	2.42 (.51)	2.24 (.53)	28.326	<.001	.37	0.38 (.08)	.001	0.56 (.09)	.001	0.18 (.05)	.006
AAQW-R	42.04 (12.00)	32.80 (10.28)	30.78 (9.42)	37.496	<.001	.44	9.25 (1.44)	.001	11.27 (1.53)	.001	2.02 (1.17)	.271
OAS	23.71 (11.45)	18.57 (9.44)	17.16 (9.25)	11.557	<.001	.19	5.14 (1.45)	.003	6.55 (1.48)	<.001	1.41 (1.36)	.920
Self-compassion	8.35 (1.54)	9.14 (1.66)	9.17 (1.69)	6.345	.003	.12	-0.80 (.25)	.006	-0.82 (.28)	.014	-0.02 (.27)	1.000
Self-judgment	8.50 (2.14)	7.62 (1.82)	7.63 (2.28)	8.217	.001	.15	0.87 (.24)	.002	0.87 (.25)	.003	-0.01 (.25)	1.000
FFMQ[a]	47.02 (6.06)	50.28 (7.14)	50.57 (7.22)	9.196	.001	.17	-3.26 (1.05)	.007	-3.55 (1.02)	.003	-0.30 (.70)	1.000

Note: [a] = Greenhouse-Geisser correction; ORWELL-97 = Obesity-related Quality-of-life; WSSQ = Weight Self-Stigma Questionnaire; BMI = Body Mass Index; TFEQ = Three Factor Eating Questionnaire; AAQW-R = Acceptance and Action Questionnaire for Weight-Related Difficulties-Revised; OAS = Others as Shamer Scale; FFMQ = Five Facet Mindfulness Questionnaire.

Table 2.

Independent Mediation analysis for Repeated measures using MEMORE macro for SPSS for changes on Health and eating-related outcomes (N = 53)

			Mediation Analysis			
Outcome: Quality-of-life	Model Summary		Indirect effect		Bootstraping 95% CI	
Mediators	ΔR^2	F	B	SE	Lower	Upper
AAQW-R	.16	4.611*	-4.80	2.12	-9.045	-.837
OAS	.43	17.710***	-3.80	1.48	-7.068	-1.244
FFMQ	.14	3.956*	-2.07	1.21	-4.863	-.240
Self-judgment	.27	8.800***	-3.39	1.41	-6.644	-1.150
Self-compassion	.03	.827	-1.15	.77	-2.990	.103
Outcome: Weight self-stigma						
AAQW-R	.17	5.180**	-3.00	1.11	-5.261	-.900
OAS	.27	8.969***	-1.96	.78	-3.719	-.699
FFMQ	.25	7.731***	-1.53	.70	-3.187	-.447
Self-judgment	.21	6.577**	-1.80	.71	-3.441	-.613
Self-compassion	.07	1.181*	-.96	.58	-2.279	-.008
Outcome: Emotional Eating						
AAQW-R	.14	4.090**	-.16	.10	-.370	-.069
OAS	.05	1.276	-.06	.05	-.168	.024
FFMQ	.11	2.818*	-.09	.05	-.194	-.013
Self-judgment	.06	1.486	-.03	.03	-.101	.032
Self-compassion	.11	3.083*	-.09	.05	-.209	-.006
Outcome: BMI						
AAQW-R	.12	3.120*	-.31	.13	-.561	-.046
OAS	.00	.066	-.02	.06	-.138	.090
FFMQ	.01	.249	-.01	.09	-.208	.168
Self-judgment	.04	.873	-.06	.07	-.213	.083

Self-compassion	.03	.672	-.01	.06	-.106	.149

Note: *** $p \leq .001$; ** $p \leq .01$; * $p \leq .05$; AAQW-R = Acceptance and Action Questionnaire for Weight-Related Difficulties-Revised; OAS = Others as Shamer Scale; FFMQ = Five facet Mindfulness Questionnaire

Health related-outcomes

Concerning quality-of-life, results showed that all hypothesized mediators (except for self-compassion) mediated the changes from baseline to post-treatment. Results showed that participants scored less in ORWELL at post-treatment relative to baseline, through the process of the intervention's effect on reducing weight-related experiential avoidance, shame and self-judgment. Furthermore, another indirect effect of the intervention on *participants' quality-of-life occurred through* the development of mindfulness abilities from baseline to post-treatment. In addition, results showed that all hypothesized mediators had a significant indirect effect on the impact of the intervention on changes in weight self-stigma from baseline to post-treatment. In fact, participants presented diminished weight self-stigma at post-treatment through the process of the intervention's influence on weight-related experiential avoidance, shame, self-criticism, mindfulness and self-compassion abilities.

Weight and Eating-related outcomes

Concerning BMI, only weight-related experiential avoidance mediated the effect of the intervention (Table 2). This result indicates that the reduction in BMI at post-treatment occurred through the process of the intervention's influence on weight-related experiential avoidance from baseline to post-intervention. Finally, concerning changes in emotional eating results indicated that changes in weight-related experiential avoidance, mindfulness and self-compassion mediated the effects of the intervention on emotional eating changes from baseline to post-treatment.

Serial Mediation analysis

Given that research has been stressing the negative role of weight-related experiential avoidance and weight self-stigma on quality-of-life (e.g., Lillis et al., 2011; Palmeira et al., 2016b), we explored whether the impact of the intervention on participants' quality-of-life (ORWELL) from baseline to post-treatment would be mediated by the reduction of weight self-stigma (WSSQ) and if these changes were mediated by decreased weight-related experiential avoidance (AAQW-R), through a serial mediation model (Figure 1). Thus, three indirect effects were explored: 1) "X" → AAQW-R → ORWELL (B = -1.32, BootSE = 1.43, 95% CI [-4.067 to 1.628]); 2) "X" →WSSQ → ORWELL (B = -2.91, BootSE = 1.42, 95% CI [-5.736 to -0.080]); and 3) "X" → AAQW-R → WSSQ → ORWELL (B = -3.52, BootSE = 1.53, 95% CI [-6.993 to -0.982]), as well as a total indirect effect (B = -7.75, SE = 2.17, 95% CI [-12.036 to -

3.498]). Also, the total effect (including direct and indirect effects) was significant ($t_{(51)}$ = -3.953, p = <.001; B = -7.31, SE = 1.85, 95% CI [-11.019 to -3.596]), whereas the direct effect of "X" on ORWELL was non-significant ($t_{(47)}$ = -1.851, p = .913; B = .44, SE = 1.85, 95% CI [-3.284 to 4.166]). The model was significant ($F_{(4,47)}$= 14.035, p <.001) and accounted for 54.4% of changes in ORWELL's from baseline to post-treatment.

Discussion

Although acceptance and mindfulness-based approaches seem to be effective in promoting quality-of-life for people with obesity (e.g., Forman et al., 2013; 2015; Lillis et al., 2009; O'Reilly et al., 2014), a growing interest exists in integrating compassion (Luoma and Platt, 2015). Results from this study provided further evidence for Kg-Free effectiveness, with changes from baseline to post-intervention being sustained at 3-month follow-up. Participants showed diminished external shame, self-judgment, weight-related experiential avoidance, weight self-stigma, emotional eating and BMI, and increased quality-of-life, mindfulness and self-compassion abilities at post-intervention and at 3 month follow-up. The effect sizes were large except for self-compassion that was medium. Although weight loss was not directly promoted in Kg-free, at post-treatment participants showed a significant, albeit small, weight loss. This was sustained at 3-month follow-up and is consistent with previous studies using acceptance and mindfulness-based interventions (O'Reilly et al., 2014; Tapper et al., 2009).

These findings support previous research that emphasises the importance of developing acceptance, mindfulness and compassion-based skills, in people living with overweight and obesity (Forman et al., 2015; O'Reilly et al., 2014; Gilbert et al., 2014), focused in improving health-related behaviours and quality-of-life, even without significant weight changes (e.g., Tylka et al., 2014). They also add to the existent knowledge by revealing the effectiveness of integrating components from different yet related approaches in people with overweight and obesity in order to promote quality-of-life and tackle weight self-stigma.

Given that Kg-Free integrated different components, it is paramount to explore whether all the processes mediated the changes found in the intervention's main outcomes. This will provide a much needed information to further develop process-focused and parsimonious interventions. Overall, results revealed that the increased quality-of-life and reductions in weight self-stigma at post-treatment were mediated by decreased levels of weight-related experiential avoidance, shame and self-judgment patterns and increased mindfulness skills. Nevertheless, self-compassion did not mediate changes in participants' quality-of-life. One possible explanation relies on the time needed to develop a self-companionate mind frame. Because self-compassion was only explicitly promoted in the intervention's last sessions, participants had less time to practice. It might be that for people with an underdeveloped soothing system, more time for practicing self-compassionate exercises is required. On the other

hand, a deshaming and non-judgmental attitude was promoted throughout the intervention. Thus, it makes sense that at the end of the intervention participants felt less shame and were less critical towards themselves but they might not be able to recognize themselves or even feel more self-compassionate. Thus, more studies are needed to fully understand the specific role of self-compassion.

Unveiling the mechanism of change in weight self-stigma is a particularly relevant finding, as weight stigma is considered a major obstacle to interventions (e.g., Lillis et al., 2009). As far as we know, our study is the first to reveal that other mechanisms, besides weight-related experiential avoidance, play a significant role in mediating the impact of the intervention on weight self-stigma.

In fact, and although the importance of shame and self-criticism in eating psychopathology has already been established (Duarte et al., 2014; Goss, 2011; Pila et al., 2015), our findings add to the existent knowledge by emphasising the negative role of shame and self-judgment as two important processes related to weight self-stigma and diminished quality-of-life in women with overweight and obesity. Moreover, our results also stress the importance of developing a more open, aware and tolerant relationship with oneself in order to promote well-being and increase the quality-of life of people with overweight and obesity. This is in line with empirical evidence that highlights the effectiveness of acceptance and mindfulness-based interventions in promoting quality-of-life (e.g., Forman et al., 2013, 2015; O' Riley et al., 2014). In addition, by showing that self-compassion plays a mediator role on weight self-stigma, our results stress the importance of promoting a warm and caring relationship with oneself in this population (e.g., Gilbert et al., 2014; Hilbert et al., 2015). It seems that by explicitly promoting self-compassion, the intervention helped participants to access their soothing system and to deactivate the threat system, which is linked to shame feelings and self-critic patterns (e.g. Gilbert, 2010; Goss, 2011).

Concerning weight and eating-related outcomes, weight-related experiential avoidance was particularly important as it mediated changes in participants' BMI and emotional eating. These findings mirror the results found after a 1-day ACT workshop for weight loss (Lillis et al., 2009; 2011). This emphasizes the need to help people to become more flexible, tolerant and accepting towards their weight and eating-related experiences in order to maintain healthy eating patterns and even lose weight. This allows individuals to be more aware and disentangle themselves from their unwanted thoughts and emotions and create willingness to just look and be with them, while maintaining healthy behaviours. These skills are thought to be very helpful in the current environment where we are constantly being prompted to eat or to be sedentary (e.g., Forman et al., 2015).

Another relevant finding was the fact that the development of mindfulness and self-compassion abilities stand out (together with weight-related experiential avoidance) as

important mediators of changes in emotional eating. It seems that promoting a more aware, non-judgmental and compassionate way to relate to one's experiences, particularly those related to eating, weight and psychical exercise, was crucial to help participants recognize their internal cues (e.g. hunger and satiety) and to find other ways to soothe themselves without using food as a mechanism to regulate difficult emotional states. Particularly, mindfulness has been proposed to be important to decrease emotional eating and binge eating as it enhances awareness of internal and external cues and helps to make healthier choices (e.g., Kristeller and Wolever, 2011). Furthermore, self-compassion seems to be essential to diminish emotional eating, as it is closely associated with shame and self-criticism (e.g., Duarte et al., 2014, Pinto-Gouveia etal., 2016). Moreover, there is some evidence that individuals with overweight and obesity struggle to be compassionate towards themselves (Gilbert et al., 2014).

Taken together, our findings highlight the importance of promoting acceptance, mindfulness and self-compassion abilities in order to decrease shame, self-criticism and internalized stigma and promote the quality-of-life of individuals living with overweight and obesity. Additionally, targeting weight-related experiential avoidance and the development of mindfulness and self-compassion abilities was crucial to reduce participants' emotional eating levels and weight.

Finally, the serial mediational model tested revealed that the improvement in participants' quality-of-life at post-treatment was fully mediated by the impact of the intervention on weight self-stigma, which in part was due to increased weight-related psychological flexibility. The model accounted for 54.4% of changes in participants' quality-of-life. This result broadens the existent evidence (Lillis et al., 2010; 2011; Palmeira et al., 2016b) by pointing out the need to target experiential avoidance patterns and weight self-stigma to promote the quality-of-life of people living with overweight and obesity.

Despite the stimulating and relevant findings, this study encloses some limitations. Firstly, the reduced sample size may compromise findings generalization. Clearly more studies with larger and heterogeneous samples (men, adolescents) are needed to corroborate the results found. Also, because there was no control group, it is not possible to unequivocally assure that treatment effects are only due to the intervention. However, the large effects found, as well as the evidence for the mediational role of the psychological processes supports the assumption that changes were likely to result from the intervention. Also, results from the previous RCT supported Kg-Free effectiveness even when compared with TAU (Palmeira et al., 2016a). Lastly, results using FFMQ-15 should be viewed with caution, especially considering its low reliability at baseline. In fact, researchers (e.g., Baer et al, 2006) already stressed the difficulties in assessing mindfulness, especially in non-meditators.

To sum up, our findings supported the effectiveness of Kg-Free in reducing weight-self-stigma, emotional eating, BMI and increasing quality-of life in women with overweight and

obesity after a 3-month follow-up. More importantly, this study unveils the psychological processes that underlie the health and eating-related outcomes. Results support and highlight the clinical relevance of promoting acceptance, mindfulness and self-compassion abilities to tackle shame, self-criticism in order to diminish emotional eating, BMI and weight self-stigma and promote quality-of-life.

Acknowledgments: The authors would like to acknowledge all participants that were brave enough to take part in the study and CHUC for approving the intervention study and providing a room for the intervention.

Declaration of Conflicting Interests: The authors declare that they have no conflicts of interest.

Funding: This research was supported by the first author´s Ph.D. Grant (SFRH/BD/84452/2012), sponsored by FCT (Portuguese Foundation for Science and Technology).

References

Adams CE and Leary MR (2007) Promoting self-compassionate attitudes toward eating among restrictive and guilty eaters. *Journal of Social and Clinical Psychology 26*:1120–1144. doi: 10.1521/jscp.2007.26.10.1120

Bacon L, Keim NL, Van Loan MD, et al. (2002) Evaluating a 'non-diet' wellness intervention for improvement of metabolic fitness, psychological well-being and eating and activity behaviors. *International Journal Obesity Related Metabolism Disorders 26*(6): 854–65.

Baer RA, Smith GT, Hopkins J, et al. (2006) Using self-report assessment methods to explore facets of mindfulness. *Assessment 13*(1): 27-45. doi: 10.1177/1073191105283504

Brion JM, Leary MR and Drabkin AS (2014) Self-compassion and reactions to serious illness: The case of HIV. *Journal of Health Psychology 19*(2): 218-229. doi: 10.1177/1359105312467391

Cappelleri JC, Bushmakin AG, Gerber RA, et al. (2009) Psychometric analysis of the Three-Factor Eating Questionnaire-R21: results from a large diverse sample of obese and non-obese participants. *International Journal of Obes*ity *33*(6): 611-20.

Castilho P, Pinto-Gouveia J and Duarte J (2015) Evaluating the Multifactor Structure of the Long and Short Versions of the Self-Compassion Scale in a Clinical Sample. *Journal of Clinical Psychology 71*(9): 856-70. doi: 10.1002/jclp.22187.

Duarte P (2016) *The Three-Factor Eating Questionnaire-R21: A Confirmatory Factor Analysis in a Portuguese sample*. Master Thesis, University of Coimbra, Portugal.

Duarte C, Pinto-Gouveia J and Ferreira C (2014) Escaping from body image shame and harsh self-criticism: exploration of underlying mechanisms of binge eating. *Eating behaviors 15*(4): 638-643. doi: 10.1016/j.eatbeh.2014.08.025

Field A (2013) *Discovering Statistics using IBM SPSS Statistics*. (4th ed.). London: SAGE.

Forman EM, Butryn ML, Juarascio AS, et al. (2013) The mind your health project: A randomized controlled trial of an innovative behavioral treatment for obesity. *Obesity 21*(6): 1119-26. doi: 10.1002/oby.20656

Forman EM and Butryn ML (2015) A new look at the science of weight control: How acceptance and commitment strategies can address the challenge of self-regulation. *Appetite 84*: *171-180*. doi: 10.1016/j.appet.2014.10.004

Forman EM, Butryn ML, Hoffman KL, et al. (2009) An open trial of an acceptance-based behavioral intervention for weight loss. *Cognitive and Behavioral Practice 16*(2): 223-235.

Forman EM, Butryn ML, Manasse SM and Bradley LE (2015) Acceptance-based behavioral treatment for weight control: A review and future directions. *Current opinion in Psychology 2*: 87-90.

Gilbert P (2010) *Compassion focused therapy: Distinctive features*. New York: Routledge/Taylor & Francis Group.

Gilbert J, Stubbs J, Gale C, et al. (2014) A qualitative study of the understanding and use of 'compassion focused coping strategies' in people who suffer from serious weight difficulties. *Journal of Compassionate Health Care 1*(9). doi: 10.1186/s40639-014-0009-5

Goss K (2011) *The compassion mind approach to beating overeating: Using Compassion Focused Therapy*. Constable London.

Goss K and Allan S (2014) The development and application of compassion-focused therapy for eating disorders (CFT-E). *British Journal of Clinical Psychology 53*(1): 62–77. doi: 10.1111/bjc.12039

Goss K, Gilbert P and Allan S (1994) An exploration of shame measures – I: The Other as Shamer Scale. Personality and Individual Differences 17(5): 713–717.

Graham CD, Gouick J, Krahé C, et al. (2016) A systematic review of the use of Acceptance and Commitment Therapy (ACT) in chronic disease and long-term conditions. *Clinical Psychology Review 46*: 46-58. doi: 10.1016/j.cpr.2016.04.009.

Gregório S, Pinto-Gouveia J, Palmeira L, et al. (in preparation) Validation of a short version of the Five Facets Mindfulness Questionnaire (FFMQ-15).

Hilbert A, Braehler E, Schmidt R, et al. (2015) Self-Compassion as a resource in the Self-Stigma Process of Overweight and Obese Individuals. *Obesity Facts 8*: 293-301. doi: 10.1159/000438681

Kristeller JL and Wolever RQ (2011) Mindfulness-based eating awareness training for treating binge eating disorder: The conceptual foundation. *Eating Disorders 19*: 49–61. doi: 10.1080/10640266.2011.533605.

Lasikiewicz N, Myrissa K, Hoyland A, et al. (2014) Psychological benefits of weight loss following behavioural and/or dietary weight loss interventions. A systematic research review. *Appetite 72*: 123-37. doi: 10.1016/ j.appet.2013.09.017.

Latner JD, Durso LE and Mond JM (2013) Health and health-related quality-of-life among treatment-seeking overweight and obese adults: associations with internalized weight bias. *Journal of Eating Disorders 1*(3). doi:10.1186/2050-2974-1-3.

Latner JD, Ebneter DS and O'Brien KS (2012) Residual obesity stigma: an experimental investigation of bias against obese and lean targets differing in weight-loss history. *Obesity 20*(10): 2035-2038. doi:10.1038/oby.2012.55.

Lillis J, Hayes SC, Bunting K, et al. (2009) Teaching acceptance and mindfulness to improve the lives of the obese: A preliminary test of a theoretical model. *Annual Behavior Medicine 37*: 58-69. doi: 10/1007/s12160-009-9083-x.

Lillis J, Luoma J, Levin M, et al. (2010) Measuring Weight Self-stigma: The Weight Self-Stigma Questionnaire. *Obesity 18*(5): 971–976. doi:10.1038/oby.2009.353.

Lillis J, Hayes SC and Levin ME (2011) Binge eating and weight control: The role of experiential avoidance. *Behavior Modification*, *35*(3): 252-64. doi: 0145445510397178.

Lilli J, Niemeier HM, Ross KM, et al. (2015) Weight loss intervention for individuals with high internal disinhibition: Design of the Acceptance Based Behavioral Intervention (ABBI) randomized controlled trial. *BMC Psychology 3*(1), 17. doi:10.1186/s40359-015-0075-2

Luoma JB and Platt MG (2015) Shame, self-criticism, self-stigma and compassion in Acceptance and Commitment Therapy. *Current opinion in Psychology 2*: 97-101

MacBeth A and Gumley A (2012) Exploring compassion: a meta-analysis of the association between self-compassion and psychopathology. *Clinical Psychology Review 32*(6): 545-552. doi: 10.1016/j.cpr.2012.06.003

McCracken LM and Gutiérrez-Martínez O (2011) Processes of change in psychological flexibility in an interdisciplinary group-based treatment for chronic pain based on Acceptance and Commitment Therapy. *Behaviour research and therapy 49*(4): 267-274.

Mannucci E, Ricca V, Barciulli E, et al. (1999) Quality-of-life and overweight: the obesity related well-being (Orwell 97) questionnaire. *Addictive Behaviors 24*(3): 345–357. doi:10.1016/S0306-4603(98)00055-0.

Matos M, Pinto-Gouveia J, and Duarte C (2016) Other as Shamer. Versão portuguesa e propriedades psicométricas de uma medida de vergonha externa [Other as Shamer: Portuguese version and psychometric properties of a measure of external shame]. *Manuscript submitted for publication*

Montoya AK and Hayes AF (2016) Two condition within-participant statistical mediation analysis: A path-analytic framework. *Psychological Methods.* Epub ahead of print 30 June. doi:10.1037/met0000086.

Murphy R, Cooper Z, Hollon SD, et al. (2009) How do psychological treatments work? Investigating mediators of change. *Behaviour research and therapy 47*(1): 1-5.

Neff KD (2003) The Development and Validation of a Scale to Measure Self-Compassion. *Self and Identity 2*: 223–250. doi: 10.1080/15298860390209035

Niemeier HM, Leahey T, Reed KP, et al. (2012) An acceptance-based behavioral intervention for weight loss: a pilot study. *Behavior Therapy 43*(2): 427–435. doi:10.1016/j.beth.2011.10.005

O'Reilly GA, Cook L, Spruijt-Metz D, et al (2014) Mindfulness-based interventions for obesity-related eating behaviours: A literature review. *Obesity Reviews 15*: 453–461. doi: 10.1111/obr.12156

Palmeira L, Cunha M and Pinto-Gouveia J (submitted-a) The weight of weight self-stigma in unhealthy eating behaviors: The mediator role of weight-related experiential avoidance. *Manuscript submitted to publication*

Palmeira L, Cunha M, Pinto-Gouveia J, et al. (2016a) New developments in the assessment of weight-related psychological inflexibility (AAQW-Revised). *Journal of Contextual Behavioral Science 5*(3): 193–200. doi: 10.1016/j.jcbs.2016.06.001

Palmeira L, Pinto-Gouveia J and Cunha M (2016b) The role of weight self-stigma on the quality of life of women with overweight and obesity: A multi-group comparison between binge eaters and non-binge eaters, *Appetite 105*(1): 782-9. doi: 10.1016/j.appet.2016.07.015.

Palmeira L, Pinto-Gouveia J and Cunha M (submitted-b) Exploring the efficacy of an acceptance, mindfulness & compassion-based group intervention for women struggling with their weight (Kg-Free): A randomized controlled trial. *Manuscript submitted to publication*

Pila E, Sabiston CM, Brunet J, et al. (2015) Do body-related shame and guilt mediate the association between weight status and self-esteem? *Journal of Health Psychology 20*(5): 659-669. doi: 10.1177/1359105315573449

Pinto-Gouveia J, Carvalho S, Palmeira L, et al. (2016) Incorporating psychoeducation, mindfulness and self-compassion in a new programme for binge eating (BEfree): Exploring processes of change. *Journal of Health Psychology 16*:1-14. doi: 10.1177/1359105316676628

Silva I, Pais- Ribeiro J and Cardoso H (2008) Contributo para a adaptação portuguesa de uma escala de avaliação da qualidade de vida específica para doentes com obesidade: a ORWELL-97. *Psicologia, Saúde & Doenças 9* (1): 29-48.

Skinta MD, Lezama M, Wells G, et al. (2015) Acceptance and Compassion-Based Group Therapy to Reduce HIV Stigma. *Cognitive and Behavioral Practice 22*: 481-490.

Tabachnick B and Fidell L (2007) *Using multivariate statistics*. New York: Pearson Education Inc.

Tapper K, Shaw C, Ilsley J, et al. (2009) Exploratory randomised controlled trial of a mindfulness-based weight loss intervention for women. *Appetite 52*: 396-404. doi: 10.1016/j.appet.2008.11.012.

Tylka TL, Annunziato RA, Burgard D, et al. (2014) The Weight-Inclusive versus Weight-Normative Approach to Health: Evaluating the Evidence for Prioritizing Well-Being over Weight Loss. *Journal of Obesity 2014*: 1-18. doi:10.1155/2014/983495

Wilson GT and Brownell KD (2002) Behavioral treatment for obesity. In: Fairburn CG and Brownell KD (eds.) *Eating Disorders and Obesity*. New York: Guilford Press.