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Petra Hanson, Emma Shuttlewood, Louise Halder, Neha Shah, FT Lam, Vinod Menon, Thomas M Barber

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Mindfulness in a tier 3 obesity service

Application of mindfulness in a tier 3 obesity service improves eating behaviour and facilitates successful weight-loss

Petra Hanson, Emma Shuttlewood, Louise Halder, Neha Shah, FT Lam, Vinod Menon, Thomas M Barber

Warwickshire Institute for the Study of Diabetes Endocrinology and Metabolism, University Hospitals Coventry and Warwickshire, Clifford Bridge Road, Coventry, CV2 2DX, UK

ORCID numbers:

0000-0002-6845-1049

Hanson

Petra

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Context: Mindfulness strategies may facilitate healthier eating behaviour but have not previously been studied in a UK-based tier 3 obesity service.

Objective: To demonstrate the clinical effectiveness of mindfulness as part of newly created group sessions within a tier 3 obesity service.

Methods: Recruitment of participants (n=53, including n=33 completers) from patients attending a tier 3-based obesity service at University Hospitals Coventry and Warwickshire (UHCW). Each participant attended 4 group sessions, at which mindfulness-based eating behaviour strategies were taught. Self-reported eating behaviour and body-weight were assessed at baseline and following completion of attendance at the group sessions. Paired-sample t-tests were performed. A p-value <0.05 was considered significant. Data are reported for the 33 completers. Weight difference was assessed in a retrospective control group of 33 patients who did not attend the group sessions but received the standard multidisciplinary input.

Results: There were statistically significant improvements (p=0.009) in self-reported eating behaviour (driven by improvements in 'fast-foodism' [p=0.031]) and reduction in body-weight (3.06kg [SD 5.2kg], p=0.002) at 6-months following completion of the group sessions. This was statistically more (p=0.036) than 6-month weight loss in control group (0.21kg). Participants reported improved self-esteem and confidence in self-management of body-weight.

Conclusion: Application of mindfulness-based eating behaviour strategies, taught at group sessions within a tier 3 obesity service, resulted in significant improvement in eating behaviour, and facilitated subsequent weight-loss over 6-months. Such a novel strategy has potential for scalability to the wider obese population.

This is the first report of application of mindfulness strategies in the context of a tier 3 obesity service in the UK, demonstrating its efficacy for positive change in eating-related behaviours.

Introduction

Mindfulness is defined as a capacity for enhanced and sustained moment-to-moment awareness of one's own mental and emotional state and being, in the context of one's own immediate environment (1). Although mindfulness forms a central tenet of the Buddhist doctrine, more recently it has become synonymous with compassion and objectiveness (1).

Mindfulness has risen to prominence within Western culture during the last 30 years, and has become adopted widely as a clinical technique, especially in the context of psychotherapy. Within the scientific literature, there are emerging data to support the clinical utility of mindfulness when used for this purpose (2), but also in many other clinical scenarios such as cardiovascular disease, chronic pain, depression, anxiety disorders and even as an adjunctive therapy for cancer management (3). Application of mindfulness in each of these clinical scenarios has been shown to improve both mental and physical functioning (3).

The global obesity epidemic is one of the most important health-related problems that we face as a species. Obesity results in numerous chronic conditions (4, 5) and also confers a substantial socio-economic burden globally. Expenditure on obesity and its numerous sequelae accounts for a substantial proportion of healthcare costs globally. Development of effective management strategies for obesity that are applicable on a population level, and which are affordable to implement are needed desperately, and should form a main priority for research. Unfortunately, effective weight-loss therapies are limited. Furthermore, although metabolic surgical techniques can result in excellent and long-term weight-loss (6), such a strategy is not applicable on a population level. Lifestyle management forms a cornerstone of weight-loss management, and generally entails dietary change and enhanced physical activity. Successful and long-term application of lifestyle strategies, however, is notoriously difficult to implement. Techniques to facilitate such application are required. Mindfulness may provide one solution.

Ultimately, obesity and its antecedent weight-gain, results from chronic and maladaptive eating-related behaviours. Such problematic behavioural traits can manifest in many different forms. These include: i) emotional eating (7); ii) 'external eating' (a tendency to overeat in response to food-related stimuli) (8, 9); iii) 'binge eating' (10); iv) reactivity to food cravings (11); v) 'restrained eating' (restricted food intake and dieting with cyclical weight-loss and weight-regain) (7, 12); vi) 'mindless eating' (13), and; vii) 'unhealthy dietary intake' (14). Although there are many potential causes of problematic eating-related behaviours, a common scenario is that food is used as a maladaptive coping strategy in response to stress, depression, or anxiety (15). Such a pattern is often instilled and entrenched during childhood (the hedonic effects of food acting as a reward and positive reinforcement) and can be heightened in response to life events. Maladaptive eating-related behaviours developed during childhood are often used as a template for similar eating-related behaviours in adulthood. These insights provide a rationale for exploring the clinical benefit of adopting a mindfulness-based technique in the management of patients with obesity.

Mindfulness has potential to modify our relationship with and reactions to personal adverse experiences, through promotion of an 'awareness and acceptance', rather than 'challenge and why me?' mental strategy (1). In this way, mindfulness can improve one's awareness of emotional and sensory cues, thereby facilitating better self-regulation of behaviour, including that related to eating (16). Mindfulness techniques enable one to step outside of one's immediate experience and in the process change the nature of that experience. Mindfulness techniques such as 'de-centering' (ability to consider multiple aspects of a situation) can also help to modulate behavioural reactivity to thought processes. These effects combined with an 'awareness and acceptance' mental strategy instilled through the mindfulness approach, reduce the likelihood of engagement in maladaptive eating-related behaviours (such as acting on food cravings) in response to both environmental and emotional cues (17).

There is some evidence to suggest that application of mindfulness techniques can modify eating-related behaviours (15, 18). However, there are very few reported studies on the application of mindfulness techniques in the obesity setting (16, 19). We present observational data following holistic group-based teaching of mindfulness techniques,

delivered within a tier 3 specialist weight-management service at University Hospitals Coventry and Warwickshire (UHCW) in the UK. Our aim was to demonstrate the clinical effectiveness of mindfulness applied within this setting, specifically regarding improvements in eating-related behaviour, relationship with food, and self-confidence in relation to weight-loss. Rather than focusing purely on change in body weight *per se*, our broader aim was to equip patients, through application of mindfulness techniques, with the necessary mental tools to facilitate a salutary change in eating-related behaviour, which over time would be expected to translate into successful weight-loss and a healthier outlook.

Methods

Participants:

We recruited participants (n=53) from those patients who were newly referred to the tier 3 weight-management service at UHCW, and who were amenable to attending group sessions and provided verbal consent. Of these, n=33 participants completed all or at least 3 out of 4 sessions (detailed below), data from whom were focused on in the analyses. The recruitment period ran from October 2016 to August 2017. Participation was entirely voluntary. Inclusion criteria included a BMI >35Kg/m², age >18 years and proficient English language skills. This was an observational study based in the clinical context of a tier 3 obesity service (Specialist Weight Assessment and Management Clinics, including specialist dietitians, doctors and psychologist) at UHCW, with no randomisation. As such, the project was registered as a 'service evaluation' with the Research, Development and Innovation Department at UHCW. All clinical investigations were conducted in accordance with the guidelines of the Declaration of Helsinki. The intervention sessions were compared to the standard of care. A control group for comparison of weight-loss was included, whereby we collected data retrospectively from 33 randomly chosen participants who had on average 6-month follow up data available. Although all the control group had undergone group sessions similar to the intervention group, importantly none of the controls had been taught any mindfulness techniques during their group sessions, and as such are representative of our 'standard care' model.

Clinical Setting:

The tier 3 specialist obesity service at UHCW is delivered by a team of specialist dietitians, psychologists and physicians. Referral criteria include a BMI>35kg/m² concomitant with weight-related co-morbidities, or a BMI>40kg/m² in the absence of such co-morbidities. Within the service, each patient is offered medical and dietetic support. Some patients subsequently undergo metabolic surgery (tier 4 weight-management) but the majority remain within the tier 3 setting. Typically, medical and dietetic appointments occur every 3-6 and 2-4 months respectively. Some patients within the tier 3 setting also undergo psychological input depending upon clinical need. In addition to individual one-to-one clinical interaction with healthcare professionals (HCPs) within the tier 3 obesity team, patients are also provided with an opportunity to attend group sessions. These sessions facilitate further contact with HCPs, provide additional educational support and offer an opportunity for patients to derive social and emotional support from other members of the group (both patients and HCPs).

The Group Sessions:

Each enrolled participant was invited to attend a series of group sessions as part of their obesity management. The group sessions (n=4) each lasted 90-minutes and were delivered fortnightly over an 8-week period. Each group consisted of between 6 and 12 patients (not all of whom were enrolled into the study). The rationale for this group size was based on optimisation of facilitated discussion and cost-effectiveness of healthcare provision. Each participant remained within the same group throughout. The participants joined a total of 8

separate groups. The group sessions were designed and delivered jointly by the dietitians and psychologist working within our tier 3 obesity service. Each participant was given an opportunity to be weighed in private by a member of the dietetic team at each group session. It should be emphasized however, that the overall aim of the group sessions (as outlined at the end of the introduction section) was not to focus on weight-loss primarily.

Each session started with an opportunity for each participant to comment on their recent progress, with primary focus on *behaviour-change* rather than weight-loss *per se*. This was followed by interactive presentations (PowerPoint and flipchart) and small- and larger-group discussions, delivered and facilitated by a member of our tier 3 obesity team (a dietician or psychologist). Each session concluded with an opportunity for each participant to comment on their experience of the session and personal aims for the following fortnight. Participants were encouraged to practice a couple of new mindfulness-based strategies between group sessions. Each session focused on lifestyle (dietary and physical activity) management of obesity, with a special emphasis on the application of mindfulness techniques to improve participant's relationship with food and eating-related behaviour. The content of each group session is summarized below:

Group session 1:

- Introduction to the overall aim of the sessions, to identify optimal methods of weight-loss and long-term weight maintenance for each participant.
- Discussion of previous weight-loss attempts to identify future successful strategies.
- Education and discussion around the complexity of weight-loss, including biological drivers for weight-regain, environmental challenges and increased activity.

Group session 2:

- Introduction to the concept of mindfulness and specifically, 'mindful-eating', with a mindful-eating exercise.
- Facilitated discussion to encourage participants to recognise key experiential differences between *mindful* and *mindless* eating behaviour, with information provided on the benefits of mindful eating.
- Facilitated discussion on enhancement of mindfulness in the context of eating.

Group session 3:

- Introduction to Compassionate Mind Therapy (which uses mindfulness within its core), and its application to eating-related behaviour.
- Opportunity to share experiences of stigma and self-critical patterns of thought, including use of 'cope' as a self-soothing strategy. This highlights the importance of awareness of self-criticism and building self-compassionate ways of coping.

Group session 4:

- Development of mindful and compassionate planning and management of relapse.
- Emphasis of relapse as a natural part of behaviour change.
- Viewing of a motivational video to support discussions around how to cope with the challenge of long-term weight maintenance, incorporating learnt mindfulness concepts discussed throughout the four group sessions.

Data collection:

The primary outcome from this study was eating-related behaviour, and how this changed for each participant following attendance at the 4 group sessions. Eating behaviour was assessed through self-completion of the 'whole person integrative eating questionnaire' (20) by each participant both at baseline (following recruitment and prior to attendance at any group session), and at 8-weeks (following completion of their attendance at all 4 group sessions).

The 'whole person integrative eating questionnaire' is a well-validated method for accurate assessment of eating-style (20). The questionnaire is based on 6 principles of healthy eating: i) eat fresh, whole foods; ii) eat with positive feelings; iii) eat with mindfulness; iv) eat with gratitude; v) eat with loving regard; and vi) eat while dining with others (20). The questionnaire was used in a previous study of >5,000 US-based subjects, analysis of data from which showed an inverse association between each of these 6 principles of healthy eating and propensity for overeating and weight-gain amongst the subjects (20). There were 7 distinct maladaptive eating-styles that emerged from this study, each of which was shown, on multivariate analysis to be significantly and independently predictive of excessive consumption of food (20). Responses were scored on a continuum from 'never, rarely, sometimes, usually, almost always and always'. The scores ranged from -175 to 205, with higher values indicating a better and healthier eating style. Body-weight was measured at baseline, during each session and at 6-months following completion of the group sessions.

Statistical analyses:

All analyses were conducted using SPSS version 24. Paired-sample student t-tests were used for comparison of data from each participant at baseline and following attendance at the group sessions. Independent sample student t-test was used to compare the control group to the intervention groups with regards to the weight-loss data. A p-value <0.05 was considered statistically significant.

Results

Of the 53 participants recruited into the study, n=33 attended all group sessions and self-completed all questionnaires. All analyses were performed on data from these 33 participants who completed the study (attended at least 3 out of 4 sessions). The majority of these 33 participants were women (n=26). The age range for the completers was 25-66 years (mean age 44.4 years [SD 11 years]). Table 1 shows the baseline characteristics of all 53 participants who entered the study, as well as the characteristics of the 33 completers and 20 non-completers. None of the participants in our study underwent bariatric surgery within the 6-months of follow-up, and whilst in this study.

There were significant differences between 33 completers (those attending 3-4 sessions) versus 20 non-completers (those attending 1-2 sessions) at baseline for weight (126.3kg vs 147.4kg, $p=0.03$ respectively), height (163.8cm vs 169.1cm respectively [$p=0.04$]) and BMI (46.5 vs 51.6 respectively [$p=0.05$]). Furthermore, completers lost significantly more weight at 6-months follow-up than non-completers. Table 1 shows the weight difference between baseline and 6-month follow-up between all 53 participants (2.3 kg, $p=0.002$), 33 completers (3.1 kg, $p=0.002$) and 20 non-completers (0.9 kg, $p=0.34$).

Eating related behaviour:

There was a statistically significant improvement of 14.3 points (4% improvement) in overall self-reported eating style ($p=0.009$) between assessments performed at baseline and following completion of attendance at the group sessions for each participant. This was driven primarily by improvements in 'fast-foodism' ($p=0.031$). Data are shown in *table 2*.

Body-weight of completers:

Mean baseline body-weight was 126.3kg (SD 36.1kg). Mean baseline BMI was 46.5 Kg/m² (SD 8 Kg/m²). There was a statistically significant reduction in body-weight (3.1kg [SD 5.2kg], $p=0.002$) between measurements taken at baseline and following completion of the group sessions at 6-months. There was no correlation between the change in eating behaviour and the magnitude of weight loss, with Pearson Correlation of 0.027 ($P=0.881$).

Within the retrospective control group, mean weight-loss was 0.21kg. Those participants who received mindfulness teaching had significantly greater weight-loss of 2.85kg than those

control participants who had no mindfulness teaching ($P=0.036$). This comparison is shown in Figure 1.

Participant feedback:

Qualitative feedback from participants following completion of attendance at the group sessions revealed enjoyment of the sessions, including social interaction with other patients (for example sharing of mindfulness-related advice or tips), and being valued and appreciated particularly. Patients also reported improved self-compassion, self-esteem, self-respect and self-value amongst the participants following completion of attendance at the group sessions. Finally, the participants improved their relationship with food, were better able to plan meals in advance, and felt more confident in self-management of weight-loss following attendance at the group sessions. Table 3 provides examples of quotes from participants who completed the mindfulness group sessions.

Discussion

We report the first study to our knowledge, to explore the effects of mindfulness techniques, taught within group sessions in the context of a tier 3-based obesity service, on eating-related behaviour and subsequent weight-loss. We demonstrate significant improvements in self-reported eating behaviour (particularly ‘fast-foodism’) and subsequent weight-loss following attendance at 4 group sessions where mindfulness techniques were taught.

Similar positive effect of mindfulness-based techniques on eating-related behaviour and body-weight have been observed in the pilot study (MEAL) undertaken in America in 2006 (16). This study had 10 participants who were followed up over 3-months. Additionally, a randomised controlled trial with 46 participants from US showed that mindfulness meditation enhanced weight-loss by 2.8kg compared to the standard weight loss program (21). A more recent meta-analysis also provides evidence to support application of mindfulness-based interventions in improving obesity-related eating behaviours and weight-reduction (22). Our own data corroborate the data from these other studies, and in addition provide proof of concept that mindfulness techniques can be implemented successfully in group-based sessions within a tier-3 obesity service.

The utility of mindfulness in the obesity context rests primarily on improved self-awareness of current emotional state and habitual food-related behaviour. A common maladaptive behaviour pattern in obesity is the misuse of unhealthy and automated eating in response to unpleasant or negative emotional cues. Adoption of mindfulness equips the patient with insight and awareness of their own emotional state, and the mental tools to avoid habitual unhealthy eating patterns, and instead adopt a healthier and more appropriate response to negative emotions. Furthermore, adoption of mindfulness can improve self-compassion (as demonstrated in our study), thereby reducing the negative impact of occasional reversions to unhealthy eating-related behaviour.

Other self-reported benefits of the group attendance included social fulfilment, and improved self-confidence of self-management of body weight. These benefits are likely to have contributed towards the facilitation of successful weight-loss following attendance at the group sessions.

The importance of social interaction in the context of obesity management should not be underestimated. This aspect of management has perhaps not been given as much attention as it deserves. In one study by Tarrant and colleagues, it was shown that the whole experiential perception of a patient attending a group session for obesity management was dependent upon their psychological connections with other members of the group (23). The shared social identity within the group was fundamentally important for successful behavioural change, and it was argued by the authors that social interaction and the establishment of a

shared social identity should be a priority in effective management of obesity (23). Although not a main focus of our study, we did however demonstrate self-reported social fulfilment in the participants of our study following attendance at the group sessions. Although it is possible that this would have occurred regardless of the content of the group work, it seems likely that at least some of the improved social benefits stemmed from instilled mindfulness within the group members. Further focused studies on the social consequences of mindfulness, and the mental, emotional and behavioural implications of such social changes are required.

Increased physical activity is an important part of any weight loss program. In our study we have not investigated the effect of mindfulness on physical activity. However, we believe that application of mindfulness techniques to improve physical activity is certainly possible. Evidence to support our hypothesis would require use of activity monitors and step-counters to demonstrate activity-related effects of mindfulness techniques, and future studies should focus on this important topic.

Our study has several limitations. As this was an observational study registered as a service evaluation, we could not include a prospective and randomized control group to compare the effect of the mindfulness-based course to standard of care, as all patients who entered the obesity service at the time of enrolment into our study were offered inclusion in the mindfulness-based group sessions. We were, however able to include a retrospective control group for comparison of weight-loss data. Unfortunately, as the timing of the data derived from this retrospective control group pre-dated the commencement of our study, it was not possible to compare changes in self-reported eating behaviours. Furthermore, as mindfulness teaching has now been incorporated into our standard group sessions within our obesity service following this study, we are not able to prospectively assess changes in eating-related behaviour following non-mindfulness-based group sessions. These factors are limitations of our study.

As the focus of our study was to explore changes in eating-related behaviour and subsequent body-weight, we did not measure mindfulness scores in the participants. Finally, in a real-world tier 3 obesity management setting, not all patients are inclined to attend group sessions, with some patients preferring one-to-one interactions with health-care professionals. There are many possible reasons for this preference. In some cases, lack of motivation for lifestyle implementation could be one contributor towards a disinclination to attend regular group sessions. It is possible that the participants who attended all their group sessions are highly-motivated patients who are therefore more likely to engage with mindfulness techniques. The adoption of mindfulness may be less successful in less motivated patients. It is interesting that there was a relatively high drop-out rate from our mindfulness group sessions. Attendance at the group sessions required a lot of commitment and motivation and not all participants could get the time off work to attend them for example. The greater baseline body weight and height for drop-outs compared with completers could be explained in part by differences in social inhibition for group attendance based on these parameters, although this is purely speculative.

To conclude, we show the first evidence for clinical benefit of adopting mindfulness strategies into group sessions within the context of a tier 3 obesity management service in the UK. This resulted in improved eating-related behaviour, social interaction and self-reported self-management of body weight. Attendance at the group sessions also facilitated longer-term weight-loss over 6-months. Following the success demonstrated by our study, the adoption of mindfulness techniques has now been fully integrated into our tier 3 obesity management pathway at UHCW, and consistently receives excellent feedback from patients who attend these group sessions.

Adoption of mindfulness techniques has potential for substantial positive impact on the patient, and their psychosocial milieu. In our study, mindfulness was taught within the context of group sessions. Alternative means of administering mindfulness (such as via on-line tools for example) in patients with obesity should be explored, given that attendance at regular group sessions is apparently not feasible or practical for a sizable minority of patients based on our data. This way, the implementation of mindfulness could be truly administered at scale on a population-level, thereby helping to fulfil one of the most important unmet needs in today's NHS and global healthcare setting: the implementation of an affordable and effective weight-loss strategy that is implementable directly to the burgeoning population with obesity. Traditional lifestyle strategies for weight-loss have focused on dietary change and physical activity. This is notoriously difficult to implement and maintain. Perhaps adoption of mindfulness techniques will provide the requisite mental and emotional tools for healthful behaviour change and enable successful implementation and maintenance of lifestyle strategies for weight-loss in the future.

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Corresponding author contact details: Petra Hanson, Clinical Sciences Research Laboratories, University Hospitals Coventry and Warwickshire, Clifford Bridge Road, Coventry, CV2 2DX, UK, *Email:* drpetrahanson@gmail.com

Conflict:

None of the authors have any conflict of interest.

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Figure 1: Weight difference in the Mindfulness group versus the Control group participants.

Table 1: Baseline characteristics of all participants (n=53), including completers and non-completers. Those who attended 1 to 2 sessions (20 participants) were classified as non-completers, those who attended 3 to 4 sessions (33 participants) were classified as completers.

	Baseline intervention group complete set	FU intervention group complete set	P-value comparison between complete set baseline vs FU	Baseline completers intervention group	FU completers intervention group	P-value comparison between completers subset baseline vs FU	Baseline non-completers intervention group	FU non-completers intervention group	P-value comparison between non-completers subset baseline vs FU	Retrospective control group baseline	Retrospective control group FU	P-value comparison between control baseline vs FU
Age	45.6 (11.3)	N/A	N/A	44.4 (11)	N/A	N/A	47.7 (11.8)	N/A	N/A	43.1	N/A	N/A
Gender	30.2	N/A	N/A	21.2	N/A	N/A	45	N/A	N/A	30	N/A	N/A

number male (proportion male) a												
BMI	48.5 (9.2)	47.06 (9.6)	0.001	46.5	45.4	0.002	51.6	51.3	0.4	45.9 (5.1)	45.7 (5)	0.7
Body weight (Kg)	134.3 (34.6)	132.1 (35.3)	0.002	126.3 (36.1)	123.3 (36.8)	0.002	147.4 (28.2)	146.5 (27.8)	0.34	129.8 (20.1)	129.6 (20.7)	0.83
Weight change a	N/A	-1.8	N/A	N/A	-2.6	N/A	N/A	-0.5	N/A	N/A	-0.1	N/A
Delta weight change (Kg)	N/A	-2.3 (4.9)	N/A	N/A	-3.1 (5.2)	N/A	N/A	-0.9 (4.1)	N/A	N/A	-0.2 (5.6)	N/A
Mindfulness eating score b	N/A	N/A	N/A	15.6	29.9	0.009	N/A	N/A	N/A	N/A	N/A	N/A ¹

¹ All data are expressed as mean (SD) unless indicated otherwise. 'a' refers to percentage, 'b' refers to the scoring based on a standard whole person integrative eating questionnaire, and a higher score indicates a more healthy and mindful eating behaviour. FU refers to follow up, BMI refers to Body Mass Index. P-value comparisons are based on a paired-sample t-test.

Table 2: Eating style Behaviours with brief description (20), scores at baseline (Before) and after (at 6-months) application of mindfulness technique for 33 completers. (More positive value indicates better eating style; P-value based on paired-sample t-test between values at baseline and at 6-months following application of group-based mindfulness techniques)

Eating style (with brief description)	Before	After	p value
Overall	15.6	29.88	0.009
Fast foodism (Consuming fast foods with limited fresh food)	5.45	8.06	0.031
Unappetizing atmosphere (Eating in unpleasant environment)	9.88	11.82	0.075
Emotional Eating (Turning to food to self-medicate for negative feelings)	-18.64	-15.73	0.12
Solo dining (Eating alone more often than not)	12.88	15.18	0.121
Food-Fretting (Dieting, self-judgement and obsessing about the best ways to eat)	-21.7	-19.21	0.135
Sensory Disregard (Eating without attention to flavours or presentation)	35.27	37.76	0.346
Task-Snacking (Eating while doing other activities)	-7.82	-8.03	0.764

Table 3: Quotes from Patients who completed the mindfulness intervention

"I think about things first and understand the implications"
"I find it very helpful in reducing my overeating"
"I would normally eat quickly, but now eating slower I find I am fuller quicker so do not need same portion sizes and eating at dinner table away from TV"
"It made me think about portion control, only eat till full, then leave food"
"food is not the enemy"
"I learnt that I am human and there can be good and bad day"
"I learnt it is ok to lapse but be positive to get back on life's journey"
"I am understanding mindful thinking and eating"
"I have never been mindful and certainly never been compassionate, I have now helped influenced others"
"it gave me more understanding of my weight loss journey and how situations can affect it"

Figure 1: Weight difference in the Mindfulness group versus the Control group participants.

