



Facultad de Estudios Superiores
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Mindfulness-based intervention for emotional regulation to reduce binge eating in a Mexican bariatric surgery sample

Intervención basada en mindfulness focalizada en la regulación emocional para reducir los atracones en una muestra mexicana candidata a cirugía bariátrica

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Abstract.

It is essential to consider eating disorders, such as binge eating disorder, before proceeding with a bariatric intervention. However, most psychological interventions focus on awareness of hunger stimuli rather than the emotion behind them. The present study explores the effectiveness of a Mindfulness-Based Cognitive Therapy (MBCT) intervention adapted to a Mexican sample and focused on emotional regulation to reduce symptoms of binge eating disorder. Six patients with obesity who were candidates for bariatric surgery participated in this study. Levels of mindfulness, emotional regulation, and weekly binge eating episodes were assessed using a multiple baseline design across participants. Results showed an increase in levels of mindfulness and emotional regulation, as well as a significant reduction in the amount of weekly binge eating, which was maintained at the 3- and 7-month post-treatment assessment. It was found that this intervention is not only effective, but also opens

space to the possibility that MBCT focused on solving the problem behind binge eating, specifically emotional regulation, can generate change in less time.

Keywords: emotional regulation, binge-eating disorder obesity, mindfulness

Resumen. Es esencial considerar los trastornos alimentarios, como el trastorno por atracón, antes de proceder con una intervención bariátrica. Sin embargo, la mayoría de las intervenciones psicológicas se centran en la conciencia de los estímulos del hambre en lugar de en la emoción detrás de ellos. El presente estudio explora la eficacia de una intervención de Terapia Cognitiva Basada en Mindfulness (MBCT) adaptada a una muestra mexicana y enfocada en la regulación emocional para reducir los síntomas del trastorno por atracón. En este estudio participaron seis pacientes con obesidad candidatas a cirugía bariátrica. Se evaluaron los niveles de atención plena, regulación emocional y episodios de atracones semanales, utilizando un diseño de línea de base múltiples entre los participantes. Los resultados mostraron un aumento en los niveles de atención plena y regulación emocional, así como una reducción significativa en la cantidad de atracones semanales, que se mantuvo en la evaluación posterior al tratamiento a los 3 y 7 meses. Se encontró que esta intervención, no sólo es efectiva, sino que también abre espacio a la posibilidad de que el MBCT enfocado a resolver el problema detrás de los atracones, específicamente la regulación emocional, pueda generar un cambio en menos tiempo.

Palabras clave: regulación emocional, trastorno por atracón, obesidad, atención plena

INTRODUCTION

The prevalence of obesity worldwide has doubled in the last three decades, reaching 16% of the adult population in 2022 (Boutari & Mantzoros, 2022). In Mexico, according to the most recent data, 36.9% of people over 20 years of age are obese, with a 21.4% increase in the prevalence of obesity between 2006 and 2022. Recent evidence suggests that this trend could continue if weight control interventions do not show consistent success (Campos-Nonato, et al., 2023; Ogden et al., 2020; Wang et al., 2020).

Treatments that have shown the most consistent achievements are surgical interventions used for weight loss called bariatric surgeries (Chang et al., 2014; Park et al., 2019). However, most cases where weight loss is achieved tend to be unsuccessful in the long-term. Individuals who lose weight typically regain half of the weight within the first year, and it is estimated that 80% of people who lose weight, return or exceed their initial weight level within three to five years (Hall & Kahan, 2018; King et al., 2020a). One of the main reasons for

weight gain after a successful reduction is the presence of eating disorders like binge eating disorder. Therefore, treatment prior to surgery is of great importance to see more consistent results in the long run (Mauro, et al., 2019; Williams et al., 2017).

Binge eating disorder (BED) is one of the most common mental health conditions among patients seeking and undergoing bariatric surgery, with prevalence rates of up to 47% (Barbuti, et al., 2022; King, et al., 2020b; Massa et al., 2023; Williams et al., 2017) with a higher prevalence observed in women compared to men (Pasquale et al., 2023; Saules & Herb, 2019). BED is characterized by recurrent and persistent episodes of impulsive factors of eating sustained by distress, without any compensatory behavior (Hudson et al., 2007). Recent research indicates that the problematic behavior exhibited by people with binge eating disorder may be due to the lack of adaptive emotional regulation strategies and skills when faced with a strong emotion (Leppanen, et al., 2022). Therefore, emotional distress should be used as a treatment modality to work with binge eating (Glisenti et al., 2018; Osoro et al., 2022).

Cognitive behavioral therapy (CBT) has been shown to be effective in reducing binge eating episodes in binge eating disorder and has become first line treatment for this disorder (Brownley et al., 2007; Linardon et al., 2018; Linardon et al., 2017; Low et al., 2021). It focuses on modifying the patterns of thinking and behavior that contribute to binge eating, achieving a significant reduction in the frequency of binge eating episodes in the short and medium term (Godfrey et al., 2015). However, the CBT may not be equally effective for all individuals, nor do they necessarily engage all of the underlying mechanisms involved (Sysko et al. 2010; Wilson et al. 2010). Other types of therapies such as mindfulness-based therapies promote greater awareness and acceptance of the underlying emotions that drive binge eating (Kristeller et al., 2014). There are different mindfulness-based interventions that have been shown to be effective in reducing binge eating disorder (Grohmann & Laws, 2021; Katterman et al., 2014; Mercado et al., 2021) such as Mindfulness Based Stress Reduction (MBSR; Kabat-Zinn, 2005), Mindfulness Based Eating Awareness Training (MB-EAT; Kristeller et al, 2013), and Mindfulness Based Cognitive Therapy (MBCT; Williams et al., 2008). Mindfulness meditation affects people's ability to regulate emotions and multiple mechanisms underlie these effects, including cultivating awareness of internal experience, disrupting highly conditioned patterns, integrating higher level processes, decreasing reactivity to stress, and enhancing a sense of control and self-acceptance (Bishop et al., 2004; Quaglia et al., 2016). Research shows that maladaptive emotional regulation strategies play a role in the onset and maintenance of binge eating episodes in binge eating disorder (Mallorquí, et al., 2018; Monell et al., 2018; Trompeter et al., 2021). Specifically, it was found in recent research that limited access to emotional regulation strategies was significantly associated with binge eating disorder in obese patients seeking bariatric surgery (Benzerouk et al., 2020). Emotional regulation is understood as the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals (Thompson, 1994).

Despite the importance of emotional regulation in the onset of binge eating, the majority of

mindfulness-based therapies focus on the development of awareness of hunger-related stimuli, generating awareness of the stimuli without reaction (O'Reilly et al., 2014) but emotional regulation is not the mediating variable for change (Mercado et al, 2021). Through this information, it can be speculated that a design of a mindfulness-based treatment modality to reduce binge eating disorder, focused on increasing emotional regulation, could generate a significant change that decreases the presence of binge eating.

Most of these interventions are long-term (8-10 weeks), which is not convenient in a hospital environment where there is a high demand for care, and resources are limited. This makes it difficult to carry out these interventions in cases of patients who are on the waiting list for bariatric surgery. Therefore, it is necessary to investigate whether it would be equally effective to use a short-term treatment. Short mindfulness-based interventions have already been reported to be effective by previous research, such as Tang et al. (2007) 5-session workout to improve attention and self-regulation. However, few studies have focused on the effects of short-term mindfulness-based interventions to improve emotional regulation in the bariatric population (Ames et al., 2022).

Furthermore, mindfulness-based treatments for binge eating are also mostly for the English-speaking population, since in Mexico it is a practice that is rarely used in the health area (Tovar & García-Campayo, 2017). In this study the intervention was adapted considering the findings of mindfulness-based approaches that are currently being implemented in Latin American populations and that have revealed a series of cultural challenges that should be taken into consideration (Olano et al., 2015; Sánchez & Moreno

, 2017; Santiago et al., 2017). Based on the narrative review by García-Campayo et al. (2017), the three main differences that need to be addressed with mindfulness teaching in Latin countries compared to countries such as the United Kingdom and the United States, are the amount of daily practice (being shorter for Latinos), the role of informal practice and interpersonal care (more important in Latino settings), and the question of potential religious influences. It is important to investigate how mindfulness can be adapted and integrated in health institutions or systems that do not yet have

any kind of approach with this practice, to account for these cultural differences.

Therefore, the purpose of this study was to find if it was possible to reduce the symptoms of binge eating disorder in patients with obesity who were candidates for a bariatric operation by increasing emotional regulation through a short mindfulness-based intervention tailored for a Mexican population.

METHOD

Design

The present study used an experimental single-case design with multiple baselines between subject (Barlow, et al., 2009), measuring variables of mindfulness, emotional regulation, and binge eating. The modality applied to this design was a combined series, in which changes in the response variable were evaluated by comparing the effects of the treatment both across different phases (intra-series) and between series of the participants (between-series).

Sample

The sample of subjects participating in the study was obtained from patients at the Obesity Clinic of the High Specialty Regional Hospital in Ciudad Victoria, Mexico. At the time of this research, the clinic had 159 registered patients since its opening in 2010 and saw around 20 patients per year. Consecutive non-probabilistic sampling was carried out with inclusion criteria

requiring patients to have obesity types 2 and 3 (BMI of 35-49.9), a diagnosis of binge eating disorder based on DSM-5 criteria, and candidacy for bariatric surgery. Exclusion criteria included any chronic disease such as malnutrition, neuropathies, liver diseases, and heart and kidney diseases.

The final sample of the study consisted of six patients; four women and two men with a mean age of 41.67 (DT=9.93) and a mean BMI of 39 (DT=0.89). The sociodemographic data of the sample are shown in table 1.

Measures

The variables that were measured in this study were mindfulness, emotional regulation, and binge eating. The instruments used were an identification card with sociodemographic data, two instruments to compare the effect between series before and after treatment of the level of mindfulness and emotional regulation levels, and two self-recording formats for evaluating intra-series effects throughout treatment of binge eating and emotional regulation variables.

Mindfulness was defined as the quality of human consciousness characterized by an increase in the capacity to attend to one's own experience intentionally and without judgment (López-Maya et al., 2015). Mindfulness levels were measured with the Mindful Attention Awareness Scale (MAAS) (Brown & Ryan, 2003), which has been widely used and validated across different populations. Moreover, it has been adapted to the Mexican population by López-Maya et al. (2015), demonstrating good reliability ($\alpha = 0.84$). The scale

Table 1. Sociodemographic data of the sample

	Sex	Age	Marital status	Scholarship	Occupation	Religion	Height (cm)	Weight (kg)	BMI
1	Female	32	Married	Graduate	Teacher	Christian	159	103	40
2	Female	41	Married	Graduate	Teacher	Catholic	167	108	38
3	Male	35	Single	Graduate	Employee	Catholic	172	116	39
4	Female	60	Married	Graduate	Housewife	Catholic	154	96	40
5	Female	38	Free Union	Graduate	Secretary	No	167	108	38
6	Male	44	Married	Graduate	Manager	Catholic	170	112	39

Note: BMI=Body Mass Index

consists of 15 items rated on a Likert scale from 1 to 6, assessing dispositional mindfulness, defined as the open, receptive awareness, and attention to what is happening in the present.

Emotional regulation was defined as the ability to monitor, evaluate, and modify emotional reactions, especially their intensity, to achieve goals. It was measured using the Spanish version of the Difficulties in Emotional Regulation Scale (DERS-E) validated by Marín et al. (2012) in a Mexican population ($\alpha = 0.85$). DERS-E assesses the ability to monitor, evaluate, and modify intense emotional states and consist of 36 items rated on a Likert scale from 1 to 5 points, so the theoretical range is between 36 (minimum score) and 180 (maximum score). It has five different subscales: Attention/Neglect, Clarity/Confusion, Acceptance/Rejection, Functioning/Interference, and Regulation/Lack of Control; and a total scale score. It is important to note that higher scores on the DERS-E indicate greater difficulties in emotional regulation. In this study, it was considered that reducing emotional dysregulation, as measured by the DERS-E, would signify an improvement in emotional regulation.

Self-records were used to measure the changes in emotional regulation throughout treatment. The instrument consisted of four columns. The first for recording the name of any intense emotion experienced during the week, the second for rating the intensity of the emotion on a scale of 1 to 10, the third for documenting the strategy used to cope with the emotion, and the fourth for rating the intensity of the emotion after employing the strategy. Weekly scores for emotional regulation were calculated by summing changes in positive and negative emotions. Positive emotions (e.g., happiness, relaxation) with increased intensity and negative emotions (e.g., sadness, anger) with decreased intensity were selected for scoring. The following formula was used to obtain a sum of the changes of positive (PE) and negative (NE) emotions: $PE = \text{“intensity of emotion after score”} - \text{“intensity of emotion score”}$. $NE = \text{“intensity of emotion score”} - \text{“intensity of emotion after score”}$. To obtain the weekly score, the sum of the PE and NE were added to create an emotional regulation score.

Binge eating episodes were defined as significant consumption of food accompanied by a sense of loss of control (American Psychiatric Association, 2014).

Episodes were measured through self-records, where the weekly binge episodes were recorded through five columns that presented each one of the symptoms corresponding to a binge episode according to the DSM-5. The participants marked the symptoms that they experienced during the episode. A binge episode was identified if three or more symptoms were experienced, including eating quickly, eating until uncomfortably full, eating large amounts when not physically hungry, eating alone due to shame, and feeling disgusted, depressed, or ashamed afterward.

Intervention program

An intervention was designed, which consisted of 3 modules each with two 1-hour sessions, with the aim of improving emotional regulation and reducing the symptoms of binge eating. The intervention was evaluated by five experts in mental health and mindfulness. The experts rated the program with a score from 1 to 5 according to their degree of agreement with the following statements in each session: the activities chosen are relevant to the dimension to be addressed in the session, the objectives are relevant to achieving the purpose during the session, the time dedicated to the activities is adequate, and the materials used are useful to facilitate understanding. After extensive evaluations, the experts rated the program with a score of over 80%. The result of the validation of the experts gave the assurance that the program was reliable and predicted high possibilities of being effective in the achievement of the objectives. The description of the intervention is presented in Table 2.

Procedure

This research project was approved by the postgraduate committee of the Unit of Social Work and Sciences for Human Development of the Autonomous University of Tamaulipas.

In the first phase, the patients who belonged to the obesity clinic and the population that met the necessary inclusion criteria for the study were contacted, selected, and invited to participate in the intervention. Then, an evaluation session was carried out with each patient where informed consent was provided, and the

Table 2. Intervention program

Module	Session	Activities	Aim	Time
Contacting with the present	Session 1: Introduction to mindfulness	Presentation	Present the treatment and generate a good therapist-patient relationship	10 min.
		Basic Concepts Explanation	Psychoeducate the patient in the basic concepts to be used during the intervention and generate motivation for practice.	5 min.
		Eating mindfully	Instruct the patient to observe what happens in their body while eating and to describe it, without judgment and focusing on the present moment.	10 min.
		The 9 attitudes of mindfulness	Explain the various components of the basic attitude in the practice of mindfulness	15 min.
		Attention to the breath meditation	Introduce breath-based meditation as a way to ground in the present moment	10 min,
		Find your place	Carry out the practice at home by choosing a place and time for it to be carried out.	5 min
	Session 2: Connecting with the body	Welcome and homework review	Recap what was reviewed the previous session, and inquire about the events of the week	5 min
		Body scan	Instruct the person to recognize and focus attention on different parts of the body	15 min
		Gratitude practice	Develop gratitude, raising awareness about the reasons why they are grateful to their body	10 min.
		Walking mindfully	Develop the ability to attend to internal and external experiences when walking	15 min.
Not reacting	Session 3: Naming my experience	Welcome and homework review	Recap what was reviewed the previous session, and inquire about the events of the week	10 min
		Describing my experience	Teach the patient to describe their experience in words, through the labels: "corporal sensations, thoughts and impulses".	20 min
		Labeling	Provide the patient with a space to perceive and label their emotions, sensations, thoughts and impulses	15 min
	Session 4: Learning to remain	Welcome and homework review	Recap what was reviewed the previous session, and inquire about the events of the week	5 min
		Explanation: How do we react to discomfort?	Make the patient aware of the tendency to seek to escape from difficult situations.	5 min
		Radical acceptance	Strengthen the patient's capacity to tolerate suffering, through a change in their attitude	10 min
	Self-Kindness meditation	Train the patient to handle difficult emotions with compassion	15 min.	
	Common mindfulness problems	Advise the patient on how to face the most common difficulties during mindfulness practice.	10 min.	
	Beware of chocolate	Describe the sensations of being around chocolate without eating it and learning to stay with it.	10 min.	

Table 2. Intervention program

Module	Session	Activities	Aim	Time
Choosing our behavior	Session 5: Mindfulness communication	Welcome and homework review	Recap what was reviewed the previous session, and inquire about the events of the week	5 min.
		Mindful communication	Make the patient aware of how present they tend to be during conversations with others	5 min.
		Mindful listening	Work on the ability to be present in conversations by listening with concentration and without interrupting for 3 minutes	15 min.
	Session 6: Developing compassion	investigating anger	Putting the patient in touch with anger and learning to restrain impulsive expression, choosing a clearer form of communication	20 min.
		Welcome and homework review	Recap what was reviewed the previous session, and inquire about the events of the week	5 min.
		Like treating a friend	Raise awareness of how much compassion they have for themselves by comparing the compassion they have for the people they love	10 min
	Compassion for yourself and others	Generate within the patient feelings of love and compassion for others	25 min.	

instruments of emotional regulation and mindfulness were applied.

In the second phase, the patient was given self-records of emotional regulation and binge eating to complete them for a week, which would become the baseline. In the third phase, the administration of the intervention was carried out, which consisted of six sessions, with one session per week. In addition, binge eating was measured after 3 and 7 months, upon finishing the intervention. The intervention was initially applied to one of the subjects and after its conclusion, the instruments of emotional regulation and mindfulness were applied again to obtain the measurements of the variables after the intervention. At the end of the process with the first subject, the intervention was administered to the second in the same way as the first and after its conclusion, the instruments were replicated in the same way until concluding with each subject.

Data analysis

For the descriptive statistics, a comparison of the mean scores obtained in the instruments pre, and post intervention were carried out. To verify significant differences in the scores of the variables, before and after

the intervention, a comparison of means was made through the Wilcoxon range test.

To assess if there was a change in the decrease in binge eating and the increase in emotional regulation throughout the treatment, Tau-U statistics was used, which measures nonoverlap between baseline and intervention phases as well as intervention phase trend (Parker et al., 2011).

Ethical Issues

This research was in accordance with the principles established in the Helsinki Declaration of the World Medical Association (WMA) (World Medical Association, 2013) and with the provisions of the General Health Law of Mexico (Title Fifth) (Ley General de Salud, 2020, Título V), as well as with the regulations of the Research Ethics Committee of the Secretary of Health of the State of Tamaulipas.

The study adhered to the Code of Ethics for Psychologists considering the relevant aspects involved in the research process. Informed consent was given, where participants gave their permission to share their records and information anonymously, respecting the confidentiality of the participants.

RESULTS

First, the results obtained in the variables that were measured between series are shown: mindfulness and emotional regulation. The variables measured within the series are presented below: emotional regulation and binge eating.

Mindfulness levels before and after treatment

When compared with the Wilcoxon test, the results obtained in the pre-intervention and post-intervention phase using the MAAS scale (Table 3), showed that there was a statistically significant difference between both phases ($z = -2.207, p < 0.05$).

This means that the increase in the mindfulness variable after the intervention was significant in the participants. Therefore, it can be understood that the intervention developed the ability to be more aware through mindfulness in all participants.

Emotional regulation before and after treatment

The change in the participants between the pre-intervention and post-intervention evaluation was statistically significant ($z = -2.207, p < 0.05$), that is, their emotional dysregulation scores decreased after the intervention. Therefore, it can be assumed that their ability to regulate improved (Table 3).

The subcategories that showed the greatest significance in the decrease after the intervention were attention / inattention ($z = -2.64, p < 0.05$) and function / interference ($z = -2.06, p < 0.05$). On the other hand, acceptance / rejection ($z = -2.02, p < 0.05$) and regulation / lack of control ($z = -2.02, p < 0.05$) also showed a significant decrease (Table 3).

While the clarity / confusion subcategory did not show a significant change, that is, it did not decrease after the intervention ($z = -1.841, p > 0.05$) (Table 3).

Binge eating episodes during treatment

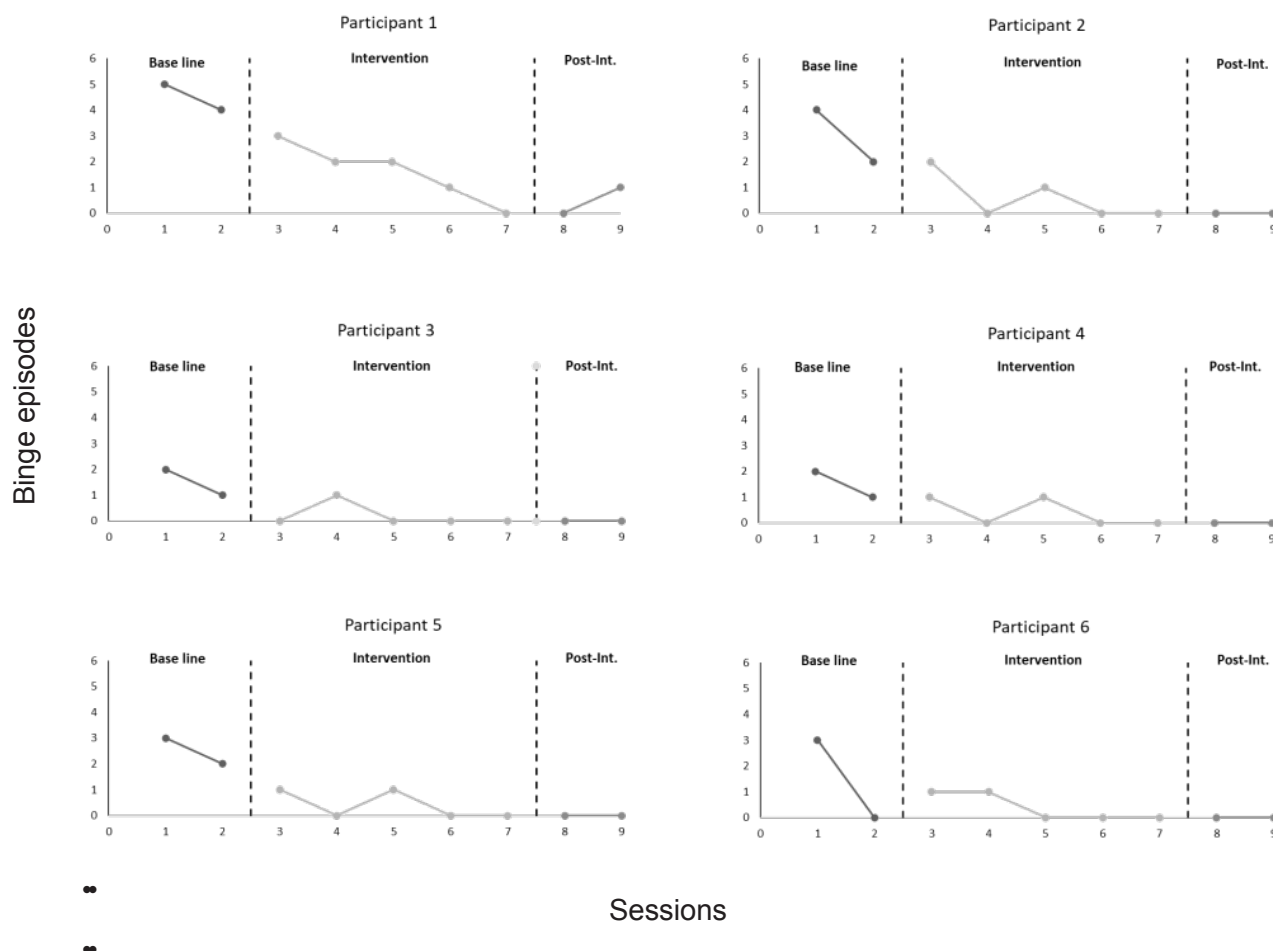
Throughout the treatment, self-records of binge eating symptoms were used to assess the weekly frequency of these episodes. Figure 1 illustrates the behavioral changes observed in each participant, where the number of weekly episodes decreased until completely disappearing in the six participants by the end of the intervention.

Similarly, the maintenance of results was observed after 3 and 7 months, with participants continuing to report zero binge eating episodes per week, except for participant 1 who presented a binge eating episode seven months after the intervention. The participants who presented more weekly binge eating prior to treatment were participant 1 with five weekly binge eating sessions, and participant 2 with four weekly binge eating sessions. On the other hand, the participants who presented lower weekly amounts of binge eating sessions before treatment were participant 3 and participant 4, who only presented two.

Table 3 . Pre and post treatment results with descriptive (M ± SD) and Wilcoxon statistics

	Pre-treatment		Post-treatment		Wilcoxon Statistics	
	Mean	SD	Mean	SD	Z	Sig.
Mindfulness	52.00	12.85	80.66	4.71	-2.207	.027
Emotional regulation	58.66	7.44	41.50	3.56	-2.207	.027
Attention / Inattention	65.83	6.64	50.00	5.47	-2.264	.024
Clarity / Confusion	52.50	16.04	41.66	8.75	-1.841	.066
Acceptance / Rejection	61.66	11.05	51.16	5.38	-2.023	.043
Function / Interference	52.50	16.04	28.33	7.52	-2.060	.039
Regulation / Lack of control	47.00	11.33	36.50	4.84	-2.023	.043

Figure 1. Binge episodes through sessions.



Additionally, employing Tau-U statistics, changes in behavior from baseline to intervention phase were evaluated for each participant, along with an examination of the collective impact of the program across all participants to assess its effectiveness. Table 4 summarizes the Tau-U values for each participant. Participant 1 exhibited a significant decrease in the number of binge eating episodes during intervention phase compared to baseline ($Tau = -1, p = 0.0528$). Similarly, participant 5 showed a significant negative association between baseline and intervention phases. Participants 2, 3, and 4 also displayed negative associations between baseline and intervention phases, although not statistically significant ($p = 0.0814$ for Participants 2 and 3; $Tau = -0.8, p = 0.1213$ for Participant 4). However, confidence intervals suggest the possibility of a negative association. In

contrast, Participant 6 showed a smaller, nonsignificant negative association ($Tau = -0.3, p = 0.5613$), indicating that the intervention may not have significantly affected their data. Overall, the results indicate varying degrees of association between baseline and intervention phases across participants, with some showing significant negative associations, others showing negative associations without statistical significance, and one participant showing no significant association.

Regarding the collective impact of the program the weighted average intervention effect, reveals a statistically significant negative association between the intervention and the outcome variable ($Tau = -0.8167, p < 0.0001$), indicating that, on average, the intervention led to a decrease in binge eating episodes compared to baseline.

Table 4. Binge Eating Self-Record: Individual Participant Comparison

Participant	Phase Contrast	TAU (Tau-U)	P Value	95% CI
1	BL Vs Int.	-1	0.0528	(-0.256, -0.151)
2	BL Vs Int.	-0.9	0.0814	(-0.156, -0.051)
3	BL Vs Int.	-0.9	0.0814	(-0.156, -0.051)
4	BL Vs Int.	-0.8	0.1213	(-0.056, 0.049)
5	BL Vs Int.	-1	0.0528	(-0.256, -0.151)
6	BL Vs Int.	-0.3	0.5613	(0.444, 0.549)

Note: The phase contrast compares baseline (BL) and intervention (Int.) phases. TAU (Tau-U) denotes the effect size of this association, where negative values signify a decrease. P values determine statistical significance, while the 95% confidence intervals offer a range for the true effect size.

Emotional regulation changes during treatment

Similarly, during the treatment, the participants maintained self-records to assess the change in emotional regulation between sessions. Figure 2 provides a visual representation of how emotional regulation scores increased throughout the sessions for the six participants.

To evaluate changes in behavior from baseline to intervention phase and examine the collective impact of the program, Tau-U statistics was used as well. Table 5 summarizes the Tau-U values for each participant. All participants (1 to 6) exhibited a positive association ($Tau = 1$) between the baseline and intervention phases, suggesting an increase in emotional regulation. However, with p-values of 0.0528, just above the conventional significance level of 0.05

Regarding the impact of the intervention on emotional regulation the weighted average intervention effect, reveals a value of 1 which indicates a positive

association between the intervention and the outcome variable, suggesting an increase compared to baseline. With a p-value of 0, the intervention effect is highly statistically significant.

DISCUSSION

The present study was designed to explore the effectiveness of a mindfulness-based intervention to increase emotional regulation and decrease episodes of binge eating disorder in patients who were candidates for bariatric surgery.

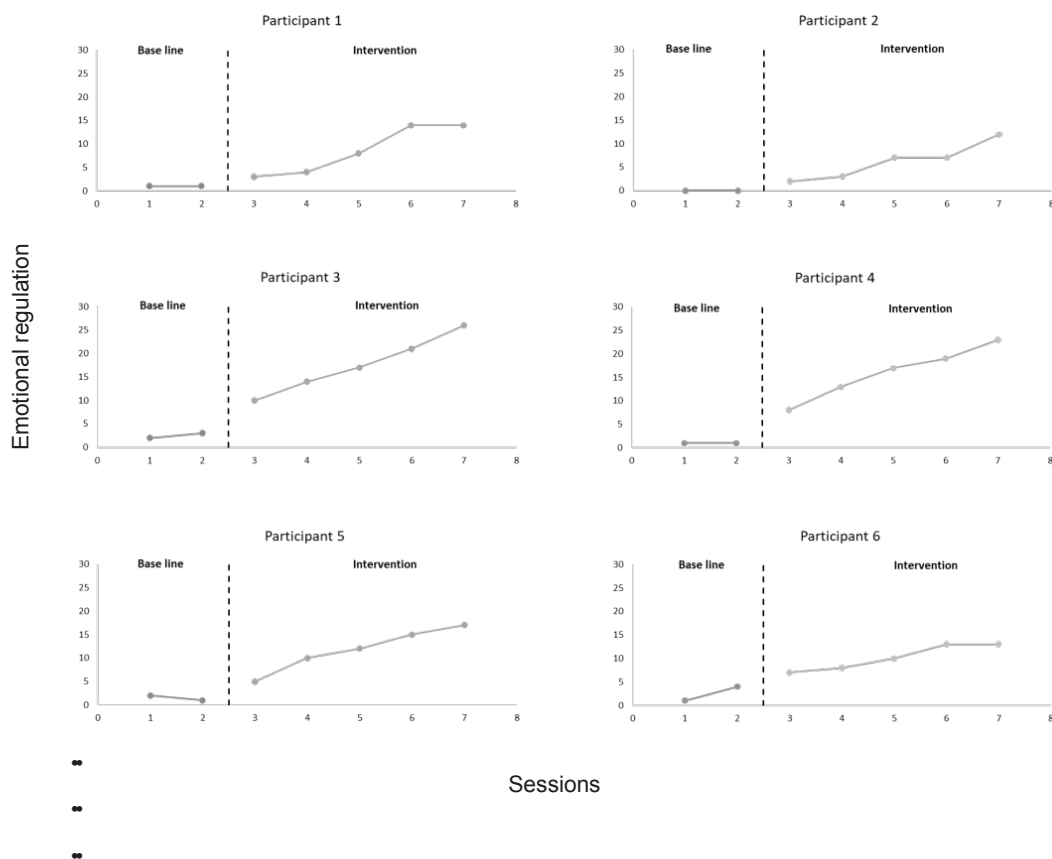
The first objective was to compare the levels of mindfulness before and after treatment to see if mindfulness skills increased after the intervention. It can be seen how in the six participants there was a significant increase after the intervention, showing that the mindfulness-based intervention had an effect on raising the levels of dispositional mindfulness, coinciding with

Table 5. Emotional regulation Self-Record: Individual Participant Comparison

Participant	Phase Contrast	TAU (Tau-U)	P Value	95% CI
1	BL Vs Int.	1	0.0528	0.256 <> 1
2	BL Vs Int.	1	0.0528	0.256 <> 1
3	BL Vs Int.	1	0.0528	0.256 <> 1
4	BL Vs Int.	1	0.0528	0.256 <> 1
5	BL Vs Int.	1	0.0528	0.256 <> 1
6	BL Vs Int.	1	0.0528	0.256 <> 1

Note: The phase contrast compares baseline (BL) and intervention (Int.) phases. TAU (Tau-U) denotes the effect size of this association, where positive values signify an increase. P values determine statistical significance, while the 95% confidence intervals offer a range for the true effect size.

Figure 2. Emotional regulation through sessions.



the findings from Quaglia et al. (2016) meta-analysis, where it is mentioned that mindfulness training affects people’s mindfulness levels even though it is assumed to be dispositional.

Patients were asked to use the techniques learned during the intervention sessions when an emotion that they classified as “strong” or “difficult” appeared. By asking participants to use mindfulness techniques when they felt some type of emotional distress, the use of adaptive responses to emotions was made instead of maladaptive ones, such as participating in binge eating. This is consistent with what O’Reilly et al. (2014) mentioned on how mindfulness training strengthens the skills for the regulation of emotions, helping reduce maladaptive behaviors that are often carried out automatically under stress.

The results of this study show that while the levels of mindfulness increased, the levels of difficulties in emotional regulation decreased in the six participants,

supporting the theory mentioned by Kristeller et al. (2013), that mindfulness-based approaches can reduce compulsive overfeeding while addressing emotional dysregulation at the same time.

Regarding emotional regulation, the six cases studied presented a significant improvement, as evidenced by both self-records and DERS total score, in which the post-treatment ranges were significantly lower than pre-treatment.

Evaluation of emotional regulation through DERS-E, showed significant changes in four of the five subcategories: attention, acceptance, functioning, and regulation. However, the clarity subcategory, which pertains to the individual’s ability to label emotions, did not show significant improvement.

Despite this, there was a notable decrease in binge eating episodes, which relates to what was previously mentioned by Smith et al. (2006) that binge-reduction was related to greater self-acceptance but not to greater

self-awareness. That being mentioned, the initial step in reducing binge eating may be based on appreciating and accepting the full range of impulses, sensations, feelings, and thoughts about eating rather than understanding the type of emotion driving these behaviors.

The results showed that the objective of the treatment, which was to reduce the number of binge episodes per week, was met. The six study participants who completed the intervention went from the presence of clinical-level binge eating symptoms (two or more weekly) to zero by the end of treatment. However, participant 6 did not exhibit a statistically significant association between the baseline and intervention phases, which can be related in some way to gender since research has suggested that women are more likely than men to engage in BE. Still, recently Pasquale et al. (2023) suggested that the gender differences in prevalence, more than reflecting lower BE among men, may be reflecting a gender bias in the current conceptualization and measurement of BE. Men regard overeating as something consistent with their gender, which complicates their ability to recognize symptoms such as loss of control eating, and consequently negates the possibility of an accurate BED diagnosis (Saules & Herb, 2019).

But even though the effect of the intervention on binge eating did not appear to be statistically significant in participant 6, in the last session and in the follow-ups, there were no binge eating episodes. Therefore, it can be concluded that the main purpose of the intervention was fulfilled, since the number of binges decreased in the six patients to whom the intervention was applied.

As a result, this study adds to the evidence, supporting the theory that mindfulness-based interventions can significantly reduce binge episodes in both genders, making this type of intervention a viable option for the effective treatment of binge eating disorder (Katterman et al., 2014; Mercado et al., 2021).

Through this study, it was demonstrated how binge eating, emotional regulation, and mindfulness changed and were able to influence each other since there was a significant increase in the levels of mindfulness and a decrease in the difficulties of emotional regulation. Consequently, a decrease in weekly binge episodes was generated, which was maintained for the following 3 and 7 months.

With what was found in the weekly records of the participants, the notion that binge eating tends to occur as a form of dysfunctional emotional regulation can also be supported (Glisenti et al., 2018), since as binge episodes decreased in the six participants, the emotional regulation points in them also increased.

These findings suggest that mindfulness can be a key component for emotional regulation and for gaining a sense of control in overeating behaviors, as overeating is the result of dysfunctional ways of relating to distress which incites binge eating (Katterman et al., 2014; O'Reilly et al., 2014).

At the same time, it should be mentioned that since participants in the intervention did not show a significant effect on binge eating, but rather a significant effect on emotional regulation, it can be shown that, as mentioned by Smith et al. (2006), a full care intervention may not have to focus solely on eating to have a significant impact on reducing binge eating. Through this study, a short mindfulness-based intervention (6-sessions) was implemented within a hospital clinic for the treatment of obesity in Mexico, adding the findings presented to the evidence of efficacy and the feasibility of short mindfulness-based treatments within health centers with a Latino population (Sánchez & Moreno, 2017; Santiago et al., 2017). This study aligns with others that demonstrate short-term mindfulness interventions are often more cost-effective and easier to implement, making them appealing to both practitioners and patients (Mercado et al., 2021). However, the reduction in binge eating symptoms achieved through these shorter programs is generally less sustained compared to longer interventions (Grohmann, & Laws, 2021). In this study, the amount of daily practice was reduced from 45 minutes to 15 and 20 minutes. Despite this reduction, several of the participants commented that they had difficulties finding time within their schedule to practice, which coincides with the results found by Olano et al. (2015), where people of Hispanic descent were less likely to participate in mindfulness practices and, therefore, to obtain the potential health benefits. Due to this, in addition to reducing practice time, participants were asked to find a time in which they had 20 minutes every day, as well as a predetermined place where they would be doing the practice. Once decided, it was shared with their family, whom patients

constantly mention, reminding them that they had to do their meditation exercises. This coincided with what was mentioned by García-Campayo et al. (2017), that the family offers an important means to face adversity related to health within the Latino population.

In the same way, to adapt to the population, informal practices were emphasized, so that in each session half of the time was dedicated to learning a new way of involving mindfulness in their daily activities and their relationships with others. The participants showed a better reception to this type of meditation since several of them commented on using it when they wanted to argue with their partner, at work with their colleagues, paying more attention, and enjoying their family more, etc. This increased focus on informal and interpersonal practice could explain why, despite spending less time practicing formal meditation, the effectiveness of training with Latino participants seems to be comparable to that observed in English speaking populations (Kabat-Zinn et al., 2016; cited in García-Campayo et al., 2017).

Finally, an attempt was made to consider the religious influences of the participants since four of them identified themselves as Catholic, one of them as Christian and one did not have any religious affiliation. There were no major difficulties due to religion, which may be mainly due to the fact that they had no prior knowledge of what mindfulness practice was prior to the first approach they were given in the first session of the intervention. Therefore, they did not approach the practice with a religious connotation, and it was presented more as “attention exercises dedicated to working care in a compassionate and non-judgmental way.” The participant who identified as a Christian was more reluctant to hear the term meditation, but when it was explained that they were a type of attention and concentration exercises, they decided to participate. This aligns with concerns among some Christians that these practices might conflict with their own traditions (Timbers & Hollenberger, 2022). Consequently, efforts have been made to adapt mindfulness to fit within the Christian tradition (Knabb & Vazquez, 2018). However, in this study, it was only enough to make a brief mention. One of the main limitations is the small sample size, consisting of only six patients, and the use of a single-case experimental design with multiple baselines

across participants. This is also a heterogeneous sample composed of patients with different ages, genders, and marital statuses, which may influence the response to the MBCT intervention. Although this approach provides valuable information about the intervention's effectiveness for the individuals studied, it limits the generalizability of the findings to a broader population. Future studies should include larger and more homogeneous sample sizes and employ controlled and randomized experimental designs. This approach would yield more robust and generalizable results, offering a broader understanding of the effectiveness of MBCT in emotional regulation and the reduction of binge eating disorder symptoms across different samples.

Other limitation of the present study include the difficulty of being able to keep a follow-up of the participants after the bariatric intervention due to the temporary closure of the obesity clinic where they were given care. Moreover, the fact that the participants in this study were patients who at some time had stopped attending the clinic and recently showed interest in returning, characterized the population with a history of little adherence to treatment.

CONCLUSION

The study demonstrated the effectiveness of a Mindfulness-Based Therapy (MBT) intervention adapted to a Mexican sample of obese patients who were candidates for bariatric surgery, focusing on emotional regulation to reduce binge eating episodes. The results showed a significant increase in levels of mindfulness and emotional regulation, as well as a notable reduction in the number of weekly binge eating episodes, which was maintained at the 3- and 7-month follow-up assessments.

Despite limitations such as the small sample size and single-case experimental design, the findings suggest that MBCT can be an effective tool for addressing the emotional issues underlying binge eating in a relatively short time. These results underscore the importance of considering approaches focused on emotional regulation rather than just awareness of hunger stimuli, offering a promising alternative for improving outcomes in patients with binge eating disorder and obesity.

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