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Meditation, Stress, Eating Behavior and Obesity: A Literature Review

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Resumo: Chronic stress may change eating behavior and thus play a role in the development of obesity. Recent research targeting obesity prevention has evaluated meditation as a resource forregulating emotion. In this literature review, 20 studies conducted in the last decade, concerning the topics of overweight and obese population that used different types of meditation were examined. These articles were focused on changes in weight, eating behavior and psychologicalfactors. The results showed that meditation reduced stress and promoted positive changes in eating behavior that help the individual to lose weight. However, the body of evidence as regards the effect on weight are still not conclusive and further research is necessary.

Keywords: Eating Behavior. HPA axis. Stress. Meditation. Obesity.

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Meditação, Estresse, Comportamento Alimentar e Obesidade: Uma revisão da literatura

Resumo: O estresse crônico pode alterar o comportamento alimentar e, assim, desempenhar um papel no desenvolvimento da obesidade. Pesquisas recentes voltadas para a prevenção da obesidade avaliaram a meditação como um recurso para regular a emoção. Nesta revisão de literatura, foram examinados 20 estudos realizados na última década, sobre os temas da população com sobrepeso e obesidade que utilizaram diferentes tipos de meditação. Esses artigos foram focados em mudanças de peso, comportamento alimentar e fatores psicológicos. Os resultados mostraram que a meditação reduziu o estresse e promoveu mudanças positivas no comportamento alimentar que ajudam o indivíduo a perder peso. No entanto, o corpo de evidências em relação ao efeito sobre o peso ainda não é conclusivo e mais pesquisas são necessárias.

Palavras-chave: Comportamento Alimentar. eixo HPA. Estresse. Meditação. Obesidade.

Introduction

The World Health Organization has estimated that 1.9 billion adults worldwide were overweight, and that of these over 650 million were obese (WHO, 2015) By 2016, 39% of the world's adult population were overweight and 13% were obese (WHO, 2015) The problem that had previously existed in countries with high income, has increased progressively in countries with low and medium incomes, especially in urban areas (WHO, 2015).

The health consequences of excessive weight gain include increased risk for numerous diseases that could raise mortality (WILBORN et al., 2005) and produce a series of psychosocial effects that result in reducing the quality of life (SIKORSKI et al., 2011).

Obesity is a chronic disease with a complex etiopathogenesis that includes several interacting factors such as genetics, metabolism, environment, sociocultural aspects, and individual eating behavior (RENNER et al., 2012) Although modest weight loss generally improves metabolic risk factors, maintaining lost weight continues to be one of the biggest challenges of weight loss programs. In 2007, a systematic review found that half of the weight lost was recovered after 4 years (FRANZ et al., 2007) However, in 2014, another systematic review found that strategies such as reduction in energy and fat intake, increase in dietary fiber, physical practices and behavioral techniques produced a positive effect on long-term weight maintenance in adults (RAMAGE et al., 2014).

One of the factors capable of contributing to weight gain is chronic psychological stress. Studies have shown that people under chronic stress could change food choices and resort to sweets, fatty foods, sugary drinks and alcoholic beverages as a way to assuage negative moods and worries, which may hamper loss or maintenance of body weight (DALLMAN, 2010; OZIER et al., 2008; PAGOTO et al., 2009; RUTTERS et al., 2009).

The failures observed in the standard treatment for obesity combined with the challenges of non-adherence and the high rate of weight regain are factors that aggravate this significant public health problem (BAUTISTA-CASTAÑO et al., 2004) Therefore, new approaches to its treatment and prevention need to be sought

(SOJCHER; GOULD FOGERITE; PERLMAN, 2012). Scientific evidence has encouraged a shift to more integrated forms of treatment and the practice of meditation has not only be shown to be useful resource when associated with conventional medical treatments, but has also shown proven health benefits (SAMPAIO; LIMA; LADEIA, 2017).

However, conducting research about meditation targeting obesity treatment has started only recently. Thus, there are few studies, some of which have methodological issues, and both the types of meditation and populations analyzed have been heterogeneous across studies. These obstacles have limited comparisons between results, making it difficult to draw conclusions about the effectiveness of meditation for obesity treatment.

Therefore, we opted to write a literature review to discuss the connection between stress, eating behavior and obesity based on consistent scientific researches that have explored the role of meditation as a way to provide patients with support in the treatment of obesity. We included 20 studies conducted in the last decade, which had the aim of studying overweight and obese population that used different types of meditation techniques.

Stress and eating behavior

The word stress refers to a series of processes that involve the perception, assessment, and response to harmful events or stimuli. These stressors may be of a physical nature or those that arise from states of the mind (FINK, 2009).

The adaptive physiological responses to stress are mediated by two main, interactive pathways, with complementary actions throughout the organism. The first is the autonomic nervous system that responds by activating the sympathetic pathway, thereby releasing adrenaline and noradrenaline and preparing the body for the most immediate response to the stressor agent. The second is the hypothalamic-pituitary-adrenal axis (HPA axis), a neuroendocrine pathway that increases adrenal secretion of cortisol when activated.

Sympathetic activation related to acute stress and cortisol release leads to physiological and behavioral changes that prepare the body for the fight or flight

responses to the stressor and inhibit other activities that require energy expenditure. Thus, in the face of acute stress, the body responds by suppressing appetite and food intake (TORRES; NOWSON, 2007). Once the stressor has ceased, stress responses are inhibited by the negative feedback mechanism, and excess cortisol (adrenals) inhibits the secretion of the adrenocorticotrophic hormone (pituitary) and corticotrophin releasing hormone (hypothalamus), thereby normalizing the function of the HPA axis.

However, when the stressful situation is prolonged and intense, a persistent deregulation of homeostasis may occur, leading to the deterioration of the body (allostatic load). One of the homeostatic conditions that is impaired is eating behavior. Recent studies have indicated that the hypothalamus is a key region in the regulation of food intake and energy balance. The chronic activation of the HPA axis deregulates its functioning, which increases levels of circulating cortisol in the blood. Cortisol favors the deposition of central, visceral fat and influences hormones related to appetite, by decreasing leptin (satiety) and increasing ghrelin (hunger), which can induce an increase in appetite and intake of palatable foods (DALLMAN, 2010).

Activation of the HPA axis, coupled with a highly palatable food diet, has been associated with increases in overall adiposity and a tendency towards visceral fat accumulation (ROSQVIST et al., 2014). The accumulation of visceral fat is a strong predictor of various complications of obesity, including insulin resistance and the metabolic syndrome (TCHERNOF; DESPRÉS, 2013). Aligned with the link between stress and obesity, the study by Sinha and Jasttreboff (2013) found that people who reported a larger number of stressful events had a higher body mass index (BMI) (SINHA; JASTREBOFF, 2013).

Studies in both animals and humans have found that stress changes the eating behavior, resulting in a significant rise in the intake of foods rich in sugar and fat, and eventually in weight

gain. The results of these studies have strongly suggested that ingestion of these high palatable foods, known as comfort food, functions as a form of comfort and self-medication to relieve the symptoms of stress. For example, Maniam and Morris (2010) observed that increased anxiety and hyperactivity of the HPA axis that have been induced by an early error in life, was reduced in rats fed with a highly palatable diet when compared with those fed with animal feed (MANIAM; MORRIS, 2010)

Similarly, Pecoraro et al (2004) identified that stressed rats had a diminished HPA axis response after 5 consecutive days of free access to sucrose and lard. Studies with human found similar results (PECORARO et al., 2004). Wardle et al. (2000) showed that individuals ate more sugar and fats during periods of higher workload. (WARDLE et al., 2000). Tomiyama et al. (2011), in a study with women, found significant associations between higher BMI, greater waist circumference, and increased comfort food intake with decreased response to stress (TOMIYAMA; DALLMAN; EPEL, 2011). In addition, Ulrich-Lai (2015) demonstrated that the ingestion of palatable foods was associated with improved mood, decreased perceived stress and reduced plasma cortisol concentration, particularly in people with elevated propensity to stress (ULRICH-LAI et al., 2015)

Understanding of this eating behavior is based on the existence of brain pathways involving learning and the memory of reward and pleasure. Moreover, habit formation and decreased cognitive control are involved (DALLMAN, 2010). Thus, at present the understanding is that stress seems to lead to eating behavior with a trend towards the strong hedonic component of palatable foods, as a way to stifle HPA axis activity.

The exceptionally high level of stress prevalent in modern society affects peoples' eating behavior and may be a factor contributing to the trend towards increasing obesity worldwide (ADAM; EPEL, 2007; OZIER et al., 2008). Although 20% of people do not change their eating behavior during periods of stress, the majority do; approximately 40% or more increase, and 40% or less decrease caloric intake under stress (DALLMAN, 2010). Based on the literature, Epel et al. (2001) found that women, to a larger extent than men, appear to be more likely to consume high-fat or sweet foods induced by stress and negative affect, which may contribute to weight gain (EPEL et al., 2001). Corroborating this result, a systematic review examining the relationship between stress and obesity reported that positive associations between stress and body weight were more frequently identified in women.(MOORE; CUNNINGHAM, 2012) However, the possibility of specific effects determined by sex needs to be further investigated.

Meditation practice

Meditation is an active mental training that has been used for millennia by diverse traditions of secular, spiritual and religious teachings, with the aim of developing of consciousness and integral health. This promotes a link between body, mind and spirit. The word meditation in Latin is meditare, which means going to the center, turning your attention to yourself, by disconnecting yourself from the outside world (DANUCALOV; SIMÕES, 2006a) It covers a wide variety of activities that seek to expand and enhance the range of the mind and its possible functioning, almost always produced by forms of sensory-motor discipline. These forms include postures such as sitting quietly, relaxing, closing eyes, consciously breathing and adopting an object of consciousness (JOHNSON, 1995). Cardoso et al. (2004) developed an operational definition for the term, specifying it as being a procedure that uses some specific technique (clearly defined) involving an altered state of consciousness, with muscle relaxation at some point in the process and logic relaxation. It is a state that is necessarily self-induced, using a “self-focus” skill (known as an "anchor") and valuing self- perception (CARDOSO et al., 2004).

There are various practices that teach the art of meditation. They can either be linked to a religious tradition or seek a connection with spirituality without any religious connotation, or even be a purely mental training unrelated to any spiritual proposal (MENEZES; DELL’AGLIO; BIZARRO, 2012). The point all of them have in common is the withdrawal of attention from the outside world and the mind focusing on a theme that varies depending on the methodology chosen. The key feature of all practices is attention control (SERVAN- SCHREIBER, 2008a). According to Levine et al. (2017), the best-known meditation practices are: Samatha, Vipassana, Mindfulness, Zen, Raja Yoga, Loving-kindness, Transcendental and Relaxation Response (LEVINE et al., 2017). However, it is important to add that there are still a vast number of meditative practices, such as those used by Osho and known as cathartic meditations, or Christian meditations such as those developed by Saint Ignatius of Loyola (DANUCALOV; SIMÕES, 2006b), and meditative practices of Healing developed by Robert Moore (TAMAS, 2013) Each of these different practices provides the possibility of entering

into a state of inner coherence that facilitates the integration of various biological rhythms and body balance functions (SERVAN-SCHREIBER, 2008b).

Contemporary studies have shown that this practice promotes changes in physiology by increasing the response of the parasympathetic nervous system, and consequently promoting a decrease in the stress response. Furthermore, it changes the functioning of the brain and mind, improving cognitive capacity, allowing greater emotional control and increasing well- being (HÖLZEL et al., 2011; LAZAR et al., 2005).

Numerous studies have demonstrated that the practice of meditation helps to strengthen the body's defense system, and to control insomnia, depression, phobias and various psychosomatic diseases by improving emotional condition. Moreover, it dramatically reduces tension, stress and anxiety; postpones aging of the cells by reducing inflammatory processes; regulates blood pressure and increases cardiovascular efficiency; improves concentration, thinking, memory and creativity; and promotes self-knowledge and spiritual growth (SAMPAIO; LIMA; LADEIA, 2017).

In 2014, Goyal et al. conducted a meta-analysis that examined the effectiveness of meditation programs for reducing psychological stress and inducing well-being. The results showed that meditation was capable of reducing the multiple negative dimensions of psychological stress (GOYAL et al., 2014).

Accordingly, meditation could be a useful tool for the treatment of obesity by helping the individual to regulate anxiety, decrease stress and promote greater self-control and well- being.

Studies about meditation and obesity

In the search for integrative approaches during the last decade, several studies have evaluated the effect of meditation on obesity control. There are significant differences in various meditative techniques and the majority of studies conducted to date have primarily been with the use of Mindfulness Meditation. We will briefly describe the 20 selected studies. Table 1 shows details of the characteristics of each study in order to demonstrate the effects of meditation on weight, eating behavior and associated factors.

Table 1. Evidence summary for the effects of meditation on weight, eating behavior and associated factors.

Author/ year	Type of study	Population	*N*	Type of intervention	Type of control	Duration	Outcomes analyzed	Instruments forevaluating outcome
Alberts 2010	Open-label randomized controlled study	Overweight and obese adults	19	Mindfulness Meditation + standard program (dietary group treatment)	Active (standard program)	Standard program: 90min/week of meeting + 60min/week of physical exercise 10 weeks Intervention group: standard + 7 weeks of manual training	Weight (*N*) Food craving (⇓)	*General Food Cravings Questionnaire Trait* (G-FCQ-T)
Alberts 2012	Open-label randomized controlled study	Women with problematic eating behavior	26	Mindfulness-based eating Meditation	Passive	2.5h/week 8 weeks	Weight (*N*) Food cravings (⇓) Emotional eating (⇓) External eating (⇓)	*General Food Cravings Questionnaire Trait* (C-FCQ-T) *Dutch Eating Behaviour Questionnaire* (DEBQ)
Alert 2013	Open-label uncontrolled study	Overweight and obese employees	31	Relaxation Response Meditation	-	3h/week 20 weeks	Weight (⇓) Hip circumference (⇓) Triglyceride levels (⇓) Perceived self-efficacy (⇑) Health-promoting behaviors (⇑)	*Eating Inventory* (EI) *General Self-Efficacy Scale* (GSE) *Impact of Weight on Quality Of Life-Lite* (IWQOL-Lite) *Health-Promoting Lifestyle Profile II* (HPLP-II)
Chacko 2016	Open-label randomized controlled study	Bariatric patients 1-5 years post-surgery	18	Mindfulness Meditation	Active (1 individual session with a dietitian)	90min/week for 10 weeks + 4h of extended silent meditation practice	Weight (*N*) Emotional eating (⇓) HbA1C (⇓)	*Three-Factor Eating Questionnaire Revised-18* (TFEQ-R18)
Chung 2016	Open-label uncontrolled study	African American women following chemotherapy for breast cancer with BMI > 25	26	Mindfulness-based eating Meditation	-	Intervention: 4x/week 12 weeks Follow-up (telephone): 2x/week 12 weeks	Weight (⇓) Mindful eating (⇑)	*Mindful Eating Questionnaire* (MEQ)
Corsica 2014	Open-label randomized controlled study	Overweight adults	53	1)Mindfulness-based stress reduction + cognitive behavioral stress eating intervention	2)Mindfulness-based stress reduction only 3)Behavioral stress eating intervention only	50 min/week for groups 2 and 3 and 80 min/week for group 1 6 weeks	Weight (*N*) Perceived-stress (*N*) Stress eating (*N*)	*Perceived Stress Scale* (PSS-10) *Eating and Appraisal Due to Emotions and Stress Questionnaire* (EADES)

Christaki 2013	Open-label randomized controlled study	Overweight and obese women who started a weight loss program	34	Relaxation Response Meditation (Stress management training) + weight-loss regime	Active (weight-loss regime)	40min/sessions 3 sessions	Weight (⇓) Restrained eating behaviour (⇑) Perceived stress level (*N*)	*Dutch Eating Behaviour Questionnaire* (DEBQ) *Perceived Stress Scale* (PSS-10)
Dalen 2010	Open-label uncontrolled study	Obese patients recruited from a local gym	10	Mindfulness Meditation	-	2h/week 6 weeks	Weight (⇓) Binge eating (⇓) Depression (⇓) Perceived stress (⇓) Physical	*Binge Eating Scale* (BES) *Three-Factor Eating Questionnaire* (TFEQ) *Beck Depression*
Daubenmier 2011	Open-label randomized controlled study	Overweight and obese women	47	Mindfulness Meditation	Passive	2.5h/week for 9 weeks + 7h of silence retreat	Weight (*N*) Cortisol awakening response (*N*) Abdominal fat (*N*) Mindfulness (⇑) Anxiety (⇓) Perceived stress (N) External eating (⇑)	*Kentucky Inventory of Mindfulness Skills* (KIMS) *State-Trait Anxiety Scale* *Perceived Stress Scale*
Daubenmier 2016	Open-label randomized controlled study	Obese adults	194	Mindfulness Meditation + standard treatment (diet-exercise intervention)	Active (standard treatment)	Both groups: 16 sessions of 2-2.5h (12 weekly, 3 biweekly, 1 monthly) 1 all-day session (5h to control group and 6.5h to intervention group)	Weight (*N*) Glucose levels (⇓) Waist circumference (*N*) Blood pressure (*N*) C-reactive protein (*N*)	-
Djuric 2009	Open-label randomized controlled study	African American women survivors of breast cancer with BMI 30-45	31	Daily meditation + standard program (dietitian-led counseling by telephone and free Weight Watchers coupons)	Active (standard program)	6 months of standard program to all 12 months of spiritual counseling + standard program to intervention group or only standard program to controls	Weight (*N*) Physical activity (*N*) Dietary intake (*N*)	*Block'98 Food Frequency Questionnaire* *Stanford 7-day recall*
Katzer 2008	Open-label randomized controlled study	Overweight and obese women with at least one other cardiovascular risk factor	225	1) Group program based on Relaxation Response Meditation	2) Group program based on healthy eating and physical activity 3) Mail-delivered version of group 2	Weekly 2-hour session for 10 weeks followed by fortnightly sessions and then monthly for another 8 months	Weight (*N*) Number of medical symptoms experienced (⇓) Stress management (⇑)	*Revised Symptom Checklist* (SCL-90-R) *Global Severity Index (GSI)* *Health-Promoting Lifestyle Profile*
Kearney 2012	Open-label uncontrolled study	Veterans with chronic health conditions	48	Mindfulness-based stress reduction	-	2.5h/week 8 weeks + 1 extra session	Emotional eating (*N*) Uncontrolled	*Questionnaire Three-Factor Eating Questionnaire*

				Meditation		on the weekend (7h)	eating (*N*) Food intake (*N*)	*Food Frequency Questionnaire* (FFQ)
Mantzios 2014	Open-label randomized controlled study	University students who aimed to lose weight	170	Mindfulness Meditation in group	Active (individual meditation)	1 session/day 6 weeks	Weight* (⇓) Mindfulness (*N*) *possible bias due to non-adherence	*Cognitive-Behavioral Avoidance Scale* *Barrat Impulsivity Scale* (BIS-11) *Mindful Attention and Awareness Scale*
Mason 2016	Open-label randomized controlled study	Obese adults	194	Mindfulness-based eating Meditation + standard program (diet and exercise intervention)	Active (standard program)	16 sessions of 2-2.5h (12 weekly, 3 biweekly, 1 monthly) 1 all-day session (5h to control group and 6.5h to intervention group)	Weight (*N*) Reward-based eating (⇓) Perceived Stress (N)	*Reward-based Eating Drive scale* (RED) *Perceived Stress Scale* (PSS-10)
Mason 2016	Open-label randomized controlled study	Obese adults	194	Mindfulness-based eating Meditation + standard intervention (diet and exercise intervention)	Active (standard intervention)	Both groups: 16 sessions of 2-2.5h (12 weekly, 3 biweekly, 1 monthly) + 1 all-day session (5h to control group and 6.5h to intervention group)	Weight (*N*) Sweet consumption (*N*) Fasting glucose levels (*N*)	*Block Food Frequency Questionnaire* (FFQ)
Sampaio 2016	Randomized controlled study – evaluator blinded	Obese adults in a weight loss maintenance program	41	Healing Meditation + standard program (weight maintenance regime)	Active (standard program)	1h/week 8 weeks	Anxiety (⇓)	*Hamilton Anxiety Scale* (HAM-A)
Spadaro 2018	Open-label randomized controlled study	Adults with BMI between 25 and <40	46	Mindfulness Meditation + behavioral weight loss program	Active (behavioral weight loss program)	Control group: 30 min/week 6 months Intervention group: 60 min/week 6 months	Weight (⇓) Weight loss eating behaviors (⇑)-+	*Block Food Frequency Questionnaire* (FFQ) *Eating Behavior Inventory* (EBI) *Eating Inventory* (EI)
Tapper 2009	Randomized controlled study – evaluator blinded	Women with BMI over 20 actively attempting to lose weight	62	Mindfulness Meditation-based weight loss	Passive	2h/week 4 weeks	Physical activity (⇑)BMI (*N*) Mental health difficulties (*N*)Eating Beahviour (N)	*Brief Physical Assessment Tool* (BPAT) *General Health Questionnaire-12* (GHQ-12)
Timmerman 2012	Open-label randomized controlled study	Perimenopausal women who eat out at least 3 times per week	35	Mindfulness-based eating Meditation	Passive	2h/week 6 weeks	Weight (⇓) Waist circumference (*N*) Self-reported daily caloric and fat intake (⇓) Barriers to weight	24-hour dietary recalls *Barriers to Weight Management in Restaurant Eating* (BarriersRE)

management when eating out (⇓)

*(*N*) without alteration, (□) increase, (□) reduction

Some studies found a positive effect on weight loss and associated factors. In a RCT, Tapper et al. (2009) explored the effectiveness of a Mindfulness Meditation intervention for weight loss in women (BMI 22.5-52.1). The Intervention Group lost 2.3 kg more than the Control Group at 6 months and showed an increase in physical activity in 3.1 sessions per week (TAPPER et al., 2009). Using the same meditation technique, Dalen et al. (2010) showed significant changes in weight (mean reduction of 4 kg) and a significant reduction in anxiety during the treatment (DALEN et al., 2010). Timmerman et al. (2012) conducted a RCT to evaluate the effect of a 6-week Mindfulness Meditation Intervention. The Meditation Group had significant weight loss (p =0.03) and showed an increase in food-related self-control (p=0.02) (TIMMERMAN; BROWN, 2012). Furthermore, Mantzios and Giannou (2014) showed the impact of individual Mindfulness Meditation on weight loss (MANTZIOS; GIANNOU, 2014), this effect of Mindfulness Meditation was also be observed by Spadaro et al. (2018). The Meditation Group lost an average of 2.8 kg more than the Control Group, in addition to showing improvement in eating behavior (p=0.02) (SPADARO et al., 2018). To the contrary, Alberts et al. (2010) conducted a RCT with obese and overweight adults with the same meditation intervention in a 10-week program. The final result showed no difference in weight reduction between the Groups, but a significant reduction in the level of food craving in the Intervention Group (ALBERTS, HUGO J.E.M. et al., 2010). Similarly, Mason et al. (2016) conducted a RCT, once again using Mindfulness Meditation. They found no differences in weight loss between the Groups, but the Meditation Group showed a significant improvement in eating per reward, a factor directly associated with weight loss (MASON; EPEL; ASCHBACHER; et al., 2016).

Another interesting study to note was that of Chung et al. (2016) who analyzed a 12- week program with Mindfulness Meditation associated with weight loss in a pilot study, in African American women (mean BMI = 35.13 kg/m2) who had undergone

chemotherapy for breast cancer. They observed a reduction of 0.91 kg and an improvement in conscious eating at the end of 12 weeks (CHUNG et al., 2016).

In the Relaxation Response Meditation, the results were also noteworthy. Alert et al. (2013) observed that immediately after this meditation intervention there was a significant reduction in weight (mean 4.3kg, 95% CI 2.8 - 5.8kg), which was maintained after 6 months of follow-up (ALERT et al., 2013) With the same meditation technique, Christaki et al. (2013) conducted a RCT and showed that the Meditation Group had greater weight reduction and more extensive dietary restriction than the control group (CHRISTAKI et al., 2013)

Some studies found no direct effect on weight loss, but showed positive results relative to important factors for long-term weight maintenance such us emotional stress. Katzer et al. (2008) conducted a 10-week RCT with overweight or obese women who had at least one cardiovascular risk factor. The Group that meditated showed reduced psychological stress and medical symptoms, even after one year. In addition, the Meditation Group showed a significant improvement in stress management (KATZER et al., 2008). Djuric et al. (2009) assessed the impact on maintaining weight loss by spiritual counseling based on Daily Meditation associated with a one-year weight loss program. Although the results showed no differences in weight maintenance between the groups, there was a significant improvement in the measures of well- being in the Intervention Group (DJURIC et al., 2009).

Daubenmier et al. (2011) explored the effects of a Mindfulness Meditation intervention on abdominal adiposity among overweight and obese women. The intervention was not

effective in reducing abdominal adiposity or improving fat distribution in all participants. However, a subgroup analysis of those women who increased self-awareness, showed significant improvements such as decreased chronic stress, morning cortisol, anxiety and food intake due to a disturbed emotional state (DAUBENMIER et al., 2011) Alberts et al. (2012) investigated the impact of an 8-week Mindfulness Meditation program, and showed a significant reduction in emotional eating and food craving (ALBERTS, H. J.E.M.; THEWISSEN; RAES, 2012)

Corsica et al. (2014) randomized overweight individuals in a Mindfulness-based stress reduction meditation program, in order to apply a cognitive behavioral

intervention for stress- induced eating or to apply a combination of the two strategies. Although the three interventions significantly reduced stress (p =0.002) and stress-induced eating (p <0.001), there was no significant effect on weight (CORSICA et al., 2014).

Sampaio et al. (2016) conducted a RCT to investigate the effect of an 8-weeks program with Healing Meditation on the anxiety of individuals undergoing weight maintenance. Their results showed a significant reduction in anxiety in the Meditation Group (49.7%) (SAMPAIO; LIMA; LADEIA, 2016).

Apart from the effect on an emotional state, meditation can also change metabolic parameters. In the Chacko et al. (2016) study the subjects were allocated into two groups, a 10-week Mindfulness Meditation intervention to avoid weight regain or standard treatment for weight control. The Intervention Group had a significant reduction in emotional eating and an improvement in glycated hemoglobin levels (p = 0.03), however, there was no difference in weight loss between the Groups (CHACKO et al., 2016) and Daubenmier et al. (2016) randomized obese adults (BMI ≥ 30 kg /m2) in a 5.5-month program with or without Mindfulness Meditation. The results showed that those who received Mindfulness training had improvements in blood glucose and fasting lipids (DAUBENMIER et al., 2016). Similarly, Mason et al. (2016) verified the impact of an intervention for weight loss based on Mindfulness Meditation on sweet food intake and fasting blood glucose. In the Intervention Group, conscious eating was associated with reduced intake of sweets and fasting blood glucose (MASON; EPEL; KRISTELLER; et al., 2016).

In disagreement with other studies, Kearney et al. (2012) conducted a RCT with 48 military veterans (87.5% male), with or without obesity to investigate whether overall stress reduction, by participating in an 8-week Mindfulness Meditation program, would influence eating behavior. There were no changes in emotional eating, uncontrolled eating, or in the intake of fats and sugars (KEARNEY et al., 2012).

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Conclusions

Obesity poses substantial health risks and due to its high prevalence, its prevention has become a top priority at present. The data suggested that chronic stress may play a role in the development of obesity by favoring a non-homeostatic diet. Evidence was shown that stress- induced cortisol hypersecretion was related to neurobiological responses that produced changes in eating behavior, leading to a higher intake of fatty and sweet foods, and a decreased perception of satiety (ADAM; EPEL, 2007; WARDLE, 2007).

The evidence observed in the studies included in this review suggested that meditation could be a useful tool for obesity treatment, since it helped the individuals to decrease anxiety and promoted a higher level of self-control and well-being. Through meditation, individuals were able to learn to manage negative emotions and stress, instead of resorting to eating comfort foods. Thus they were enabled to maintain food choices that led to losing or maintaining lost weight. However, meditation research is at an incipient stage and up to now, no firm conclusions could be drawn, hence further investigation into this interesting and promising area is necessary.

Compliance with ethical standards

This research is a review of the literature, and did not involve any trial with humans beings or animals. Therefore, we did not need to ask for informed consent. Furthermore, we have no conflicts of interest to disclose.

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