Obrela JOURNAL Dialogues in Clinical Neuroscience & Mental Health

e-ISSN: 2585-2795 • Printed-ISSN: 2654-1432
DOI 10.26386/obrela.v4i4.121

Efficacy of stress management interventions on emotional eating in childhood and adolescence: A systematic review

Despina S. Kalogiratou[1], Elena Critselis[1,3], Maria Charalampopoulou[1], George P. Chrousos[1,2], Christina Darviri[1]

[1]*Postgraduate Course Stress Management and Health Promotion, Medical School, National and Kapodistrian University of Athens, Athens, Greece*

[2]*First Department of Pediatrics, Medical School, National and Kapodistrian University of Athens, Aghia Sophia Children's Hospital, National and Kapodistrian University of Athens, Athens, Greece*

[3]*Department of Nutrition and Dietetics, School of Health Science and Education, Harokopio University, Athens, Greece*

Abstract

Eating as a compensatory mechanism to adverse emotional experiences in children and adolescents has been associated with high rates of overweight and obesity, binge eating and various problematic eating behaviors. Children and adolescents who display emotional eating are likely to develop eating disorders in adult life. Stress management may be an important target to decrease emotional eating in youth. A systematic review was conducted to determine the efficacy of stress management interventions on reducing and managing emotional eating in children and adolescents. Using a combination of terms, Scopus, Pubmed and Web of Science databases were searched. After removing duplicates, 734 publications were screened and 26 identified as potentially relevant. Two randomized controlled trials were assessed for their methodological quality using the Jadad Scale. Our findings suggest that stress management strategies favorably influenced outcomes related to childhood and adolescence emotional eating and highlight the urgent need for more, high-quality studies to examine the efficacy of stress management interventions in emotional eating amongst children and adolescents.

Keywords:

Emotional eating; Stress management; Children; Adolescents; Coping techniques

Corresponding author: Despina S. Kalogiratou, Postgraduate Course Stress Management and Health Promotion, Medical School, National and Kapodistrian University of Athens, 4 Soranou Ephessiou Str., Athens 11527, Greece, E-mail : despinakalogiratou@outlook.com

DOI 10.26386/OBRELA.V4I4.121

Background

Emotional eating is defined as an increase in food intake as a compensatory mechanism to negative emotions such as anger, depression, boredom, anxiety, loneliness, stress (1), shame (2), as it is thought to temporarily provide comfort and distraction (3). Eating as a compensatory mechanism to negative emotions in children and adolescents is a topic of increasing concern amongst healthcare professionals. Amongst children and adolescence evidence exists of a link between emotional eating and a strong preference for high energy dense foods (4), binge eating (5), as well as high rate of obesity (6) and eating pathology (7).

Stress occurs when homeostasis is threatened or perceived to be so (8) and can lead to changes in eating attitude (9). Stressors activate a neural stress-response network that can cause formed habits to be used rather than a cognitive appraisal of responses. Additionally, stress-induced secretion of glucocorticoids increases motivation for food, and insulin, which promotes food intake and obesity (10). Childhood and adolescence are critical periods characterized by increased vulnerability to stressors (11). School children have reported daily stressors including academic challenges to interpersonal conflict (12), personal and irreversible loss, events characterized as socially taboo and poor academic performance (13). Early stress exposure predicts increases in child eating behaviors known to associate with overweight and obesity (14). Emotional symptoms and life stress could increase the risk of restrained, emotional, external eating among adolescents (15). A study by Young D et al. demonstrated that higher levels of perceived stress and an avoidant coping style increased adolescents propensity for depressive emotional eating (16).

Most recently, there has been a strong interest in the application of mind-body approaches to diminish disordered eating in adults. There is some evidence on the effectiveness of several interventions such as cognitive based therapy (17), working memory training (18), relaxation training (19) on emotional eating reduction in adult clinical populations. Mindfulness based approaches have also gained growing empirical support as a promising psychoeducational and behaviour based treatment for obesity-related eating behaviors such as emotional eating (20). A systematic review by Katterman et al. indicated that mindfulness meditation effectively decreases binge eating and emotional eating in adult populations engaging in this behavior (21). In addition, it has been suggested that higher levels of trait mindfulness skills are associated with greater awareness of healthy dietary practices and lower tendency to consume food products as a compensatory mechanism to adverse emotional experiences (22). For instance, in an 8-week mindfulness based stress reduction intervention, the participants (mean age: 48.5 years old) reported significantly lower levels of emotional eating (p=0.03) after the intervention period, compared to a waiting list control group (23).

Children and adolescents who display maladaptive eating behaviors are likely to develop additional weight-related difficulties. Treating their current eating issues is of most importance in order to prevent future unhealthy eating patterns (24). Given that children feel the urge to eat when under emotional distress (25,26), stress management may be an important target to decrease emotional eating in children and adolescents (27). However, there is not a published review focused on the efficacy of stress management interventions (including evidence based coping techniques, such as progressive muscle relaxation, autogenic training, relaxation response, biofeedback, emotional freedom technique, guided imagery, diaphragmatic breathing, transcendental meditation, cognitive behavioral therapy, mindfulness based stress reduction and emotional freedom technique (28)) on emotional eating in youth. Hence, the aim of our study was to systematically review the efficacy of stress management programs on emotional eating in childhood and adolescence.

Methods

Literature Search

A systematic search for English language papers published from the start of the literature until June 8, 2020 was carried out in Pubmed, Scopus and Web of Science databases. The combinations utilized were ("progressive muscle relaxation" OR "guided imagery" OR "autogenic training" OR "relaxation response" OR biofeedback OR "diaphragmatic breathing" OR

DOI 10.26386/OBRELA.V4I4.121

"emotional freedom technique" OR meditation OR "cognitive behavioral therapy" OR mindfulness) AND (children OR adolescents OR students) AND ("emotional eating" OR "emotional undereating" OR "emotional overeating" OR "dietary patterns" OR "eating in response to emotions" OR "eating in response to feelings"). In addition, a snowball technique was employed in order to include any potential studies not revealed through this process. Issues of related journals, reference lists of included studies, and other relevant papers in the field were rummaged through in an attempt to locate possible records. The flow of information from record identification to inclusion followed the principles of the PRISMA statement (29).

Study Selection

The inclusion criteria were as follows: 1. original articles published in peer-reviewed journals, 2. two arm trials including an intervention and an active control group, 3. being published in English, 4. applying an evidence based stress-management intervention or a combination of more or in combination with any other healthy lifestyle modification (e.g. physical activity), 5. including a sample aged less than 19 years old, 6. measuring emotional eating, 7. involving a baseline and at least one post-interventional assessment. Identified abstracts were stored using reference management software. Duplicates were deleted and a unique identification was assigned to each citation. When the information provided by the title and abstracts was found to be relevant to the present research, or when this information was insufficient to decide on inclusion, the full text article was retrieved and evaluated. All remaining articles were read in their entirety and a final selection was made.

Data Extraction

The extracted data from the papers included in our analysis was: reference, country, sample size and age, intervention, control condition, measures used, intervention main findings, control group main findings, feasibility and acceptability. The quality of trials was estimated by using the Jadad Scale. The Jadad Scale is a brief (score range: 0-5 points) instrument used to rate the quality of a trial by assessing the methods relevant to random assignment, double blinding, and the flow of patients. Randomization and double blinding were given two points each, while reporting withdrawal and dropout reasons received a single point (Table 1) (30).

Results

The initial literature search by key words revealed 757 papers. After excluding duplicates and irrelevant papers by review of titles and abstracts, this number was reduced to 26. On closer inspection of these 26 papers, an additional 24 were excluded according to the selection criteria (Figure 1). Two (8,3%) studies had not randomized or matched control group, two (8,3%) studies contained insufficient statistical data, two (8,3%) studies did not use a stress management intervention, eight (33,3%) studies included a sample aged upper 19 years old and ten (41,6%) studies did not contain desired outcome result. The final two papers were randomized controlled (31,32). The participants in all studies were measured at baseline, those in the intervention group were provided with stress management to be practiced during the full length of follow-up, and all were measured during an endpoint assessment. Apart from the small sample size, there was also a discrepancy across studies regarding their specific characteristics (e.g., the measures used). These characteristics are detailed in Table 2. The quality of the eligible studies was found to be moderate (rating of 3 points) on the Jadad Scale. Due to the small number of the included in the review studies and their small sample sizes, pooling of results was not considered to be a wise option. Thus, the eligible studies are presented narratively in the next section.

Summaries of Included Studies

Mazzeo et al. (31) tested the efficacy of LIBER8 (Linking Individuals Being Emotionally Real) intervention to reduce loss of control (LOC) eating in a racially diverse sample of adolescent girls. LIBER8 integrated components of dialectical behavior therapy, such as mindfulness and distress tolerance skills training, and cognitive behavioral therapy. 45

DOI 10.26386/OBRELA.V4I4.121

girls (age 13-17 years; 44.4% white, 42.2% black) were randomized into a LIBER8 or an active control group (behaviorally weight management group called to "2BFit"). Participants completed assessments of eating behavior and related psychological constructs at baseline, immediately following the intervention, and at 3-month follow-up. Eating Disorder Examination-Questionnaire (EDE-Q), Emotional Eating Scale adapted for Children and Adolescents (EES-C) and Eating in the Absence of Hunger Questionnaire for Children and Adolescents (EAH-C) were used as outcome measure tools. Descriptive statistics indicated that LIBER8 was feasible and participants were highly satisfied with this intervention. Significant reductions in eating disorder cognitions, dietary restraint and eating in response to negative affect were observed for participants in both groups, with no differences between LIBER8 and 2BFit. Participants in 2BFit also manifested reductions in several outcomes such as eating concern, shape concern, weight concern, global disordered eating attitudes and emotional eating (31).

Weigensberg et al. (32) tested a new 12-week lifestyle intervention using a randomized trial design in obese Latino adolescents, in order to determine the effects of the mind-body modality of interactive guided imagery over and above those of a didactic lifestyle education, on insulin resistance, eating and physical activity behaviors, stress and stress biomarkers. Obese (BMI>95th percentile) adolescents (n=35, age 14-17 years old) were randomized to receive either 12 weekly sessions of a lifestyle education plus Guided Imagery program (GI) or lifestyle education plus a Digital Storytelling computer program (DS). Physical activity was assessed using the 3-day Physical Activity Recall (3-DPAR), stress was assessed using the Perceived Stress Scale (PSS), dietary intake was assessed using 3-day diet records, intuitive eating was assessed using Hawks' Intuitive Eating Scale (HIES). HIES consists of 4 subscales: 1. Intrinsic eating, relating to reliance on physical cues to start and stop eating; 2. Extrinsic eating, relating to avoidance of emotional or external prompts for eating decisions; 3. Anti-dieting measuring disagreement with dieting behaviors; 4. Self-care, assessing an orientation that favors health and fitness over fashion or beauty. The GI group demonstrated significant reductions in leisure sedentary behavior and an increase in moderate physical activity compared to DS group. Salivary cortisol was acutely reduced by stress reduction guided imagery. Additionally, there was evidence of an increase in the targeted intuitive eating behaviors in response to GI, specifically a decreased reliance on emotional or external rules to guide eating (Extrinsic Eating) and an increase in orientation to health and fitness over appearance (Self-care) (32).

Conclusions

Despite the necessity for stress management prevention or treatment programs in emotional eating in youth, a very limited number of papers were found that discussed managing or preventing controlled interventions with emotional eating as outcome measure. Our findings indicated only two interventions which utilized a stress management practice and showed promise in improving emotional eating behavior amongst children and adolescents. Nonetheless, the high heterogeneity of self-reporting tools leaded to no directly comparable results.

Both studies selected were randomized controlled trials, had small sample size and they discussed different stress management program, ranging from a short program to (one 45-minute session) a rather intensive program (90-minute sessions). One of them reported significant effects in emotional eating as measured by EES-C and the other reported significant effects in increase in avoidance of emotional or external prompts for eating decisions as measured by HIES. The stress management programs used varied in type, in that one program used components of dialectical behavior therapy, such as mindfulness and distress tolerance skills training, and cognitive behavioral therapy in comparison to a behaviorally weight management control condition, and the other program used a lifestyle education plus guided imagery program in comparison to a lifestyle education plus a digital storytelling computer control condition. The reported stress management programs did not follow one concept, and used either one measure or a combination of measures. Both of these programs were liked by the participants.

Mazzeo et al. (31) demonstrated that participants in the group which integrated components of dialectical behav-

DOI 10.26386/OBRELA.V4I4.121

ior therapy, such as mindfulness and distress tolerance skills training, and cognitive-behavioral therapy manifested reductions in eating concern, shape concern, global disordered eating attitudes, restraint and negative affect but not emotional eating from baseline to post-testing. However participants in the active control group manifested reductions in several outcomes concerning disordered eating as well as emotional eating indicating that behaviorally weight management interventions focusing on nutrition and exercise habits are useful in reducing disordered eating cognitions and behaviors. Weigensberg et al. (32) found an increase in the targeted intuitive eating behaviors in response to GI, specifically a decreased reliance on external or emotional prompts to guide eating (Extrinsic Eating). As a non-cognitive, affect-based process, GI might be more developmentally appropriate and effective in motivating behavior change in adolescents than didactic, cognitive approaches, since adolescents' thought processes may not always be logical, rational, or linear.

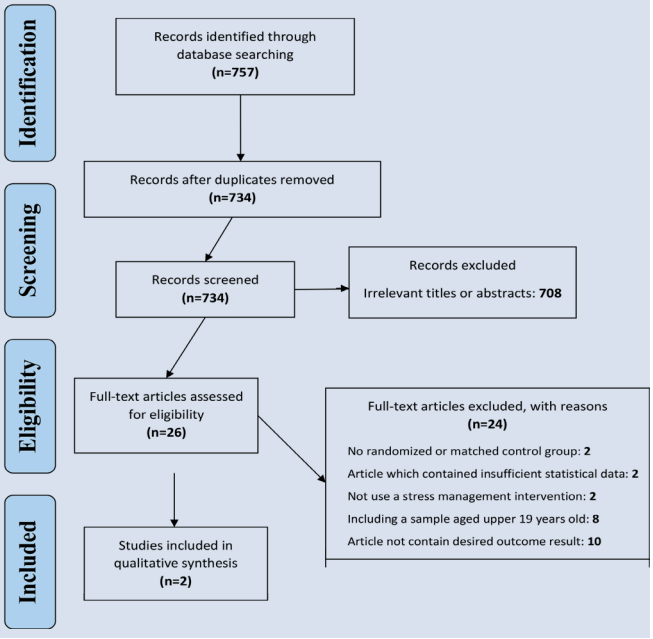
The present systematic review is the first study that clearly focuses on the effects of stress managements programs on emotional eating in children and adolescents. Only one systematic review of behaviour change interventions was conducted to find evidence of behaviour change techniques (BCTs) that are most effective in changing physical activity and/or eating behaviour for the prevention or management of childhood obesity (33). Results indicated six BCTs that may be effective components of future management interventions (provide information on the consequences of behaviour to the individual, environmental restructuring, prompt practice, prompt identification as role model/position advocate, stress management/emotional control training and general communication skills training), and one BCT that may be effective in prevention interventions (prompting generalization of a target behaviour) (33).

Our findings suggest that stress management strategies favorably influenced outcomes relating to childhood and adolescence emotional eating. Our understanding is constrained by the small number of studies selected for review. Further large, high-quality, randomized controlled trials are required to determine the efficacy of stress management programs in emotional eating in childhood and adolescence. Such programs could be introduced in school curricula; for example, by recruiting a stress management expert in primary or secondary schools.

Table 1. Jadad scale

1. Was the study described as randomized (this includes words such as randomly, random, and randomization)? (+1 Point)
2. Was the method used to generate the sequence of randomization described and appropriate (table of random numbers, computer-generated, etc)? (+1 Point)
3. Was the study described as double blind? (+1 Point)
4. Was the method of double blinding described and appropriate (identical placebo, active placebo, dummy, etc)? (+1 Point)
5. Was there a description of withdrawals and dropouts? (+1 Point)
6. Deduct one point if the method used to generate the sequence of randomization was described and it was inappropriate (patients were allocated alternately, or according to date of birth, hospital number, etc)
7. Deduct one point if the study was described as double blind but the method of blinding was inappropriate (e.g., comparison of tablet vs. injection with no double dummy

Figure. 1. Information Flowchart



DOI 10.26386/OBRELA.V4I4.121

Table 2. Extracted data

Reference	N/Age	Intervention Group	Control group	Measures used	Intervention Main findings	Control group Main findings	Feasibility/ Acceptability
Mazzeo et al. (31)	45/ 13-17 years old	LIBER8 12 weekly sessions (90min. per session)	2BFit (active behavio-rally-based weight management group) 12 weekly sessions (90min. per session)	EDE-Q EES-C EAH-C	Improved eating concern, shape concern, weight concern, restraint Reduced negative affect	Improved eating concern, shape concern, weight concern, restraint Reduction in emotional eating (depression subscale, anxiety, anger, and frus-tration subscale)	Feasibility: LIBER8 64.9% 2Bfit 68.5% Acceptability: 81%
Weigensberg et al.(32)	35/ 14-17 years old	Didactic life-style educa-tion + Guided im-agery 12-weekly sessions (45min. per session)	Didactic life-style educa-tion + Digital story-telling 12-weekly sessions (45min. per session)	PSS HIES 3-day diet records 3-day Physical activity recall	Reduction in leisure sedentary behavior, stress Increase in moder-ate physical activity Increase in extrinsic eating and self-care		Feasibility: - Acceptability: 90-100%

N: number of patients; LIBER8: Linking Individuals Being Emotionally Real; EDE-Q: Eating Disorder Examination -Questionnaire; EES-C: Emotional Eating Scale-adapted for children; EAH-C: Eating in the Absence of Hunger Questionnaire for Children and Adolescents; PSS: Perceived Stress Scale; HIES: Hawks' Intuitive Eating Scale

Conflict of Interest

Authors declare no conflicts of interest.

DOI 10.26386/OBRELA.V4I4.121

References

1. Ganley RM. Emotion and eating in obesity: A review of the literature. Int J Eat Disord. 1989 May 1;8(3):343–61, doi: 10.1002/1098-108X(198905)8:3<343::AID-EAT2260080310>3.0.CO;2-C
2. Wong M, Qian M. The role of shame in emotional eating. Eat Behav. 2016;23:41–7, doi: 10.1016/j.eatbeh.2016.07.004
3. Spoor STP, Bekker MHJ, Van Strien T, van Heck GL. Relations between negative affect, coping, and emotional eating. Appetite. 2007 May 1;48(3):368–76, doi: 10.1016/j.appet.2006.10.005
4. Nguyen-Michel ST, Unger JB, Spruijt-Metz D. Dietary correlates of emotional eating in adolescence. Appetite. 2007 Sep 1;49(2):494–9, doi: 10.1016/j.appet.2007.03.005
5. Stice E, Presnell K, Spangler D. Risk factors for binge eating onset in adolescent girls: A 2-year prospective investigation. Health Psychol. 2002;21(2):131–8, doi: 10.1037/0278-6133.21.2.131
6. Braet C, Van Strien T. Assessment of emotional, externally induced and restrained eating behaviour in nine to twelve-year-old obese and non-obese children. Behav Res Ther. 1997 Sep 1;35(9):863–73, doi: 10.1016/S0005-7967(97)00045-4
7. Braet C, Claus L, Goossens L, Moens E, Van Vlierberghe L, Soetens B. Differences in Eating Style between Overweight and Normal-Weight Youngsters. J Health Psychol. 2008 Sep;13(6):733–43, doi: 10.1177/1359105308093850
8. Chrousos GP. Stress and disorders of the stress system. Nat Rev Endocrinol. 2009 Jul;5(7):374–81, doi: 10.1038/nrendo.2009.106
9. Greeno CG, Wing RR. Stress-Induced Eating. Psychol Bull. 1994;115(3):444–64, doi: 10.1037/0033-2909.115.3.444
10. Dallman MF. Stress-induced obesity and the emotional nervous system. Trends Endocrinol Metab. 2010 Mar 1;21(3):159–65, doi: 10.1016/j.tem.2009.10.004
11. Charmandari E, Kino T, Souvatzoglou E, Chrousos GP. Pediatric stress: hormonal mediators and human development. Horm Res. 2003;59(4):161–79, doi: 10.1159/000069325
12. Sotardi VA. Exploring school stress in middle childhood: interpretations, experiences, and coping. Pastor Care Educ. 2017;35(1):13–27, doi: 10.1080/02643944.2016.1269360
13. Leontopoulou S, Jimerson S, E. Anderson G. An international exploratory investigation of students' perceptions of stressful life events: Results from Greece, Cyprus, and the United States. Sch Psychol Int. 2011 Dec 1;32:632–44, doi: 10.1177/0143034311403059
14. Miller AL, Gearhardt AN, Retzloff L, Sturza J, Kaciroti N, Lumeng JC. Early Childhood Stress and Child Age Predict Longitudinal Increases in Obesogenic Eating Among Low-Income Children. Acad Pediatr. 2018;18(6):685–91, doi: 10.1016/j.acap.2018.01.007
15. Hou F, Xu S, Zhao Y, Lu Q, Zhang S, Zu P, et al. Effects of emotional symptoms and life stress on eating behaviors among adolescents. Appetite. 2013 Sep 1;68:63–8, doi: 10.1016/j.appet.2013.04.010
16. Young D, Limbers CA. Avoidant coping moderates the relationship between stress and depressive emotional eating in adolescents. Eat Weight Disord - Stud Anorex Bulim Obes. 2017 Dec 1;22(4):683–91, doi: 10.1007/s40519-017-0396-7
17. Cassin SE, Sockalingam S, Du C, Wnuk S, Hawa R, Parikh SV. A pilot randomized controlled trial of telephone-based cognitive behavioural therapy for preoperative bariatric surgery patients. Behav Res Ther. 2016 May 1;80:17–22, doi: 10.1016/j.brat.2016.03.001
18. Houben K, Dassen FCM, Jansen A. Taking control: Working memory training in overweight individuals increases self-regulation of food intake. Appetite. 2016 Oct 1;105:567–74, doi: 10.1016/j.appet.2016.06.029
19. Manzoni GM, Pagnini F, Gorini A, Preziosa A, Castelnuovo G, Molinari E, et al. Can relaxation training reduce emotional eating in women with obesity? An exploratory study with 3 months of follow-up. J Am Diet Assoc. 2009 Aug;109(8):1427–32, doi: 10.1016/j.jada.2009.05.004
20. O'Reilly GA, Cook L, Spruijt-Metz D, Black DS. Mindfulness-based interventions for obesity-related eating behaviours: a literature review. Obes Rev. 2014;15(6):453–61, doi: 10.1111/obr.12156
21. Katterman SN, Kleinman BM, Hood MM, Nackers LM, Corsica JA. Mindfulness meditation as an intervention for binge eating, emotional eating, and weight loss: a systematic review. Eat Behav. 2014 Apr;15(2):197–204, doi: 10.1016/j.eatbeh.2014.01.005
22. Pidgeon A, Lacota K, Champion J. The Moderating Effects of Mindfulness on Psychological Distress and Emotion-

DOI 10.26386/OBRELA.V4I4.121

al Eating Behaviour. Aust Psychol. 2013;48(4):262–9, doi: 10.1111/j.1742-9544.2012.00091.x

23. Alberts HJEM, Thewissen R, Raes L. Dealing with problematic eating behaviour. The effects of a mindfulness-based intervention on eating behaviour, food cravings, dichotomous thinking and body image concern. Appetite. 2012 Jun 1;58(3):847–51, doi: 10.1016/j.appet.2012.01.009
24. Wilfley DE, Kolko RP, Kass AE. Cognitive Behavioral Therapy for Weight Management and Eating Disorders in Children and Adolescents. Child Adolesc Psychiatr Clin N Am. 2011 Apr;20(2):271–85, doi: 10.1016/j.chc.2011.01.002
25. Michels N, Sioen I, Boone L, Braet C, Vanaelst B, Huybrechts I, et al. Longitudinal association between child stress and lifestyle. Health Psychol Off J Div Health Psychol Am Psychol Assoc. 2015 Jan;34(1):40–50, doi: 10.1037/hea0000108
26. Michels N, Sioen I, Braet C, Eiben G, Hebestreit A, Huybrechts I, et al. Stress, emotional eating behaviour and dietary patterns in children. Appetite. 2012;59(3):762–9, doi: 10.1016/j.appet.2012.08.010
27. Chao A, Grey M, Whittemore R, Reuning-Scherer J, Grilo CM, Sinha R. Examining the mediating roles of binge eating and emotional eating in the relationships between stress and metabolic abnormalities. J Behav Med. 2016 Apr;39(2):320–32, doi: 10.1007/s10865-015-9699-1
28. Liza V. Stress management techniques: evidence-based procedures that reduce stress and promote health. Health Sci J [Internet]. 2011 [cited 2019 Feb 13];5(2), E-ISSN:1791-809X
29. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. BMJ. 2009 Jul 21;339:b2700, doi: 10.1136/bmj.b2700
30. Moher D, Jadad AR, Nichol G, Penman M, Tugwell P, Walsh S. Assessing the quality of randomized controlled trials: An annotated bibliography of scales and checklists. Control Clin Trials. 1995 Feb 1;16(1):62–73, doi: 10.1016/0197-2456(94)00031-W
31. Mazzeo SE, Lydecker J, Harney M, Palmberg AA, Kelly NR, Gow RW, et al. Development and preliminary effectiveness of an innovative treatment for binge eating in racially diverse adolescent girls. Eat Behav. 2016;22:199–205, doi: 10.1016/j.eatbeh.2016.06.014
32. Weigensberg MJ, Lane CJ, Ávila Q, Konersman K, Ventura E, Adam T, et al. Imagine HEALTH: Results from a randomized pilot lifestyle intervention for obese Latino adolescents using Interactive Guided ImagerySM. BMC Complement Altern Med. 2014;14, doi: 10.1186/1472-6882-14-28
33. Martin J, Chater A, Lorencatto F. Effective behaviour change techniques in the prevention and management of childhood obesity. Int J Obes. 2013 Oct;37(10):1287, doi: 10.1038/ijo.2013.107