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Integrated CBT and Inhibitory Control Training Intervention: Effects on Eating Behavior and Obesity

Intervenção Integrada de TCC e Treino de Controle Inibitório: Efeitos no Comportamento Alimentar e Obesidade

Intervención Integrada de TCC y Entrenamiento de Control Inhibitorio: Efectos sobre el Comportamiento Alimentario y Obesidad

Andressa Paiva Porto[1], Maria José Nunes Gadelha[2], Melyssa Kellyane Cavalcanti Galdino[3], Andrómeda Ivette Valencia[4], Ezequiel Batista Do-Nascimento[5], José Rodolfo Lopes de Paiva Cavalcanti[1]

[1] Universidade Estadual do Rio Grande do Norte, Laboratório de Neurologia Experimental - Mossoró - Rio Grande do Norte - Brasil.
[2] Universidade Federal do Rio Grande do Norte, Faculdade de Ciências da Saúde - FACISA - Santa Cruz - Rio Grande do Norte - Brasil.
[3] Universidade Federal da Paraíba, Departamento de Psicologia - João Pessoa - Paraíba - Brasil.
[4] Universidad Autónoma del Estado de Hidalgo, Instituto de Ciências da Saúde - Pachuca - Hidalgo - México.
[5] Universidade Federal do Sul da Bahia, Laboratório de Psicologia Experimental e Neurociências - Teixeira de Freitas - Bahia - Brasil.

Abstract

Obesity and overweight represent a growing public health problem. Factors such as difficulties in emotional regulation and certain executive functions (EFs) influence the eating patterns adopted by this population. Given this context, the present study compared two interventions: Cognitive-Behavioral Therapy (CBT) versus CBT with inhibitory control training (ICT, adapted from the Go/No-Go task) in a group of 18 overweight and obese individuals (mean age 36.7 ± 7.8 SD). The results proved changes in eating behavior, emotional regulation, Body Mass Index (BMI), and impulsivity (future planning) among participants. However, the combined intervention did not prove superior to the group that only received CBT, the outcomes were similar in both groups. This investigation suggests that although ICT combined with CBT demonstrates feasibility and preliminary evidence of benefits for emotional regulation and eating behaviors, it does not appear to offer any additional advantages over CBT for this population.

Keywords: Obesity. Cognitive-Behavioral Therapy. Feeding Behavior

Resumo

A obesidade e o sobrepeso representam um crescente problema de saúde pública. Fatores como dificuldades na regulação emocional e em algumas funções executivas influenciam os padrões alimentares adotados por essa população. Diante do exposto, a presente pesquisa comparou duas intervenções: a Terapia Cognitivo- Comportamental (TCC) em grupo isolada versus a TCC associada a um treinamento de controle inibitório (TCI, adaptado da tarefa Go/No-Go) em um grupo de 18 indivíduos (idade média 36,7 ± 7,8 DP) obesos e com sobrepeso. Os resultados encontrados indicaram mudanças no comportamento alimentar, regulação emocional, índice de massa corporal (IMC) e impulsividade (planejamento futuro) dos participantes. No entanto, a intervenção combinada não se mostrou superior à Terapia Cognitivo-Comportamental em Grupo, uma vez que os resultados foram semelhantes em ambos os grupos. Este estudo sugere que, embora o TCI combinado com a TCC demonstre viabilidade e evidências preliminares de benefícios para a regulação emocional e os comportamentos alimentares, não parece oferecer vantagens adicionais em relação à TCC isolada para essa população.

Palavras-chave: Obesidade. Terapia Cognitivo-Comportamental. Comportamento Alimentar

Correspondence:
Ezequiel Batista Do-Nascimento
E-mail: ezequiel.nascimento@ufsb.edu.br | izaquen@gmail.com

Resumen

La obesidad y el sobrepeso representan un creciente problema de salud pública. Factores como dificultades en la regulación emocional y determinadas funciones ejecutivas influyen en los patrones alimentarios adoptados por esta población. En este contexto, el presente estudio comparó dos intervenciones: la Terapia Cognitivo-Conductual (TCC) Grupal aislada versus la TCC asociada a un entrenamiento de control inhibitorio (ECI, adaptado de la tarea Go/No-Go) en un grupo de 18 individuos con sobrepeso y obesidad (edad media 36,7 ± 7,8 DE). Los resultados demostraron cambios en el comportamiento alimentario, la regulación emocional, el índice de masa corporal (IMC) y la impulsividad (planificación futura) de los participantes. Sin embargo, la intervención combinada no se mostró superior a la Terapia Cognitivo-Conductual Grupal aislada, ya que los resultados fueron similares en ambos grupos. Esta investigación sugiere que, aunque el ECI combinado con la TCC demuestre viabilidad y evidencias preliminares de beneficios para la regulación emocional y los comportamientos alimentarios, no parece ofrecer ventajas adicionales en comparación con la TCC aislada para esta población.

Palabras clave: Obesidad. Terapia Cognitivo-Conductual. Conducta Apetitiva

Highlights of Clinical Impact

- Integrated Intervention Feasibility: The study demonstrated that combining computerized inhibitory control training with group CBT is feasible for obese and overweight individuals, offering a practical approach to address eating behaviors.
- Comparable Efficacy to CBT by itself: Despite the added benefits in executive function domains such as future planning, the combined intervention did not yield significantly superior outcomes compared to standard group CBT, suggesting that CBT remains a robust stand-alone treatment.
- Implications for Clinical Practice: These findings inform clinicians that while incorporating inhibitory control training can be beneficial, further research is needed to determine its incremental advantage over conventional CBT protocols in obesity management.

The substantial upsurge in food consumption has emerged as a global health issue, as indicated by the elevated prevalence of obesity and overweight on a global scale (Le et al., 2023) An epidemiological study on global public health risks, undertaken in the last decade, observed a worldwide increasing trend in overweight and obesity (Murray et al., 2020). Findings from the World Health Organization (WHO) during the same period support this data, indicating a rise in these conditions. Consequently, it is projected that by 2025, the global population of overweight individuals will reach 2.3 billion, out of whom 700 million would be classified as obese (Boutari & Mantzoros, 2022). Despite significant progress in treatment and prevention of obesity and overweight, these treatments have not yet proven to be completely effective in resolving this issue. This phenomenon occurs because a significant proportion of individuals tend to regain weight that they had previously lost within a span of five years (Hall & Kahan, 2018).

Evidence indicates that brief interventions, such as guidance and usual care in obesity management, may not be effective in preventing weight regain over extended periods (De Lannoy et al., 2021; Machado et al., 2022). It is crucial to recognize that obesity is closely linked to behavioral and emotional factors, particularly emotional dysregulation (Atwood, 2024). This condition often contributes to dysfunctional behaviors, such as emotional and uncontrollable eating, which persist in individuals with stress-reactive traits or impairments in cognitive processes that regulate emotional responses and behavior (Jentsch & Wolf, 2024).

Executive Functions (EFs) have been extensively researched in its correlation with eating behavior (Chen et al., 2024; Harris et al., 2024). EFs encompass abilities that enable individuals to regulate their own behavior, emotions, and adapt to various contexts and circumstances. Concerning the association between EFs and eating behavior, notable functions include inhibitory control, working memory, and cognitive flexibility (Byrne et al., 2021).

It has been noted that individuals within this cohort who struggle more with emotional regulation and certain EFs, including planning, decision-making, cognitive flexibility, inhibitory control and working memory, are more prone to experiencing weight regain due to long-term difficulty in maintaining acquired behaviors (De Klerk et al., 2023; Herzog et al., 2024). Research findings indicate that overweight or obese individuals demonstrate markedly higher inhibition failures when responding to no-go objects than to neutral sights. This indicates that salient food-related cues may lead to disinhibition in this population (Anderson & Flack, 2022; Cunningham et al., 2024). These findings suggest a potential involvement of inhibitory control deficits, where individuals may be unable to resist the behavioral response and impulsively consume food when confronted with highly salient food stimuli (Mas et al., 2024; Silva et al., 2024). An increased inability to resist the impulse

to eat, especially when experiencing negative emotions, may lead to emotional eating in stressful situations— a behavior also associated with deficits in inhibitory control processes (Ramos et al., 2024; Spinner et al., 2024)

While current interventions focused on behavioral change demonstrate encouraging outcomes in managing emotional reactions, several research highlight the necessity for techniques to improve the cognitive elements associated with behavior regulation and adaptability, including executive functioning (Dalle Grave et al., 2020; Michaelides et al., 2022). Currently, various therapeutic approaches have explored intervention protocols aiming to assess the potential of cognitive training in improving EFs. It is observed that computerized cognitive training programs generally aim to enhance inhibitory control or attention to promote behavioral changes (Oldrati et al., 2020). In populations with overweight and obesity, Inhibitory Control Training (ICT) programs have been applied with the goal of improving inhibitory control capacity to suppress reward-driven behaviors (Iannazzo et al., 2024). Thus, there is ongoing research investigating the potential of cognitive training for EFs as a novel therapeutic approach for eating disorders and weight loss (Forman et al., 2019; Manasse et al., 2020).

A recent meta-analysis has demonstrated the promising potential of Cognitive-Behavioral Therapy (CBT) in managing and preventing weight regain in both clinical and non-clinical populations (Kurnik Mesarič et al., 2023). This effect is particularly significant in the long term, as CBT promotes improved emotional regulation and the development of effective stress-coping strategies, thereby reducing the occurrence of emotional eating behaviors (Jamshidi et al., 2023; Madjd et al., 2020; Torres et al., 2020). The interaction between CBT, a behaviorally oriented psychotherapeutic approach, and neuropsychological components, including cognitive training, provides an innovative therapeutic alternative. Nevertheless, a limited number of studies (Manasse et al., 2020; Nakamura et al., 2024) have combined these two types of intervention.

Considering the intricate nature of the difficulties related to managing obesity and overweight individuals, the substantial rates of relapse, and a lack of research examining viable alternatives in this context, it is essential that we consider innovative approaches. This research aimed to evaluate the feasibility and preliminary evidence of efficacy for a group intervention combining CBT and ICT, focusing on emotional regulation and its impact on components of dysfunctional eating behaviors, as well as weight loss and maintenance.

METHOD

Participants

This research involved the voluntary participation of 18 individuals, aged between 18 and 59 years, who were divided at random into either a CBT group or a CBT with ICT group. Initially, the study had 24 volunteers, but there were 4 dropouts, and 2 participants were excluded from the sample for exceeding the allowed number of absences, resulting in (n=9) for the CBT group and (n=9) for the CBT + ICT group. All volunteers were selected through screening and met the necessary criteria to participate in the study, with none of them having any relationship with the researchers.

The research was published through social media, and interested individuals underwent a semi-structured interview to assess inclusion and exclusion criteria. Inclusion criteria were adults with overweight or obesity (BMI above 25), aged between 18 and 59 years, reporting at least two unsuccessful weight loss efforts (physical exercise, nutritional counseling, psychotherapy) in the last two years, and reporting patterns of emotional eating and/or uncontrolled eating. Dropout criteria were; the use of appetite suppressants, a diagnosis of severe depression, anorexia nervosa, and bulimia nervosa according to the International Classification of Diseases (ICD-10), weight changes due to organic causes, pregnancy, and continuous psychotherapeutic treatment. Additionally, participants with absences totaling more than 25% of the total intervention time were excluded from the sample. The research project was approved by the Ethics Committee of Universidade do Estado do Rio Grande do Norte under protocol number 5.296.887. Participants were informed about the research objectives, as well as the potential benefits and/or risks. All participants signed the Informed Consent Form.

Study setting

At first, all volunteers underwent an initial interview in which health status and symptoms consistent with Anorexia Nervosa, Bulimia Nervosa, and Major Depressive Disorder were investigated. Previous difficulties related to weight loss and eating were also assessed. The interview was conducted through open-ended questions and self-reports, which was structured in advance based on the diagnostic criteria of the International Classification of Diseases (ICD-10) and the Diagnostic and Statistical Manual of Mental Disorders - DSM 5. Anthropometric evaluation of participants was also performed through weighing and measurement. Body Mass Index (BMI) was calculated using the formula BMI = kg/m2, where kg represents a person's weight in kilograms and m^2 represents their height in meters squared. Weight was measured using an electronic scale and height was measured using a conventional stadiometer. We followed the classification of the World Health Organization, which considers BMI ≥ 25.0kg/m^2 (overweight) and BMI ≥ 30.0kg/m^2 (obesity). After these assessments, participants completed a protocol that included assessment instruments for eating behavior, impulsivity, emotional dysregulation, and depressive symptoms. Eight weeks after the end of the interventions, participants were reassessed. The study adopted a 7-month follow-up for the reassessment of BMI.

Data collection tools

Three Factor Eating Questionnaire - R21 (TFEQ – R21)

It is a self-reported questionnaire consisting of 21 items on a Likert scale ranging from 1 to 4, with calculations on a scale of 0 to 100 points, subsequently converted into percentages. The TFEQ-R21 was validated for Brazil by De Medeiros et al. (2017). This instrument assesses eating patterns in three different factors: Cognitive Restraint (CR), Emotional Eating (EE), and Uncontrolled Eating (UE). The objective of this measure was precisely to evaluate the eating behavior pattern of the participants in the group.

Beck Depression Inventory (BDI)

The Beck Depression Inventory-2 (BDI-II) is a self-report instrument consisting of 21 items designed to assess depressive symptoms in individuals aged 13 to 80. The instrument has been validated for the Brazilian population, demonstrating good psychometric properties and a cutoff score of >13 for depressive symptomatology (Gomes-Oliveira et al., 2012). This instrument was used as part of the screening and eligibility process in the study since one of the inclusion criteria was the absence of depressive symptoms.

Impulsivity Assessment Scale (ESAVI)

The impulsivity evaluation scale in question consists of 31 items that can be categorized into four factors: cognitive control, planning ahead, audacity and recklessness, and lack of concentration and persistence (Ávila-Batista & Rueda, 2011). Throughout the 31 items, the individual responds to questions and records their answers in the workbook provided. Correction is exclusively done through the online platform by entering the participant's responses.

Difficulties in Emotion Regulation Scale (DERS)

A 36-item scale that assesses difficulties in emotional regulation, considering 6 factors: non-acceptance of negative emotions, inability to engage in goal-directed behaviors when experiencing negative emotions, difficulty controlling impulsive behavior in the face of negative emotions, limited access to emotional regulation strategies, lack of emotional awareness, and lack of emotional clarity (Cancian et al., 2019).

Procedures

Following the initial screening process, the selected participants were randomly allocated into two intervention groups. The CBT group participated exclusively in a structured CBT intervention, with each session lasting 1 hour and 30 minutes. The CBT + ICT group received CBT across 12 weekly sessions, each lasting 90 minutes, and additionally participated in ICT utilizing the go/no-go task, spanning 12 weeks with each session lasting 30 minutes. The third phase involved conducting a post-intervention assessment precisely two months (8 weeks) after the intervention. Subsequently, a follow-up period of 7 months was conducted, during which new BMI measurements were taken to assess weight maintenance.

The therapeutic intervention lasted for a period of 12 weeks (details provided in Supplementary Material (Figure S1). The entire duration of the intervention was two hours, with the treatment group received 1 hour and 30 minutes, and the cognitive control training application lasting for 30 minutes. The intervention design used in this study was adapted from various CBT protocols, emphasizing cognitive restructuring and training in emotional regulation and stress-coping skills (Jamshidi et al., 2023; Madjd et al., 2020; Moraes et al., 2021; Torres et al., 2020). The ICT was based on the modified go/no-go paradigm, as described in the research by Nakamura et al. (2024). During this training, participants were directed to click the "go" button whenever a stimulus from the "Go" category (such as images of healthy foods, which were the goal stimuli) appeared, and to click "No-Go" if a stimulus from the "No-Go" category (such as high-fat and high-sugar foods) appeared. During the second phase of the experiment, participants were directed to hit the Enter key when images of nutritious foods were displayed and refrain from responding when images of unhealthy foods were shown.

Data analysis

The collected data were analyzed using the Shapiro-Wilk test (Shapiro & Wilk, 1965) to assess the normal distribution of variables. Following this, the scores from the utilized instruments were transformed into mean, standard deviation, and standard error. The level of statistical significance was evaluated with the criterion of $p < 0.05$. The repeated measures ANOVA test was employed to determine if changes occurred in the domains (EE, UE, BMI, emotional dysregulation, and impulsivity) before and after the intervention in both groups. The results, presented in mean, standard deviation, and standard error, were analyzed for effect size using partial eta-squared (η_p^2). The effect size values were interpreted according to Cohen's criteria (Lakens, 2013), where values of 0.01, 0.06, and 0.14 represent small, medium, and large effects, respectively. All statistical analyses were conducted using the SPSS® software, Version 20 for Windows®.

RESULTS

All participants met the inclusion criteria for the study. The initial sample comprised a total of 24 individuals, including 18 females and 6 males, with ages ranging from 36.7 ± 7.8 years (mean ± SD). The participants were allocated randomly into two groups: a CBT group (n=12) and an CBT+ICT (n=12) group. In total, 16.6% were classified as overweight, 29.2% had grade I obesity, 41.6% had grade II obesity, and 12.5% had grade III obesity. The mean weight of the subjects prior to the intervention was 98.5 kg. Nevertheless, the trial was only completed by 18 participants (CBT = 9 and CBT+ICT = 9), as 4 individuals withdrew and 2 were removed based on their excessive number of absences.

Figure 1. Protocol of the Cognitive-Behavioral Therapy (CBT) intervention applied to both groups.

Session	Theme	Techniques
01	• Group introduction, objectives, and the therapeutic contract • Introduction to Group Cognitive-Behavioral Therapy • Presentation of the daily food intake record	• Psychoeducation • Socratic questioning • Daily record of food intake
02	• Cognitive-Behavioral Model of Eating Behaviors • Stress and obesity • Therapeutic goals	• Psychoeducation • Cognitive restructuring • Guided discovery
03	• Distinction between losing weight and maintaining weight • Difficulties losing weight • Automatic negative thoughts • Emotion regulation, stress coping and seeking pleasure (hedonic hunger)	• Psychoeducation • Cognitive restructuring • ABC functional analysis • Reframing negative thoughts
04	• Core and intermediate beliefs • Cognitive-Behavioral Model and weight cycling • Stress response and non-adaptative behaviors	• Psychoeducation • Cognitive restructuring • ABC functional analysis • Reframing negative thoughts • Guided Discovery • Socratic questioning
05	• Pillars of self-esteem • Responding to automatic thoughts • Generating alternative thoughts	• Psychoeducation • ABC functional analysis • Daily record of food intake • Guided Discovery • Unraveling cognitive distortions • Journaling
06	• Cognitive distortions and inaccurate thoughts – identification and management Part I	• Psychoeducation • Fact-Checking • Successive approximation • Behavioral activation • The downward arrow
07	• Cognitive distortions and inaccurate thoughts – identification and management Part II	• Psychoeducation • Coping cards • Fact-Checking • Mindful eating • Fact-Checking
08	• Emotional regulation: understanding and accepting emotions	• Relaxation and stress-reduction techniques • Diaphragmatic breathing • Mindful eating
09	• Emotional regulation: how to cope with stress and difficult emotions	• Psychoeducation • Coping cards • Progressive Muscle Relaxation • Reframing negative thoughts • Daily record of food intake
10	• Fair vs. Unfair Comparisons – Assessing your progress	• Decision balance sheet • Fact-Checking
11	• Relapse prevention strategies	• Psychoeducation • Safety Plan • Functional analysis with intervention planning
12	• Ending stage of the group and feedback	• Feedback

Note. The intervention protocol was conducted over 12 consecutive weeks, with each session structured around specific themes and corresponding cognitive-behavioral techniques.

Eating Behavior Domains

The evaluation of eating behavior was carried out in three areas: EE, UE, and CR, utilizing the Three Factor Eating Questionnaire - R21 (TFEQ-R21). Statistical analysis in the domain of EE did not show any significant group effect [$F(1, 16) = 0.08$, $p = .77$] or group x sessions interaction impact [$F(1, 16) = 0.11$, $p = .73$]. However, a significant sessions effect was identified [$F(1, 16) = 31.97$, $p = .001$, $\eta_p^2 = .66$]. These findings

indicate that, regardless of the participants' group, there was a decrease in the tendency to eat in response to emotional states as an indicator of emotional regulation (Figure 2).

Statistical analysis did not find a significant group effect [$F(1, 16) = 0.10$, $p = .74$] or a significant interaction effect between group and sessions [$F(1, 16) = 1.48$, $p = .24$]. However, a significant sessions effect was identified [$F(1, 16) = 25.91$, $p = .001$; $\eta_p^2 = .61$] in relation to the domain of UE. This indicates that regardless of the group, there was an evident influence on decreasing scores for uncontrolled eating (Figure 2).

When analyzing the domain of CR, the statistical analysis did not show any significant effects across groups [$F(1, 16) = 2.89$, $p = .10$] or any interaction effects between groups and sessions [$F(1, 16) = 0.18$, $p = .66$]. However, there was a significant effect of sessions [$F(1, 16) = 9.26$, $p = .001$, $\eta_p^2 = .36$]. Figure 2 demonstrates a variance in this factor throughout the sessions, independent of the group's influence.

Emotion regulation response

To assess difficulties in emotional regulation, the Emotional Regulation Difficulties Scale (DERS) was used. The statistical analysis did not reveal a group effect [$F(1, 16) = 0.15$, $p = .69$], nor a significant interaction between groups and sessions [$F(1, 16) = 2.31$, $p = .14$], but a significant effect of sessions was observed [$F(1,16) = 22.20$, $p = .001$, $\eta_p^2 = .58$]. This suggests that, regardless of the group, there was an improvement in emotional regulation among the participants (Figure 3).

Body Mass Index

To evaluate changes in weight and the degree of obesity and overweight, we utilized the anthropometric measure of BMI. In this parameter, the statistical analysis did not reveal a group effect [$F(1, 16) = 2.08$, $p = .16$] or a group x sessions interaction effect [$F(1, 16) = 3.52$, $p = .07$], but a sessions effect was observed [$F(1, 16) = 36.96$, $p = .001$, $\eta_p^2 = .46$]. The Tukey post

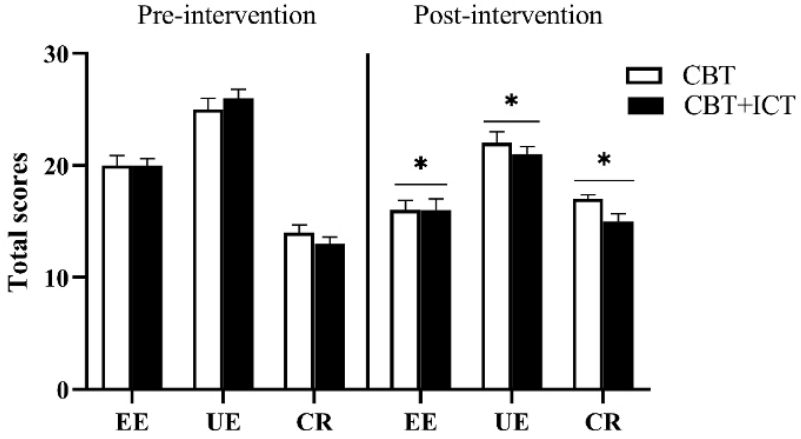

Figure 2. Effects of Interventions on Eating Behavior Domains Assessed by the Three-Factor Eating Questionnaire-R21 (TFEQ-r21).

Note. The impact of CBT and CBT combined with ICT on eating behavior. Total scores in the domains of EE, UE, and CR were analyzed. The analysis involved repeated measures ANOVA with Tukey's correction for multiple comparisons. Statistical significance for the effects of the interventions was set at $*p < .05$, comparing pre- and post-intervention. Data are presented as mean (M) and standard error of the mean (SEM).

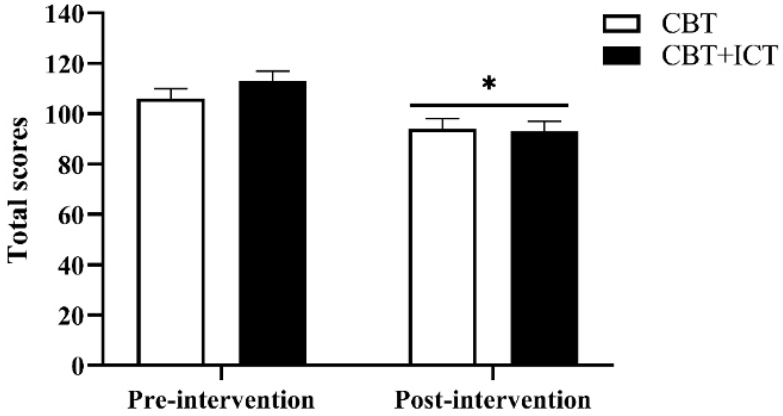

Figure 3. Effects of Interventions on Difficulties in Emotion Regulation Scale (DERS)

Note. The effects of CBT, and CBT combined with ICT on emotional regulation difficulties. The analysis employed repeated ANOVA measures, followed by Tukey's correction for multiple comparisons. Statistical significance was determined at $*p < .05$, examining session effects before and after the intervention. Data are presented as mean (M) and standard error of the mean (SEM).

hoc analysis indicated a reduction in the BMI of participants in both groups when comparing measurements taken before and after the intervention. This reduction remained consistent during the follow-up seven months later (Figure 4).

Impulsivity Behavior

To investigate the impact of the intervention on impulsivity, we analyzed the factors of the ESAVI scale. Regarding the persistence factor, the statistical analysis did not reveal differences between the groups [$F(1, 16) = 3.36$, $p = .08$], sessions [$F(1, 16) = 1.00$, $p = .15$], or the interaction between groups and sessions [$F(1, 16) = 1.06$, $p = .31$]. When assessing the cognitive control factor, it was not possible to observe effects in the groups [$F(1,16) = 21.78$, $p = .40$], sessions [$F(1, 16) = 0.59$, $p = .45$], or the interaction between sessions and groups [$F(1, 16) = 1.00$, $p = .14$]. No differences were identified for the audacity and recklessness factor, either in the groups [$F(1, 16) = 0.23$, $p = .63$], sessions [$F(1, 16) = 2.97$, $p = .10$], or in the interaction between groups and sessions [$F(1, 16) = 2.36$, $p = .14$]. Finally, when analyzing the future planning factor, the statistical analysis did not reveal a group effect [$F(1,16) = 0.93$, $p = .76$], nor an interaction between groups and sessions [$F(1, 16) = 2.17$, $p = .15$], however, a sessions effect was observed [$F(1, 16) = 5.26$, $p = 0.03$, $\eta_p^2 = .24$]. This measure suggests that, regardless of the group, there was a reported increase in future planning among the participants (Table 1).

DISCUSSION

The primary outcome of this study revealed that the intervention that combined CBT and ICT did not show superiority over the intervention model that focused on emotional regulation and weight loss, as viewed through the perspective of CBT. Twelve weeks after the end of therapies, both groups exhibited the following changes: 1) Decrease in scores for the EE and UE domains, and an increase in scores for the CR domain; 2) Reduction in emotional dysregulation; 3) Decrease in BMI; 4) Improvement in the future planning domain.

Our findings indicate changes in human eating behavior domains related to emotional and cognitive aspects. Notably, both groups showed improvements in reducing eating patterns associated with emotional states, as well as in enhancing

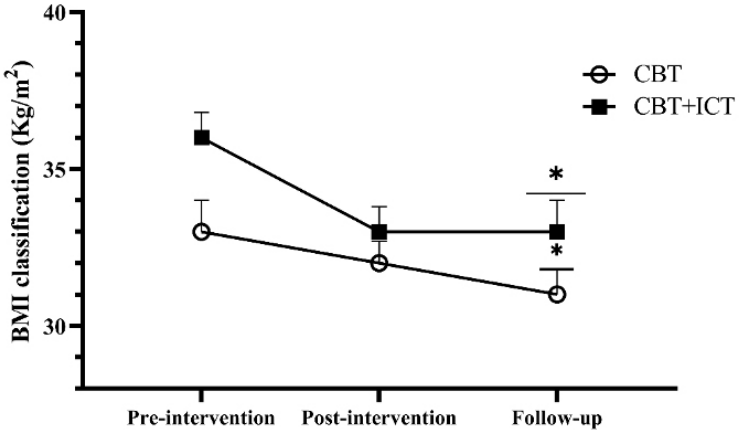

Figure 4. Effects of Interventions on Body Mass Index at Pre-Intervention, Post-Intervention, and 7/Month Follow-Up

Note. The effects of CBT, and CBT combined with ICT on BMI were evaluated. The assessment used repeated ANOVA measures, followed by Tukey's post hoc test for multiple comparisons. Statistical significance was indicated by $*p < .05$, comparing post-intervention and 7-month follow-up results with pre-intervention values. Data are presented as M and SEM.

Table 1. Effects of Intervention on the Impulsivity Domains of the Impulsivity Assessment Scale

Impulsivity Domains	Pre-intervention		Post-intervention	
	CBT	CBT+ICT	CBT	CBT+ICT
Persistence	35.4 ± 4.1	40.4 ± 4.6	34.6 ± 3.5	40.1 ± 4.6
Cognitive control	27.1 ± 3.9	25.9 ± 3.7	28.1 ± 4.3	26.2 ± 4.5
Audacity and recklessness	15.8 ± 3.4	17.9 ± 4.8	15.7 ± 2.8	15.8 ± 3.9
Planning ahead	14.7 ± 3.5	15.3 ± 2.1	19.3 ± 3.6*	19.7 ± 2.5*

Note. Comparison of impulsivity scale domains between the CBT group and the group receiving CBT combined with ICT. $*p < .05$ values in the table indicate statistically significant differences between pre-intervention and post-intervention assessments for both groups. Data are expressed as M and standard deviation (SD), they were analyzed using repeated ANOVA measures.

cognitive control over food intake. Consistent with our results, Stahre et al. (2023) evaluated a CBT protocol's efficacy in a sample of 83 participants. The intervention led to an increase in cognitive restraint eating, while uncontrolled and emotional eating decreased significantly, suggesting improvements in eating behavior patterns contributed to better outcomes, including waist circumference, waist-to-hip ratio, weight, and BMI, assessed before and six months after the CBT protocol. This study demonstrated the relationship between dysfunctional cognitive and emotional aspects and an obesogenic profile. Furthermore, obesity-related psychosocial stressors significantly decreased during the intervention, indicating the intervention may have improved stress coping strategies and emotional regulation, thus preventing the emergence of dysfunctional eating patterns associated with stress and anxiety. Indeed, in another study, we observed improvements in state anxiety and cortisol levels were reduced through CBT, accompanied by a decrease in eating behavior driven by emotional dysregulation (Porto et al., 2025). One possible explanation is that psychological distress or emotional dysregulation is linked to increased reward-seeking behaviors, such as the consumption of highly palatable foods (Dakanalis et al., 2023; Fuente González et al., 2022). Researchers suggest these emotions influence people's food choices, leading to a preference for pleasant but less nutritious meals. Consequently, the pursuit of palatable foods as a form of reward-seeking behavior is commonly referred to as emotional eating. This phenomenon arises from the role of food in alleviating unpleasant emotional states. These findings suggest that CBT effectively modifies dysfunctional eating behaviors by addressing underlying cognitive, emotional, and stress-coping components. This approach can be applied in clinical contexts and used as a strategy for identifying risk factors in primary care settings.

Numerous investigations have evaluated interventions utilizing CBT for the purpose of promoting weight loss and modifying eating behavior (Egoshi et al., 2024; Moraes et al., 2021; Smith et al., 2023). The focus of the treatment is on behavioral and cognitive changes, assisting in the modification of thoughts and dysfunctional beliefs, the acquisition of new behaviors such as future planning, stimulus control, and the adoption of healthier habits like physical activity and balanced nutrition. CBT is currently recognized as the leading non-pharmacological intervention among psychological methods and is endorsed by health guidelines as the primary strategy for managing and preventing obesity (Kurnik Mesarič et al., 2023). Although initially effective, it is noted that over time, a significant number of individuals have weight regain, as reported by Cooper et al. (2010), Rudolph and Hilbert (2020), and Moraes et al. (2021). The literature speculates that neurocognitive components related to cognitive control and behavioral adjustment may underlie the difficulties in maintaining weight.

In our study, we tested the hypothesis that using ICT focused on stimulating inhibitory control could enhance the outcomes of CBT on dysfunctional eating patterns, as well as in weight loss and maintenance. However, we did not observe that the combined CBT and ICT intervention was superior to the isolated CBT intervention. While EFs training may improve cognitive functions related to behavioral changes, such as diet and exercise planning, its direct impact on weight loss outcomes remains uncertain. One study evaluated the efficacy of Behavioral Weight Loss Programs with cognitive training focused on inhibition, working memory, and mental flexibility, examining the effect of these neurocognitive predictors on self-regulation and self-efficacy and their impact on weight maintenance over intervals of 3 months, 6 months, and two years (Szabo-Reed & Donnelly, 2021). The researchers observed that EFs stimulation can influence short-term weight maintenance and that better long-term weight maintenance outcomes vary in individuals with better EFs performance. Similarly, another study evaluated a 12-week program called Novel Executive Function Training (NEXT) for weight loss, which adapts cognitive training for adults seeking treatment for overweight or obesity with EF deficits. The findings suggest that EF training, as a compensatory strategy focused on cognitive control elements such as working memory, cognitive flexibility, problem solving, and decision making, may produce more durable treatment effects than traditional interventions (Eichen et al., 2021). The lack of efficacy in our combined CBT and ICT intervention may lie in the fact that we focused solely on inhibitory control. This function is known to regulate emotional responses, prepotent behavioral responses, and impulsivity (Bielecki et al., 2024). It is also suggested that behavioral changes related to eating behavior require improvements in both neurocognitive functions for emotion regulation and cognitive control for monitoring, planning, and decision-making. This hypothesis was also discussed in the meta-analysis by Yang et al. (2018), which identified 72 studies with a total of 4,904 participants, demonstrating that overweight individuals showed significant deficits in inhibition and working memory, along with moderated effects of obesity on working memory and decision-making.

Evidence for the effectiveness of EFs stimulation may vary according to age and aspects related to the developmental stage of executive functions. A meta-analysis study in children demonstrated that stimulating EFS during critical periods of brain development can lead to improved weight control outcomes (Du et al., 2021). Specifically, EF training in children with obesity can enhance self-control and emotional regulation, resulting in better emotional well-being and overall quality of life. This improvement, in turn, contributes to better management of food choices and facilitates weight loss. Moreover, providing EF training to children with obesity enhances their self-control and emotional regulation, further improving emotional well-being and overall quality of life. Consequently, this leads to more effective management of dietary choices and supports weight loss (Sanchez-Castañeda et al., 2021). The relationship between EFs and indicators of overweight and obesity in children and adolescents was the subject of a literature review by Mamrot &

Hanć (2019). The results indicate notable disparities among the groups, with the normal BMI group demonstrating superior ability in inhibitory control. Seventy-five percent of studies investigating higher EFs observed notable distinctions across groups, with the healthy weight group exhibiting greater performance. In children and adolescents, ICT may serve as an additional resource for managing weight regain and maintenance, while evidence in adults points to the effectiveness of stimulating different components of EFs.

Concerning emotional dysregulation, a reduction was observed during the follow-up period, regardless of the group, indicating that the intervention combining CBT and ICT was not superior to the group that used only the CBT-based intervention. Vasileiou and Abbott (2023) noted a higher level of emotional eating in obese adults compared to adults with a healthy BMI. In the review conducted by the authors, the use of food as a means of emotional regulation is highlighted in the literature as a phenomenon that can establish a negative association between emotional states and eating habits, triggering a dysfunctional cycle in which eating serves as a self-regulation mechanism. In the CBT protocol applied in this study, emotional regulation strategies were implemented specifically to reduce the use of food as a means of emotional regulation. The literature indicates that CBT-based interventions that provide individuals with greater awareness of their emotions, as well as acceptance strategies and behavioral change techniques, lead to improvements in the emotional regulation of these individuals (Saccaro et al., 2024). Emotion regulation strategies should be imperative for CBT protocols, particularly for managing dysfunctional behaviors linked to emotional states. These strategies are designed to help individuals modify their emotional experiences, proving effective in addressing issues such as anxiety and food craving episodes. Consequently, they enhance psychological outcomes and overall emotional well-being.

The study assessed BMI and found a decrease following the intervention, which continued for seven months regardless of the group. According to Russell et al., (2023), cognitive and behavioral therapies are among the most extensively studied and evidence-based approaches for interventions targeting obesity and overweight individuals. Its advantages include altering behavior, controlling stimuli, and modifying unhealthy thoughts about eating. CBT has gained significant recognition as an evidence-based psychotherapeutic method, often used in conjunction with other approaches such as pharmacotherapy, for effectively treating obesity (Egoshi et al. (2024); Moraes et al. (2021).

Throughout our interventions, qualitative feedback collected during session discussions revealed that nearly all participants reported either restarting or establishing a consistent routine of physical activity, engaging in exercise 3 to 5 times per week. Initially, in the control group of 9 individuals, only 2 were engaged in regular physical exercise. During the intervention, four inactive participants reported initiating a consistent regimen of physical exercise. Initially, only one participant in the CBT + ICT consistently engaged in physical activity. Following the formation of the group, six out of the eight individuals who were previously inactive reported engaging in physical exercise again. This included activities such as walking, weightlifting, running, or dance workout. It is crucial to emphasize that this fact may have influenced the weight loss outcomes of the group participants, which is beneficial, as the CBT intervention emphasizes behavioral modifications that lead to the adoption of a better way of life. Weight reduction is a result of these modifications (Kurnik Mesarič et al., 2023).

In our study, we evaluated the impact of ICT on components of impulsivity. Statistical analysis revealed an improvement in the future planning domain in both groups after the intervention, suggesting that the CBT model may have enhanced participants' ability to think ahead and plan long-term actions by considering future consequences before making decisions. This enhanced long-term planning likely made individuals more aware of the repercussions of their food choices, helping them avoid the frequent consumption of unhealthy foods. Indeed, according to Cury et al. (2020), one of the main challenges faced by individuals dealing with emotional or uncontrolled eating is the difficulty in delaying rewards, which contributes to challenges in planning and decision-making. This, in turn, results in failures to organize and execute dietary plans and increases their vulnerability to dysfunctional eating behaviors. These findings highlight the need for evaluating cognitive and behavioral aspects in CBT protocols for managing dysfunctional eating behaviors and controlling overweight and obesity. Assessing impulsivity, particularly components relevant to planning and maintaining healthy behaviors, is clinically necessary for achieving optimal long-term outcomes.

CONCLUSIONS

This study investigated the feasibility and preliminary effectiveness of a group emotional regulation intervention combining CBT and computerized ICT. The findings did not reveal significant differences between the intervention categories across the variables analyzed. However, the CBT protocol in both groups, which focused on emotional regulation components, demonstrated a positive impact on eating behaviors, particularly by reducing emotional and uncontrolled eating. Additionally, participants reported improvements in emotional regulation and future planning following the intervention, highlighting the potential value of the protocol in addressing key outcomes. A direct impact on BMI was observed seven months after the intervention. The statistical differences found yielded a large effect size, which increases confidence in the observed statistical differences. However, studies with larger and more diverse samples are necessary to ensure the generalizability of these findings to the broader population. The lack of significant difference between CBT and CBT + ICT groups might reflect the

fact that only inhibitory control was investigated as an executive function. Evidence highlights the role of other components, such as cognitive flexibility, working memory, and planning, in human eating behavior. The study notes that the CBT + ICT group had additional activities related to computerized training, exposing this group to different stimuli linked to this task. Although both interventions achieved similar post-intervention outcomes, it is necessary for the CBT group to undergo similar activities to standardize the intervention delivery across groups. Lastly, the evaluated parameters might be impacted by uncontrolled variables in this study, such as socioeconomic indicators, educational attainment, motivation, or external influences, which might contribute to the observed improvements. Future research should explore these variables further to optimize intervention strategies across different delivery models.

REFERENCES

Anderson, R., & Flack, K. (2022). Food-Related Stimuli Impair Inhibitory Control in Adults Classified as Overweight to Obese. *Current Developments in Nutrition*, *6*, 1046. https://doi.org/10.1093/cdn/nzac070.005

Atwood, M. E. (2024). Emotion dysregulation and obesity: A conceptual review of the literature. *Clinical Obesity*, *14*(6), e12699. https://doi.org/10.1111/cob.12699

Ávila-Batista, A. C., & Rueda, F. J. M. (2011). Construção e estudos psicométricos de uma Escala de Avaliação da Impulsividade [Construction and psychometric studies of an Impulsivity Assessment Scale]. *Psico-USF*, *16*, 285–295. https://doi.org/10.1590/S1413-82712011000300005

Bielecki, M., Tyburski, E., Plichta, P., Samochowiec, J., Kucharska-Mazur, J., Podwalski, P., Rek-Owodziń, K., Waszczuk, K., Sagan, L., Michalczyk, A., Rudkowski, K., Karabanowicz, E., Świątkowska, K., Misiak, B., Bąba-Kubiś, A., & Mak, M. (2024). Impulsivity and inhibitory control in deficit and non-deficit schizophrenia. *BMC Psychiatry*, *24*(1), 473. https://doi.org/10.1186/s12888-024-05918-6

Boutari, C., & Mantzoros, C. S. (2022). A 2022 update on the epidemiology of obesity and a call to action: As its twin COVID-19 pandemic appears to be receding, the obesity and dysmetabolism pandemic continues to rage on. *Metabolism: Clinical and Experimental*, *133*, 155217. https://doi.org/10.1016/j.metabol.2022.155217

Byrne, M. E., Tanofsky-Kraff, M., Lavender, J. M., Parker, M. N., Shank, L. M., Swanson, T. N., Ramirez, E., LeMay-Russell, S., Yang, S. B., Brady, S. M., Zenno, A., Chivukula, K. K., Kelly, N. R., & Yanovski, J. A. (2021). Bridging executive function and disinhibited eating among youth: A network analysis. *The International journal of eating disorders*, *54*(5), 721–732. https://doi.org/10.1002/eat.23476

Cancian, A. C. M., Souza, L. A. S. de, Silva, V. H. P. E., Machado, W. de L., & Oliveira, M. da S. (2019). Psychometric properties of the Brazilian version of the Difficulties in Emotion Regulation Scale (DERS). *Trends in Psychiatry and Psychotherapy*, *41*(1), 18–26. https://doi.org/10.1590/2237-6089-2017-0128

Chen, M., Lam, W. W. T., Yuan, J., Dong, M., Yang, L., Chan, D. K. C., & Liao, Q. (2024). Executive function, perceived stress and eating behaviors among Chinese young adults. *Stress and Health*, *40*(4), e3397. https://doi.org/10.1002/smi.3397

Cunningham, P. M., Roe, L. S., Pearce, A. L., Keller, K. L., & Rolls, B. J. (2024). Poorer inhibitory control was related to greater food intake across meals varying in portion size: A randomized crossover trial. *Appetite*, *194*, 107168. https://doi.org/10.1016/j.appet.2023.107168

Cury, M. E. G., Berberian, A., Scarpato, B. S., Kerr-Gaffney, J., Santos, F. H., & Claudino, A. M. (2020). Scrutinizing domains of executive function in binge eating disorder: A systematic review and meta-analysis. *Frontiers in Psychiatry*, *11*, 288. https://doi.org/10.3389/fpsyt.2020.00288

Dakanalis, A., Mentzelou, M., Papadopoulou, S. K., Papandreou, D., Spanoudaki, M., Vasios, G. K., Pavlidou, E., Mantzorou, M., & Giaginis, C. (2023). The association of emotional eating with overweight/obesity, depression, anxiety/stress, and dietary patterns: A review of the current clinical evidence. *Nutrients*, *15*(5), 1173. https://doi.org/10.3390/nu15051173

Dalle Grave, R., Calugi, S., Bosco, G., Valerio, L., Valenti, C., El Ghoch, M., & Zini, D. (2020). Personalized group cognitive behavioral therapy for obesity: A longitudinal study in a real-world clinical setting. *Eating and Weight Disorders, 25*(2), 337–346. https://doi.org/10.1007/s40519-018-0593-z

de Klerk, M. T., Smeets, P. a. M., & la Fleur, S. E. (2023). Inhibitory control as a potential treatment target for obesity. *Nutritional Neuroscience*, *26*(5), 429–444. https://doi.org/10.1080/1028415X.2022.2053406

de Lannoy, L., Cowan, T., Fernandez, A., & Ross, R. (2021). Physical activity, diet, and weight loss in patients recruited from primary care settings: An update on obesity management interventions. *Obesity Science & Practice*, *7*(5), 619–628. https://doi.org/10.1002/osp4.514

de Medeiros, A. C. Q., Yamamoto, M. E., Pedrosa, L. F. C., & Hutz, C. S. (2017). The Brazilian version of the three-factor eating questionnaire-R21: Psychometric evaluation and scoring pattern. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, *22*(1), 169–175. https://doi.org/10.1007/s40519-016-0256-x

Du, Z., Li, J., Huang, J., Ma, J., Xu, X., Zou, R., & Xu, X. (2021). Executive functions in predicting weight loss and obesity indicators: A meta-analysis. *Frontiers in Psychology*, *11,* 604113. https://doi.org/10.3389/fpsyg.2020.604113

Egoshi, M., Saito, A., Nordeng, L., Takayama, Y., & Furukawa, Y. (2024). Retrospective study of cognitive behavioral therapy for obesity modified as FIRE method (CBT-F) in combination with medication for weight loss. *Medicine*, *103*(19), e38141. https://doi.org/10.1097/MD.0000000000038141

Forman, E. M., Manasse, S. M., Dallal, D. H., Crochiere, R. J., Loyka, C. M., Butryn, M. L., Juarascio, A. S., & Houben, K. (2019). Computerized neurocognitive training for improving dietary health and facilitating weight loss. *Journal of Behavioral Medicine*, *42*(6), 1029–1040. https://doi.org/10.1007/s10865-019-00024-5

Fuente González, C. E., Chávez-Servín, J. L., de la Torre-Carbot, K., Ronquillo González, D., Aguilera Barreiro, M. de L. Á., & Ojeda Navarro, L. R. (2022). Relationship between emotional eating, consumption of hyperpalatable energy-dense foods, and indicators of nutritional status: A systematic review. *Journal of Obesity*, *2022*, 4243868. https://doi.org/10.1155/2022/4243868

Gomes-Oliveira, M. H., Gorenstein, C., Neto, F. L., Andrade, L. H., & Wang, Y. P. (2012). Validation of the brazilian portuguese version of the beck depression inventory-ii in a community sample. *Revista Brasileira de Psiquiatria*, *34*(4), 389–394. https://doi.org/10.1016/j.rbp.2012.03.005

Hall, K. D., & Kahan, S. (2018). Maintenance of lost weight and long-term management of obesity. *The Medical clinics of North America*, *102*(1), 183–197. https://doi.org/10.1016/j.mcna.2017.08.012

Harris, C. L., Chapman, H., & Groves, N. (2024). Eating competence is related to executive function skills in college students. *Eating Behaviors*, *55*, 101922. https://doi.org/10.1016/j.eatbeh.2024.101922

Herzog, N., Hartmann, H., Janssen, L. K., Kanyamibwa, A., Waltmann, M., Kovacs, P., Deserno, L., Fallon, S. J., Villringer, A., & Horstmann, A. (2024). Impaired updating of working memory representations in individuals with high BMI: Evidence for dopaminergic mechanisms. *eLife*, *13*. RP93369. https://doi.org/10.7554/eLife.93369.1

Iannazzo, L. H., Hayden, M. J., Lawrence, N. S., Kakoschke, N., Hughes, L. K., Van Egmond, K., Lum, J., & Staiger, P. K. (2024). Inhibitory control training to reduce appetitive behaviour: A meta-analytic investigation of effectiveness, potential moderators, and underlying mechanisms of change. *Health Psychology Review*, *19*(1), 66-96. https://doi.org/10.1080/17437199.2024.2410018

Jamshidi, A., Abedi, P., Hamid, N., & Haghighizadeh, M. (2023). Effect of group cognitive behavioural therapy on self-efficacy and anthropometric indices among overweight and obese postpartum women. *South African Journal of Clinical Nutrition*, *36*(4), 147–153. https://doi.org/10.1080/16070658.2023.2172707

Jentsch, V. L., & Wolf, O. T. (2024). The bidirectional interplay between stress and cognitive emotion regulation. *Psychoneuroendocrinology*, *160*, 106719. https://doi.org/10.1016/j.psyneuen.2023.106719

Kurnik Mesarič, K., Pajek, J., Logar Zakrajšek, B., Bogataj, Š., & Kodrič, J. (2023). Cognitive behavioral therapy for lifestyle changes in patients with obesity and type 2 diabetes: A systematic review and meta-analysis. *Scientific Reports*, *13*(1), 12793. https://doi.org/10.1038/s41598-023-40141-5

Lakens, D. (2013). Calculating and reporting effect sizes to facilitate cumulative science: A practical primer for t-tests and ANOVAs. *Frontiers in Psychology*, *4*, 863. https://doi.org/10.3389/fpsyg.2013.00863

Le, T. H., Disegna, M., & Lloyd, T. (2023). National food consumption patterns: Converging trends and the implications for health. *EuroChoices*, *22*(1), 66–73. https://doi.org/10.1111/1746-692X.12272

Machado, A. M., Guimarães, N. S., Bocardi, V. B., Silva, T. P. R. da, Carmo, A. S. do, Menezes, M. C. de, & Duarte, C. K. (2022). Understanding weight regain after a nutritional weight loss intervention: Systematic review and meta-analysis. *Clinical Nutrition ESPEN*, *49*, 138–153. https://doi.org/10.1016/j.clnesp.2022.03.020

Madjd, A., Taylor, M. A., Delavari, A., Malekzadeh, R., Macdonald, I. A., & Farshchi, H. R. (2020). Effects of cognitive behavioral therapy on weight maintenance after successful weight loss in women; a randomized clinical trial. *European Journal of Clinical Nutrition*, *74*(3), 436–444. https://doi.org/10.1038/s41430-019-0495-9

Mamrot, P., & Hanć, T. (2019). The association of the executive functions with overweight and obesity indicators in children and adolescents: A literature review. *Neuroscience and Biobehavioral Reviews*, *107*, 59–68. https://doi.org/10.1016/j.neubiorev.2019.08.021

Manasse, S. M., Lampe, E. W., Gillikin, L., Payne-Reichert, A., Zhang, F., Juarascio, A. S., & Forman, E. M. (2020). The project REBOOT protocol: Evaluating a personalized inhibitory control training as an adjunct to cognitive behavioral therapy for bulimia nervosa and binge-eating disorder. *The International Journal of Eating Disorders*, *53*(6), 1007–1013. https://doi.org/10.1002/eat.23225

Mas, M., Chambaron, S., Chabanet, C., & Brindisi, M.-C. (2024). Inhibition and shifting across the weight status spectrum. *Applied Neuropsychology. Adult*, *31*(4), 494–501. https://doi.org/10.1080/23279095.2022.2039656

Michaelides, A., Mitchell, E. S., Behr, H., Ho, A. S., Hanada, G., Lee, J., & McPartland, S. (2022). Executive function-related improvements on a commercial CBT-based weight management intervention: Pilot randomized controlled trial. *International Journal of Environmental Research and Public Health*, *19*(14), 8763. https://doi.org/10.3390/ijerph19148763

Moraes, A. dos S., Padovani, R. da C., La Scala Teixeira, C. V., Cuesta, M. G. S., Gil, S. dos S., de Paula, B., dos Santos, G. M., Gonçalves, R. T., Dâmaso, A. R., Oyama, L. M., Gomes, R. J., & Caranti, D. A. (2021). Cognitive behavioral approach to treat obesity: A randomized clinical trial. *Frontiers in Nutrition*, *8,* 611217. https://doi.org/10.3389/fnut.2021.611217

Murray, C. J. L., Aravkin, A. Y., Zheng, P., Abbafati, C., Abbas, K. M., Abbasi-Kangevari, M., Abd-Allah, F., Abdelalim, A., Abdollahi, M., Abdollahpour, I., Abegaz, K. H., Abolhassani, H., Aboyans, V., Abreu, L. G., Abrigo, M. R. M., Abualhasan, A., Abu-Raddad, L. J., Abushouk, A. I., Adabi, M., Lim, S. S. (2020). Global burden of 87 risk factors in 204 countries and territories, 1990–2019: A systematic analysis for the global burden of disease study 2019. *The Lancet*, *396*(10258), 1223–1249. https://doi.org/10.1016/S0140-6736(20)30752-2

Nakamura, Y., Okemoto, M., & Ikuta, T. (2024). Food go/no-go training alters neural circuits for food evaluation for appetite reduction. *Appetite*, *192*, 107099. https://doi.org/10.1016/j.appet.2023.107099

Oldrati, V., Corti, C., Poggi, G., Borgatti, R., Urgesi, C., & Bardoni, A. (2020). Effectiveness of computerized cognitive training programs (CCTP) with game-like features in children with or without neuropsychological disorders: A meta-analytic investigation. *Neuropsychology Review*, *30*(1), 126–141. https://doi.org/10.1007/s11065-020-09429-5

Porto, A. P., Rabelo, L. N., & Nascimento, E. B. do. (2025). A pilot study of obesity management: contributions of cognitive-behavioral group therapy to stress, anxiety, and emotional eating. *Actualidades En Psicología*, *39*(138), 1-23. https://doi.org/10.15517/ap.v39i138.54969

Ramos, R., Vaz, A. R., Rodrigues, T. F., Baenas, I., Fernández-Aranda, F., & Machado, P. P. (2024). Exploring the relationship between emotion regulation, inhibitory control, and eating psychopathology in a non-clinical sample. *European Eating Disorders Review: The Journal of the Eating Disorders Association*, *32*(1), 66–79. https://doi.org/10.1002/erv.3024

Rudolph, A., & Hilbert, A. (2020). Cognitive-behavioral therapy for postbariatric surgery patients with mental disorders: A pilot study. *Frontiers in Psychiatry*, *11,* 14. https://doi.org/10.3389/fpsyt.2020.00014

Saccaro, L. F., Giff, A., De Rossi, M. M., & Piguet, C. (2024). Interventions targeting emotion regulation: A systematic umbrella review. *Journal of Psychiatric Research*, *174*, 263–274. https://doi.org/10.1016/j.jpsychires.2024.04.025

Shapiro, S.S. and Wilk, M.B. (1965) An analysis of variance test for normality (complete samples). Biometrika, *52*, 591-611.

Silva, C., Ocampo, A. M., & Alcántara, González, K.E. (2024). Toma de decisiones, planificación y flexibilidad cognitiva: Caracterización de un grupo de adultos con sobrepeso [Decision making, planning and cognitive flexibility: Caracterization of a group of overweight adults]. *CES Psicología*, *17*(2), 45-57. https://doi.org/10.21615/cesp.6624

Smith, J., Ang, X. Q., Giles, E. L., & Traviss-Turner, G. (2023). Emotional eating interventions for adults living with overweight or obesity: A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health*, *20*(3), 2722. https://doi.org/10.3390/ijerph20032722

Spinner, H., Thompson, K. A., Bauman, V., Lavender, J. M., Thorstad, I., Schrag, R., Sbrocco, T., Schvey, N. A., Ford, B., Ford, C., Wilfley, D. E., Jorgensen, S., Klein, D. A., Quinlan, J., Yanovski, J. A., Haigney, M., & Tanofsky-Kraff, M. (2024). Emotional dysregulation moderates the relation between perceived stress and emotional eating in adolescent military dependents. *The International Journal of Eating Disorders*, *57*(7), 1609–1615. https://doi.org/10.1002/eat.24217

Stahre, L., Blomstrand, A., & Hällström, T. (2023). Effectiveness of cognitive behaviour therapy targeting eating behaviour for patients with abdominal obesity in an ordinary primary health care setting. *Novel Research Aspects in Medicine and Medical Science 8*, 102–118. https://doi.org/10.9734/bpi/nramms/v8/6507B

Szabo-Reed, A. N., & Donnelly, J. E. (2021). Cognitive training: Associations and implications for weight management and translational research. *Translational Journal of the American College of Sports Medicine*, *6*(2), e000151. https://doi.org/10.1249/TJX.0000000000000151

Torres, S., Sales, C. M. D., Guerra, M. P., Simões, M. P., Pinto, M., & Vieira, F. M. (2020). Emotion-focused cognitive behavioral therapy in comorbid obesity with binge eating disorder: A pilot study of feasibility and long-term outcomes. *Frontiers in Psychology*, *11*, 343. https://doi.org/10.3389/fpsyg.2020.00343

Vasileiou, V., & Abbott, S. (2023). Emotional eating among adults with healthy weight, overweight and obesity: A systematic review and meta-analysis. *Journal of Human Nutrition and Dietetics: The Official Journal of the British Dietetic Association*, *36*(5), 1922–1930. https://doi.org/10.1111/jhn.13176

Yang, Y., Shields, G. S., Guo, C., & Liu, Y. (2018). Executive function performance in obesity and overweight individuals: A meta-analysis and review. *Neuroscience and Biobehavioral Reviews*, *84*, 225–244. https://doi.org/10.1016/j.neubiorev.2017.11.020.

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