Exploring the Relationship Between Emotion Regulation, Inhibitory Control, and Eating Psychopathology in a Non-Clinical Sample

Rita Ramos[1*]

[1]Psychotherapy and Psychopathology Research Lab, Psychology Research Centre (CIPsi), School of Psychology, University of Minho, Braga, Portugal

rita.ramos@psi.uminho.pt

*Corresponding author

ORCID: 0000-0001-7792-7179

Ana Rita Vaz[2,3]

[2]University Clinic of Psychiatry and Medical Psychology, Faculty of Medicine, University of Lisbon, Lisbon, Portugal

[3]Eating Disorders Unit, Psychiatry and Mental Health Department, Centro Hospitalar Universitário Lisboa Norte, Lisbon, Portugal

ana.r.vaz@edu.ulisboa.pt

ORCID: 0000-0002-7084-0094

Tânia F. Rodrigues[1]

[1]Psychotherapy and Psychopathology Research Lab, Psychology Research Centre (CIPsi), School of Psychology, University of Minho, Braga, Portugal

tcfrodrigues@psi.uminho.pt

ORCID: 0000-0002-2054-3489

Isabel Baenas[4,5,6]

[4]Department of Psychiatry, University Hospital of Bellvitge, Barcelona, Spain

[5]CIBER Fisiopatología Obesidad y Nutrición (CIBERObn), Instituto de Salud Carlos III (ISCIII), Madrid, Spain

[6]Psychoneurobiology of Eating and Addictive Behaviours Group, Neurosciences Programme, Bellvitge Biomedical Research Institute (IDIBELL), Barcelona, Spain

ibaenas@bellvitgehospital.cat

ORCID: 0000-0001-7415-0616

Fernando Fernández-Aranda[4,5,6,7]

[4]Department of Psychiatry, University Hospital of Bellvitge, Barcelona, Spain

[5]CIBER Fisiopatología Obesidad y Nutrición (CIBERObn), Instituto de Salud Carlos III (ISCIII), Madrid, Spain
[6]Psychoneurobiology of Eating and Addictive Behaviours Group, Neurosciences Programme, Bellvitge Biomedical Research Institute (IDIBELL), Barcelona, Spain
[7]Department of Clinical Sciences, School of Medicine and Health Sciences, University of Barcelona, Barcelona, Spain
ffernandez@bellvitgehospital.cat
ORCID: 0000-0002-2968-9898

Paulo P. P. Machado[1]
[1]Psychotherapy and Psychopathology Research Lab, Psychology Research Centre (CIPsi), School of Psychology, University of Minho, Braga, Portugal
pmachado@psi.uminho.pt
ORCID: 0000-0003-4277-9203

Declarations:

Data availability statement. The data that support the findings of this study are available from the corresponding author upon reasonable request.

Funding statement. This work was conducted at the Psychology Research Centre (PSI/01662), School of Psychology, University of Minho, and partially supported by the Portuguese Foundation for Science and Technology (FCT) and the Portuguese Ministry of Science, Technology and Higher Education (UID/PSI/01662/2019), through the national funds (PIDDAC); a grant by the FCT and the Portuguese Ministry of Science, Technology and Higher Education through national funds and co-financed by FEDER through COMPETE2020 under the PT2020 Partnership Agreement (POCI-01-0145-FEDER-028145 / PTDC/PSI-ESP/28145/2017) to Paulo Machado; and a PhD studentship granted to the first author (2022.12203.BD), supported by the FCT, funded with allocations from the State Budget of the Ministry for Science, Technology and Higher Education and with allocations from the European Social Fund. The funding body had no role in the design, collection, analysis, and interpretation of data; the writing of the manuscript; or the decision to submit the manuscript for publication.

Conflicts of interest. The authors declare that they have no conflict of interest.

Ethics approval statement. This study was approved by the Ethical Committee of the University of Minho, Braga, Portugal.

Ramos, R., Vaz, A. R., Rodrigues, T. F., Baenas, I., Fernández-Aranda, F., & Machado, P. P. P. (2023). Exploring the relationship between emotion regulation, inhibitory control, and eating psychopathology in a non-clinical sample. *European Eating Disorders Review*, 1–14. https://doi.org/10.1002/erv.3024

Abstract

Objective: The present study aimed to explore the relationship between difficulties in emotion regulation and deficits in inhibitory control, and the role of these processes in eating psychopathology in a non-clinical sample. We also explored the specificity in which deficits in inhibitory control may underlie eating psychopathology, namely whether they can be conceptualized as context specific or more extensive in nature.

Method: Participants were 107 healthy individuals recruited at a major Portuguese university, aged between 18 and 43 years-old ($M = 21.23$, $SD = 4.79$). Two computerized neuropsychological tasks (i.e., emotional go/no-go and food go/no-go tasks) were used to assess response inhibition in the presence of general vs. context-specific stimuli. A set of self-report measures was used to assess variables of interest such as emotion regulation and eating psychopathology.

Results: Results indicated higher response inhibition deficits among participants with higher difficulties in emotion regulation comparing to those with lower difficulties in emotion regulation, particularly in the context of food-related stimuli. In addition, the relationship between difficulties in emotion regulation and eating psychopathology was moderated by inhibitory control deficits in both the context of food and pleasant stimuli.

Conclusions: The present findings highlight inhibitory control as an important process underlying the relationship between difficulties in emotion regulation and eating psychopathology in non-clinical samples. Findings have important implications for clinical practice and the prevention of eating psychopathology in healthy individuals and individuals with eating disorders.

Highlights

- Greater deficits in response inhibition were observed in participants with higher difficulties in emotion regulation, particularly in the context of food-related stimuli.
- Inhibitory control deficits in the context of food stimuli moderated the relationship between difficulties in emotion regulation and eating psychopathology.
- Inhibitory control deficits in the context of pleasant stimuli moderated the relationship between difficulties in emotion regulation and eating psychopathology.

Keywords: difficulties in emotion regulation; inhibitory control; eating psychopathology; emotional go/no-go task; food go/no-go task.

Introduction

In the last decade, extensive research has focused on the processes underlying the etiology and maintenance of eating psychopathology. One of the variables consistently assessed was emotion regulation, defined as the processes by which individuals influence the experience or expression of emotions (Gross et al., 1998). In fact, several empirical studies point to the link between difficulties in emotion regulation and dysfunctional eating behaviors, both in clinical (e.g., Brockmeyer et al., 2014; Svaldi et al., 2012) and non-clinical (e.g., Goldschmidt et al., 2017; Ridout et al., 2010) samples. For instance, in a recent study conducted with a sample of patients with eating disorders (ED), the authors found increased difficulties in emotion regulation amongst people with EDs compared to healthy controls (Mallorquí-Bagué et al., 2018), reinforcing the potential transdiagnostic role of difficulties in emotion regulation in ED psychopathology. Similar results were found in a meta-analytic review by Aldao and colleagues (2010), with ED symptoms being positively associated with maladaptive emotion regulation strategies such as rumination, avoidance, and suppression, while negatively associated with problem solving. Eating-disordered behaviors (e.g., binge eating, purging, eating restraint) have been suggested to function as maladaptive strategies to regulate negative affect (Brockmeyer et al., 2012; Leehr et al., 2015; Macht, 2008), providing short-term distraction or escape from undesired negative emotions.

In non-clinical samples, a recent study conducted with undergraduate students found a positive association between emotion regulation difficulties and restrictive eating (Haynos et al., 2018). Goldschmidt and colleagues (2017) found evidence for the role of emotion regulation difficulties in the development and maintenance of loss of control eating in adolescents. These results seem to suggest that the link between emotion dysregulation and dysfunctional eating behaviors may be relevant beyond clinical samples, in individuals without an ED diagnosis.

Inhibitory control, the ability to control thoughts, behaviors, and emotions in order to achieve a goal or do what is more contextually appropriated for a certain individual, has been noted as crucial for successful emotion and eating behavior regulation (Gil et al., 2022; Liu et al., 2020; Smith et al., 2018). In fact, resisting the temptation to eat tasty, high-calorie foods, or other unhealthy options that are readily available in our culture requires an effective ability to inhibit impulsive and inappropriate responses.

Evidence suggests a positive association between efficient inhibitory control and the use of adaptive emotion regulation strategies, such as cognitive reappraisal (e.g., Cohen & Mor, 2018; Salas et al., 2014). In addition, a recent study conducted with a non-clinical sample found support for a downregulating function of inhibitory control over the experience of negative emotions (Gil et al., 2022). Interestingly, Kalanthroff and colleagues (2013) found impaired inhibitory control after the exposure to negative stimuli, reinforcing a potential bidirectional interrelation between both processes.

Over the last years, an extensive body of research highlighted the critical role of inhibitory control deficits across disorders characterized by difficulties in emotion regulation, including EDs (Bartholdy et al., 2016; Smith et al., 2018; Wu et al., 2013). Specifically, data suggest that inhibitory control deficits may contribute to difficulties controlling urges to binge or purge in clinical samples; and to overeating in the face of negative emotional states and engagement in unhealthy eating in non-clinical samples (Bartholdy et al., 2016; Jasinska et al., 2012). However, empirical evidence on the role of inhibitory control deficits in eating pathology is needed, as inconsistent findings have been reported (c.f., Bartholdy et al., 2016). In addition, exploring inhibitory control using well-validated and replicable objective paradigms (e.g., Go/No-Go task) is of great importance.

Increasing interest has also been directed to whether inhibitory control deficits contributing to ED psychopathology may be conceptualized as general or context-specific (i.e., food-related, emotion-related), as it would inform the specific conditions in which response inhibition deficits occur. For instance, in a systematic review and meta-analysis, Wu and colleagues (2013) found evidence for reduced inhibitory control in bulimic-type EDs (i.e., anorexia nervosa binge/purge

subtype, bulimia nervosa, binge eating disorder) to general stimuli, although with a small effect size. More consistent findings were reported for disorder-relevant stimuli (e.g., food/body-shape) in patients with bulimia nervosa (Wu et al., 2013) and binge eating disorder (Giel et al., 2017; Kittel et al., 2015), suggesting that inhibitory control deficits in EDs may be particularly salient in disorder-specific contexts.

In a recent study exploring emotion-related inhibitory control in patients with EDs compared to healthy controls, Mallorquí-Bagué and colleagues (2020) found no significant differences between groups in both emotional and non-emotional inhibitory control, both at behavioral and neural level. These results suggest that inhibitory control may not be particularly affected by the emotional context. However, given the literature on the link between difficulties in emotion regulation and dysfunctional eating behaviors, further investigation on how response inhibition may be modulated by the emotional context is needed both in clinical and non-clinical samples. Studies exploring how inhibitory control deficits may contribute to ED psychopathology and in what specific contexts these deficits occur is an important topic that can inform clinical practice.

The present study aims to explore the relationship between inhibitory control deficits and difficulties in emotion regulation, and its potential precursor role to eating psychopathology in a non-clinical sample. First, we explore the differences in inhibitory control between high and low levels of difficulties in emotion regulation, using two neuropsychological tasks (i.e., food go/no-go and emotional go/no-go tasks). In addition, we explore the potential moderating role of inhibitory control on the relationship between difficulties in emotion regulation and eating psychopathology. As far as we know, this is the first study exploring the interrelations between these processes in a non-clinical sample. We expect lower global ability of response inhibition (i.e., lower accuracy to no-go trials) in participants with higher difficulties in emotion regulation, and a moderating role of inhibitory control on the relationship between emotion regulation and eating psychopathology. Specifically, we hypothesize a stronger positive association between emotion dysregulation and eating psychopathology at higher levels of inhibitory control deficits.

Methods

Participants

One hundred and eighty healthy students, at a major Portuguese public university, enrolled in the study through an online institutional platform developed for research dissemination purposes. Of these, 22 participants did not meet the inclusion criteria: 1) no self-reported history of an eating disorder, 2) at least 18 years old, 3) no current psychotropic medication, and 4) no self-reported history of any psychiatric or neurologic condition that may affect neurocognitive performance. Additionally, 51 participants did not complete the study. The final sample consisted of $N = 107$ participants (98 female, 9 male), ages ranging from 18 to 43 years-old ($M = 21.23$, $SD = 4.79$), and body mass index ranging from 17.51 to 33.59 kg/m^2 ($M = 22.66$, $SD = 3.47$). The majority ($n = 102$; 95.3%) were Portuguese, and 5 (4.6%) were from other Portuguese-speaking countries. One hundred and four participants (97.2%) were single and 3 (2.8%) were married or lived with a partner. All participants were informed about the aims of the study and its voluntary nature before starting their participation. Course credits were provided to all participants as a form of compensation for participating in the study.

Procedures

After enrollment in the study, all participants had automatic access to an online informed consent form developed using *Google Forms* for detailed reading about the research objectives, conditions of participation, and the possibility of leaving the study at any time, without any consequences. Those who agreed to participate were asked to sign the informed consent form before starting their participation. After that, all participants had direct access to a sociodemographic questionnaire and a set of self-report measures lasting approximately 10 minutes. Detailed instructions for participating in both online neuropsychological tasks and respective unidentifiable participation codes and links were sent via e-mail the same day (RR).

These codes were stored at the University of Minho facilities and accessible only to authorized researchers. All information was deleted after the data collection was completed, and no participants could be identified at any moment.

All participants were asked to complete both tasks on the same day, and to perform the tasks in a quiet occasion, without any external noise or interference that could influence their performance. The study was approved by the University's Ethical Committee, and data collection occurred between December 2021 and May 2022.

Measures

Self-report measures

Participants completed a questionnaire to obtain anthropometric and sociodemographic data, namely weight (kg) and height (cm), age, sex, relationship status, lifetime history of any eating disorder, history of a psychiatric or neurological condition, and current medication use. They also completed a set of self-report measures, described below.

Eating Disorder Examination-Questionnaire (EDE-Q, Fairburn & Beglin, 2008): is a 28-item measure that assesses ED symptoms and associated psychopathology focusing on the last 28 days. It consists of 22 items rated on a 7-point Likert scale ranging from 0 ("No days") to 6 ("Every day"), yielding four subscale scores (eating restraint, eating concern, shape concern, and weight concern) and a total score. Higher scores represent greater eating pathology. It also includes six items assessing the frequency of key ED behaviors. The Portuguese version of the EDE-Q was used in this study (Machado et al., 2014), and demonstrated good internal consistency, with Cronbach's alphas ranging from .72 to .94 in non-clinical samples.

Difficulties in Emotion Regulation Scale (DERS, Gratz & Roemer, 2004): is a 36-item measure that assesses patient´s response to negative emotional states, rated from 1 ("Almost never") to 5 ("Almost always"). It generates six subscales: 1) Nonacceptance; 2) Goals; 3) Impulse; 4) Awareness; 5) Strategies; and 6) Clarity. The global score ranges from 36 to 180, and

higher scores represent greater difficulties in emotion regulation. The Portuguese version of the DERS was used in this study (Coutinho et al., 2010), and demonstrated good internal consistency, with a Cronbach's alpha of .92 for the global score in a non-clinical sample.

Depression, Anxiety and Stress Scales (DASS-21, Lovibond & Lovibond, 1995): is a 21-item measure that assesses three negative emotional states (depression, anxiety, and stress). Each subscale is constituted by 7 items, rated from 0 ("Did not apply to me at all") to 3 ("Applied to me very much or most of the time"). Subscale scores are calculated by summing the respective items and can range from 0 to 21 points. Higher scores represent greater symptom severity. In the Portuguese version (Pais-Ribeiro et al., 2004), the DASS-21 revealed good internal consistency levels with Cronbach's alphas of .85, .74 and .81 for depression, anxiety and stress, respectively.

Behavioral measures

Emotional Go/No-Go Task:

The Emotional Go/No-go task consisted in the presentation of 90 affective pictures categorized into three emotional valence categories: pleasant (n = 30), neutral (n = 30), and unpleasant (n = 30). All pictures were selected from the Portuguese adaptation of the International Affective Picture System (IAPS) (Soares et al., 2014), based on their standardized ratings of arousal and valence. Table 1 describes the mean and standard deviation normative valence and arousal ratings of each emotional context.

All pictures were presented five times, corresponding to a total of 450 trials divided into three blocks of 150 trials each (i.e., pleasant, neutral, and unpleasant). Each picture was superimposed with one of two capital letters ("W" or "M"), *Arial* font, colored in yellow, and with a black outline. Participants were asked to respond as quickly and accurately as possible by pressing the "spacebar" with the index finger of their dominant hand to Go stimuli (letter "M"), and to inhibit their response to No-Go stimuli (letter "W"). Block order presentation was counterbalanced for all participants.

Each block was constituted by 105 Go stimuli and 45 No-Go stimuli, corresponding to a percentage of 70% “M” and 30% “W”, respectively, in order to create a prepotent tendency to respond. Stimuli was presented in a semi-random order, avoiding the presentation of two consecutive No-go trials, and the presentation of more than four consecutive Go trials. Between each block, participants were allowed to take a 1-minute break.

Each trial consisted in the presentation of a Go or No-go stimuli for 600ms, preceded by a white fixation cross superimposed on a black background (500ms). The Go stimuli were terminated by pressing the “spacebar” to a maximum of 1000ms. The interstimulus interval was 800ms (see Figure 1). Both the fixation cross and the Go/No-go stimuli were presented centered above the background.

Before starting the experiment, all participants completed a practice block constituted by 10 trials (7 Go and 3 No-go) with a neutral picture as a background to ensure understanding of the task instructions.

The task was programed using E-Prime 3.0 software and run in E-Prime Go (1.0.2.57) (Psychology Software Tools, Pittsburgh, PA), allowing remote data collection. All participants were asked to respond in a quiet environment, without any noise or external factors that could interfere with their performance. The task took approximately 20 minutes to complete.

Mean reaction time to Go stimuli was calculated after eliminating incorrect responses and anticipatory errors (i.e., reaction times below 150ms).

<Insert Table 1 about here>

<Insert Figure 1 about here>

Food Go/No-Go Task:

In the food Go/No-go task, participants were asked to respond by pressing the “spacebar”, as quickly and accurately as possible to Go stimuli (letter “M”), and to inhibit their response to

No-Go stimuli (letter "W"). The stimuli were presented in capital letters, *Aria*l font, colored in yellow and with a black outline to ensure visibility. Both letters were displayed in the center of the screen, superimposed on a background picture that represented one of three different emotional contexts: neutral (i.e., black background), food-related, and non-food-related background. Two food-related pictures and two non-food related pictures were selected from the Portuguese adaptation of the IAPS. Also, the black background was presented twice, making a total of six separate blocks (i.e., two food-related, two non-food-related, and two neutral). Only one picture was presented in each block. Block order was counterbalanced across participants. Mean normative valence ratings were 7.15 and 7.05 for food-related and non-food-related pictures, respectively. Mean normative arousal ratings were 5.45 and 5.06 for food-related and non-food-related pictures, respectively[1].

Each block was constituted by 93 Go stimuli and 40 No-Go stimuli, corresponding to a percentage of 70% "M" and 30% "W", respectively. Stimuli was presented in a semi-randomized order, avoiding the presentation of two consecutive No-go stimulus, and the presentation of more than four consecutive Go trials. Between each block, participants were allowed to take a 1-minute break.

Each trial consisted in the presentation of a Go or No-go stimuli for 200ms, followed by a fixation cross (800ms). After 500ms, the next Go/No-go stimuli appeared. Therefore, participants had a maximum of 1500ms to respond (See Figure 2).

Before starting the experiment, all participants completed a practice block constituted by 12 trials (8 Go and 4 No-go) with a neutral picture as a background to ensure understanding of the task instructions. The task was programed using E-Prime 3.0 and run in E-Prime Go software. All participants were asked to respond in a quiet environment, without any noise or external factors that could interfere with their performance. The task took approximately 25 minutes to complete.

[1] IAPS pictures (Food-related): 7350, 7405
IAPS pictures (Non-food-related): 5215, 7650

Mean reaction time to Go stimuli was calculated after eliminating incorrect responses and anticipatory errors (i.e., reaction times below 150ms).

<Insert Figure 2 about here>

Statistical Analysis

In the present study, a median split of the DERS total score was performed to assign participants to groups with higher and lower difficulties in emotion regulation. Specifically, those who had a score equal or above the median score of the total sample (i.e., DERS total score ≥ 72) (n = 55) were assigned to the group of higher difficulties in emotion regulation, with the remaining being assigned to the group of lower difficulties in emotion regulation (n = 52). Median split of the DERS total score was performed since cut off points for this scale are not available (Coutinho et al., 2010), and to allow exploration of main effects and interactions between group, type (the emotional context of the tasks) and condition (go vs. no-go) using mixed analyses of variance.

Descriptive statistics were performed to characterize the sample in all measures in study. Differences between groups with higher and lower difficulties in emotion regulation in terms of the self-report measures were estimated with Mann-Whitney tests.

With respect to behavioral data, reaction times (RTs) to Go stimuli were analyzed for the three emotional contexts of the emotional Go/No-go task and food Go/No-go task after excluding outliers (i.e., RT below 150ms). Accuracy to Go and No-go trials (i.e., number of correct responses divided by the number of Go and No-go trials, respectively) were also calculated for each emotional context.

Mixed analyses of variance (ANOVA) were performed to analyze RTs in the emotional Go/No-go task, defining "Group" (<DERS total score and >DERS total score) as between-subjects factor, and "Type" (Pleasant, Neutral, Unpleasant) as within-subjects factor. The same analysis was performed to analyze RTs in the food Go/No-go task, defining "Group" as between-subjects factor, and "Type" (Food-related, non-food-related, neutral) as between-subjects factor.

As for accuracy, mixed ANOVAS were also conducted for both tasks. Specifically, "Type" (Pleasant, Neutral, Non-pleasant) and "Condition" (Go, No-Go) were defined as within-subjects factor for the emotional Go/No-go task, and "Group" as between-subjects factor. The same analysis was performed for the food Go/No-go task, defining "Type" (Food-related, Non-food-related, Neutral) and "Condition" as within-subjects factor, and "Group" as between-subjects factor. Bonferroni tests for post-hoc comparisons were conducted. Non-ED psychopathology (i.e., depression, anxiety, and stress) were introduced as co-variates in exploratory analyses.

Pearson's correlations coefficients were used to analyze the associations between the variables under study, and to inform the moderating models to test.

Moderation analyses were conducted using the PROCESS macro (Model 1) for SPSS (Hayes, 2018) to test the possible moderating role of inhibitory control in the relationship between difficulties in emotion regulation (IV) and ED psychopathology (DV). For this purpose, accuracy to no-go trials in the context of food and pleasant-related stimuli were inserted as moderators in two individual models tested. When significant interactions were observed, simple slope analyses were conducted to interpret the moderation effect.

All analysis were conducted using IBM SPSS Statistics software (version 28) (IBM Corp, Armonk, NY, USA).

Results

Self-report measures

Table 2 shows the means, standard deviations, and Mann-Whitney tests of the differences between groups with higher and lower difficulties in emotion regulation in all measures in the study, namely eating psychopathology, depression, anxiety and stress, and body mass index.

<Insert Table 2 about here>

Statistically significant differences were found between groups with higher and lower difficulties in emotion regulation in all measures in the study. Mann-Whitney U tests showed that participants with higher difficulties in emotion regulation presented significantly higher eating psychopathology, depression, anxiety, and stress than participants with lower difficulties in emotion regulation. No significant differences were found between groups in body mass index.

Behavioral measures

Table 3 describes the mean and standard deviation of the RTs and accuracy for both the emotional and food go/no-go tasks, comparing participants with higher and lower difficulties in emotion regulation.

<Insert Table 3 about here>

Emotional Go/No-Go Task:

Reaction Time (Go Trials)

The ANOVA results revealed a non-significant main effect of group (Z (1,105) = .000, p = .984, $\eta 2$ = .000), a marginally significant effect of type (Z (1.28,134.25) = 2.793, p = .087, $\eta 2$

= .026), and a non-significant effect of the group x type interaction (Z (1.28, 134.25) = 1.657, *p* = .201, η2 = .016). Therefore, results pointed out that RTs were not modulated by the emotional context.

Accuracy

Regarding accuracy, results indicated a significant main effect of condition (Z (1, 105) = 204.243, *p* < .001, η2 = .660) and group (Z (1,105) = 8.887, *p* = .004, η2 = .078), and a non-significant effect of type, Z (1.88,197.20) = .060, *p* = .942, η2 = .001). The interaction group x condition (Z (1,105) = 4.517, *p* = .036, η2 = .041) and group x type (Z (1.88, 197,20) = 3.327, *p* = .041, η2 = .031) was significant. No significant interaction was found between condition x type (Z (2, 210) = .531, *p* = .589, η2 = .005), or condition x group x type (Z (2, 210) = .843, *p* = .432, η2 = .008). Pairwise comparisons indicated that the main effect of condition was explained by higher accuracy means presented in Go trials than No-go trials (*p* < .001), and that the main effect of group was explained by higher accuracies in participants with lower difficulties in emotion regulation than those with higher difficulties in emotion regulation (*p* = .004). Pairwise comparisons also revealed that the interaction group x condition was related to lower accuracies to go and no-go stimuli for those with higher difficulties in emotion regulation, and the interaction group x type was related to lower accuracies for those with higher difficulties in emotion regulation, both in the context of pleasant (*p* = .001) and neutral stimuli (*p* = .001).

Food Go/No-Go Task:

Reaction Time (Go Trials)

Results revealed a significant main effect of type (Z (2,204) = 3.619, *p* = .029, η2 = .034), a marginally significant effect of group (Z (1,102) = 3.211, *p* = .076, η2 = .031), and a non-significant group x type interaction (Z (2,204) = 0.584, *p* = .559, η2 = .006). Pairwise comparisons indicate that the main effect of type was related to higher reaction time values in the non-related

than neutral emotional context (p = .038). A higher reaction time was also observed in the food-related context than in the neutral context, although differences were marginally significant (p = .079).

Accuracy

The ANOVA results indicated that there was a significant main effect of condition (Z (1, 105) = 409.22, p < .001, η2 = .796), type (Z (2, 210) = 7.739, p < .001, η2 = .069), and group (Z (1, 105) = 4.015, p = .048, η2 = .037). Both the interactions group x type (Z (2, 210) = 3.485, p = .032, η2 = .032), condition x type (Z (2, 210) = 7.739, p <.001, η2 = .060), and group x condition (Z (1, 105) = 4.015, p = .048, η2 = .037) were significant. Also, the interaction condition x group x type was significant (Z (2, 210) = 3.485, p = .032, η2 = .032). Pairwise comparisons revealed that the main effect of condition was related to higher accuracies in Go trials than No-go trials (p < .001), the main effect of type was related to higher accuracies in neutral context than food-related (p = .002) or non-related (p = .004) contexts, and the main effect of group was related to lower accuracies in participants with higher difficulties in emotion regulation (p = .048). The interaction group x type was due to lower accuracy means for participants with higher difficulties in emotion regulation in the context of food-related stimuli (p = .009). A similar result was obtained for the non-food related context; however, differences were marginally significant (p = .069), Pairwise comparisons also indicated that the interaction condition x type was explained by lower accuracies to no-go stimuli in the context of food-related (p = .002) and non-food related (p = .004) stimuli, pointing to a modulation of the emotional context in inhibitory responses. The interaction group x condition was explained by lower accuracy to no-go stimuli for those with higher DERS score (p = .048), indicating higher difficulties in response inhibition in this subgroup. Also, the interaction condition x group x type was explained by lower accuracy in no-go trials in the context of food-related stimuli by participants with higher difficulties in emotion regulation (p = .009). The interaction condition x group x type was not statistically significant

when depression (Z (2, 208) = 1.685, p = .188, η2 = .016), anxiety (Z (2, 208) = 1.490, p = .228, η2 = .014) or stress (Z (2, 208) = 1.785, p = .170, η2 = .017) were introduced as co-variates.

Associations of the variables in study

Pearson's (r) correlations coefficients were used to analyze the associations between the DERS total score and the accuracy to no-go trials for all the contexts of the emotional and food go/no-go tasks. The DERS total score was negatively associated with the accuracy to no-go trials in the context of pleasant (r = -.326, p < .001) and neutral (r = -.298, p = .002) stimuli of the emotional go/no-go task. No significant associations with the accuracy to no-go trials in the context of unpleasant stimuli were found (r = -.155, p = .110). A significant association was also observed between the DERS total score and the accuracy to no-go trials in the context of food-related stimuli of the food go/no-go task (r = -.257, p = .007). No significant associations with non-food related (r = -.170, p = .080) and neutral (r = -.136, p = .162) stimuli were observed.

Moderation analyses

The moderating role of accuracy to no-go trials on the relationship between difficulties in emotion regulation and ED psychopathology was tested for both the context of food and pleasant related stimuli.

Results showed that the interaction between the DERS total score and the accuracy to no-go trials in the context of food-related stimuli was significant (b = -.050, 95% CI [-.09--.01], t = -2.34, p = .02), indicating that the association between difficulties in emotion regulation and ED psychopathology was moderated by the accuracy to no-go trials in the context of food-related stimuli (Table 4). Specifically, this association was significant for both high (b = .020, p <.001), average (b = .027, p <.001), and low (b = .034, p <.001) levels of accuracy to no-go trials, with the magnitude being stronger for those with lower accuracy (i.e., higher response inhibition difficulties in the context of food-related stimuli) (Figure 3).

<Insert Table 4 about here>

<Insert Figure 3 about here>

The second model tested showed that the interaction between the DERS total score and the accuracy to no-go trials in the context of pleasant stimuli was significant (b = -.054, 95% CI [-.09--.01], t = -2.67, p = <.01). Therefore, the association between difficulties in emotion regulation and ED psychopathology was moderated by the accuracy to no-go trials in the context of pleasant stimuli (Table 5). Specifically, this association was significant for both high (b = .019, p <.001), average (b = .026, p <.001), and low (b = .033, p <.001) levels of accuracy to no-go trials, with the magnitude being stronger for those with lower accuracy (i.e., higher response inhibition difficulties in the face of pleasant stimuli) (Figure 4).

<Insert Table 5 about here>

<Insert Figure 4 about here>

The moderating effect of accuracy to no-go trials in the non-food and neutral contexts of the food go/no-go task, and in the non-pleasant and neutral contexts of the emotional go/no-go task was also explored. Although food and non-food-related stimuli were equivalent in terms of emotional valence, no moderating effect of non-food-related stimuli was observed on the relationship between difficulties in emotion regulation and ED psychopathology (b = .027, 95% CI [-.06--.04], t = -.34, p = .737). The same result was obtained for the neutral context (i.e., black background) of the food go/no-go task (b = .026, 95% CI [-.09-.01], t = -1.55, p = .125). As for the emotional go/no-go task, no moderator effect was observed for the non-pleasant stimuli (b = .023, 95% CI [-.06-.03], t = -.58, p = .560), but a significant moderator effect was found for the neutral stimuli (b = .020, 95% CI [-.10--.02], t = -2.87, p <.10). Specifically, the association was significant for both high (b = .017, p <.001), average (b = .025, p <.001), and low (b = .032, p

<.001) levels of accuracy to no-go trials, with the magnitude being stronger for those with lower accuracy (i.e., higher response inhibition difficulties in the context of neutral stimuli).

Discussion

The present study aimed to explore the relationship between difficulties in emotion regulation and deficits in inhibitory control, and the role of these processes in eating psychopathology in a non-clinical sample. Two neuropsychological tasks (i.e., emotional go/no-go and food go/no-go tasks) were used to assess the modulation of different emotional contexts on response inhibition.

Findings from the emotional go/no-go task pointed to lower accuracies to no-go trials comparing to go trials, indicating that the task was effective in inducing a prepotent response pattern. Interestingly, lower response accuracies among participants with higher difficulties in emotion regulation were found compared to those with lower difficulties in emotion regulation, particularly in the context of pleasant and neutral stimuli; however, no significant differences between groups were found in indices of inhibitory control, either in the face of pleasant, neutral, or unpleasant stimuli. Overall, these results suggest a modulatory effect of the emotional context on response execution between groups, but not on response inhibition. Nevertheless, it is important to note that markedly lower accuracies in no-go trials were observed for participants with higher difficulties in emotion regulation both in the context of pleasant and neutral stimuli, highlighting the need to further explore potential increased emotion-related inhibitory control deficits in this subgroup.

In line with the present findings, previous studies have found evidence for the interference of positive valence contexts on response execution and inhibition. For instance, a study conducted with a non-clinical sample found increased difficulties withholding prepotent responses in the context of pleasant than negative stimuli, suggesting that response inhibition in positive valence contexts requires greater inhibitory control resources (Albert et al., 2010). Similarly, higher response inhibition difficulties have been found to happy faces compared to sad (Schulz et al.,

2007) and neutral or fearful faces (Hare et al., 2005), underscoring the role of positive stimuli in facilitating approach-related behavior.

The findings that emotional stimuli interfere with task performance to a greater extent in participants with higher difficulties in emotion regulation are of particular interest and may be explained by the fact that emotional stimuli may capture greater attentional resources in this subsample, consequently impairing performance on the ongoing task (McKenna & Sharma, 1995). However, the processes by which response execution and inhibition may be related with levels of emotion dysregulation, and how these deficits in response inhibition are modulated by particular emotional contexts is an important topic that warrants further investigation.

In a second analysis, results from the food go/no-go task indicated higher response inhibition deficits among participants with higher difficulties in emotion regulation, particularly in the context of food-related stimuli. Interestingly, although food-related and non-food-related stimuli were equivalent in terms of emotional valence (i.e., positive valence), only food stimuli modulated the differences in response inhibition between groups. These data suggest that differences were not related to emotional valence alone, but also to an increased interference of food stimuli between groups. In fact, it has been pointed out that the perception of a stimulus as rewarding (e.g., palatable food) captures greater attention and elicits an approach behavior towards that stimulus (Tsegaye et al., 2020). Therefore, it may be that participants with higher difficulties in emotion regulation may be particularly responsive to the rewarding characteristics of food, consequently directing attention to these stimuli and presenting greater difficulty in inhibiting the response.

This is the first study to find evidence of increased deficits in response inhibition at higher levels of difficulties in emotion regulation in the context of food stimuli, in a non-clinical sample. Overall, results provide further evidence for a positive association between difficulties in emotion regulation and deficits in inhibitory control (e.g., Gratz & Roemer, 2004; Joormann & Gotlib, 2010; Leehr et al., 2018). Of note, effective inhibitory control has been implicated as crucial for both successful emotion and eating behavior regulation (Gil et al., 2022; Smith et al., 2018), which can also elucidate the observed findings of higher deficits in response inhibition to food stimuli

in individuals with higher emotion dysregulation. These findings provide an important first step towards a better understanding of the processes by which difficulties in emotion regulation may be associated with eating psychopathology in non-clinical samples.

In agreement with these findings, a moderating role of inhibitory control in the context of food stimuli on the relationship between emotion regulation and eating psychopathology was found. Specifically, results indicated a stronger magnitude of association between these variables at higher deficits in inhibitory control (i.e., lower response inhibition). These data suggest that the link between difficulties in emotion regulation and engagement in dysfunctional eating behaviors as potential maladaptive strategies of emotion regulation is particularly observable in individuals with higher deficits in inhibitory control towards food. Overall, these results extend previous research on the relationship between emotion regulation and eating psychopathology (e.g., Mallorquí-Bagué et al., 2018) by highlighting the role of inhibitory control as an important process underlying this relationship. The present findings may also provide relevant data for clinical practice with EDs. In fact, extensive research has pointed out the role of difficulties in emotion regulation and food-related inhibitory control deficits in the etiology and maintenance of disordered eating (e.g., Mallorquí-Bagué et al., 2018; Wu et al., 2013), although less research has explored the interrelation between these processes.

Interestingly, inhibitory control deficits in the context of pleasant stimuli were also found to moderate the association between emotion regulation and ED psychopathology. Specifically, the link between difficulties in emotion regulation and eating psychopathology was stronger for individuals with higher deficits in inhibitory control towards pleasant (i.e., positive valence) stimuli. Of note, despite extensive research on the link between difficulties in emotion regulation in the context of unpleasant emotional states and engagement in dysfunctional eating behaviors (Berg et al., 2015; Leehr et al., 2015; Wonderlich et al., 2022), no moderating effect of inhibitory control in the context of unpleasant stimuli was found. On the contrary, present findings suggest that the relationship between difficulties in emotion regulation and dysfunctional eating behaviors may be related to increased response inhibition deficits to positive emotional contexts, at least in healthy individuals. In this line, a previous study has found evidence for greater consumption of

highly palatable foods after positive mood induction compared to negative mood induction (Cardi et al., 2015). In addition, higher engagement in hedonic eating in the face of positive emotions has been reported in healthy individuals (Macht, 1999; Macht et al., 2002). Therefore, it may be that individual differences in response inhibition abilities in the context of pleasant stimuli may contribute to exacerbated engagement in dysfunctional eating behaviors and eating psychopathology in non-clinical samples, particularly in those with higher difficulties in emotion regulation. Research on the link between inhibitory control in the context of positive emotional contexts and eating pathology is scarce, and future studies exploring these processes in both clinical and non-clinical samples are needed to better understand these processes across the spectrum of ED pathology.

To the best of our knowledge, this is the first study exploring the relationship between inhibitory control, emotion regulation, and eating psychopathology in a non-clinical sample. Notably, the present findings have important implications for clinical practice and the prevention of eating psychopathology in both healthy and ED-diagnosed individuals. The fact that efficient inhibitory control, particularly in positive valence contexts (i.e., food and pleasant related stimuli), has found to be a protective factor for eating psychopathology provide evidence for the importance of assessing and addressing inhibitory control as a possible target for intervention. Nevertheless, further research is needed to explore the specific contexts in which response inhibition deficits may occur and are related to emotion dysregulation, and how they may contribute to the maintenance of eating psychopathology. Differences between groups in food-related inhibitory control did not remain significant after controlling for co-occurring psychopathology (i.e., depression, anxiety and stress), which should be considered when interpreting the findings. In fact, previous studies have found evidence for an association between anxiety and depressive symptoms and poor executive functioning (Billingsley-Marshall et al., 2013; Shimony et al., 2021). Future studies should take into account the presence of comorbid symptomatology as possible variables influencing cognitive performance.

This study was conducted with a sample of healthy individuals, and exploration of these processes across the spectrum of ED psychopathology (e.g., restrictive vs. binge-purging types)

are warranted to dimensionally understand these processes. Also, future replication using longitudinal assessments is needed to better inform the predictive value of inhibitory control on ED psychopathology.

In conclusion, the present study provides further evidence for the role of emotion regulation and inhibitory control in eating psychopathology in a non-clinical sample, using two well-validated behavioral measures of response inhibition. Findings suggest that inhibitory control may be an important target of intervention, in addition to emotion regulation.

References

Albert, J., López-Martín, S., & Carretié, L. (2010). Emotional context modulates response inhibition: Neural and behavioral data. *NeuroImage*, *49*(1), 914–921. https://doi.org/10.1016/j.neuroimage.2009.08.045

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. In *Clinical Psychology Review* (Vol. 30, Issue 2, pp. 217–237). https://doi.org/10.1016/j.cpr.2009.11.004

Bartholdy, S., Dalton, B., O'Daly, O. G., Campbell, I. C., & Schmidt, U. (2016). A systematic review of the relationship between eating, weight and inhibitory control using the stop signal task. In *Neuroscience and Biobehavioral Reviews* (Vol. 64, pp. 35–62). Elsevier Ltd. https://doi.org/10.1016/j.neubiorev.2016.02.010

Berg, K. C., Crosby, R. D., Cao, L., Crow, S. J., Engel, S. G., Wonderlich, S. A., & Peterson, C. B. (2015). Negative affect prior to and following overeating-only, loss of control eating-only, and binge eating episodes in obese adults. *International Journal of Eating Disorders*, *48*(6), 641–653. https://doi.org/10.1002/eat.22401

Billingsley-Marshall, R. L., Basso, M. R., Lund, B. C., Hernandez, E. R., Johnson, C. L., Drevets, W. C., McKee, P. A., & Yates, W. R. (2013). Executive function in eating disorders: The role of state anxiety. *International Journal of Eating Disorders*, *46*(4), 316–321. https://doi.org/10.1002/eat.22086

Brockmeyer, T., Holtforth, M. G., Bents, H., Kämmerer, A., Herzog, W., & Friederich, H. C. (2012). Starvation and emotion regulation in anorexia nervosa. *Comprehensive Psychiatry*, *53*(5), 496–501. https://doi.org/10.1016/J.COMPPSYCH.2011.09.003

Brockmeyer, T., Skunde, M., Wu, M., Bresslein, E., Rudofsky, G., Herzog, W., & Friederich, H. C. (2014). Difficulties in emotion regulation across the spectrum of eating disorders.

Comprehensive Psychiatry, *55*(3), 565–571. https://doi.org/10.1016/j.comppsych.2013.12.001

Cohen, N., & Mor, N. (2018). Enhancing Reappraisal by Linking Cognitive Control and Emotion. *Clinical Psychological Science*, *6*(1), 155–163. https://doi.org/10.1177/2167702617731379

Coutinho, J., Ribeiro, E., Ferreirinha, R., & Dias, P. (2010). Versão Portuguesa da escala de dificuldades de regulação emocional e sua relação com sintomas psicopatológicos. *Revista de Psiquiatria Clinica*, *37*(4), 145–151. https://doi.org/10.1590/S0101-60832010000400001

Fairburn, C., & Beglin, S. (2008). Eating Disorder Examination Questionnaire. *Cognitive Behaviour Therapy and Eating Disorders*, 309–313.

Giel, K. E., Teufel, M., Junne, F., Zipfel, S., & Schag, K. (2017). Food-related impulsivity in obesity and binge eating disorder—a systematic update of the evidence. *Nutrients*, *9*(11). https://doi.org/10.3390/nu9111170

Gil, M., Cohen, N., & Weinbach, N. (2022). The influence of inhibitory control on reappraisal and the experience of negative emotions. *Cognition and Emotion*, *36*(2), 364–371. https://doi.org/10.1080/02699931.2021.1997923

Goldschmidt, A. B., Lavender, J. M., Hipwell, A. E., Stepp, S. D., & Keenan, K. (2017). Emotion Regulation and Loss of Control Eating in Community-Based Adolescents. *Journal of Abnormal Child Psychology*, *45*(1), 183–191. https://doi.org/10.1007/s10802-016-0152-x

Gratz, K. L., & Roemer, L. (2004). Multidimensional Assessment of Emotion Regulation and Dysregulation: Development, Factor Structure, and Initial Validation of the Difficulties in Emotion Regulation Scale 1. In *Journal of Psychopathology and Behavioral Assessment* (Vol. 26, Issue 1).

Gross, J. J., Feldman Barrett, L., John, O., Lane, R., Larsen, R., & Pennebaker, J. (1998). The Emerging Field of Emotion Regulation: An Integrative Review. In *Review of General Psychology* (Vol. 2, Issue 5).

Hare, T. A., Tottenham, N., Davidson, M. C., Glover, G. H., & Casey, B. J. (2005). Contributions of amygdala and striatal activity in emotion regulation. *Biological Psychiatry*, *57*(6), 624–632. https://doi.org/10.1016/j.biopsych.2004.12.038

Hayes, A. F. (2018). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A regression-based approach* (2nd ed.). The Guilford Press.

Haynos, A. F., Wang, S. B., & Fruzzetti, A. E. (2018). *Eating Disorders The Journal of Treatment & Prevention Restrictive eating is associated with emotion regulation difficulties in a non-clinical sample*. https://doi.org/10.1080/10640266.2018.1418264

Jasinska, A. J., Yasuda, M., Burant, C. F., Gregor, N., Khatri, S., Sweet, M., & Falk, E. B. (2012). Impulsivity and inhibitory control deficits are associated with unhealthy eating in young adults. *Appetite*, *59*(3), 738–747. https://doi.org/10.1016/j.appet.2012.08.001

Joormann, J., & Gotlib, I. H. (2010). Emotion regulation in depression: Relation to cognitive inhibition. *Cognition and Emotion*, *24*(2), 281–298. https://doi.org/10.1080/02699930903407948

Kalanthroff, E., Cohen, N., & Henik, A. (2013). Stop feeling: Inhibition of emotional interference following stop-signal trials. *Frontiers in Human Neuroscience*, *FEB*. https://doi.org/10.3389/fnhum.2013.00078

Kittel, R., Brauhardt, A., & Hilbert, A. (2015). Cognitive and emotional functioning in binge-eating disorder: A systematic review. *International Journal of Eating Disorders*, *48*(6), 535–554. https://doi.org/10.1002/EAT.22419

Leehr, E. J., Krohmer, K., Schag, K., Dresler, T., Zipfel, S., & Giel, K. E. (2015). Emotion regulation model in binge eating disorder and obesity - a systematic review. *Neuroscience and Biobehavioral Reviews*, *49*, 125–134. https://doi.org/10.1016/j.neubiorev.2014.12.008

Leehr, E. J., Schag, K., Dresler, T., Grosse-Wentrup, M., Hautzinger, M., Fallgatter, A. J., Zipfel, S., Giel, K. E., & Ehlis, A. C. (2018). Food specific inhibitory control under negative mood in binge-eating disorder: Evidence from a multimethod approach*. *International Journal of Eating Disorders*, *51*(2), 112–123. https://doi.org/10.1002/EAT.22818

Liu, W., Peeters, N., Fernández, G., & Kohn, N. (2020). Common neural and transcriptional correlates of inhibitory control underlie emotion regulation and memory control. *Social Cognitive and Affective Neuroscience*, *15*(5), 523–536. https://doi.org/10.1093/scan/nsaa073

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, *33*(3), 335–343. https://doi.org/10.1016/0005-7967(94)00075-U

Machado, P. P. P., Martins, C., Vaz, A. R., Conceição, E., Bastos, A. P., & Gonçalves, S. (2014). Eating disorder examination questionnaire: Psychometric properties and norms for the Portuguese population. *European Eating Disorders Review*, *22*(6), 448–453. https://doi.org/10.1002/erv.2318

Macht, M. (1999). Characteristics of Eating in Anger, Fear, Sadness and Joy. In *Appetite* (Vol. 33). http://www.idealibrary.comon

Macht, M. (2008). How emotions affect eating: A five-way model. *Appetite*, *50*(1), 1–11. https://doi.org/10.1016/J.APPET.2007.07.002

Macht, M., Roth, S., & Ellgring, H. (2002). Chocolate eating in healthy men during experimentally induced sadness and joy. *Appetite*, *39*(2), 147–158. https://doi.org/10.1006/appe.2002.0499

Mallorquí-Bagué, N., Testa, G., Lozano-Madrid, M., Vintró-Alcaraz, C., Sánchez, I., Riesco, N., Granero, R., Perales, J. C., Navas, J. F., Megías-Robles, A., Martínez-Zalacaín, I., Veciana de las Heras, M., Jiménez-Murcia, S., & Fernández-Aranda, F. (2020). Emotional and non-emotional facets of impulsivity in eating disorders: From anorexia nervosa to bulimic spectrum disorders. *European Eating Disorders Review*, *December 2019*, 1–13. https://doi.org/10.1002/erv.2734

Mallorquí-Bagué, N., Vintró-Alcaraz, C., Sánchez, I., Riesco, N., Agüera, Z., Granero, R., Jiménez-Múrcia, S., Menchón, J. M., Treasure, J., & Fernández-Aranda, F. (2018). Emotion Regulation as a Transdiagnostic Feature Among Eating Disorders: Cross-sectional and Longitudinal Approach. *European Eating Disorders Review*, *26*(1), 53–61. https://doi.org/10.1002/erv.2570

McKenna, F. P., & Sharma, D. (1995). Intrusive Cognitions: An Investigation of the Emotional Stroop Task. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *21*(6), 1595–1607. https://doi.org/10.1037/0278-7393.21.6.1595

Pais-Ribeiro, J. L., Honrado, A., & Leal, I. (2004). Contribuição para o Estudo da Adaptação Portuguesa das Escalas de Ansiedade, Depressão e Stress (EADS) de 21 Itens de Lovibond e Lovibond. *Psicologia, Saúde e Doenças*, *V*(2), 229–239.

Ridout, N., Thom, C., & Wallis, D. J. (2010). Emotion recognition and alexithymia in females with non-clinical disordered eating. *Eating Behaviors*, *11*(1), 1–5. https://doi.org/10.1016/j.eatbeh.2009.07.008

Salas, C. E., Gross, J. J., & Turnbull, O. H. (2014). Reappraisal generation after acquired brain damage: The role of laterality and cognitive control. *Frontiers in Psychology*, *5*(MAR). https://doi.org/10.3389/fpsyg.2014.00242

Schulz, K. P., Fan, J., Magidina, O., Marks, D. J., Hahn, B., & Halperin, J. M. (2007). Does the emotional go/no-go task really measure behavioral inhibition?. Convergence with measures on a non-emotional analog. *Archives of Clinical Neuropsychology*, *22*(2), 151–160. https://doi.org/10.1016/j.acn.2006.12.001

Shimony, O., Einav, N., Bonne, O., Jordan, J. T., Van Vleet, T. M., & Nahum, M. (2021). The association between implicit and explicit affective inhibitory control, rumination and depressive symptoms. *Scientific Reports*, *11*(1). https://doi.org/10.1038/s41598-021-90875-3

Smith, K. E., Mason, T. B., Johnson, J. S., Lavender, J. M., & Wonderlich, S. A. (2018). A systematic review of reviews of neurocognitive functioning in eating disorders: The state-of-the-literature and future directions. In *International Journal of Eating Disorders* (Vol. 51, Issue 8, pp. 798–821). John Wiley and Sons Inc. https://doi.org/10.1002/eat.22929

Soares, A. P., Pinheiro, A. P., Costa, A., Frade, C. S., Comesaña, M., & Pureza, R. (2014). Adaptation of the International Affective Picture System (IAPS) for European Portuguese. *Behavior Research Methods*, *47*(4), 1159–1177. https://doi.org/10.3758/s13428-014-0535-2

Svaldi, J., Griepenstroh, J., Tuschen-Caffier, B., & Ehring, T. (2012). Emotion regulation deficits in eating disorders: A marker of eating pathology or general psychopathology? *Psychiatry Research*, *197*(1–2), 103–111. https://doi.org/10.1016/j.psychres.2011.11.009

Tsegaye, A., Kökönyei, G., Baldacchino, A., Urbán, R., Demetrovics, Z., & Logemann, H. N. A. (2020). The psychological basis of obesity. In *Obesity and Obstetrics* (pp. 37–44). Elsevier. https://doi.org/10.1016/B978-0-12-817921-5.00004-7

Wonderlich, J. A., Crosby, R. D., Engel, S. G., Crow, S. J., Peterson, C. B., le Grange, D., Wonderlich, S. A., & Fischer, S. (2022). Negative affect and binge eating: Assessing the unique trajectories of negative affect before and after binge-eating episodes across eating

disorder diagnostic classifications. *International Journal of Eating Disorders*, *55*(2), 223–230. https://doi.org/10.1002/eat.23648

Wu, M., Hartmann, M., Skunde, M., Herzog, W., & Friederich, H. C. (2013). Inhibitory control in bulimic-type eating disorders: A systematic review and meta-analysis. *PLoS ONE*, *8*(12). https://doi.org/10.1371/journal.pone.0083412

Table 1. Mean and standard deviations of the valence and arousal ratings of the pleasant, neutral, and unpleasant contexts of the emotional Go/No-go task.

	Pleasant[2] ***M (SD)***	**Neutral**[3] ***M (SD)***	**Unpleasant**[4] ***M (SD)***
Valence	7.63 (0.40)	4.96 (0.53)	2.60 (0.28)
Arousal	5.15 (0.56)	5.10 (0.50)	5.33 (0.34)

Note. M = Mean; *SD* = Standard deviation.

[2] IAPS pictures (Pleasant): 5621, 8158, 1710, 1722, 1920, 2170, 2151, 2274, 2347, 2360, 2398, 5215, 5300, 5626, 5470, 8193, 5910, 7489, 7492, 7501, 7530, 7580, 8031, 8163, 8179, 8370, 8500, 8501, 2311, 2550

[3] IAPS pictures (Neutral): 1726, 1390, 1505, 1645, 5950, 8116, 5920, 2312, 3360, 5961, 7014, 6837, 8117, 1560, 2521, 7033, 5040, 7081, 8192, 7547, 7211, 7240, 9422, 7017, 2309, 7632, 7640, 2590, 7497, 8475

[4] IAPS pictures (Unpleasant): 1271, 1274, 1280, 2115, 2120, 2490, 2694, 2722, 6200, 6562, 6800, 6840, 7135, 9001, 2456, 9008, 9031, 9110, 9171, 9395, 9290, 9341, 7046, 9582, 9584, 9592, 9830, 9832, 9905, 9468

Table 2. Means, standard deviations and Mann-Whitney tests of the differences between groups in all measures in study

	Low DERS (n = 52) M (SD)	High DERS (n = 55) M (SD)	Mann-Whitney U		
			U	Z	p
EDE-Q					
Restraint	0.24 (0.43)	0.91 (1.13)	746,50	-4,433	<.001
Shape concern	0.75 (0.84)	2.08 (1.52)	530,50	-5,614	<.001
Weight concern	0.74 (0.78)	1.84 (1.59)	767,00	-4,151	<.001
Eating concern	0.10 (0.21)	0.63 (1.07)	877,50	-3,785	<.001
Total	0.46 (0.48)	1.36 (1.19)	527,00	-5,629	<.001
DASS-21					
Depression	2.13 (2.65)	7.07 (5.04)	480,00	-5,960	<.001
Anxiety	1.54 (1.89)	4.80 (4.07)	707,00	-4,580	<.001
Stress	4.5 (3.62)	8.62 (3.98)	593,500	-5,232	<.001
BMI	22.38 (2.68)	22.92 (4.10)	2784,00	-.150	.881

Note. N = 107. DERS – Difficulties in Emotion Regulation Scale; EDE-Q – Eating Disorder Examination – Questionnaire; DASS-21 – Depression, Anxiety and Stress Scale; BMI – Body Mass Index.

Table 3. Means and standard deviations of reaction times and accuracies in the emotional and food go/no-go tasks

Task	Measure	Condition	Type	Low DERS (n = 52) M (SD)	High DERS (n = 55) M (SD)
Emotional Go/No-Go Task	Reaction Time	Go	Pleasant	386.79 (60.70)	408.56 (79.14)
			Unpleasant	406.35 (72.96)	394.96 (56.55)
			Neutral	424.80 (127.81)	415.17 (109.46)
	Accuracy	Go	Pleasant	0.99 (0.01)	0.97 (0.06)
			Unpleasant	0.98 (0.04)	0.98 (0.03)
			Neutral	0.99 (0.02)	0.98 (0.03)
		No-Go	Pleasant	0.87 (0.10)	0.81 (0.14)
			Unpleasant	0.85 (0.11)	0.82 (0.13)
			Neutral	0.87 (0.09)	0.80 (0.15)
Food Go/No-Go Task	Reaction Time	Go	Related	341.33 (43.02)	358.51 (57.67)
			Neutral	333.02 (38.00)	357.74 (62.22)
			Non-Related	344.28 (35.51)	361.19 (53.48)
	Accuracy	Go	Related	1.00 (0.00)	1.00 (0.00)
			Neutral	1.00 (0.00)	1.00 (0.00)
			Non-Related	1.00 (0.00)	1.00 (0.00)
		No-Go	Related	0.79 (0.11)	0.72 (0.16)
			Neutral	0.80 (0.13)	0.78 (0.13)
			Non-Related	0.78 (0.11)	0.73 (0.14)

Note. M - Mean*; SD* - Standard deviation.

Table 4. Moderating role of accuracy to no-go trials (Food-related context) in the relationship between difficulties in emotion regulation and ED psychopathology

	B	**S.E.**	***t***	***p***
DERS total score	.027 (.02-.03)	.004	7.34	<.001
Accuracy_no-go (Food)	.683 (-.52-1.88)	.605	1.13	.26
DERS total score X Accuracy_no-go (Food)	-.050 (-.09--.01)	.02	-2.34	.02

Note. DERS – Difficulties in Emotion Regulation Scale

Table 5. Moderating role of accuracy to no-go stimuli (Pleasant context) in the relationship between difficulties in emotion regulation and ED psychopathology

	B	S.E.	*t*	*p*
DERS total score	.026 (.02-.03)	.004	6.91	<.001
Accuracy_no-go (Pleasant)	.917 (-.48-2.32)	.706	1.30	.20
DERS total score X Accuracy_no-go (Pleasant)	-.054 (-.09--.01)	.020	-2.67	<.01

Note. DERS – Difficulties in Emotion Regulation Scale

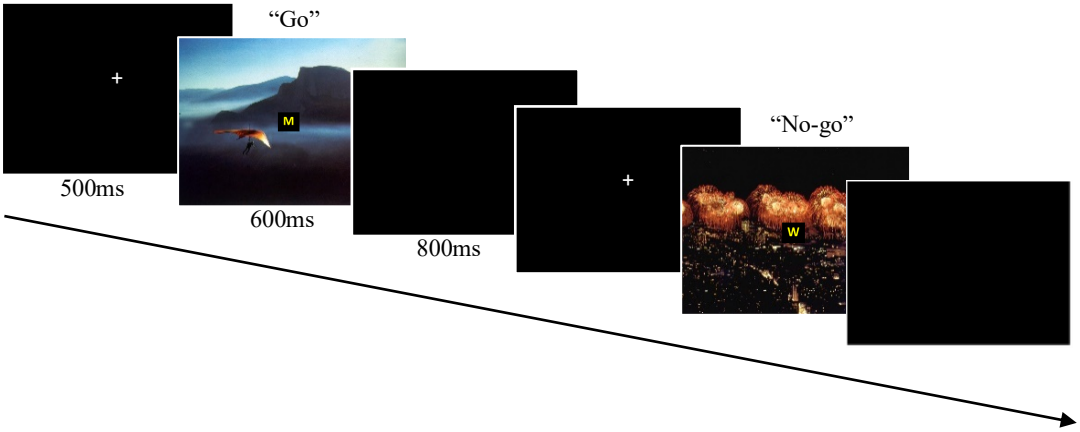


Figure 1 – Example of trials displayed in the positive context of the emotional Go/no-go task.

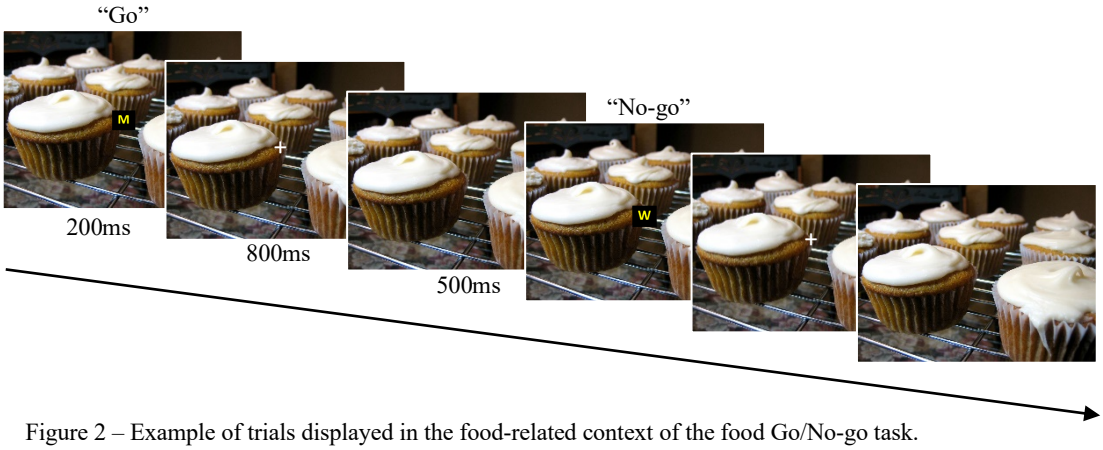


Figure 2 – Example of trials displayed in the food-related context of the food Go/No-go task.

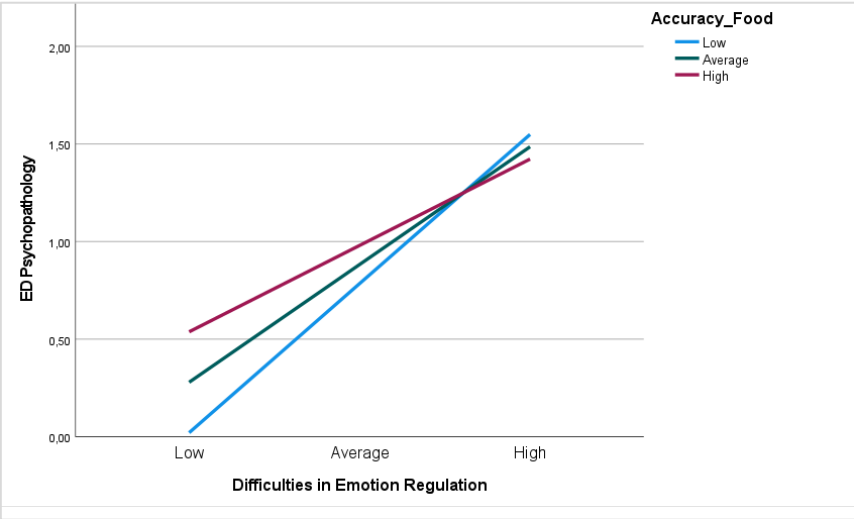


Figure 3 - Moderating effect of accuracy to no-go trials in the context of food-related stimuli in the relationship between difficulties in emotion regulation and ED psychopathology

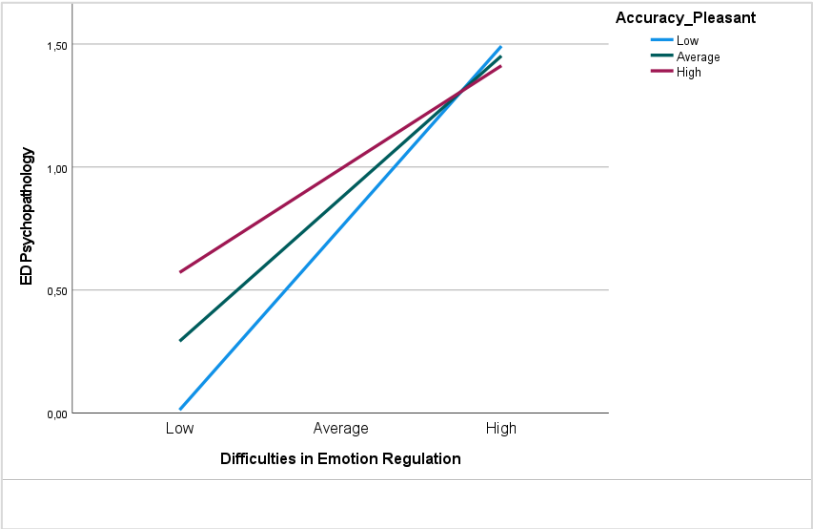


Figure 4 - Moderating effect of accuracy to no-go trials in the context of pleasant stimuli in the relationship between difficulties in emotion regulation and ED psychopathology