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Food cravings: What psychosocial interventions have been used to reduce them and what is the effectiveness of an adapted eye movement desensitisation and reprocessing (EMDR) protocol at reducing the intensity of craving-related mental imagery and cravings?

by

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Thesis for the degree of Doctor in Clinical Psychology

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Abstract

Faculty of Environmental and Life Sciences

School of Psychology

Doctorate in Clinical Psychology

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Food cravings are common and research has shown that they are a precipitant to binge-eating episodes, which can be linked to obesity. Current clinical guidelines recommend behavioural interventions for binge-eating disorder and obesity, which may not address the underlying craving experience that drives the eating behaviour. A systematic review and synthesis of 24 empirical studies examining psychosocial interventions for food cravings was conducted. The results showed that a variety of interventions from a range of theoretical orientations have been used, and that psychosocial interventions can be helpful in reducing food cravings. However, more research is needed to establish which intervention type is the most beneficial.

The second paper details an empirical project, which was conducted to examine the effectiveness of an adapted eye movement desensitisation and reprocessing (EMDR) protocol in reducing food cravings and craving related mental imagery. Participants were allocated to 3 conditions: bilateral eye movements; working memory task; and mental imagery only; and took part in a weekly group intervention for 4 weeks. Overall, participants in all conditions reported a reduction in trait craving and there was no difference between the conditions. There was no clear pattern of change in state craving, although it was associated with reduction in feeling state, image-specific craving, vividness and pleasantness. This empirical project adds to a small existing research base and future researchers may wish to replicate the project with a larger sample.

This thesis highlights the psychological aspects of food cravings and demonstrates that psychological interventions can be effective at reducing them.

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Research Thesis: Declaration of Authorship

Print name: ALICE COULSON

Title of thesis: Food cravings: What psychosocial interventions have been used to reduce them and what is the effectiveness of an adapted eye movement desensitisation and reprocessing (EMDR) protocol at reducing the intensity of craving-related mental imagery and cravings?

I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. None of this work has been published before submission

Signature: Date: 9th October 2024

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Last, but not least, thank you to Imi for being a fantastic research partner and for making the whole process enjoyable – we make an excellent research duo!

Abbreviations

ACT.....	Acceptance and commitment therapy
ACQ.....	Attitudes to chocolate questionnaire
AIP.....	Adaptive information processing
ANOVA	Analysis of variance
BLS.....	Bilateral stimulation
BMI.....	Body mass index
CBT.....	Cognitive behavioural therapy
CBT-E	Cognitive behavioural therapy for eating disorders
CoEQ.....	Control of eating questionnaire
EAT-26	Eating attitudes test-26
EFT	Emotional freedom techniques
EM.....	Eye movement
EMDR	Eye movement desensitisation and reprocessing
ERGO.....	Ethics research and governance online
FCQ-S.....	Food craving questionnaire state
FCQ-T.....	Food craving questionnaire trait
FCQ-T-r.....	Food craving questionnaire trait-reduced
FSAP.....	Feeling state addiction protocol
IO	Imagery only
NICE.....	National institute for health and care excellence
PRISMA.....	Preferred reporting items for systematic reviews
PTSD.....	Post-traumatic stress disorder
RCTs.....	Randomised controlled trials
ROB.....	Risk of bias
SWiM	Synthesis without meta-analysis
UoS	University of Southampton
VAS.....	Visual analogue scale/s
WHO.....	World health organisation
WM.....	Working memory

Chapter 1 Psychosocial interventions for food cravings in adults: A systematic review

This systematic review has been written for *Obesity Reviews* and in line with their publishing guidelines, which are included in appendix A.

1.1 Abstract

Objective: There is a clinical need to address food cravings, therefore this study aimed to examine which psychosocial interventions have been used to reduce food cravings, and what is their efficacy.

Methods: A systematic review for controlled trials that examined a psychosocial intervention for food cravings was conducted. A systematic search was conducted, and risk of bias was assessed. Relevant data was extracted and synthesised narratively, and effect sizes were calculated and presented in a forest plot for studies with adequate data.

Results: Twenty-four records were reviewed. The following interventions were used: mindfulness-based interventions, cognitive behavioural-based interventions, emotional freedom techniques, interventions aimed at attention and/or approach bias to food, and a dynamic visual noise intervention. Four studies included follow-up. Study methodology was heterogenous. Risk of within-study bias was not considered to influence the results. Effect sizes ranged (95% CI [0.00, 2.55]), and there was no intervention type with consistently larger effect sizes.

Conclusion: Psychosocial interventions for reducing food cravings are efficacious, with some more so than no intervention and some more so than alternative interventions, several control conditions also reduced cravings. There are interesting clinical implications of these findings. However, more research is needed to assess the intervention type with the most efficacy.

Keywords: Food cravings, psychosocial interventions, systematic review

1.2 Introduction

Food cravings are common and refer to an intense desire or urge to consume specific foods (Richard et al., 2017). In research and clinical practice, several self-report measures are used to assess state, past and trait food cravings (see Taylor, 2019 for a review). In western societies, food cravings are typically for low-nutritious and high-energy foods (Rodriguez-Martin & Meule, 2015). The experience of a food craving is multi-dimensional and includes cognitive (e.g., thinking about food), emotional (e.g., desire or change in mood), behavioural (e.g., seeking food) and physiological aspects (e.g., salivating) (Rodriguez-Martin & Meule, 2015).

Food cravings can involve complex and competing desires to consume, and not to consume certain foods (Verzija et al., 2022). Food cravings are a feature of disordered eating (i.e., binge eating episodes in binge eating disorder and in bulimia-nervosa) and can be a feature of obesity (Potenza & Grilo, 2014). Binge eating episodes are characterised by eating a large amount over a short period of time (<2 hours) accompanied by a sense of loss of control, and are associated with obesity (Faulconbridge & Bechtel, 2014). In 2016 the World Health Organisation (WHO) reported that worldwide >1.9 billion adults were overweight (BMI \geq 25), and of those 650 million (13%) were obese (BMI \geq 30) (WHO, 2021). Obesity is a risk factor for the development of critical illnesses, including cardiovascular disease, cancer and diabetes (Ripoll & Bittner, 2023); and worldwide, the recent Covid-19 pandemic highlighted the significance of obesity in the management of critical illness (Aderson & Shashaty, 2021).

The NICE guidelines for obesity (2014) recommend lifestyle modification (i.e., increase calorie-deficit) or pharmacological treatment if lifestyle modification has not resulted in adequate weight loss. Bariatric surgery is only recommended for people who have a BMI of \geq 40, or \geq 35 in the presence of other significant comorbidities, and where other strategies (e.g., lifestyle modification and/or pharmacological treatment) have been tried (NICE, 2014). Psychological interventions targeting binge-eating episodes and obesity (e.g., cognitive behavioural therapy for eating disorders; CBT-E) are predominantly rooted in behavioural theory, where target eating behaviours are identified and become the focus of interventions to address the underpinning cognitions and emotions (Mulken & Waller, 2021). CBT-E has been shown to reduce binge-eating frequency, but only in the short term, and has not been shown to consistently result in weight-loss for obesity (Palavras et al., 2017).

There is a complex interaction of biopsychosocial and environmental factors leading to the development and maintenance of binge-eating and obesity. Research has predominantly focused on cognitive models to conceptualise the maintenance of binge-eating episodes; the cognitive model proposes that strong beliefs about eating and self-image develop early in life,

which can lead to preoccupation with eating, shape and weight, and this preoccupation typically results in cycles of eating restriction and binge-eating (Burton & Abbott, 2017; Fairburn et al., 2003). The cognitive model acts as a rationale for treatments such as CBT-E, however, Burton & Abbott in their 2017 review of theoretical conceptualisations of binge-eating suggest that there may be maintenance factors not addressed by cognitive-behavioural treatments as their long-term efficacy can be poor.

Since then, research has focused on the role of food cravings and a theoretical model from the addiction literature has been adapted for eating behaviour (Verzija et al., 2018). This model proposes that during attempts to restrict eating, food cravings are activated and people become more sensitive to food cues, meaning there is an increased likelihood of overeating or binge-eating (Verzija et al., 2018; Polivy & Herman, 2017). In line with this model, food cravings have been identified as a typical precipitant to binge-eating episodes (Ng & Davis, 2013; Greeno et al., 2000). This highlights a need for interventions targeting the management and reduction of food cravings, which may contribute towards more effective and long-lasting psychosocial interventions for binge-eating episodes and obesity.

Food cravings are common across the general population, with women reporting more frequent and intense cravings than men (Hill, 2007). Psychosocial interventions for food cravings have typically been tested in a general, non-clinical, population to ensure that additional treatment (i.e., pharmacological or psychosocial interventions from weight management or eating disorder services) do not confound the results of the psychosocial intervention being tested. In this review, a non-clinical sample is defined as those not receiving treatment for disordered eating or obesity. However, due to the prevalence across the population, samples may include overweight or obese individuals.

A limitation of systematic reviews examining psychosocial interventions is that they do not define what they consider to be a psychosocial intervention. A metareview by Hodges et al. (2009) found that none of the 66 systematic reviews included in the review had an explicit definition of a psychological intervention. In this review a psychosocial intervention is defined within the methods section, and this definition was developed by two members of the research team.

The purpose of this systematic review is to examine the empirical literature on psychosocial interventions for food cravings, with the goal of providing recommendations for clinical practice and future research. The review has two aims: 1) to describe the psychosocial interventions that have been used to reduce the frequency or intensity of food cravings in a non-clinical adult population and 2) to assess the efficacy of these interventions.

1.3 Methods

This review has been reported in line with the PRISMA (Page et al., 2021) reporting guidelines. The protocol for this review was registered with PROSPERO, the international prospective register for systematic reviews on 23rd November 2023, registration number CRD42023485642.

1.3.1 Design

In this review a psychosocial intervention is defined as an intervention which had a psychological component where a) participants were introduced to a strategy or technique b) were encouraged and/or reminded to use the strategy/technique and c) the intervention was engaged in for >24 hours. This definition was developed by two members of the research team (AC and IF) prior to the literature screening phase to ensure that the interventions included were long-term and intensive enough to mimic those typically used in a clinical setting. Bishop-Fitzpatrick et al., 2013 in their review of psychosocial interventions for Autism do not include studies of lab-tested interventions (i.e., a brief (< 24 hours), one off experimental task conducted in a laboratory). Similarly, in this review lab-tested interventions were excluded with the rationale that they were not long-term and intensive enough to meet the definition of a psychosocial intervention outlined above. A similar review by Cassin et al. (2020) of psychosocial interventions for the concept of 'food addiction' also excluded lab-tested interventions.

1.3.2 Search Strategy

A systematic search of peer-reviewed literature was undertaken on 29th November 2023. The following databases were searched: PubMed and MEDLINE using EMBASE, Web of Science, Cochrane Central Register of Controlled Trials (CENTRAL), PsycINFO, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Scopus, as well as the first 10 pages of Google Scholar.

Taylor's (2019) review of food craving measures was used to ensure the most accurate and appropriate search terms for food cravings were included, in addition to more generic terms. For the full search strategy see appendix B.

1.3.3 Study Selection

The primary reviewer (AC) screened all titles and abstracts returned by the searches in-line with the inclusion/exclusion criteria below to determine articles for inclusion. Where this

was unclear, full text articles were screened to establish a) if the primary aim of the intervention was to reduce food cravings and b) if the article reported a substantive intervention, i.e. not a lab-tested, one-off task. The second reviewer (IF), then independently screened the remaining full text articles and gave recommendations on the final article inclusion. Any disagreements between AC and IF, of which there were two, were resolved through discussion.

1.3.3.1 Inclusion Criteria

Only controlled trials (i.e., studies with \geq one active or inactive control group) were included, as compared to non-controlled trials, they provide less bias when reporting effects of interventions (Higgins et al., 2023).

A study was included if a) it was an empirical paper with \geq one control group; b) a psychosocial intervention was delivered to an adult sample not receiving other clinical treatment for disordered eating or obesity; c) the primary aim of the intervention was a reduction in naturally occurring food cravings, or where this was less specific there was a directional hypothesis regarding reduction of food craving; d) a standardised or non-standardised quantitative measure of food craving frequency or intensity was a primary outcome variable; and e) the food craving measure was administered at baseline and post-intervention. For the corresponding exclusion criteria see appendix C.

1.3.4 Data Extraction

Study characteristics and data were extracted, which included: author, publication year, country, population type, participants' mean age, % of female participants, sample total (N), participants randomised and included in analysis, intervention (type, length, frequency and format), measure of food craving and timepoints, follow-up and main results. Means (M) and standard deviations (SD) for all food craving outcome measures and sample sizes were extracted for all intervention and control groups at pre and post intervention and follow-up. If study information was missing, or there was incomplete data to calculate an effect size, the corresponding author was contacted.

1.3.5 Study Quality Assessment

Two reviewers (AC and IF) independently assessed risk of bias within each study using the Cochrane recommended Risk-of-Bias tool (RoB 2; Sterne et al., 2019), which is widely used to assess for RoB in the findings of randomised controlled trials (RCTs). One disagreement was resolved by discussion. The tool is structured into five domains, in which bias might occur, including: the randomisation process, deviations from the intended intervention, missing data,

outcome measures, selection of the reported results (Sterne et al., 2019). Based on these domains an overall RoB judgement is made (low, some concerns, or high).

1.3.6 Synthesis

Studies were assessed to determine eligibility for a statistical meta-analysis, this was not suitable for the following reasons.

Firstly, the included interventions derive from a variety of theoretical models, differ in length, and employ different control conditions. Bringing them together risks 'combining apples and oranges' and providing a result that is meaningless to the research question (Higgins et al., 2023). Additionally, each intervention is of intrinsic interest, and relevance to the research question, on its own.

Secondly, there were several multi-arm studies, which risks unit-of-analysis error. This error occurs when one arm is entered into the meta-analysis twice as the groups are correlated (Rücker et al., 2017). There are several ways of overcoming this. The Cochrane recommended way is to combine the treatment arms (Higgins et al., 2023). Another option is to split the shared group into subgroups of roughly equal size, one for each treatment arm (Rücker et al., 2017). However, this only partially overcomes the error because there is still correlation (Higgins et al., 2023). Rücker et al. (2017) suggest an exact adjustment to account for the correlation but note that this should be avoided when using a random effects model (which would be the model used for meta-analysis), and echo Cochrane's recommendations. Combining the treatment arms to facilitate a meta-analysis would mean losing key differences between the intervention types (e.g., the difference between cognitive restructuring and cognitive defusion) and would not be helpful in answering the research question.

Instead of statistical meta-analysis effect sizes for each intervention were compared narratively and graphically. Cohen's *d* was used to calculate an intervention effect for the food craving outcome/s in each study where there was adequate data (i.e., *M*, *SD* and *n*). Post data for intervention and control groups were used. Post-intervention was considered to be immediately after the intervention period. Alongside this, a narrative synthesis of all included studies was presented and reported in line with the SWiMs guidelines (Campbell et al., 2020).

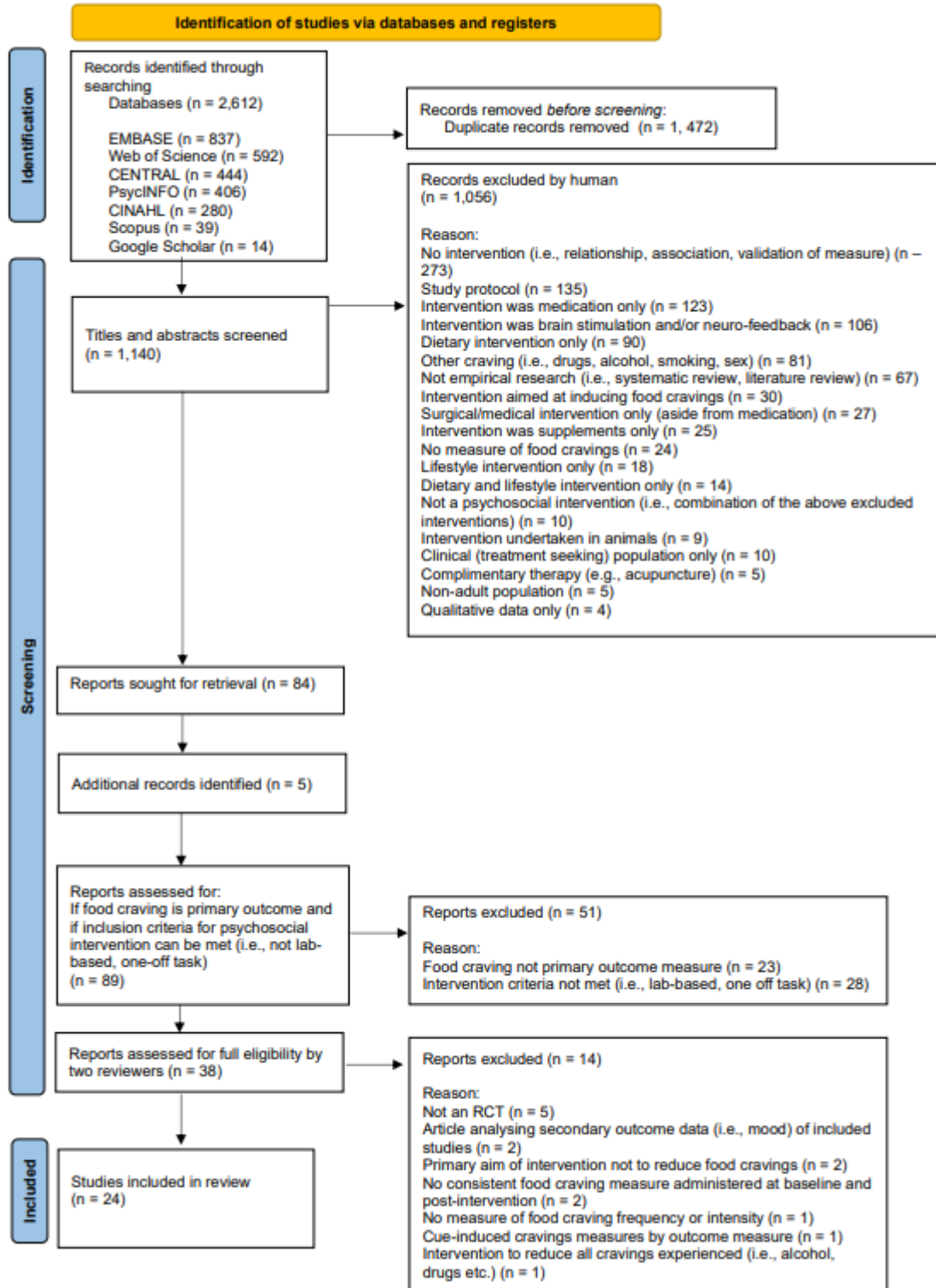
1.4 Results

1.4.1 Study Selection

The study selection process is described in the PRISMA (Page et al., 2021) flow diagram in figure 1. The search strategy returned 1,140 non-duplicate records, 89 full text reports were screened by the primary reviewer (AC) and 51 were excluded. Two researchers (AC & IF) independently assessed 38 full text articles for full eligibility and agreed to include 24 in the final review. Table A1 (appendix D) summarises the 14 studies that were excluded in the final round and reasons for exclusion.

Figure 1-1

PRISMA (2020) flow diagram



1.4.2 Study Characteristics

The characteristics of the included studies are presented in table 1. Twenty-four papers were included, two of which were follow-up studies of empirical studies that were also included. A total of four studies had follow-up, three had both 6- and 12-month follow-up and one had 12-month follow-up only. Eight studies recruited an all-female sample. In the studies that recruited other genders, the samples were predominantly female (mean 75%, range 30%). Most studies recruited a general sample population, however, six studies recruited a student sample only. Most studies recruited from their country of origin (Australia, Austria, Canada, Cuba, Cyprus, Germany, Netherlands, Spain, U.K, USA) except for Devonport et al. (2022), which recruited worldwide during the Covid-19 pandemic. All participants self-identified as wanting to improve their management of food cravings and all outcome measures were self-report, meaning the participants were not blinded to the outcome. The intervention periods differed in length, ranging from 4 days to 3 months, with the most frequent being 1 week.

1.4.2.1 Outcomes

Most studies were concerned with cravings for any food. However, five studies were concerned with chocolate cravings only, as this is cited as the most frequently craved food (Rodriguez-Martin & Meule, 2015). Across the studies the outcome measures used to measure trait food cravings were the General Food Craving Questionnaire-Trait (Nijs et al., 2007), Food Craving Questionnaire-Trait (FCQ-T; Capeda-Benito et al., 2000) and the reduced version (FCQ-T-r; Meule et al., 2014), Attitudes to Chocolate Questionnaire (ACQ; Benton et al., 1998) and the Control of Eating Questionnaire (CoEQ; Dalton et al., 2015), as well as self-reported craving frequency and intensity. State food cravings were measured using the Food Craving Questionnaire-State (FCQ-S; Capeda-Benito et al., 2000), as well as self-reported craving intensity and vividness. State and trait food cravings were measured using the Food Craving Inventory (Nijs et al., 2007).

1.4.2.2 Characteristics of the Interventions Used

The delivery of the interventions differed. Seven studies delivered one or more group information or training sessions, with one of these studies also delivering individual sessions, the rest were self-directed only. The cognitive bias modification interventions and the response inhibition training encouraged training as part of a daily routine, all other studies encouraged participants to use the intervention strategies or techniques in response to a craving, or for the mindfulness-based eating interventions whilst eating.

Eight studies examined the effect of mindfulness-based interventions only. Two further studies examined a mindfulness-based technique called cognitive defusion and compared this to a cognitive-behavioural technique called cognitive restructuring. One study also examined cognitive defusion, but compared this to guided imagery. Two more studies examined guided imagery interventions, and one study examined an imagery and non-imagery intervention. Three studies examined emotional freedom techniques (EFT) with one comparing EFT to cognitive behavioural therapy (CBT). Three studies examined cognitive bias modification interventions. One study examined response inhibition training, and one examined a dynamic visual noise intervention.

1.4.2.3 Characteristics of the Control Conditions Used

Eight studies used a waitlist control. One study used a control that was given no instruction, and one study used a placebo control. One study used data from a community sample, one study used both an inactive and a placebo control, and the remaining ten studies used an active control. The active control conditions used were thought control, completion of a food craving diary, distraction, psychoeducation, listening to an audio-recorded narrative, instructions to control cravings using willpower, and instruction to form a goal to reduce cravings.

1.4.3 Study Quality Assessment

Risk of bias analysis was conducted using the Risk-of-Bias tool (RoB 2; Sterne et al., 2019) and the results are presented in figure 2. Overall, 17 studies had 'low risk of bias' and seven studies had 'some concerns of bias'. The overall risk of bias is included in the study characteristics table (table 1) and a breakdown of the results by domain for each study are presented in figure A1 (appendix E). Some concerns were found in study 2 of Hinojosa-Aguayo & Gonzalez (2022) and in Hopper et al. (2011) as there was no information about the randomisation process and it was unclear if participants had been randomly allocated. Some concerns were found in More et al. (2023), Stapleton et al. (2016) and (2019) due to attrition at follow-up. Some concerns were also found in Gehlenborg et al. (2023) due to attrition at follow-up, as well as non-randomisation of participants and significant baseline differences between groups, although this was controlled for at analysis. Some concerns were found in Moffitt et al. (2012) as only two subscales from the outcome measure were used, indicating that this may not be an accurate representation of trait food cravings. However, the overall results suggest that inclusion of the intervention effects from these studies in a synthesis will not be influenced by significant within-study bias.

Table 1-1

Study characteristics table

Author, Year	Country of Study Origin	Population Type	Age (SD)	Gender (% female)	Participants randomised: Total (N) Intervention (I) Control (C)	Participants analysed: Total (N) Intervention (I) Control (C)	Intervention Type	Group Arms	Length of Intervention	Frequency of intervention	Food craving measure/s	Main Findings	Overall Risk of Bias Result (RoB 2)
Mindfulness-based Interventions													
Alberts et al., 2012	Netherlands	Female only, general sample population	48.5 (7.90)	100%	N = 26 I = 12 C = 14	N = 26 I = 12 C = 14	Mindfulness-based eating programme	Mindfulness-based eating programme (MBCT); wait list control	8 weeks	Weekly 2.5 hour group sessions led by a mindfulness practitioner + 45-60 minute daily self-directed practice	General Food Craving Questionnaire-Trait (G-FCQ-T; Nijs et al., 2007)	The MBCT led to a significant reduction in trait food cravings from pre to post intervention, compared to a waitlist control.	Low
Chapman et al., 2018	Australia	Female only, general sample population	30.49 (13.74)	100%	N = 151 I = 63 C = 88	N = 57 I = 22 C = 35	Mindfulness (Acceptance, based on urge surfing)	Acceptance; active control (thought control: actively pushing away craving and ignoring the urge)	4 weeks	Self-directed practice on average 4 times per week	General Food Craving Questionnaire-Trait (G-FCQ-T; Nijs et al., 2007)	The active control condition (thought control) led to a significant reduction in trait food cravings from pre to post intervention, compared to the acceptance condition.	Low
Devonport et al., 2022	UK (participants recruited from U.K, Finland, Philippines, Spain, Italy, Brazil, North America, S. Korea, China)	General sample population	33.64 (12.42)	80%	N = 165 I = 77 C = 88	N = 165 I = 77 C = 88	Mindfulness-based Eating Programme	Mindfulness-based eating programme plus food craving diary; active control (food craving diary only)	1 week	Self-directed mindfulness eating guidelines plus daily food craving diary	Self-reported craving frequency (trait)	Participants in both conditions reported a significant reduction in trait food cravings from pre to post intervention, however, there were no significant differences between conditions.	Low
Hinojosa-Aguayo & Gonzalez, 2022	Spain	Female only, student population	20.15 (SD 2.27)	100%	N = 44 I = 22 C = 22	N = 20 I = 10 C = 10	Mindfulness (Cognitive Defusion)	Cognitive defusion; Active control (audio recorded reading of narrative)	2 weeks	Self-directed whenever a craving was experienced	Food Craving Questionnaire – Trait (FCQ-T; Capeda-Benito et al., 2000) (Spanish version)	Participants in both conditions reported a non-significant reduction in trait food cravings from pre to post intervention, and there were no significant differences between conditions.	Some concerns
Note: study 2 only													

Chapter 1

Author, Year	Country of Study Origin	Population Type	Age (SD)	Gender (% female)	Participants randomised: Total (N) Intervention (I) Control (C)	Participants analysed: Total (N) Intervention (I) Control (C)	Intervention Type	Group Arms	Length of Intervention	Frequency of intervention	Food craving measure/s	Main Findings	Overall Risk of Bias Result (RoB 2)
Mindfulness-based Interventions Continued													
Hulbert-Williams et al., 2019	UK	Student & university staff population	22.6 (6.4)	81%	N = 63 I = 23 I2 = 20 C = 20	N = 63 I1 = 23 I2 = 20 C = 20	Mindfulness (defusion, Acceptance)	Acceptance (urge surfing) (I1); cognitive defusion (I2); active control (distraction)	1 week	1 group session (8 minute) + take home leaflet with instructions, then self-directed whenever a craving was experienced	Food Craving Inventory (FCI; White et al., 2002) for chocolate cravings only	Participants in all conditions reported a significant reduction in trait and state chocolate cravings from pre to post intervention, however, there were no significant differences between conditions.	Low
Lacaille et al., 2014	Canada	Student population	19.93 (2.50)	91.3%	N = 196 I1 = 37 I2 = 39 I3 = 37 I4 = 43 C = 40	N = 126 I1 = 26 I2 = 21 I3 = 23 I4 = 24 C = 32	Mindfulness (Awareness, Acceptance, Disidentification)	Awareness (become aware of craving) (I1); Awareness + Acceptance (I2); Awareness + Disidentification (separate oneself from thoughts about craving) (I3); Awareness + Acceptance + Disidentification (I4); control (distraction technique)	2 weeks	1 x training session + daily self-directed whenever a chocolate craving was experienced	Attitudes to Chocolate Questionnaire (ACQ; Benton et al. 1998)	Participants in the awareness + disidentification condition reported a significant reduction in trait chocolate cravings (ACQ), compared to all other conditions. Participants in the awareness only condition reported a significant reduction in trait chocolate cravings, compared to the control condition, but not compared to the other conditions.	Low
Schnepfer et al., 2019	Austria	German speaking general sample population	Intervention: 31.0 (10.3); control: 38.9 (15.2)	73%	N = 46 I = 23 C = 23	N = 46 I = 23 C = 23	Mindfulness prolonged chewing intervention (MbT/PCH)	MbT/PCH eating intervention; waitlist control	8 weeks	2 individual sessions + 2 groups sessions + regular practice of MbT/PCH exercises over 8 weeks	Food Craving Questionnaire Trait-reduced (FCQ-T-r; Meule et al., 2014) (German version)	Participants in the MbT/PCH condition reported a significant reduction in trait food cravings from pre to post intervention, compared to the control condition.	Low

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Author, Year	Country of Study Origin	Population Type	Age (SD)	Gender (% female)	Participants randomised: Total (N) Intervention (I) Control (C)	Participants analysed: Total (N) Intervention (I) Control (C)	Intervention Type	Group Arms	Length of Intervention	Frequency of intervention	Food craving measure/s	Main Findings	Overall Risk of Bias Result (RoB 2)
Mindfulness-based Interventions Continued													
Hooper et al., 2011	Cyprus, Louisiana (USA), Kent (UK) & Swansea (UK)	Student population	21.37 (4.29)	59%	N = 47 I1 = 17 I2 = 16 C = 14	N = 47 I1 = 17 I2 = 16 C = 14	Thought Suppression v Cognitive Defusion	Thought suppression (I1); cognitive defusion (I2); control (given no instruction)	1 week	Self-directed whenever a craving was experienced	Self-reported chocolate craving frequency (trait)	Participants in all conditions reported a non-significant reduction in trait chocolate cravings pre to post intervention, and there were no significant differences between conditions.	Some concerns
Cognitive Defusion v Cognitive Restructuring Interventions													
Karekla et al., 2020	Cyprus	Student population	19.65 (missing)	89%	N = 65 I1 = 24 I2 = 24 C = 17	N = 65 I1 = 24 I2 = 24 C = 17	Cognitive Defusion v Cognitive Restructuring	Cognitive defusion (I1); cognitive restructuring (I2); active control (psychoeducation + discussion)	1 week	1 x 45 minute group session per condition (delivered by a trainee clinical psychologist) + self-directed whenever a chocolate craving was experienced	Food Craving Questionnaire-State (FCQ-S; Capeda-Benito et al., 2000) & Food Craving Questionnaire-Trait (FCQ-T; Capeda-Benito et al., 2000) & Daily Food Craving Diary.	The omnibus ANOVA showed a significant reduction in state and trait chocolate cravings from pre to post intervention. Follow-up comparisons showed a significant decrease in trait (but not state) cravings for the cognitive defusion and restructuring conditions from pre to post intervention, but not the control. There were significant differences in trait (but not state) cravings between the cognitive defusion and control conditions at post-intervention.	Low
Moffitt et al., 2012.	Australia	General sample population	46.21 (14.59)	85.5%	N = 110 I1 = 38 I2 = 36 C = 36	N = 110 I1 = 38 I2 = 36 C = 36	Cognitive Defusion v Cognitive Restructuring	Cognitive defusion (I1); Cognitive restructuring (I2); waitlist control	1 week	1 x group teaching session + self-directed over 1 week whenever a craving was experienced	Food Craving Questionnaire Trait (FCQ-T; FCQ-T; Capeda-Benito et al., 2000) – (lack of control over eating + thoughts and preoccupation with food subscales only)	Participants in all conditions reported a significant reduction in lack of control over eating and thoughts and preoccupation with food from pre to post intervention, however, there were no significant differences between conditions.	Some concerns

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Author, Year	Country of Study Origin	Population Type	Age (SD)	Gender (% female)	Participants randomised: Total (N) Intervention (I) Control (C)	Participants analysed: Total (N) Intervention (I) Control (C)	Intervention Type	Group Arms	Length of Intervention	Frequency of intervention	Food craving measure/s	Main Findings	Overall Risk of Bias Result (RoB 2)
Cognitive Defusion v Guided Imagery Intervention													
Schumacher et al., 2018	Australia	Female only, student population	21.96 (7.45)	100%	N = 118 I1 = 42 I2 = 39 C = 37	N = 118 I1 = 42 I2 = 39 C = 37	Cognitive Defusion v Guided imagery	Cognitive defusion (I1); Guided Imagery (image of being in a forest) (I2); Control (food craving and consumption diary)	1 week	Self-guided listening to a 2-minute audio whenever a craving was experienced	Self-reported craving frequency and craving intensity	Participants in both the cognitive defusion and guided imagery conditions reported a significant reduction in trait craving frequency from pre to post intervention, compared to the control condition, and there were no significant differences between the two intervention conditions. Participants in the cognitive defusion and guided imagery conditions also reported a significant reduction in trait craving intensity, however, there was insufficient data to assess if this differed to the control condition.	Low
Imagery Interventions													
Giacobbi et al., 2018	USA	Female only, general sample population	Intervention: 47.9 (7.9); control 43.7 (12.9)	100%	N = 48 I = 21 C = 27	N = 35 I = 16 C = 19	Guided Imagery	Guided imagery; waitlist control	6 weeks	Daily self-directed practice over 6 weeks + weekly telephone call with a researcher	General Food Craving Questionnaire-Trait (G-FCQ-T; Nijs et al., 2007)	The guided imagery intervention led to a significant reduction in trait food cravings from pre to post intervention, compared to a waitlist control	Low

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Author, Year	Country of Study Origin	Population Type	Age (SD)	Gender (% female)	Participants randomised: Total (N) Intervention (I) Control (C)	Participants analysed: Total (N) Intervention (I) Control (C)	Intervention Type	Group Arms	Length of Intervention	Frequency of intervention	Food craving measure/s	Main Findings	Overall Risk of Bias Result (RoB 2)
Imagery Interventions Continued													
Knäuper et al 2011	Canada	Student & university staff population	21.8 (3.1)	75.8%	N = 119 Insufficient data to report by conditions	N = 91 I1 = 18 I2 = 21 I3 = 25 C = 27	Imagery	Implementation Intention (to reduce cravings) (I1); Implementation Intention + Cognitive Task (alphabet backwards) (I2); Implementation Intention + Active Imagery (replace image of craving with image of favourite activity) (I3); control (formed a goal intention to reduce cravings)	4 days	Self-directed over 4 days	Self-reported craving intensity	Participants in implementation intention + active imagery condition (I3) reported a significant reduction in self-reported state craving intensity from pre to post intervention, compared to other conditions.	Low
Imagery & Non-Imagery Intervention													
Rodríguez-Martín et al., 2013	Cuba	Spanish speaking general sample population	39.34 (13.61)	72.5%	N = 80 I = 40 C = 40	N = 80 I = 40 C = 40	Working memory intervention (imagery & non-imagery)	Self-help manual to control intrusive thoughts and cravings related to food using imagery and non-imagery tasks to tax the working memory; control (control cravings and thoughts using willpower)	3 months	Daily self-directed for 3 months whenever a craving was experienced	Food Craving Questionnaire Trait (FCQ-T; Capeda-Benito et al., 2000) (Spanish version)	Participants in the self-help condition reported a significant reduction in trait food cravings from pre to post intervention, compared to the control condition.	Low

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Author, Year	Country of Study Origin	Population Type	Age (SD)	Gender (% female)	Participants randomised: Total (N) Intervention (I) Control (C)	Participants analysed: Total (N) Intervention (I) Control (C)	Intervention Type	Group Arms	Length of Intervention	Frequency of intervention	Food craving measure/s	Main Findings	Overall Risk of Bias Result (RoB 2)
Dynamic Visual Noise Intervention													
Kemps & Tiggemann, 2013	Australia	Female only, student population	21.27 (2.35)	100%	N = 48 I = 24 C = 24	N = 46 I = 23 C = 23	Dynamic Visual Noise	Dynamic visual noise (watching a flickering pattern of black and white pixels); control (craving diary)	2 weeks	2 x information sessions per condition + daily self-directed whenever a craving was experienced	Self-reported craving intensity (VAS)	Participants in the dynamic visual noise condition reported a significant reduction in state craving intensity from pre to post intervention, however, a limitation is that this analysis was not compared to the control condition and there is inadequate control group data to run the necessary analysis.	Low
Emotional Freedom Techniques													
Stapleton et al., 2019	Australia	General sample population	Insufficient data to calculate	81.5%	N = 838 I = 610 C = 228	N = 384 I = 314 C = 70 6 month follow-up: N = 216 12 month follow-up N = 145	Emotional Freedom Techniques (EFT)	Online Emotional Freedom Techniques (EFT); waitlist control	8 weeks	7 self-directed, online modules over 8 weeks + use of EFT outside of training	Food Craving Inventory (FCI; White et al., 2002)	Participants in the EFT condition reported a significant reduction in state and trait food cravings from pre to post intervention, compared to the control condition, and this reduction was maintained at 6 and 12 month follow-up.	Some concerns
Stapleton et al., 2011	Australia	General sample population	Insufficient data to calculate	88.5%	N = 96 I = 49 C = 47 6 month follow-up: N = 41	N = 96 I = 49 C = 47 6 month follow-up: I = 41 C = 43	Emotional Freedom Techniques (EFT)	Emotional Freedom Techniques (EFT); waitlist control	4 weeks	4 x 2 hour weekly group sessions (10 – 15 participants in each group) + homework between sessions	Food Craving Inventory (FCI; White et al., 2002)	Participants in the EFT condition reported a significant reduction in state and trait food cravings from pre to post intervention, compared to the control condition, and this reduction was maintained at 6 month follow-up.	Low
Stapleton et al., 2012	Note: 12 month follow-up of the above study						Note: 12 month follow-up of the above study					Participants who received the EFT intervention reported a significant reduction in state and trait food cravings, which was maintained at 12 month follow-up.	Low

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Author, Year	Country of Study Origin	Population Type	Age (SD)	Gender (% female)	Participants randomised: Total (N) Intervention (I) Control (C)	Participants analysed: Total (N) Intervention (I) Control (C)	Intervention Type	Group Arms	Length of Intervention	Frequency of intervention	Food craving measure/s	Main Findings	Overall Risk of Bias Result (RoB 2)
<i>Emotional Freedom Technique v Cognitive Behavioural Therapy</i>													
Stapleton et al., 2016	Australia	General sample population	Insufficient data to calculate	87.9%	N = 85 I1 = 51 I2 = 34 C = 92 (community sample, not randomised)	N = 56 I1 = 32 I2 = 24 C = 92 (community sample, not randomised)	Emotional Freedom Techniques (EFT) v Cognitive Behavioural Therapy (CBT)	Emotional freedom techniques (I1); Cognitive behavioural therapy (I2); control sample (community sample)	8 weeks	8 x 2 hour weekly group sessions (10 – 15 participants in each group) + use of techniques whenever a craving was experienced	Food Craving Inventory (FCI; White et al., 2002)	Participants in both conditions reported a significant reduction in state and trait food cravings from pre to post intervention, this was maintained at 6 and 12 month follow-up, and there were no significant differences between the conditions. Pre intervention, participants in the EFT and CBT conditions reported significantly higher state and trait food cravings compared to the community sample. At post intervention, there was no significant difference, indicating that on average at post intervention the participants state and trait food cravings had reduced so that they were no longer significantly different to those reported by the community sample.	Some concerns

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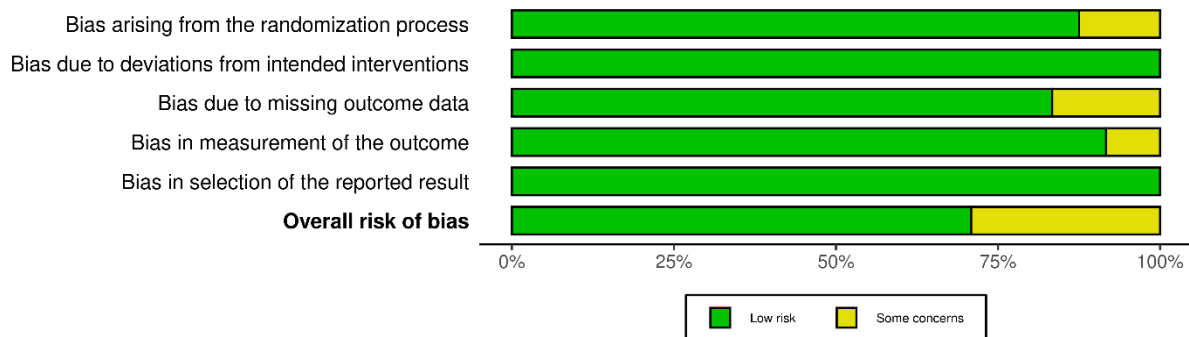
Author, Year	Country of Study Origin	Population Type	Age (SD)	Gender (% female)	Participants randomised: Total (N) Intervention (I) Control (C)	Participants analysed: Total (N) Intervention (I) Control (C)	Intervention Type	Group Arms	Length of Intervention	Frequency of intervention	Food craving measure/s	Main Findings	Overall Risk of Bias Result (RoB 2)
Cognitive Bias Modification Interventions													
Meule et al., 2019	Germany & Austria	German speaking student & general sample population	23.4 (5.07)	85.7%	N = 105 I = 35 C1 = 35 C2 = 35	N = 105 I = 35 C1 = 35 C2 = 35	Approach Avoidance Training	Approach avoidance training (swiped upwards on chocolate stimuli on smartphone-based app) (1); Placebo control (C1); Inactive control (C2)	10 days	5 x self-directed training sessions over 10 days	Food Craving Questionnaire Trait-Reduced for chocolate cravings (FCQ-T-r; Meule et al., 2014) & Food Cravings Questionnaire State for chocolate cravings (FCQ-S; Capeda-Benito et al., 2000))	Participants in all conditions reported a significant reduction in state and trait chocolate cravings from pre to post intervention, however, there were no significant differences between conditions.	Low
Jonker et al., 2019	Netherlands & Australia	Female only, student & general sample population	20.99 (3.21)	100%	N = 113 I = 57 C = 56	N = 103 I = 51 C = 52	Attentional Bias Modification Training	Attentional Bias Modification Training (bouncing image task); waitlist control	1 week	Daily, self-directed (up to 10 minutes/day)	General Food Craving Questionnaire-Trait (G-FCQ-T; Nijs et al., 2007)	Participants in both conditions reported a significant reduction in trait food cravings from pre to post intervention, however, there were no significant differences between conditions.	Low

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Author, Year	Country of Study Origin	Population Type	Age (SD)	Gender (% female)	Participants randomised: Total (N) Intervention (I) Control (C)	Participants analysed: Total (N) Intervention (I) Control (C)	Intervention Type	Group Arms	Length of Intervention	Frequency of intervention	Food craving measure/s	Main Findings	Overall Risk of Bias Result (RoB 2)
Cognitive Bias Modification Interventions Continued													
Moritz et al., 2019	Germany	Female, German speaking, general sample population	Intervention standard 49.35 (9.89); Intervention with reminders 47.77 (11.61); control 48.79 (11.77)	100%	N = 384 I1 = 91 I2 = 93 C = 200	N = 384 I1 = 91 I2 = 93 C = 200	Imaginal Retraining	Imaginal retraining standard (without daily reminders); imaginal retraining with daily reminders; waitlist control	6 weeks	Daily self-directed practice for 6 weeks	Food Craving Questionnaire Trait-Reduced (FCQ-T-r; Meule et al., 2014) & VAS for trait craving	The imaginal retraining intervention led to a significant reduction in trait craving for high-calorie food (VAS) and FCQ-T-r from pre to post intervention, compared to a waitlist control. The intervention effect was larger in the condition that received daily reminders.	Low
Gehlenborg et al., 2022	Note: 12 month follow-up of the above study	49.48 (10.93)	Note: 12 month follow-up of the above study		N = 174 Users of imaginal retraining over 12 months (n = 78); non-users (n = 96)		Note: 12 month follow-up of the above study		On average users used the intervention on 24.28 days over 12 months			No significant group differences were found for the VAS or FCQ-T-r measures at 12-month follow-up. The low completion rate, and low intervention use, were cited as possible reasons for this.	Some concerns
Response Inhibition Training													
Moore et al., 2023	Australia	General sample population	Intervention: 29.98 (13.53); control 31.08 (12.53)	63%	N = 84 I = 45 C = 39	After week 1: N = 68 I = 32 C = 36 After week 2 (latent phase): N = 61 I = 27 C = 34	Response Inhibition Training	Smartphone-based response inhibition training (I1); Placebo control (fruit ninja game)	1 week training + latent phase for 1 week	Daily smartphone training sessions (12 mins) over 1 week + latent stage in week 2 (participants instructed not to engage with training)	Control of Eating Questionnaire (CoEQ; Dalton et al., 2015)	Participants in both conditions reported a significant decrease in trait food cravings over the training week, but this was not significant in the latency week, and there were no significant differences between conditions.	Some concerns

Note. I1, I2, I3 or I4 indicates intervention group and correlates with the conditions listed in the 'group arms' column. The General Food Craving Questionnaire-Trait (G-FCQ-T) (Nijs et al., 2007) is a modified version of the Food Craving Questionnaire-Trait (FCQ-T) by Capeda-Benito et al. (2000). The FCQ-T-r (Meule et al., 2014) is a reduced 15-item version of the 39-item FCQ-T (Capeda-Benito et al., 2000).

Figure 1-2

Risk of bias (RoB 2) within studies summary

1.4.4 Narrative Synthesis of Findings by Intervention Type

The studies are organised by intervention type. This was necessary given the heterogeneity of the studies (i.e., different intervention types, lengths, formats of delivery, and control conditions) and was considered the most appropriate to answer the research question.

1.4.4.1 Mindfulness-based Interventions

The following mindfulness-based techniques feature in the included studies: awareness, acceptance, cognitive defusion and disidentification. *Awareness* is defined as the ability to recognise and monitor cravings and *acceptance* is defined as the ability to refrain from judging or trying to control the craving experience (Lacaille et al., 2014). Studies used the term *cognitive defusion* interchangeably with *disidentification*, and they both refer to the ability to separate oneself from thoughts about cravings, and associated emotions, so the individual can choose how to respond to them instead of them dictating behaviour (e.g., giving into the craving) (Hinojosa-Aguayo & Gonzalez, 2022).

Eight studies examined mindfulness-based interventions only (Alberts et al., 2012; Schnepfer et al., 2019; Devonport et al., 2022; Chapman et al., 2018; Hooper et al., 2011; Lacaille et al., 2014; Hulbert-Williams et al., 2019; Hinojosa-Aguayo & Gonzalez, 2022) and one study that was examining another intervention type (imagery) examined a mindfulness-based intervention as a control condition (Schumacher et al., 2018).

Of these studies, three examined the effect of a mindfulness-based eating intervention (Alberts et al., 2012; Devonport et al., 2022; Schnepfer et al., 2019). The rest of the studies applied mindfulness-based techniques to cravings as they arose; one study examined several different combinations of mindfulness-based techniques (Lacaille et al., 2014) and five studies

examined the application of a single mindfulness-based technique (either *acceptance* or *cognitive defusion*) (Chapman et al., 2018; Hinojosa-Aguayo & Gonzalez, 2022; Hooper et al., 2011; Hulbert-Williams et al., 2019; Schumacher et al., 2018).

The mindfulness-based eating interventions led to a reduction in trait food cravings, but Devonport et al. (2022) found this type of intervention was no more efficacious than their control condition (a food craving diary). *Awareness plus disidentification* was found to be the most efficacious combination of techniques for reducing trait chocolate cravings (Lacaille et al., 2014). There were mixed findings for the efficacy of using a single mindfulness-based technique. Overall, it seemed that *acceptance* alone was efficacious at reducing state and trait cravings for chocolate, but no more beneficial than *cognitive defusion* or distraction (Hulbert-Williams et al., 2019) and that thought suppression was more beneficial than *acceptance* at reducing trait cravings for all foods (Chapman et al., 2018). It seemed that *cognitive defusion* alone was efficacious at reducing trait chocolate cravings when taught at a group session first, but no more so than *acceptance* or distraction (Hulbert-Williams et al., 2019). *Cognitive defusion* was also efficacious at reducing trait cravings for all foods when the intervention involved listening to a 2-minute audio for 1-week (but not a 3-minute audio for 2 weeks), but no more so than an alternative (imagery) intervention (Schumacher et al., 2018). Otherwise, *cognitive defusion* alone was not found to be efficacious at significantly reducing trait cravings for chocolate (Hooper et al., 2011) or all foods (Hinojosa-Aguayo & Gonzalez, 2022).

1.4.4.2 Cognitive Defusion v Cognitive Restructuring Interventions

Outside of its use within mindfulness-based interventions, *cognitive defusion* is cited within the Acceptance and Commitment Therapy (ACT) literature and *cognitive restructuring* originates from Cognitive Behavioural Therapy (CBT) literature. *Cognitive restructuring* is distinctly different from *cognitive defusion* as it aims to challenge the content of a thought and replace it with an alternative, while the aim of *cognitive defusion* is less concerned with the content of the thought and more with creating distance between oneself and the thought (Moffitt et al., 2012).

Two studies compared *cognitive defusion* and *cognitive restructuring* (Karekla et al., 2020; Moffitt et al., 2012). Both techniques were taught at a group session first, and were efficacious at reducing state and trait cravings for chocolate (Karekla et al., 2020) and at reducing lack of control over eating and thoughts and preoccupation with all foods (Moffitt et al., 2012). Neither technique led to more significant results than the other, and Moffitt et al., 2012 found that neither was more beneficial than a waitlist control.

1.4.4.3 Cognitive Behavioural Intervention

One study (Stapleton et al., 2016) examined a CBT intervention, which included cognitive restructuring, emotional recognition, progressive muscle relaxation and goal setting. The intervention led to a reduction in state and trait food cravings so that these cravings were indistinguishable from a large community sample (Stapleton et al., 2016). This reduction was maintained at 6- and 12-month follow up; however, the intervention was no more beneficial than an alternative (EFT) intervention (Stapleton et al., 2016).

1.4.4.4 Emotional Freedom Techniques (EFT)

Emotional Freedom Techniques (EFT) incorporate a mind-body approach and combine cognitive and exposure techniques with stimulation (tapping) of acupuncture points (Stapleton et al., 2016). In the following studies, the participants established a 'set-up', which focused on their difficulties and ended with a statement of self-acceptance (e.g., "Even though I have a strong craving for chocolate, I deeply and completely accept myself") (Stapleton et al., 2016, p. 242). This statement was voiced, while tapping specific acupuncture points.

Three studies by Stapleton and colleagues (Stapleton et al., 2011; Stapleton et al., 2016; Stapleton et al., 2019) examined an EFT intervention, and two of these included 6-month and 12-month follow-up (Stapleton et al., 2012; Stapleton et al., 2019). EFT was found to be efficacious at reducing state and trait food cravings compared to no intervention and this reduction was maintained at follow-up. However, EFT was no more beneficial than an alternative (CBT) intervention (Stapleton et al., 2016).

1.4.4.5 Imagery Interventions

Imagery interventions for food cravings are based on the Elaborated-Intrusion Theory of Desire (Kavanagh et al., 2005), which suggests that a craving starts with an intrusive thought that is elaborated by a vivid mental image of the food, resulting in an intense craving experience (Shahriari et al., 2020). Imagery interventions aim to distract attention away from this mental image and replace it with an alternative image, to lessen the craving experience (Schumacher et al., 2018). Three studies examined imagery interventions (Giacobbi et al., 2018; Knäuper et al 2011; Schumacher et al., 2018). The imagery interventions were found to be efficacious at reducing trait food cravings compared to no intervention and a control (food craving diary) (Giacobbi et al., 2018; Schumacher et al., 2018) and were found to be the most efficacious at reducing state craving intensity when combined with an intention to reduce cravings (Knäuper et al 2011).

1.4.4.6 Imagery and Non-Imagery Intervention

One study examined a daily self-help intervention that was also based on the Elaborated-Intrusion Theory of Desire (Kavanagh et al., 2005) and aimed to disrupt the elaboration of an intrusive thought using both imagery (visualising eating a craved food, performing a pleasant activity) and non-imagery tasks (writing about values, keeping alert while preparing food). This was found to be efficacious at reducing trait food cravings compared to willpower alone (Rodríguez -Martin et al., 2013).

1.4.4.7 Dynamic Visual Noise Intervention

Dynamic Visual Noise interventions are also based on the Elaborated-Intrusion Theory of Desire (Kavanagh et al., 2005) and aim to disrupt the elaboration of an intrusive thought by introducing a competing visual task; they differ from imagery interventions, as the competing visual task is not imagined (Kemps & Tiggemann, 2013). One study (Kemps & Tiggemann, 2013) examined the effect of this type of intervention and found it was efficacious at reducing self-reported state craving intensity; however, it is not known how the intervention compared with a control condition (craving diary only) as the necessary analysis was not run and there was insufficient data to run it (Kemps & Tiggemann, 2013).

1.4.4.8 Cognitive Bias Modification Interventions

Having an attention bias (meaning paying greater attention) to food cues, as well as an approach bias to (meaning an automatic tendency to move towards) food cues are both associated with increased food craving (Hardman et al., 2021; Brockmeyer et al., 2015). Three studies (Jonker et al., 2019; Meule et al., 2019; Moritz et al., 2019) targeted these biases with the aim of reducing or altering the bias, subsequently leading to a reduction in food cravings.

A self-directed smartphone based intervention targeting an approach bias led to a reduction in state and trait chocolate cravings (Meule et al., 2019) and trait cravings for all foods (Moritz et al., 2019), particularly when reminders were sent (Moritz et al., 2019). While this type of intervention was more beneficial than a waitlist control (Moritz et al., 2019), it was no more beneficial than a placebo control (Meule et al., 2019). The intervention effect was not shown to be maintained at 12-months, although this could have been due to low intervention use (Gehlenborg et al., 2023). A self-directed computer-based intervention targeting attentional bias was effective at reducing trait food cravings, but no more beneficial than a waitlist control (Jonker et al., 2019). Therefore, there is only a small amount of evidence to suggest that cognitive bias modification interventions are effective at reducing food cravings, and may be no more efficacious than placebo-type interventions.

1.4.4.9 Response Inhibition Training

The concepts of attention and approach bias also underpin response inhibition training, which aims to increase inhibitory control when exposed to food cues; it shares similarities with cognitive bias modification, however, is more behavioural (Moore et al., 2023). One study (Moore et al., 2023) examined a smartphone-based response inhibition training intervention which was efficacious at reducing trait food cravings, but no more beneficial than a placebo control; and the intervention effect was not sustained one week after the intervention (Moore et al., 2023).

1.4.5 Between-group Analysis

Individual effect sizes (95% CI) of the intervention/s compared with control group for each study (where there was adequate data) are depicted in the forest plot (figure 3), and the corresponding information about the studies and the data is presented in table 2. Standardised mean differences (Cohen's *d*) were calculated using a random-effects model and the post-intervention data (*M*, *SD*, *n*) used to calculate this is presented in table A2 (appendix F). Follow-up was not included in this analysis, as only four studies had follow-up data and there was inadequate data for the control groups in three of these. The following findings reflect the 'main findings' summary for the included studies, which is presented in the study characteristics table. It is important to note that this between-group analysis does not include all the papers included in this review as there was missing data (*M*, *SD*, *n*) for Lacaille et al. (2014), Schnepper et al. (2019), Moffitt et al. (2012). Giacobbi et al. (2018), Meule et al. (2019), Gehlenborg et al. (2023) and Kemps & Tiggemann (2013).

1.4.5.1 Significant Intervention Effects

The forest plot (figure 3) indicates the biggest significant intervention effect on trait cravings (when compared to a control) for the mindfulness-based eating programme (Alberts et al., 2012); although this also has the biggest confidence interval. The forest plot also indicates a significant intervention effect on trait cravings (when compared to a control) for the imagery and non-imagery intervention (Rodriguez-Martin et al., 2013), and a significant intervention effect on state cravings for the implementation + active imagery intervention (Knäuper et al., 2011) and the EFT intervention in two studies (Stapleton et al., 2011; Stapleton et al., 2019). The cognitive defusion intervention in Karekla et al. (2020) also indicates a significant effect on trait cravings, when compared to the control, which is representative of the follow-up comparisons that showed a difference between the cognitive defusion and control groups at post-intervention.

1.4.5.2 Significant Control Group Effects

The forest plot also indicates a significant control group effect on trait craving for the active control (thought control) in Chapman et al. (2018). A significant control group effect on state craving is shown for the active control (goal intention with no concrete strategy) when compared with the implementation only intervention (form an implementation statement to reduce cravings and repeat it) in Knäuper et al., 2011.

1.4.5.3 No Between-group Difference

All other confidence intervals cross the null value (0.00) line, which indicates no significant differences between the groups.

Table 1-2

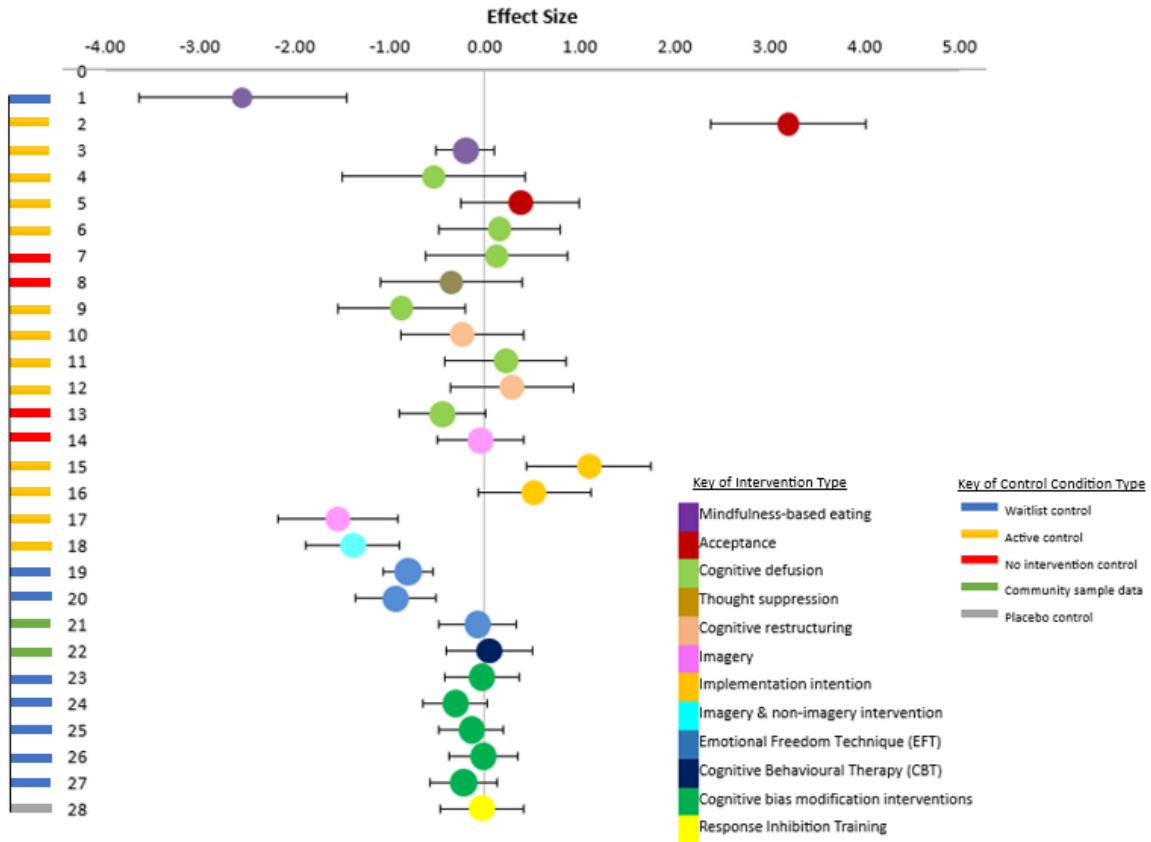
Forest plot data of standardised mean difference effect sizes (d) for food craving outcomes (for studies where there was adequate data)

	Study name	Conditions	Measure	d	95% CI lower	95% CI upper
1	Alberts et al., 2012	MBCT; waitlist control	G-FCQ-T (trait)	-2.55	-3.64	-1.46
2	Chapman et al., 2018	Acceptance; active control	G-FCQ-T (trait)	3.20	2.39	4.01
3	Devonport et al., 2022	Mindfulness-based eating programme; active control	Craving Frequency (trait)	-0.20	-0.51	0.11
4	Hinojosa-Aguayo & Gonzalez, 2022	Cognitive defusion; active control	FCQ-T (trait)	-0.54	-1.49	0.42
5	Hulbert-Williams et al., 2017	Acceptance; active control	FCI (state & trait)	0.38	-0.25	1.00
6	Hulbert-Williams et al., 2017	Cognitive defusion; active control	FCI (state & trait)	0.16	-0.48	0.80
7	Hooper et al., 2011	Cognitive defusion; control	Craving Frequency (trait)	0.13	-0.62	0.88
8	Hooper et al., 2011	Thought suppression; control	Craving Frequency (trait)	-0.36	-1.10	0.39
9	Karekla et al., 2020	Cognitive defusion; active control	FCQ-T (trait)	-0.87	-1.54	-0.20
10	Karekla et al., 2020	Cognitive restructuring; active control	FCQ-T (trait)	-0.24	-0.88	0.41
11	Karekla et al., 2020	Cognitive defusion; active control	FCQ-S (state)	0.22	-0.42	0.86
12	Karekla et al., 2020	Cognitive restructuring; active control	FCQ-S (state)	0.29	-0.35	0.93
13	Schumacher et al., 2018	Cognitive defusion; control	Craving frequency (trait)	-0.44	-0.90	0.01
14	Schumacher et al., 2018	Guided imagery; control	Craving frequency (trait)	-0.04	-0.50	0.41
15	Knäuper et al., 2011	Implementation intention; active control	Craving intensity (state)	1.10	0.44	1.76
16	Knäuper et al., 2011	Implementation intention + cognitive task; active control	Craving intensity (state)	0.52	-0.07	1.12
17	Knäuper et al., 2011	Implementation intention + active imagery; active control	Craving intensity (state)	-1.55	-2.18	-0.91
18	Rodriguez-Martin et al., 2013	Imagery & Non-imagery intervention; control	FCQ-T (trait)	-1.39	-1.88	-0.89
19	Stapleton et al., 2019	Online EFT; waitlist control	FCI (state & trait)	-0.81	-1.07	-0.54
20	Stapleton et al., 2011	EFT; waitlist control	FCI (state & trait)	-0.94	-1.37	-0.51
21	Stapleton et al., 2016	EFT; control community sample	FCI (state & trait)	-0.07	-0.48	0.33
22	Stapleton et al., 2016	CBT; control community sample	FCI (state & trait)	0.05	-0.41	0.50
23	Jonker et al., 2019	Attentional bias modification; waitlist control	G-FCQ-T (trait)	-0.03	-0.42	0.36
24	Moritz et al., 2019	Imaginal retraining with reminder; waitlist control	VAS (trait)	-0.31	-0.65	0.03
25	Moritz et al., 2019	Imaginal retraining with reminder; waitlist control	FCQ-T-r (trait)	-0.14	-0.48	0.20
26	Moritz et al., 2019	Imaginal retraining without reminder; waitlist control	VAS (trait)	-0.01	-0.37	0.35
27	Moritz et al., 2019	Imaginal retraining without reminder; waitlist control	FCQ-T-r (trait)	-0.22	-0.58	0.14
28	Moore et al., 2023	Response inhibition training; placebo control	Experience of cravings (CoEQ) (trait)	-0.03	-0.46	0.41

Note. d = standardised mean difference effect size. Follow-up data not included. Karekla et al. (2020) and Moritz et al. (2019) had two food craving outcome measures with adequate data and intervention effects for both outcome measures have been presented. Data for the following studies is missing as there was inadequate data, Lacaille et al. (2014), Schnepfer et al. (2019), Moffitt et al. (2012), Giacobbi et al. (2018), Meule et al. (2019), Gehlenborg et al. (2022) and Kemps & Tiggemann (2013).

Figure 1-3

Forest plot data of standardised mean difference effect sizes (d) for food craving outcomes



Note. The circle represents the effect estimate and the horizontal line running through it indicates the confidence interval. If the effect estimate is to the left of the vertical line at 0.00 (i.e., negative effect size) this favours the intervention, if it is to the right of the vertical line (i.e., positive effect size) this favours the control. The numbers of the left had side of the plot correspond with the study data presented in table 2 above, and the coloured rectangles to the left indicates the different control condition types and correlates with the key included on this plot.

1.5 Discussion

The aim of this paper was to systematically review the empirical literature to a) examine what psychosocial interventions have been used to reduce food cravings and b) assess their efficacy at reducing these cravings. This was to make recommendations for clinical practice when working with adults, as food cravings have been identified as precipitants to binge-eating episodes and linked with obesity (Ng & Davis, 2013; Greeno et al., 2000).

The most common interventions used to reduce food cravings were mindfulness-based, which is not surprising given existing literature suggests that mindfulness interventions are useful in targeting craving related behaviour in substance use disorder as they encourage non-judgemental observation of the craving experience and enable the individual to choose how to respond to the craving (Demina et al., 2023). Other interventions used were cognitive behavioural-based interventions, emotional freedom techniques, imagery interventions, a dynamic visual noise intervention, and interventions aimed at modifying attentional and approach bias towards food (cognitive bias modification and response inhibition training).

It was not possible to conduct a meta-analysis or to determine the most efficacious intervention as there was too much heterogeneity in the study methodology, and in the control conditions. However, the results suggest that some psychosocial interventions can support a reduction in cravings and that some types of interventions may be more beneficial than no intervention, or alternative interventions. Overall, the findings suggest that psychosocial interventions may be worth considering to inform for clinical practice. However, future research is needed to establish the most efficacious type of intervention to enable best-practice in services that support people with disordered eating and obesity.

1.5.1 Clinical Implications

Mindfulness-based eating interventions are efficacious, but no more so than completion of a food diary. This suggests that bringing awareness to food cravings and their associated emotions may be enough to reduce cravings and the inclusion of mindfulness-based eating techniques (e.g., awareness of the sensation of eating) may be no more beneficial (Devonport et al., 2022). In terms of other mindfulness-based techniques, no single technique (e.g., awareness, disidentification) was found to be more helpful than another; and instead, for a mindfulness-based intervention to be most beneficial it should include awareness and disidentification together as this is shown to be the most efficacious combination, and more efficacious than a single technique (Lacaille et al., 2014). Interventions that incorporate both of

these techniques will encourage the individual to be able to recognise their cravings and choose how to respond to them, rather than the craving dictating their eating behaviour.

Cognitive defusion and cognitive restructuring are both efficacious at reducing cravings, including lack of control over eating and thoughts and preoccupation with food, and neither was shown to be more efficacious than the other (Karekla et al., 2020; Moffitt et al., 2012). The clinical implications of these findings are interesting as cognitive defusion and cognitive restructuring are two distinct techniques and existing research has examined the mechanisms of change that underpin the techniques in a mental health context (Kraft et al., 2021; Levin et al., 2018). Cognitive defusion has been shown to increase self-compassion and cognitive decentering (observing thoughts as just thoughts, not facts) and cognitive restructuring has been hypothesised to improve a person's perceived accuracy of their thoughts and their self-efficacy in coping with them (Levin et al., 2018). For mental health problems, cognitive defusion and cognitive restructuring are efficacious and shown to be more efficacious than a waitlist control (Levin et al., 2018). However, in the present review the findings differ as neither technique was shown to be more efficacious than a waitlist control at reducing lack of control over eating and thoughts and preoccupation with food (Moffitt et al., 2012). This suggests that more research is needed to examine the process mechanisms that underpin successful interventions for food cravings; and from the findings in this review it could be hypothesised that just bringing attention to the craving experience may be an efficacious intervention.

CBT and EFT are efficacious at reducing cravings and show promise for sustained intervention effects at 6- and 12-months (Stapleton et al., 2011; 2012; 2016; 2019). These were the few intervention types where follow-up data was available, suggesting that more follow-up studies are needed to assess the longer-term efficacy of the other intervention types. However, clinicians could consider using CBT or EFT if their aim is to support a sustained craving reduction over time. These intervention types seemed to require the most input from the practitioner (with content typically delivered over 4-8 sessions). However, as online pre-recorded content was efficacious, this could be considered as a potentially more efficient method of delivery (Stapleton et al., 2019).

Imagery interventions, as well as an imagery intervention that includes aspects of non-imagery (e.g., writing about values, keeping alert while preparing food) are efficacious at reducing cravings (Giacobbi et al., 2018; Rodriguez-Martin et al., 2013; Schumacher et al., 2018); and may be most efficacious at reducing cravings in the moment when combined with an intention to reduce the craving (Knäuper et al., 2011). This suggests that these types of intervention may be most efficacious if the aim of the intervention is to reduce craving intensity

in the moment; however, more research comparing imagery interventions to other types of interventions is needed to confirm this.

A dynamic visual noise intervention is also efficacious at reducing craving intensity in the moment, although there is less evidence to support this and it is not known if this is more efficacious than other interventions (Kemps & Tiggemann, 2013). While the findings from Kemps & Tiggemann (2013) show promise, future research may wish to examine the effects of dynamic visual noise interventions so that there is more evidence to support its use (or otherwise) for food cravings, particularly as this type of intervention may be low intensity and easy to deliver.

Interventions targeting approach or attentional biases towards foods, or both of these, are efficacious at reducing cravings but may not be more efficacious than no intervention (Moritz et al., 2019; Jonker et al., 2019) or a placebo intervention (Meule et al., 2019; Moore et al., 2023); and the intervention effects may not be longstanding (Gehlenborg et al., 2023; Moore et al., 2023). Overall, more research is needed to determine the efficacy of these types of interventions, particularly as they may be most accessible to the general population as they can be self-directed on a smartphone.

While meta-analysis was not possible, the forest plot (displaying the post-intervention difference between each intervention and its control) shows that although many of the effect sizes cluster around the null value (0.00) line, more of the studies whose confidence interval did not touch the null value line were in favour of the intervention, than in favour of the control.

The forest plot indicates the largest intervention effect for the mindfulness-based eating programme (Alberts et al., 2012) and the largest control effect for thought control (Chapman et al., 2018). Yet, both of these also have the largest confidence intervals, suggesting that there is the most uncertainty in these effect sizes (Altman & Bland, 2014). The plot also suggests that the active imagery intervention plus implementation intention in Knäuper et al. (2011) and the imagery and non-imagery intervention in Rodriguez-Martin et al. (2013) may be the next most efficacious interventions compared to their controls.

However, the forest plot needs to be interpreted with caution as it does not include all the interventions in this review and because the control conditions were not comparable (some controls were active interventions, and others were waitlist controls or a community sample). Although the other studies in the forest plot (to those mentioned in the paragraph above) may have shown less difference between the effect of their intervention versus control, often the control condition had an active element (e.g., recording cravings, or instructions to respond to cravings in a certain way); therefore, the interventions appeared to have small effects due to the control condition also leading to a reduction in craving.

1.5.2 Future Research

Due to the heterogeneity of the studies, it was not possible to form conclusions about what style of intervention delivery or length had the most efficacy, and for whom the intervention was most efficacious. Reviewing the data there did not appear to be a clear relationship between intervention effect and intervention length, with the studies showing the largest positive effect sizes on the forest plot having interventions that ranged from 4 days (Knäuper et al., 2011) to 8 weeks (Alberts et al., 2012) to 3 months (Rodríguez-Martin et al., 2013). It was not possible to run analyses to examine the relationship between intervention effect and length as there were several variables that would have confounded the results (intervention type, quality, delivery and the study sample size). Future research may wish to examine the relationship between the efficacy of psychosocial interventions and their length as research in this area is lacking. However, there is literature that highlights the importance of personalised interventions (including intervention length) which has been shown to improve outcomes, particularly for a clinical population (Nye et al., 2023).

For future research looking to recruit participants who experience food cravings and run an intervention, it should be noted that the interventions lasting 4-weeks or longer with the largest sample sizes tended to have self-guided interventions (i.e., Chapman et al., 2018, Rodríguez-Martín et al., 2013, Stapleton et al., 2019, Moritz et al., 2019); whereas, the interventions that had smaller sample sizes tended to involve more commitment, such as weekly or fortnightly groups (i.e., Alberts et al., 2012, Schnepfer et al., 2019, Stapleton et al., 2016). Therefore, if researchers wish to recruit a larger sample they should consider making the intervention self-guided.

The population sample in this review was predominantly female (mean 75%, range 30%). This is unsurprising given that women report more frequent and intense cravings, compared to men (Hill, 2007). It was outside of the scope of this review to consider intervention efficacy by gender, however, given that the sample was predominantly female it could be concluded that the findings will be most applicable to females. Future research may wish to consider intervention efficacy by gender to establish the most beneficial interventions for males; this may be particularly important given the health implications of research suggesting that men typically consume more high-fat, fast food, than women (Leow et al., 2021).

1.5.3 Strengths and Limitations

This review followed the PRISMA reporting guidelines (Page et al., 2021) and aimed to provide as much information as possible to ensure transparency and reproducibility. A strength of the review is the inclusion of a clear definition of a psychosocial intervention, the lack of which

has been identified as a limitation in similar systematic reviews (Hodges et al., 2009). The inclusion criteria was thorough and ensured the inclusion of relevant papers; and the inclusion of only a non-clinical population ensured that additional treatment (i.e., pharmacological, or interventions from weight or eating disorder services) did not confound the results of the interventions being tested, which increases confidence in the results of this review. However, the inclusion of papers written only in English may mean that papers in other languages are missing and may represent a bias in the reported data.

A limitation of this review was that due to the heterogeneity of the included studies, particularly as some did not explore a one-tailed hypothesis of the intervention versus non-active control, it was not appropriate to run a risk of publication bias (e.g., funnel plot). This would have assessed if the inclusion of unpublished data may have changed the results (Lin et al., 2018). However, the risk of bias assessment (RoB 2) did not indicate bias in the selection of the reporting of results, suggesting that there is a low risk that the studies only reported significant results. There was also low risk of bias due to deviations from the intended interventions, suggesting that the intervention was delivered as intended and the results are unlikely to be subject to bias due to other factors (Sterne et al., 2019). Overall, the intervention effects reported and discussed in this review are considered to be reliable and at low risk of bias.

The results of the intervention effects can be considered reliable, as only controlled study designs were included which provides less bias when reporting effects of interventions (Higgins et al., 2023). However, not all studies included an inactive control condition (i.e., waitlist) and therefore it was not possible to assess the efficacy of each intervention compared to no intervention. Future research should consider the inclusion of waitlist controlled studies only as this may enable clearer conclusions about the effect of the intervention at reducing food cravings, compared to no intervention.

1.6 Conclusion

This review suggests that some psychosocial interventions can support a reduction in food cravings in adults and that there is most evidence to support the use of mindfulness-based interventions, cognitive behavioural interventions, emotional freedom techniques and imagery intervention; although this may be because these are the most researched intervention types. Overall, while some psychosocial interventions can be efficacious at reducing cravings, so can instructing people to become aware of their cravings, and set an intention to reduce their cravings. Therefore, the findings suggest that more research is needed to understand the process mechanisms that underpin beneficial interventions for food cravings.

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Chapter 2 An experimental study examining the effect of bilateral eye movements on food-related mental imagery and food cravings

This empirical paper has been written for the *Journal of EMDR Practice & Research* and in line with their publishing guidelines, which are in appendix G.

2.1 Abstract

This study is the first to examine the efficacy of a desensitisation phase from an adapted EMDR for addiction protocol on food cravings and craving related mental imagery. Fourteen participants were allocated to 3 conditions: Bilateral eye movements; working memory task; and mental imagery only. A group intervention was delivered weekly for 4 weeks and craving was measured with self-report questionnaires. Overall, participants in all conditions reported a reduction in trait craving with no significant differences between the conditions. There was no clear pattern of change in state craving, although it was associated with reduction in feeling state, image-specific craving, vividness and pleasantness. The findings add to a small research base and future researchers may wish to replicate the study with a larger sample.

Keywords: EMDR, eye movements, food craving, mental imagery, working memory

2.2 Introduction

Eye movement desensitisation and reprocessing (EMDR) is a psychotherapeutic approach that was first developed for the treatment of post-traumatic stress disorder (PTSD) (Shapiro, 1989). When compared with no-treatment, EMDR has been shown to be effective at reducing levels of distress in PTSD and other anxiety disorders, with higher treatment efficacy when delivered by an experienced therapist and over more sessions (Cahill et al., 1999; Rasines-Laudes & Serrano-Pintado, 2023).

Within an EMDR therapeutic protocol there are several phases, including desensitisation and reprocessing, as well as the incorporation of positive cognitions, body scanning and relaxation (Shapiro, 2001). In the desensitisation phase of EMDR, the client is asked to perform sets of approximately 10-20 lateral eye movements (EM) while engaging in imaginal recall of aspects of a target memory (Cahill et al., 1999). These lateral EM are referred to as bilateral stimulation (BLS) (Shapiro, 2001). Current cognitions, emotions and physical sensations are reported after each set of BLS, to gauge the sensory richness of the memory, and the cycle is repeated until the sensory richness has decreased and the memory is less emotionally intense to recall so that it can be updated and appropriately processed (Littel et al., 2016).

EMDR is thought to be underpinned by the Adaptive Information Processing (AIP) model (Shapiro & Laliotis, 2011), which proposes that psychopathology is due to the incomplete processing of experiences and their associated beliefs, emotions and physical sensations, by the brain's processing system (Shapiro & Laliotis, 2011). As the memory has not been updated or changed (i.e., has not been processed), each time it is retrieved the associated beliefs, emotions and physical sensations are re-activated and experienced as they were originally experienced leading to psychopathology (Shapiro & Laliotis, 2011). There has been debate about how and why EMDR is effective with one hypothesis being that it is repeated and prolonged exposure to the memory that leads to a reduction in distress (Flatot-Blin et al., 2023). However, the *working memory* (WM) hypothesis is more widely researched and accepted; the working memory is the brain's system that is responsible for the temporary storage and manipulation of information and is required for complex cognitive tasks, as well as learning and reasoning (Baddeley, 1992).

The WM theory (Baddeley, 1986) suggests that our WM has limited capacity and when two tasks that both demand attention are performed together the primary task deteriorates (Shapiro, 2001). In the desensitisation phase of EMDR, recalling a memory draws on the *visuospatial sketchpad* which is part of the WM that is responsible for visually storing and

processing information. Meanwhile, performing EM (i.e., BLS) also relies on the WM as it requires cognitive effort, as well as the visuospatial sketchpad as the task requires spatial and visual information. As the WM has limited capacity, the competition between recalling a memory and performing EM is thought to ‘deteriorate’ the ability to recall the memory vividly, meaning the memory is less vivid and emotionally intense (Shapiro, 2001).

There is debate about whether the use of EM in EMDR contributes to higher treatment efficacy. A 2001 meta-analysis by Davidson and Parker suggested it does not. However, a 2013 meta-analysis by Lee and Cuijpers found a significant effect of eye movement, compared with no eye movement, and highlighted methodological limitations in the 2001 meta-analysis. Studies exploring the WM hypothesis of EMDR have used alternative conditions which tax WM without BLS, such as mental arithmetic, to replicate the dual task process. A 2021 meta-analysis concluded that a dual task which taxes WM, performed whilst keeping an emotional memory in mind, led to a reduction in vividness and emotionality of the memory on recall and that this was effective for negative and positive memories (Mertens et al., 2021).

Positive memories can also lead to psychopathology (Andrade & De Micheli, 2016). In addictive disorders, a previous experience of using a substance, including the emotional impact of it (e.g. relaxation), is stored in the episodic memory and can be activated by a cue, leading to craving and desire (Boening, 2001). The Elaborated Intrusion Theory of Desire (Kavanagh et al., 2005) suggests that a craving starts with an intrusive thought, which is elaborated by a mental image of the substance (Shahriari et al., 2020). This mental image is based on the previous experience of consuming the substance, which is stored in the episodic memory, and is key in the maintenance of cravings (Boening, 2001).

Food cravings are also conceptualised in this way and mental imagery has been shown to be a key element in the experience of food craving, and more vivid imagery is associated with higher craving intensity (Shahriari et al., 2020; Tiggemann & Kemps, 2005). A food craving is defined as an intense desire to eat a specific food (Weingarten & Elston, 1990). Food cravings differ from feelings of hunger; hunger is initiated by an empty stomach and can be alleviated by the consumption of any food, whereas food cravings are typically only alleviated by the consumption of the food that is being craved (Meule, 2020). Food cravings are conceptualised and measured in two ways, *state* and *trait*. A *state* craving is used to define the craving in any given moment and can change in response to a stimuli or event, whereas *trait* craving describes the craving experience over time and across situations (Vander Wal et al., 2007).

In line with the WM theory, the visuospatial sketchpad is responsible for visually storing and processing information and is therefore responsible for the mental imagery that underpins the food craving experience (Kemps et al., 2004). Interventions that target the WM, including the

visuospatial sketchpad, with the aim of reducing the vividness of mental imagery, have been shown to reduce food craving intensity (Kemps et al., 2004; Littel et al., 2016), as well as craving for other substances (Scelles & Bulnes, 2021).

Research suggests that food cravings play an important role in disordered eating (i.e., binge-eating episodes and bulimia-nervosa) and obesity, with food cravings typically a precipitant to binge-eating episodes (Ng & Davis, 2013; Whatnall et al., 2022). Binge-eating episodes can be associated with obesity (Faulconbridge & Bechtel, 2014). >1.9 billion adults worldwide are overweight or obese (WHO, 2021); and obesity is a risk factor in the development and management of critical illnesses (Anderson & Shashaty, 2021).

Typically, psychological treatment for disordered eating or obesity is cognitive and behavioural in approach (i.e., cognitive behavioural therapy for eating disorders; CBT-E). This is because research has predominantly focused on the cognitive-model of eating behaviour. This model suggests that beliefs about eating and self-image develop early in life and can result in preoccupation with food, shape and weight, which can lead to a cycle of eating restriction and binge-eating (Burton & Abbott, 2017; Fairburn et al., 2003). This cycle occurs because eating restriction is associated with a heightened responsiveness to food cues, which can lead to overeating when exposed to tempting foods (Polivy & Herman, 2017). CBT-E has been shown to be effective in the short-term, however, findings about its long-term effectiveness are mixed (Kaidesoja et al., 2022). This is thought to be because there are certain cognitive aspects of eating that are not addressed in cognitive behavioural therapy (i.e., food cravings) (Burton & Abbott, 2017). Subsequently, more research has focused on the role of food cravings and a theoretical model has been adapted from the addiction literature to propose that food cravings are activated during attempts at dietary restraint, and once activated increase the likelihood of overeating or binge-eating (Verzjil et al., 2018). This suggests there is a need for interventions targeting the management and reduction of food cravings, as these may be more long-lasting than currently available psychological interventions for overeating or binge-eating (i.e., CBT-E) and may be beneficial as an adjunctive to other interventions for obesity (e.g., lifestyle medication or surgery).

To our knowledge, three laboratory experiments have targeted the reduction of food cravings using a visuospatial task (Kemps et al., 2008; McClelland et al., 2006; Steel et al., 2006); and these types of interventions have shown beneficial results, as all three experiments found a significant reduction in the vividness of the food-related mental imagery when compared with a control condition. All studies were undertaken in a student population, and were based on the theory that the visuospatial sketchpad is part of the working memory that is responsible for the mental imagery that underpins the food craving experience (Kemps et al.,

2004). A 2016 study by Littel et al., built on these findings and also targeted the working memory by delivering a single session EM intervention, simulating the BLS component of EMDR, for food cravings.

Littel et al. (2016) found that, compared to a control, a single session of EM whilst recalling a food-related mental image significantly reduced the vividness of the image, and significantly reduced self-reported craving for that food. The control condition was imagery recall only (without EM) and in this condition vividness and *state* food cravings increased (Littel et al., 2016). There was no follow-up to this study, so it is not known if these effects were long-lasting. However, Littel et al., (2016) note that for prolonged craving reduction, specific instructions need to be given to retrieve the image of the craved substance before engaging in the dual task.

2.2.1 The present study

The present study builds on the findings from Littel et al. (2016) and is the first study to examine the efficacy of a desensitisation phase from an adapted EMDR for addiction protocol on food cravings. This study employs three conditions, all three conditions involve recalling a mental image of a specific target food, but one condition also involves EM (called the BLS condition), one involves an alternative WM task (called the WM condition), and another involves no dual task (called the imagery only (IO) condition). Therefore, the findings from this study are also of relevance to the WM theory that underpins the experience of cravings and answers Mertens et al's (2021) call for more research to establish the efficacy of dual-task interventions in health.

Studies that support the WM hypothesis have used alternative conditions to EM that tax WM, such as mental maths, which have also shown a reduction in the vividness and emotionality of a distressing image on recall (Engelhard et al., 2011). Engelhard et al., (2011) found intermediate subtraction to have superior effects, compared with no dual task or complex subtraction. In the present study participants in the WM condition are asked to perform an intermediate subtraction task.

An adapted version of the desensitisation phase of Miller's (2012) feeling state addiction protocol (FSAP) is used as the intervention (Oakley & Proudlock, 2020). This was initially adapted by Sanja Oakley (psychotherapist) and further adapted by one of the research team (SR). Littel et al. (2016) include visual analogue scale (VAS) ratings of vividness, pleasantness and image-specific craving in their study, which have also been incorporated into the adapted FSAP for use in this study.

The FSAP has been shown to be effective at reducing a *feeling state* (positive emotions and physical sensations) associated with gambling and sex addiction and through a reduction in feeling state the addictive behaviours also reduced (Miller, 2012). The phrase feeling state will be referred to from here on and describes the emotions and physical sensations that are associated with the food craving experience (e.g., happiness and a sense of warmth). This is in line with the terminology used in the FSAP (Miller, 2012).

The study intervention is intended to run online, in a group setting. Research has found that online EMDR is effective at reducing symptoms of PTSD (Strelchuk et al., 2023) and anxiety and depression (McGowan et al., 2021); and is effective when delivered in a group setting (Kaptan et al., 2023).

The primary aim of the study is to answer the following research question: What effect does eye movement have on reducing *state* and *trait* food cravings, compared to an alternative working memory task and no dual task in those who experience food cravings? The secondary aim is to assess if a reduction in food craving is associated with a reduction in craving related mental imagery, based on the following research question: Is a reduction in food craving associated with a) a reduction in feeling state and b) a reduction in image-specific vividness, pleasantness and craving?

In line with the findings of Little et al. (2016) the primary hypotheses are that eye movement (BLS) will have a superior effect at reducing *state* and *trait* food cravings compared to the working memory task, and that no dual task (IO) will increase *state* and *trait* food cravings. The secondary hypotheses are that eye movement (BLS) will lead to a greater reduction in feeling state, compared to the working memory task and no dual task (IO), as well as a greater reduction in image-specific vividness, pleasantness and craving of the target food. It is also hypothesised that a reduction in *state* and *trait* craving will be associated with a reduction in image-specific vividness, pleasantness and craving of the target food, as well as a reduction in feeling state.

2.3 Methods

2.3.1 Design

A 3 x 2 matched design is used with condition as the between subjects' factor and time as the within subjects' factor. Conditions are matched based on age and gender; and if a University of Southampton (UoS) participant, also based on student/staff status. The independent variable is condition (i.e., BLS, WM or IO). The dependent variables are *state* and

trait food cravings, feeling state, as well as image-specific vividness, pleasantness, and craving of the target food.

2.3.2 Co-creation and Consultation

This study was co-created alongside two EMDR trained clinical psychologists (LC & SR) who have experience of working clinically with people experiencing and struggling with food cravings. SR, who adapted the FSAP for use in this study, has experience of delivering this protocol clinically and found it led to a reduction in craving. Prior to study recruitment, all three conditions were piloted by the research team.

An assistant psychologist (LR) with relevant experience, and an expert by experience from a tier 3 weight loss programme, were consulted regarding the group format, most frequently craved foods, the study advertisement, the value of doing this research, and to ensure the questionnaires accurately captured the craving experience.

2.3.3 Participants

2.3.3.1 Sample Size Calculation

An a priori power analysis using G*Power indicated that 78 participants (26 per condition) would be sufficient to detect a medium effect size ($d = 0.5$) based on a 3x2 ANOVA, an 80% power, and an alpha level of 0.05 (Faul et al., 2007)

2.3.3.2 Recruitment

This study was granted ethical approval by the UoS Research Ethics Committee (UREC; ERGO 82200). The study was run in two phases due to low participant numbers in the first phase. The first phase of recruitment was for UoS students and staff only and took place between 02/10/23– 31/10/23 and the intervention ran between 6/11/23 – 29/11/23. The second phase of recruitment was for the general public and took place between 02/01/24 – 12/02/24 and the intervention ran between 19/02/24 - 11/03/24.

Participants were recruited via advertisements that called for people who experienced food cravings and who try to limit the foods they crave the most, the latter was a requirement to fulfil the study criteria of IF's study (another trainee clinical psychologist involved in the design and running of this study). The advertisement stated that participating in the study might help reduce food cravings. Advertisements for students and staff were placed across the university campus and distributed in e-newsletters, posted on relevant Facebook groups, on X (formerly Twitter) and via email to faculty administrators to distribute amongst their staff/students.

Advertisements for the general public were placed in village halls where community groups ran, posted on relevant Facebook groups and forums (Mumsnet and Reddit), on Instagram and on X.

2.3.4 Materials

2.3.4.1 Intervention Protocols

An adapted version of the desensitisation phase of Miller's (2012) FSAP by psychotherapist Sanja Oakley (Oakley & Proudlock, 2020) and further adapted by one of the research team (SR) was used as the intervention. Copies of Miller's (2012) original version and the adapted version are presented in appendices H and I respectively, and copies of the protocols used in the present study are presented in appendices J – L. In the WM condition the intermediate subtraction task involved subtracting three from a given number until told to stop and the starting number differed each time the task was required, a copy of the numbers used can be found in appendix M.

2.3.4.2 Target Foods

The top four foods that the participants from recruitment phase one craved the most were calculated, and these became the target foods for the study (see table A3, appendix N). The order of target foods was the same for each condition, week 1 (chocolate), week 2 (cake/biscuits), week 3 (takeaways) and week 4 (pastries – sweet or savoury). Although the top four most craved foods differed for phase two participants (see table A3, appendix N) the target foods remained the same to enable the data to be pooled across the phases.

2.3.5 Measures

2.3.5.1 Screening measure

To recruit a non-clinical population, and for ethical reasons, the Eating Attitudes Test (EAT-26) (Garner et al., 1982) was used to screen-out participants who scored within the clinical range for disordered eating (score of ≥ 20). A copy of the EAT-26 is in appendix O. Higher scores suggest more symptoms associated with disordered eating. The EAT-26 has shown excellent reliability across general and clinical samples, with a Cronbach's $\alpha = .91$ (Mitz & O'Halloran, 2000; Garner, 1982), as well as acceptable reliability in a Chinese community sample (Cronbach's $\alpha = 0.78$; Lee et al., 2002) and in a sample of black women (Cronbach's $\alpha = 0.74$; Kelly et al., 2012). Therefore, the EAT-26 is shown to be a reliable measure to use cross-culturally and for the majority of participants who completed the screening questionnaire in this study.

2.3.5.2 Food craving measures

State food craving was measured using The Food Cravings Questionnaire – State (FCQ-S). This is a 15-item questionnaire by Capeda-Benito et al. (2000) and has excellent reliability (Cronbach's $\alpha = .9$). *Trait* food cravings were measured using The Food Cravings Questionnaire – Trait – reduced (FCQ-T-r). This is a reduced, 15-item, version of a 39-item questionnaire by Capeda-Benito et al. (2000). The reduced version has excellent internal reliability (Cronbach's $\alpha = .94$) (Hormes & Meule, 2016). Copies of the FCQ-S and FCQ-T-r are in appendices P and Q.

The standard deviation (14.6) of the FCQ-T-r from a sample of people with 'food addiction' from Meule et al. (2018), and their value of Cronbach's ($\alpha = 0.953$) was used to calculate the minimum change in score that would indicate a reliable change 8.77 (95% CI), as this was considered the most analogous sample to the sample in the present study given the similarity of the sample means (FCQ-T-r mean in the present study is 56.21, FCQ-T-r mean in Meule et al. (2018) for sample with 'food addiction' is 61.0). The calculations and formula are presented in appendix R.

2.3.5.3 Feeling state measure

As per Littel et al's (2016) study, participants were asked to identify a feeling state, which described the emotions and physical sensations associated with the target food. They were also asked to rate this using a Visual Analogue Scale (VAS), ranging from 0 (feeling state not present) - 10 (as strong as that feeling could be). Copies of the VAS are in appendix S.

2.3.5.4 Target food-related mental imagery measures

VAS were also used to measure target food-related mental imagery. Participants were asked to recall an image of the target food and rate its vividness, pleasantness, and image specific craving intensity (e.g., how strong the urge to eat the food is) as per Littel et al's (2016) study. Each VAS ranged from 0 – 10, with 0 being the least and 10 being the most. For vividness this meant 0 = not vivid at all, 10 = the most vivid it could be. For pleasantness, 0 = not pleasant at all, 10 = the most pleasant it could be. For craving, 0 = not craving it at all, 10 = the most intense craving it could be.

2.3.5.5 Measure of online engagement

Participants were asked about online engagement, with the following question: 'How engaged were you during today's session?'. 0 = completely disengaged, 10 = completely engaged.

2.3.6 Procedure

2.3.6.1 Screening

The screening questionnaire was completed via Qualtrics, it featured participant information (see appendix T) and asked for consent to taking part in the study. It included the EAT-26 and asked for demographic information including occupation, knowledge or experience of EMDR, top four most craved foods, how often they tried to stop themselves eating these foods, and how easy it was to bring an image of these foods to mind.

2.3.6.2 Inclusion

Participants were included if they were aged 18 or over, self-identified as experiencing food cravings, and were willing to take part in a 4-part study over 4 consecutive weeks.

2.3.6.3 Exclusion

Participants were excluded if they scored within the clinical range on the EAT-26 (≥ 20). Additional exclusion criteria were those who were pregnant, those receiving professional support for problems related to eating and those who selected only negatively orientated emotions in relation to their cravings. Participants who were not eligible were informed and sent debrief information (see appendix U), which included signposting to relevant services for support.

2.3.6.4 Allocation to Condition

Eligible participants were given a participant number, and a random number generator allocated them to one of the three conditions. The average age, gender and occupation was unbalanced across the conditions at this stage. Therefore, the researchers (AC & IF) amended the groups to make the average age, gender and occupation as balanced as possible across the conditions. Participants were contacted with dates and times for the study depending on their condition. Some participants were moved into a different condition depending on their availability and to ensure they could still take part in the study. The participants were sent a calendar invitation to a Microsoft Teams meeting relevant to their study condition, which re-occurred over four weeks, as well as the pre-intervention measure (FCQ-T-r) to complete via Qualtrics.

2.3.6.5 Phase One Participants – UoS Students & Staff

In phase one there were 39 complete responses to the screening questionnaire, 12 were not eligible (scored ≥ 20 on the EAT-26 ($n = 7$); scored ≥ 20 on the EAT-26 + met additional

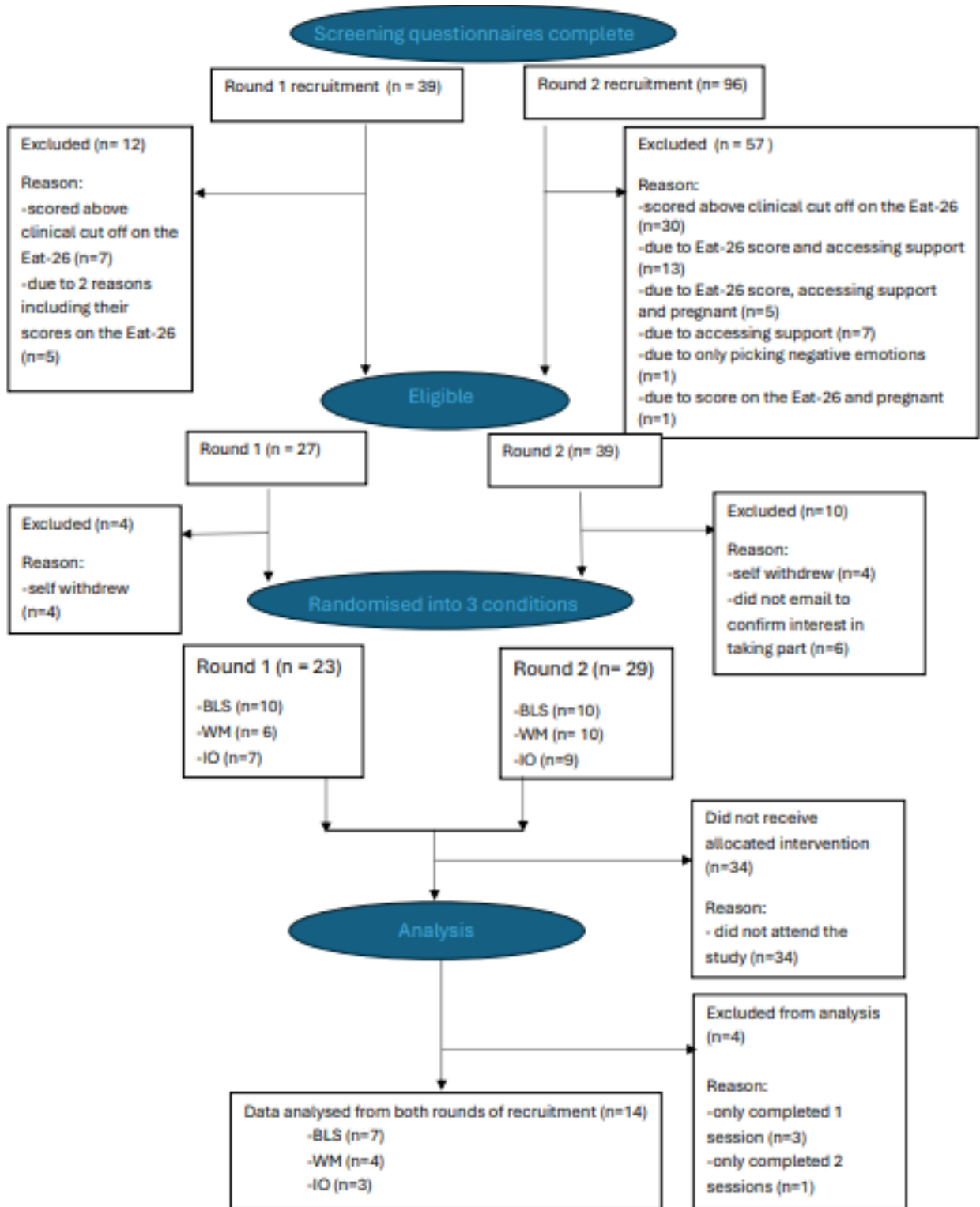
exclusion criteria (n = 5)). Exclusion is detailed in the CONSORT flow diagram in figure 1. Twenty-seven eligible participants were allocated to one of the three conditions. Participants who were not available on the study dates/times were withdrawn from the study (n = 4), leaving 23 participants who were eligible and available to take part. Participants were allocated to the conditions as follows: IO (n = 7), WM (n = 6), BLS condition (n = 10).

2.3.6.6 Phase Two Participants – General Population Sample

In phase two there were 96 complete responses to the screening questionnaire after duplicates were removed. 57 were not eligible (scored ≥ 20 on the EAT-26 (n = 30); scored ≥ 20 on the EAT-26 + met additional exclusion criteria (n = 18); met additional exclusion criteria only (n = 9). Exclusion is also detailed in figure 1. Thirty-nine screening responses met the eligibility criteria. In phase one a high proportion of eligible participants were allocated to a condition, but then dropped-out between screening and the running of the intervention. To avoid this happening in phase two, an email was sent to all eligible respondents asking for email confirmation that they would like to participate. Twenty-nine participants responded confirming their participation and 4 withdrew, leaving 29 eligible participants to be allocated to one of the three conditions. Participants were allocated to the conditions as follows: IO (n = 9), WM (n = 10), BLS (n = 10).

Figure 2-1

CONSORT flow diagram, which details participants screened, those eligible and not eligible and the reasons why, as well as participants allocated to condition and included in analysis



2.3.6.7 Intervention Procedure

Following recruitment and screening, the participants attended an online group session once a week, on the same day each week, for 4 weeks. In phase one the conditions ran at 12.00-13.00GMT on different days of the week (Monday (IO), Tuesday (WM) or Wednesday (BLS)). In phase two, due to availability of the EMDR therapist and facilitating researchers, all conditions ran on a Monday at different times (12.30-13.30GMT (IO), 13.30-14.30GMT (WM) or 14.30-15.30GMT (BLS)).

One EMDR practitioner from the research team and one trainee clinical psychologist from the research team facilitated each online session. The trainee clinical psychologists had been in contact with each participant before they attended the online group session, so were familiar to the participants. In phase one, one EMDR practitioner (SR) facilitated all conditions on week 1 and week 3 and another EMDR practitioner (LC) facilitated all conditions on week 2 and week 4. In phase two, one EMDR practitioner (LC) facilitated all conditions across the 4 weeks.

During the 1-hour group session the participants were required to be in a quiet space and have their cameras on. First, the participants were asked to complete pre-session measures (FCQ-S) via Qualtrics. Then, the EMDR practitioner (who was presented full screen, showing their head and shoulders against a pale blue background) led the group through the adapted desensitisation protocol. The participants were asked to choose their feeling state in relation to the target food and complete the VAS measures via Qualtrics throughout the session, when prompted. Participants were asked to switch between Microsoft Teams and their web browser to facilitate this and were always asked to return to Microsoft Teams to see the EMDR practitioner on their full screen. Once the protocol had been delivered, the participants were asked to stay online to complete the post-session measure (FCQ-S) via Qualtrics and answer a question about their engagement during the session. The participants were invited to ask questions via the chat function throughout the session and otherwise did not communicate with one another about their experiences.

This procedure was the same across all conditions and across all four weeks, except in the BLS condition the participants completed 7 sets of eye movements whilst holding in mind their feeling state, in the WM condition the participants completed 7 sets of intermediate subtractions whilst holding in mind their feeling state, and in the IO condition the participants were asked only to focus on an image of their target food and their feeling state and not to perform a dual-task for 7 sets. Each set was timed for 15 seconds to ensure it was the same across conditions. One week after the final group session, the participants were sent a post-

intervention measure (FCQ-T-r) to complete via Qualtrics. Participants were also sent debrief information (see appendix V).

2.3.7 Statistical analysis

Data was analysed using SPSS (IBM, version 29). Matching of the groups was checked based on key demographics (age, gender, ethnicity) and *trait* food cravings (FCQ-T-r) at baseline, as well as self-reported engagement to assess for differences across conditions. To assess the primary research question, *trait* food cravings were analysed by a 3 (condition) x 2 (time) mixed model ANOVA. To analyse *state* food cravings a 3 (condition) x 4 (time) ANOVA was planned, however, due to the small sample this was not feasible. As the small sample causes issues with generalising from the data, an ideographic focus was adopted; the data was explored graphically and clinically significant and reliable change scores were calculated for individual participants (Jacobson & Traux, 1991). To assess the secondary research question, correlation analysis was run to assess correlations between all VAS and cravings.

2.4 Results

2.4.1 Participant Characteristics

Fifty-two participants were allocated to a one of three conditions and invited to participate; 34 participants did not attend any session. Three participants completed only one session, one participant only completed two sessions, and 14 participants completed three or more sessions. Only data for participants who completed three or more sessions has been included in analysis (N = 14). The sociodemographic characteristics of the participants per condition are presented in table 1.

A chi-square test of independence showed that there were no significant differences in gender, $\chi^2(2, N = 14) = 0.52, p = .772$ or ethnicity, $\chi^2(6, N = 14) = 3.36, p = .762$ across the conditions. A one-way ANOVA showed that there were no significant differences in age $F(2,11) = 0.14, p = .871, \eta_p^2 = .025$ across the conditions. The mean FCQ-T-r for the full sample at baseline was 56.21 (7.62) and this did not differ significantly across the conditions, $F(2,11) = 0.09, p = .914, \eta_p^2 = .016$. Therefore, it is assumed that the conditions did not differ significantly at baseline.

A one-way ANOVA showed that there were no significant differences in self-reported engagement $F(2,11) = 2.90, p = .098, \eta_p^2 = .345$ across the conditions. Mean and *SD* for self-reported engagement and weekly pre-session feeling state VAS are reported in table 1.

Table 2-1

Sociodemographic characteristics of participants at baseline, and mean (SD) for online engagement and pre-session feeling state across all weeks, by condition and for the full sample

Baseline characteristics	BLS condition	WM condition	IO condition	Full sample	
	<i>n</i>	<i>n</i>	<i>n</i>	<i>N</i>	%
Gender					
Female	5	2	2	9	64
Male	2	2	1	5	36
Ethnicity					
White: White British, White Irish, any other White background	4	2	1	7	50
Asian or Asian British: Indian, Pakistani, Bangladeshi, Chinese, any other Asian background	2	1	1	4	29
Black or Black British: African, Caribbean, any other Black background	0	1	1	2	14
Prefer not to say	1	0	0	1	7
Student status					
Student	3	1	1	5	36
Non-student	4	3	2	9	64
Age M (SD)	32.86 (10.32)	28.75 (10.72)	33.00 (21.80)	31.7 (12.35)	
Online engagement M (SD)	6.80 (1.73)	8.63 (1.64)	5.78 (1.17)	7.10 (1.84)	
Weekly feeling state pre-session M (SD)					
Week 1	6.86 (2.41)	6.00 (1.83)	4.67 (4.51)	6.14 (2.71)	
Week 2	8.00 (.89)	5.75 (1.26)	7.67 (2.08)	7.23 (1.59)	
Week 3	6.00 (2.12)	7.33 (.58)	7.00 .	6.56 (1.67)	
Week 4	6.86 (1.35)	5.75 (1.89)	8.33 (.58)	6.86 (1.61)	

Note. Participant age did not differ significantly by condition. Online Engagement VAS (0 = completely disengaged, 10 = completely engaged). Feeling State VAS (0 = feeling state not present, 10 = as strong as that feeling could be).

2.4.2 Trait Food Craving (FCQ-T-r)

Group Analysis. Means and standard deviations for the FCQ-T-r measure pre and post intervention by condition are presented in table 2.

Table 2-2*Pre and post intervention FCQ-T-r means (SD) by condition*

	FCQ-T-r baseline		FCQ-T-r post-intervention	
BLS condition	56.29	(9.45)	54.43	(9.47)
WM condition	55.00	(5.03)	48.25	(5.12)
IO condition	57.67	(8.14)	49.67	(12.66)
Full sample	56.21	(7.63)	51.64	(8.98)

For this study's purpose and in line with the pre-registered statistical analysis plan, a 3 (condition) x 2 (time) mixed model ANOVA was run to assess change in *trait* food craving (FCQ-T-r) from baseline to post intervention. The within subject variable was time and the between subject variable was condition. However, due to the small sample size and particularly the small number of participants in the IO condition, the results will should be interpreted with caution, as there are issues with the statistical assumptions required to perform an ANOVA.

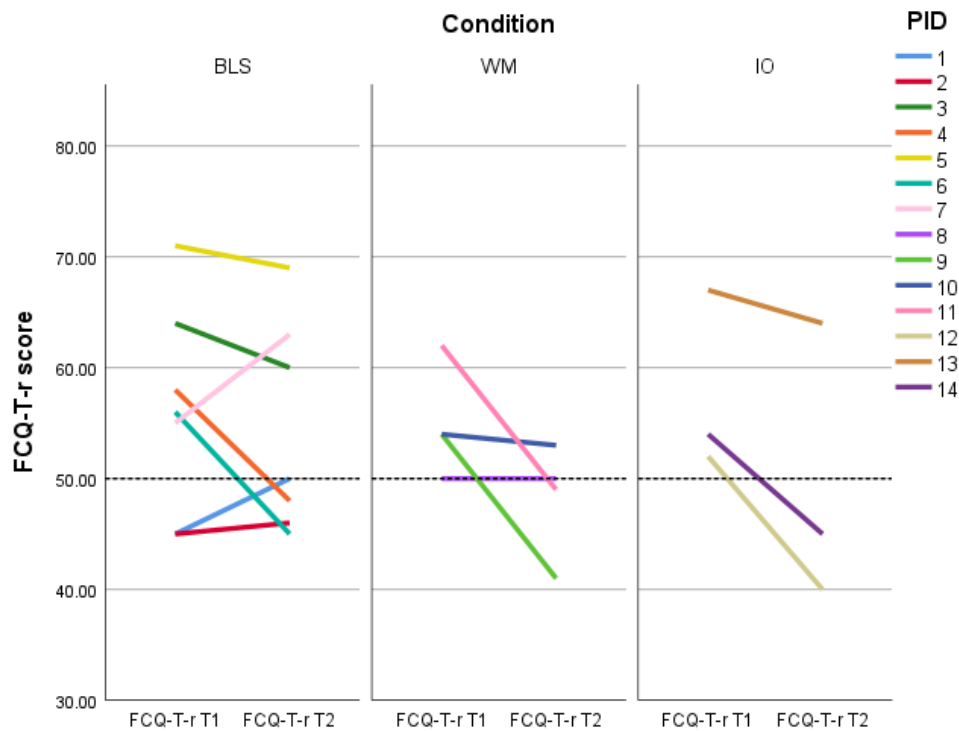
There was a main effect of time $F(1, 11) = 8.26, p = .015, \eta_p^2 = .429$, indicating that *trait* craving reduced over time across all conditions. The time x condition interaction was not significant $F(2, 11) = 1.15, p = .352, \eta_p^2 = .173$ indicating that change in *trait* craving over time did not differ by condition. The main effect of condition was not significant $F(2, 11) = 0.28, p = .765, \eta_p^2 = .048$, indicating that there were no significant differences in mean *trait* craving scores between the conditions.

To overcome the issue that the IO condition was much smaller than the other conditions, the WM and IO conditions were pooled to create one control condition ($n = 7$), which was of equal size to the BLS condition. A 2 (condition) x 2 (time) mixed model ANOVA was run to assess change in *trait* food craving (FCQ-T-r) from baseline to post intervention. There was still a main effect of time $F(1, 12) = 6.91, p = .022, \eta_p^2 = .365$. The time x condition interaction was not significant $F(1, 12) = 2.44, p = .145, \eta_p^2 = .169$. The main effect of condition was not significant $F(1, 12) = 0.48, p = .504, \eta_p^2 = .038$. Both analyses, with and without the pooled control condition, indicated the same conclusion. This suggests that although *trait* craving reduced in all conditions, the condition variable did not lead to differences in the *trait* craving variable.

Single Case Analysis. Graph 1 shows change in *trait* craving scores for each participant by condition, and indicates that 11 participants (five in the BLS condition, three in the WM and three in the IO conditions) reported clinically relevant levels of *trait* food craving at baseline. A clinically significant improvement (moving from above to below the clinical cut-off boundary indicated by the dotted line) was found for six participants (two in the BLS condition, two in the WM condition, two in the IO condition), five of these participants showed reliable improvement (95% CI).

Graph 2-1

Change in FCQ-T-r scores from baseline to post-intervention for each participant by condition

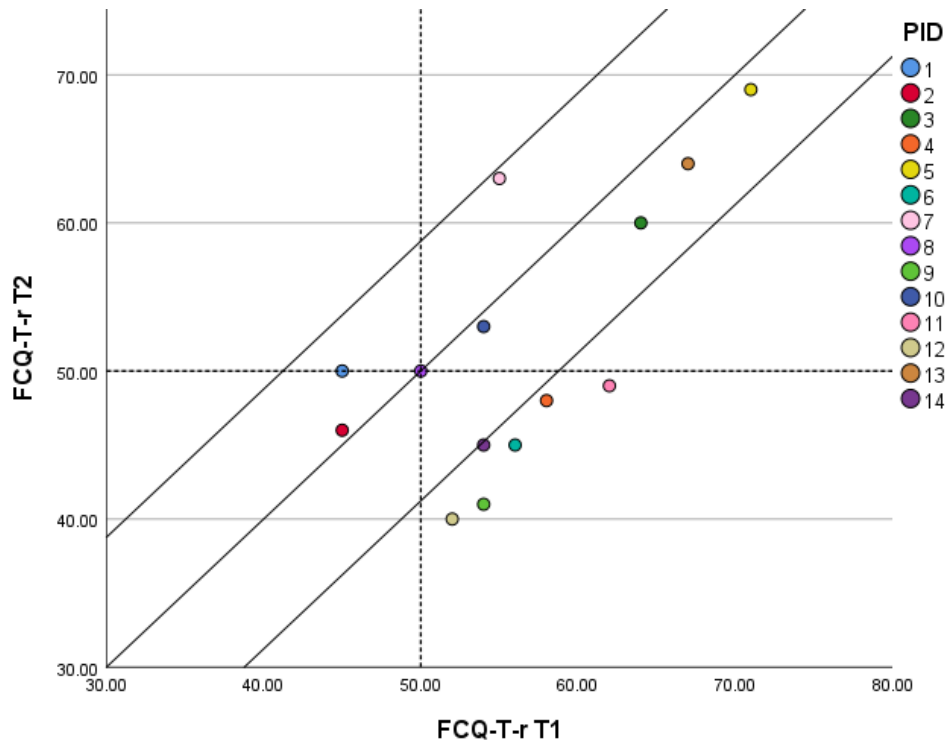


Note. The dotted line identifies clinically relevant cut-off score of 50, lines crossing the dotted line indicate change between clinically relevant and non-clinically relevant FCQ-T-r scores.

On the FCQ-T-r a reliable reduction was found for five participants (95% CI) (two in the BLS condition, two in the WM condition, one in the IO condition); this is illustrated in graph 2. This graph shows change in FCQ-T-r scores from baseline to post-intervention for each participant by condition. All points falling below the central diagonal line represent reduced *trait* craving and points falling below the lower diagonal line represent a reliable reduction (i.e. a reliable improvement in *trait* craving scores). Points falling above the central diagonal line represent an increase in *trait* craving and points falling above the upper diagonal line represent a reliable increase. The graph indicates that three participant's FCQ-T-r score increased in the BLS condition, and one participant's scores remained the same in the WM condition. All other participants reported reduced FCQ-T-r scores post-intervention, although only five of these were below the reliable change boundary (the lower diagonal line). A cut-off score of 50 on the FCQ-T-r (indicated by the dotted line) is used to indicate clinical levels of *trait* food cravings (Meule, 2018).

Graph 2-2

Change in FCQ-T-r scores from baseline to post-intervention for each participant, indicating reliable change (95% CI)



Note. Reliable change with 95% CI calculated as 8.77. All points falling below the central diagonal line represent reduced trait craving and points falling below the lower diagonal line represent a reliable reduction (i.e., a reliable improvement in trait craving scores). Points falling above the central diagonal line represent an increase in trait craving and points falling above the upper diagonal line represent a reliable increase. The dotted line identifies the clinically relevant cut-off score of 50, and points falling below the dotted line show post-intervention scores outside of the clinical range. PID 1 – 7 were in the BLS condition, PID 8 – 11 were in the WM condition, PID 12 – 14 were in the IO condition.

2.4.3 State Food Craving (FCQ-S)

Weekly means and standard deviations for the FCQ-S are presented in table 3. The planned 3 (condition) x 8 (time) mixed-model ANOVA to assess change in *state* food craving (FCQ-S) from pre to post session across the weeks is not feasible due to low participant numbers and there being more levels in the time IV than participants in the IO condition. Instead, weekly change in FCQ-S scores from pre to post session for each participant by condition is depicted in graph 3. The graph indicates no clear pattern of change in *state* craving either by condition or by week. However, most weeks some participants in the WM condition and one participant in the IO condition scores increased. Two participants in the IO condition scores usually decreased and participants in the BLS condition seemed more variable, with several participants scores often not changing much at all.

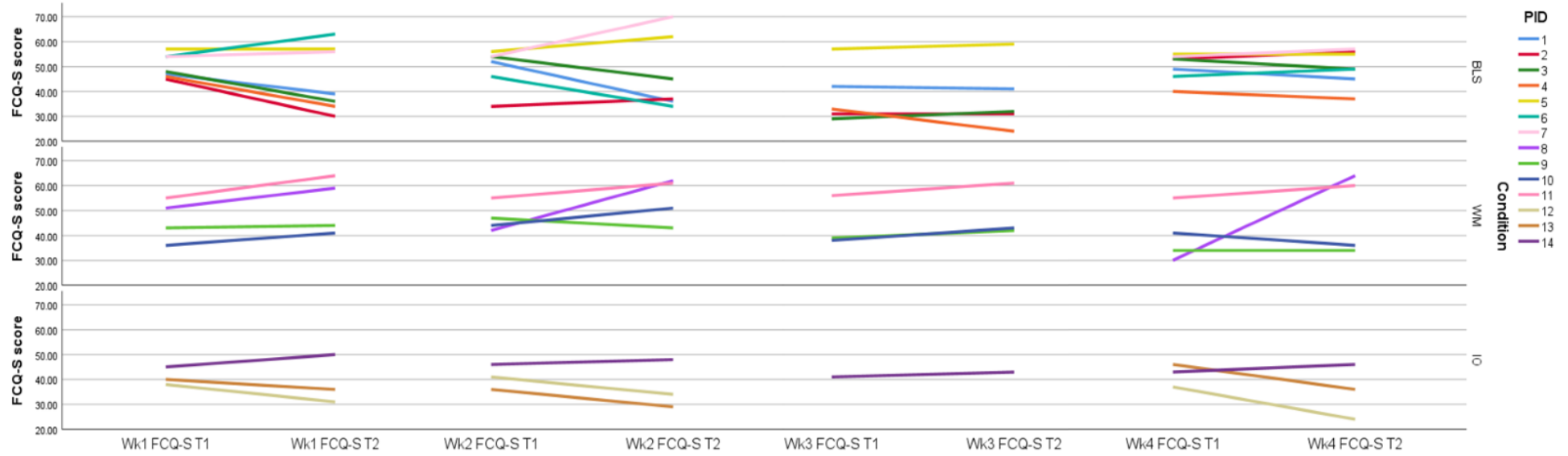
Table 2-3

Weekly means (SD) for FCQ-S pre and post-session by condition

		BLS condition		WM condition		IO condition		Full sample	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Week 1									
	FCQ-S pre-session	50.14	4.74	46.25	8.46	41.00	3.61	47.07	6.53
	FCQ-S post-session	45.00	13.24	52.00	11.22	39.00	9.85	45.71	12.16
Week 2									
	FCQ-S pre-session	49.33	8.26	47.00	5.72	41.00	5.00	46.69	7.24
	FCQ-S post-session	47.33	15.15	54.25	9.00	37.00	9.85	47.08	13.21
Week 3									
	FCQ-S pre-session	38.40	11.52	44.33	10.12	41.00	.	40.67	10.01
	FCQ-S post-session	37.40	13.50	48.67	10.70	43.00	.	41.77	12.23
Week 4									
	FCQ-S pre-session	50.00	5.42	40.00	10.98	42.00	4.58	45.43	8.22
	FCQ-S post-session	49.71	7.13	48.50	15.70	35.33	11.02	46.29	11.60

Graph 2-3

Weekly change in FCQ-S scores from pre to post-session for each participant by condition



2.4.4 Visual Analogue Scales (VAS)

For each of the four sessions, change during the session in the VAS measures of: feeling state, craving, vividness, and pleasantness, and FCQ-S was calculated by subtracting post-session scores from pre-session scores. Means and standard deviation FCQ-T-r baseline to post-intervention change scores were calculated by subtracting post-intervention scores from pre-intervention scores. Group pre- and post-session means (*SD*) for the VAS and FCQ-S, and all change scores can be found in table A4 and A5 (appendix W). One-way ANOVAs were run to assess whether condition impacted change in VAS during the session. There were no significant differences in change in VAS feeling state, craving, vividness or pleasantness between the conditions (table A6, appendix X).

Correlation analysis between *trait* food craving (FCQ-T-r) and the VAS measures were run for the full sample and correlations are presented in table 4. No significant correlation was found between change in FCQ-T-r and change in VAS feeling state, vividness, pleasantness, or craving.

Correlation analyses were also run for *state* food craving (FCQ-S) and the VAS for the full sample and correlations are also presented in table 4. A significant strong positive correlation was found between change in FCQ-S and change in VAS vividness, pleasantness and craving in week 2 and 4, but not in week 3. In week 1 a significant positive correlation was found between change in FCQ-S and change in VAS pleasantness. A significant strong positive correlation was found between change in FCQ-S and change in VAS feeling state in all weeks, except week 3.

Table 2-4*Correlations for study variables by week for the full sample*

Variable	1	2	3	4	5	6
Week 1 (N = 14)						
1. FCQ-T-r change	-					
2. FCQ-S change	-.19	-				
3. Feeling state change	.06	.68**	-			
4. Craving change	.34	.41	.69**	-		
5. Vividness change	.02	.48	.71**	.64*	-	
6. Pleasantness change	-.17	.59*	.77**	.41	.74**	-
Week 2 (N = 13)						
1. FCQ-T-r change	-					
2. FCQ-S change	.32	-				
3. Feeling state change	.09	.79**	-			
4. Craving change	.17	.61*	.71**	-		
5. Vividness change	-.06	.76**	.93**	.68*	-	
6. Pleasantness change	.14	.80**	.96**	.74**	.85**	-
Week 3 (N = 9)						
1. FCQ-T-r change	-					
2. FCQ-S change	-.03	-				
3. Feeling state change	-.11	-.04	-			
4. Craving change	.41	.46	.46	-		
5. Vividness change	.04	-.60	.36	-.02	-	
6. Pleasantness change	.04	.09	.54	.71*	-.11	-
Week 4 (N = 14)						
1. FCQ-T-r change	-					
2. FCQ-S change	.18	-				
3. Feeling state change	.09	.73**	-			
4. Craving change	.04	.57*	.83**	-		
5. Vividness change	.06	.65*	.90**	.70**	-	
6. Pleasantness change	-.06	.75**	.85**	.85**	.82**	-

* $p < .05$. ** $p < .01$.

2.5 Discussion

The primary aim of this study was to examine the effectiveness of eye movements at reducing *state* and *trait* food cravings, compared to a working memory task and no dual task, in a sample of people who experience food cravings. The study employed three conditions, an eye movement condition, a working memory condition and an imagery only condition. The first hypothesis was that the eye movement condition would lead to a greater reduction in *state* and *trait* food cravings compared to the working memory task and no dual task.

The planned analysis to examine the effect on *state* food cravings could not be undertaken due to the small sample size. However, a graph of individual participant's *state* food craving scores did not indicate a clear pattern of change, which is contrary to our hypothesis. Overall, participants in all conditions reported a reduction in *trait* food cravings from pre to post intervention. However, contrary to our hypothesis this change was similar in all intervention conditions. Although we cannot reject the null hypothesis here, we cannot underestimate the effect of the study being underpowered and the potential effects this had on the results. A re-run of the study with a larger sample, and adequate power, may indicate differences between the conditions.

Additional analysis showed that a large proportion (79%) of the participants reported clinically relevant levels of *trait* food cravings at pre-intervention and just over half of these participants (55%) reported non-clinically relevant levels at post-intervention (although one of these participants did not show reliable improvement). This finding, in combination with the finding that overall participants tended to report a reduction in *trait* food cravings, might be explained by the participants' awareness being drawn to their food cravings and associated feeling states during the intervention. This is in line with findings from Devonport et al. (2022) where a reduction in food craving was observed in the experimental and active control conditions, which both involved completion of a food craving diary that increased participants' awareness of their cravings and felt emotions. We also cannot rule out the effect of the participants' expectations when signing up to this study, as they were aware that taking part could lead to a reduction in food cravings, and therefore a placebo effect cannot be ruled out.

The secondary aim of this study was to assess if a reduction in food craving was associated with a reduction in intensity of feeling state, as well as image-specific vividness, pleasantness and craving. We hypothesised that the eye movement condition would lead to a greater reduction in feeling state, as well as image specific-vividness, pleasantness and craving, compared to the working memory task and no dual task. Contrary to our hypothesis there were no significant differences between the conditions in changes in feeling state or image-specific vividness, pleasantness and craving. This is not surprising given that we could not reject the null

hypotheses from our primary aim. Although we cannot reject this null hypothesis either, we also cannot rule out that a larger sample with adequate power may have found differences between the conditions, particularly as our findings differ from Littel et al.'s (2016) findings that eye movements lead to a significant decrease in image-specific vividness and craving compared to no eye movements.

We also hypothesised that change in *state* and *trait* food craving would be associated with change in feeling state and image-specific vividness, pleasantness and craving. Contrary to our hypothesis, change in *trait* food craving was not associated with change in feeling state or change in image-specific vividness, pleasantness and craving across any of the weeks. However, partially in line with our hypothesis, in all weeks except week 3 (perhaps due to the small number of participants that week) change in *state* food craving was associated with change in feeling state, meaning that when one moved in a certain direction (increased or decreased) the other tended to move in the same direction. Our results also show that in weeks 2 and 4 change in *state* food craving was associated with change in image-specific vividness, pleasantness and craving. This was also the case in week 1 for change in *state* food craving and change in image-specific pleasantness. A larger sample with adequate power may show significant relationships between these variables across all weeks. However, these results are promising and suggest that there might be an association between *state* food craving for target foods, the associated emotional and physical sensations, as well as image-specific vividness, pleasantness and craving; these findings are in line with The Elaborated Intrusion Theory of Desire (Kavanagh et al., 2005) and suggest that *state* food craving may be associated with an elaborated mental image of the food being craved.

2.5.1 Strengths, Limitations and Future Research

This study is novel and to our knowledge is the first to examine the efficacy of a desensitisation phase from an adapted EMDR for addiction protocol by Miller (2012) for food cravings; although Miller's protocol was not originally developed to be used for food cravings, there are currently no food craving specific protocols available. This study is only the second study to examine the effects of eye movements on food cravings and craving specific mental imagery. This study is also the first to examine the effect of an alternative working memory task, which has previously only been used in relation to vivid and emotionally distressing images, and not for food craving related mental imagery. Given the limitations of this study due to the small sample size, future researchers may wish to replicate the study whilst considering any recommendations for future research made below.

Chapter 2

A strength of this study was the experimental design, which allowed the manipulation of just one variable (eye movement) and allowed us to compare the effect of eye movement with an alternative working memory task and no dual task. In addition, there were no significant differences in age, gender or ethnicity between the conditions, as well as no significant differences in *trait* food cravings at baseline, which increases the study's internal validity. Another strength of the study was that the protocol was delivered by EMDR trained clinical psychologists with expertise and experience of delivering EMDR therapy, which is associated with higher treatment efficacy (Cahill et al., 1999).

In this study we were able to recruit a sample of people who experienced food cravings, with a large proportion (79%) reporting clinically relevant levels of *trait* food cravings prior to the intervention, suggesting that this intervention is relevant to a student and university staff population, as well as the general public. However, recruitment into the study was more difficult than anticipated meaning that the study is underpowered and some of the planned analysis could not be performed. In addition, not all participants included in the statistical analysis attended all four weeks of the intervention and there was a large proportion of participants (64%) who did not attend week 3 and therefore data for only one participant in the 'no dual task' condition in week 3.

Difficulty with recruitment and retention at week 3 may have been due to the length of commitment (4 weeks), as well as the timing of the sessions (afternoon). It is notable that studies of interventions for food cravings lasting 4-weeks or longer with larger sample sizes tended to have interventions that were self-guided (i.e., Chapman et al., 2018, Rodríguez-Martín et al., 2013, Stapleton et al., 2019, Moritz et al., 2019); and 4-week or longer interventions that require more commitment, such as weekly or fortnightly group session (i.e., Alberts et al., 2012, Schnepfer et al., 2019, Stapleton et al., 2016) tend to have smaller samples. Difficulty with recruitment may have also been due to experiences of body shame, as individuals who experience food cravings have been shown to experience high levels of body shame (O'Loughlen et al., 2021). Potential participants may have been deterred from engaging due to experiences of body shame, particularly due to the group setting and being on camera. Future studies may wish to consider shortening the intervention period, running the intervention during evenings or at weekends and/or making the intervention self-guided; and future research may also wish to explore the acceptability of aspects of the procedure used in the present study. A self-guided version of the procedure may be challenging as it relied on the facilitators gauging the correct amount of time for participants to identify their feeling states and complete measures during the intervention.

EMDR for PTSD typically relies on a person experiencing high levels of emotional distress associated with a target memory, which becomes the focus of the intervention. This study was a little different as the focus of the intervention was on the participants 'feeling state' (e.g., a sense of comfort or warmth that was associated with the target food). The results suggest that the participants generally experienced quite strong feeling states (on average between 6-7/10), however, this varied by condition and by week. It is possible that the intervention effect may have been clearer if the participants had experienced stronger feeling states at the start of each week, and future research may wish to spend more time developing a highly intense feeling state at the start of each intervention session.

A limitation of the study recruitment was the use of the EAT-26 as a screening measure, as this may have excluded a significant number of participants who could have been ideal candidates for the study. The rationale behind the use of the EAT-26 was ethical, and was to ensure we did not deliver an intervention to reduce food cravings to participants who already experienced symptoms of a restrictive eating disorder. However, given that the EAT-26 measure is most typically used within the context of an eating disorder service (and not within the general population in a non-clinical context) it may not have been the most appropriate measure for our study population. Future studies may wish to consider using an alternative screening tool, such as the 'SCOFF questionnaire' (Morgan et al., 1999) which screens for eating disorders and is designed to be used routinely across different contexts.

Effort was made to select target foods for each week that were relevant for the majority of participants, however, there may have been weeks where the target food may not have been craved by a participant. Food cravings also differ cross culturally and having a predominantly white British sample may have resulted in target foods that were more relevant to white British participants and not to participants from Asian, Black or other cultures. It may have been more difficult for a participant to conjure up a feeling state in relation to a food that they did not crave, and elicit specific images of this food; however, there is currently no literature to support this. Nevertheless, future studies may want to consider personalising the intervention to the participant, so that each participant is targeting a food that is their most craved.

Ideally recruitment for the study, and the intervention, would only have taken place once. However due to low participant numbers in phase one, recruitment and the intervention were re-run (phase two). This may have introduced some bias, particularly as the intervention in phase two was run at different times of the day compared to phase one, and it was only delivered by one EMDR trained clinical psychologist rather than two (as in phase one). In addition, the intervention in phase two took place during Lent and Ramadan. Participants were not asked about religion or if they were taking part any religious observances, however, research

has shown that dietary restraint can elevate food cravings (Whatnall et al., 2022). Future studies should ensure that only one round of recruitment and intervention takes place, and that the intervention does not happen during times when some participants may be engaging in dietary restraint.

The study relied on self-report measures, which increases the risk of response bias and given the stigma and shame that can be experienced alongside food cravings the study may have been subject to social desirability bias. Participants were also incentivised for taking part, which may have impacted their level of engagement as some participants may have taken part only for the incentive. On average, participants indicated that they slightly engaged (i.e., more engaged than not engaged) and this did not differ significantly between conditions. However, whilst running the intervention it was noted that a few participants appeared to find it difficult to follow the instructions. This calls into question if the intervention was too complex and if the instructions need to be simplified. Future studies should consider the level of complexity of the intervention, particularly when it is delivered in a group setting where comprehension, concentration and ability may vary, and ensure participant understanding. The study also relied on a certain level of technical ability and future studies could consider using alternative methods of data collection, such as paper copies of questionnaires, which may make it easier for participants.

In Miller's FSAP (2012) the number of eye movements sets are personalised to the individual, and they repeat until the feeling state associated with the craving has reduced to 0 or 1 out of 10 (Miller et al., 2012). In the present study, due to the group setting, it was not feasible to personalise the sets of eye movements. Instead, seven sets were chosen, based on the clinical experience of the EMDR trained clinical psychologist who had previously delivered the protocol. Some participants may have needed more than seven sets of eye movements to reduce their feeling state and future studies should consider personalising the number of sets to maximise the effectiveness of the intervention. The number of sets that lead to a reduction in craving may vary; Little et al., (2016) used four sets and a similar study by Markus et al., (2016) for nicotine craving used 12 sets, both studies found the eye movements led to a significant reduction in cravings immediately post intervention. Despite not being able to offer individualised eye movement, group EMDR has been shown to be effective for a range of mental health problems; with the group format shown to increase a sense of belonging, offer additional emotional support, and improve the therapeutic relationship (which is associated with improved treatment outcomes) (Kaptan et al., 2020).

In this study the participants did not communicate with one another directly and therefore their ability to create a sense of belonging and receive additional emotional support from the

group was limited. Similarly, the participants had little opportunity to build a therapeutic relationship with the EMDR therapist as they only met during the intervention sessions, which were scripted, to enable accurate testing of the independent variable (condition); this may have impacted participant's engagement in the intervention and the intervention outcome. Future studies may wish to consider offering a space for the participants build a therapeutic relationship with the EMDR therapist ahead of the intervention. As well as an opportunity for the participants to share their experiences with each other in the group as this may facilitate a sense of belonging and would allow them to experience the benefits of the group format.

2.5.2 Clinical Implications

Many participants who were interested in taking part in this study scored within the clinical range for disordered eating during the screening phase, suggesting that people who self-identify as experiencing food cravings and are drawn to interventions to manage their food cravings, may also be experiencing symptoms of disordered eating. This is in line with previous research, which has identified food cravings as a feature of disordered eating and as a precipitant to binge-eating episodes (Ng & Davis, 2013; Whatnall et al., 2022). Our findings suggest that symptoms of disordered eating may be prevalent in the general population, highlighting the importance of developing interventions targeting food cravings and ensuring that these are accessible to a general population.

The results from this study, although needing to be interpreted with caution due to the small sample size, suggest that engaging in an intervention that draws awareness to food cravings and their associated emotions and physical sensations (i.e., feeling state) may be affective at reducing craving experience over time and across situations (i.e., *trait* food cravings) for people who experience food cravings; and if they are aware the intervention may reduce their cravings. The findings also suggest that interventions aimed at targeting emotional and physical sensations related to target food cravings and craving specific imagery (i.e., vividness, pleasantness and craving) may be effective at reducing *state* food cravings. However, more research is needed with a larger sample to adequately confirm these findings.

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Appendix A **Obesity Review publishing guidelines**

Which can be found at:

<https://onlinelibrary.wiley.com/page/journal/1467789x/homepage/forauthors.html>

Your main document file should include:

- A short informative title containing the major key words. The title should not contain abbreviations;
- The full names of the authors with institutional affiliations where the work was conducted, with a footnote for the author's present address if different from where the work was conducted;
- Acknowledgments;
- Abstract structured (intro/methods/results/conclusion) or unstructured;
- Up to seven keywords;
- Practitioner Points (optional) Authors will need to provide no more than 3 'key points', written with the practitioner in mind, that summarize the key messages of their paper to be published with their article;
- Main body: formatted as introduction, materials & methods, results, discussion, conclusion;
- References;
- Tables (each table complete with title and footnotes);
- Figure legends: At initial submission, figures can be included in the manuscript or can be submitted in separate files. Should your manuscript reach revision stage, figures and tables must be provided as separate files.

Appendix B **Full search strategy**

The following search terms were used:

(Intervention* OR therap* OR treatment* OR psychotherap* OR counsel* OR technique* OR task* OR strateg* OR retrain* OR restructuring OR mindfulness OR modification*)

AND

(“food craving*” OR “craving experience*” OR “food craving questionnaire*” OR “chocolate questionnaire” OR “control of eating questionnaire” OR “questionnaire on craving for sweet or rich foods” OR “food craving inventory”)

Appendix C Study exclusion criteria

A study was excluded if a) it was not an empirical paper (i.e., review, trial protocol) or there was not a control group b) the intervention was \leq 24 hours or was lab-based; c) the intervention was surgical, pharmacological, diet, exercise or lifestyle, a complementary therapy or yoga, brain stimulation and/or neurofeedback; d) the intervention aimed at, or included the induction of food cravings; e) cravings were for non-nutritious foods (i.e. chalk, hair, soil etc.) or for other substances; e) the intervention was delivered to a child, adolescent or clinical sample; f) there was no qualitative measure of food craving administered at baseline and/or post-intervention.

Appendix D **Table A1***Excluded studies in final round of screening and reason*



Study author, date	Reason for exclusion
Boswell et al., 2018, Mason et al., 2018,	No controlled study design (n = 5)
Rioux & Howerter, 2019, Sagui-Henson et al., 2021, Sun et al., 2023.	
Stapleton et al., 2017, Stapleton & Stewart, 2020.	Article analysing secondary outcome data (i.e., mood) of included studies (n = 2) (N.B. the primary data studies are Stapleton et al., 2016 & Stapleton et al., 2020)
Carels et al., 2019, Crane et al., 2023.	Primary aim of intervention was not to reduce food cravings (i.e., intervention aim was weight loss, or behavioural/lifestyle or modifying home environment) (n = 2)
Forman et al., 2013. Forman et al., 2007.	No same food craving measure administered at baseline and post-intervention (n = 2)
Hsu et al., 2014	No measure of food craving frequency or intensity (measure of number of foods consumed instead) (n = 1)
Oomen et al., 2018	Cue-induced cravings, rather than naturalistic cravings, measured by outcome measure (n = 1)
Skorka-brown et al., 2015	Intervention aimed at reducing all cravings, not aimed specifically at food cravings (n = 1)

Appendix E Figure A1

Risk of bias within studies traffic light plot, presented by study and domain

Study	Risk of bias domains					Overall
	D1	D2	D3	D4	D5	
Alberts et al., 2012	+	+	+	+	+	+
Chapman et al., 2018	+	+	+	+	+	+
Devonport et al., 2022	+	+	+	+	+	+
Gehelenborg et al., 2022	-	+	-	-	+	-
Giacobbi et al., 2018	+	+	+	+	+	+
Hinojosa-Aguayo & Gonzalez, 2022 (study 2 only)	-	+	+	+	+	-
Hooper et al., 2011	-	+	+	+	+	-
Hulbert-Williams et al., 2019	+	+	+	+	+	+
Jonker et al., 2019	+	+	+	+	+	+
Karekla et al., 2020	+	+	+	+	+	+
Kemps & Tiggemann, 2013	+	+	+	+	+	+
Knäuper et al., 2011	+	+	+	+	+	+
Lacaille et al., 2014	+	+	+	+	+	+
Meule et al., 2019	+	+	+	+	+	+
Moffitt et al., 2012	+	+	+	-	+	-
Moore et al., 2023	+	+	-	+	+	-
Moritz et al., 2019	+	+	+	+	+	+
Rodriguez-Martin et al., 2013	+	+	+	+	+	+
Schnepper et al., 2019	+	+	+	+	+	+
Schumacher et al., 2018	+	+	+	+	+	+
Stapleton et al., 2011	+	+	+	+	+	+
Stapleton et al., 2012	+	+	+	+	+	+
Stapleton et al., 2016	+	+	-	+	+	-
Stapleton et al., 2019	+	+	-	+	+	-

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

Judgement
 Some concerns
 Low

Appendix F

Appendix F **Table A2**

Post-intervention mean (M), standard deviation (SD) and number of participants (n) for each condition, which was used to calculate standardised mean difference effect sizes

Study name	Conditions	Measure	M ₁	M ₂	S ₁	S ₂	n ₁	n ₂	
1	Alberts et al., 2012	MBCT; waitlist control	G-FCQ-T (trait)	3.70	3.19	0.20	0.20	14	12
2	Chapman et al., 2018	Acceptance; active control	G-FCQ-T (trait)	34.06	40.73	1.88	2.38	35	22
3	Devonport et al., 2022	Mindfulness-based eating programme; active control	Craving Frequency (trait)	2.50	2.30	1.00	1.00	88	77
4	Hinojosa-Aguayo & Gonzalez, 2022	Cognitive defusion; active control	FCQ-T (trait)	57.29	47.89	16.01	18.92	10	10
5	Hulbert-Williams et al., 2017	Acceptance; active control	FCI (state & trait)	26.45	41.43	26.68	48.12	20	23
6	Hulbert-Williams et al., 2017	Cognitive defusion; active control	FCI (state & trait)	26.45	31.37	26.68	35.44	20	20
7	Hooper et al., 2011	Cognitive defusion; control	Craving Frequency (trait)	11.71	13.25	8.54	14.12	14	16
8	Hooper et al., 2011	Thought suppression; control	Craving Frequency (trait)	11.71	9.29	8.54	4.96	14	17
9	Karekla et al., 2020	Cognitive defusion; active control	FCQ-T (trait)	106.18	81.21	21.38	32.67	17	24
10	Karekla et al., 2020	Cognitive restructuring; active control	FCQ-T (trait)	106.18	98.04	21.38	41.17	17	24
11	Karekla et al., 2020	Cognitive defusion; active control	FCQ-S (state)	33.88	36.22	9.94	11.15	17	24
12	Karekla et al., 2020	Cognitive restructuring; active control	FCQ-S (state)	33.88	36.72	9.94	9.72	17	24
13	Schumacher et al., 2018	Cognitive defusion; control	Craving frequency (trait)	4.49	3.19	2.84	3.01	37	42
14	Schumacher et al., 2018	Guided imagery; control	Craving frequency (trait)	4.49	4.38	2.84	2.23	37	39
15	Knäuper et al., 2011	Implementation intention; active control	Craving intensity (state)	2.49	2.62	0.11	0.13	27	18
16	Knäuper et al., 2011	Implementation intention + cognitive task; active control	Craving intensity (state)	2.49	2.55	0.11	0.12	27	21
17	Knäuper et al., 2011	Implementation intention + active imagery; active control	Craving intensity (state)	2.49	2.32	0.11	0.11	27	25
18	Rodriguez-Martin et al., 2013	Imagery & non-imagery intervention; control	FCQ-T (trait)	148.1	100.3	33.07	35.81	40	40
19	Stapleton et al., 2019	Online EFT; waitlist control	FCI (state & trait)	81.31	67.25	18.93	17.05	70	314
20	Stapleton et al., 2011	EFT; waitlist control	FCI (state & trait)	61.51	48.63	14.56	12.82	47	49
21	Stapleton et al., 2016	EFT; control community sample	FCI (state & trait)	49.03	47.97	14.81	12.89	92	32
22	Stapleton et al., 2016	CBT; control community sample	FCI (state & trait)	49.03	49.75	14.81	19.59	92	24
23	Jonker et al., 2019	Attentional bias modification; waitlist control	G-FCQ-T (trait)	60.96	60.39	21.14	19.63	52	51
24	Mortiz et al., 2019	Imaginal retraining with reminder; waitlist control	VAS (trait)	6.21	5.6	2.04	1.79	149	44
25	Mortiz et al., 2019	Imaginal retraining with reminder; waitlist control	FCQ-T-r (trait)	44.79	42.75	15.01	13.66	149	44
26	Mortiz et al., 2019	Imaginal retraining without reminder; waitlist control	VAS (trait)	6.21	6.19	2.04	2.02	149	38
27	Mortiz et al., 2019	Imaginal retraining without reminder; waitlist control	FCQ-T-r (trait)	44.79	41.51	15.01	13.92	149	38
28	Moore et al., 2023	Response inhibition training; placebo control	Experience of cravings (CoEQ) (trait)	43.5	43	17.3	16.8	39	45

Note. 1 = control group data, 2 = intervention group data. . Follow-up data not included. Karekla et al. (2020) and Moritz et al. (2019) had two food craving outcome measures with adequate data and intervention effects for both outcome measures have been presented. Data for the following studies is missing as there was inadequate data, Lacaille et al. (2014), Schnepfer et al. (2019), Moffitt et al. (2012). Giacobbi et al. (2018), Meule et al. (2019), Gehlenborg et al. (2022) and Kemps & Tiggemann (2013). |

Instructions for authors for comparative research studies to be published in the Journal of EMDR Practice and Research, taken from <https://media.springerpub.com/media/springer-journals/EMDR-guidelines.pdf>

Journal of EMDR Practice and Research

INSTRUCTIONS FOR AUTHORS

The *Journal of EMDR Practice and Research* is a quarterly, peer-reviewed publication devoted to integrative, state-of-the-art papers about Eye Movement Desensitization and Reprocessing. It is a broadly conceived interdisciplinary journal that stimulates and communicates research and theory about EMDR, and their application to clinical practice. The journal publishes experimental studies; theoretical, review, and methodological articles; case studies; brief reports; and book reviews. Examples of research areas include: randomized clinical trials; treatment outcomes with specific populations; investigation of treatment processes; evaluation of the role of eye movements and bilateral stimulation; and contribution of individual factors and personality variables to treatment outcome and/or process. Articles address theoretical issues and clinical challenges to broaden clinicians' understanding and skills; they discuss such complex issues as: strengths and weaknesses in the literature; impact of ethnicity and culture; and evaluation of client readiness for treatment.

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The following are guidelines for developing and submitting a manuscript. Manuscripts that do not conform to these guidelines will be returned to the author without review, and with recommendations for changes needed to complete the submission process.

1. Manuscripts must be professionally prepared in accordance with the most recent edition of the *Publication Manual of the American Psychological Association*.
2. Manuscripts are generally expected to be 20-25 pages in length and double-spaced throughout; however, longer manuscripts may be considered. Brief reports will be 10-15 pages in length.
3. The title page must include authors' names, positions, titles, affiliations, full contact information (address, phone, fax, and e-mail). This information should not be included elsewhere in the manuscript, to ensure blind review.
4. The second page should contain the title of the paper and an abstract of no more than 125 words as well as 3 to 5 key words listed below the abstract. Key words should express the precise content of the manuscript, as they are used for indexing purposes.
5. All articles must contain a comprehensive literature review. For example, a manuscript describing EMDR treatment of a certain disorder would summarize the literature about the nature of that disorder, review research studies that investigated outcomes of other treatments, as well as studies that evaluated EMDR treatment of that disorder.
6. Articles that recommend a clinical approach that differs from EMDR's standard protocol or its foundational Adaptive Information Processing model (Shapiro, 2001) should explain these differences.

7. In order to promote critical thinking and an unbiased approach for the dissemination of ideas, recent advances, and current research, all articles must take an objective, scientific stance, and a respectful tone.
8. It is recommended that Case Studies comply with the following format: (1) Literature review, (2) Introduction of the case, (3) Presenting problems, (4) Client history, (5) Assessment, (6) Case conceptualization, (7) Course of treatment, including assessment of progress and outcome, (8) Discussion of treatment implications, (9) Recommendations, and (10) References.
9. Photos and line art figures should be sent as tiff (300ppi) or eps (800ppi) files.
10. Contributors are responsible for obtaining written permission from copyright owners for illustrations, adaptations, or quotes of more than 300 words.

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The following descriptions summarize the types of articles published by the *Journal of EMDR Practice and Research*. Authors are encouraged to use this information to assist them in writing their article, and to ensure that their manuscript meets requirements. We recognize that sometimes authors' manuscripts have dual purposes and may fall into more than one category; in such cases, the authors should ensure that their paper meets all requirements for each relevant category.

Comparative Research Studies

Purpose:

- Compares two or more (treatment) conditions (e.g., EMDR versus exposure therapy; e.g., eye movements versus bilateral tones)
- Tests hypotheses to answer specific questions relating to areas such as:
 - the effectiveness of a specific application of EMDR
 - the effectiveness of EMDR with a specific population or problem
 - the effectiveness of a new EMDR protocol
 - EMDR's mechanisms of action

Treatment provided in the study:

- Treatment conditions may be standard EMDR procedures, protocol variations, experimental procedures, other treatment procedures, or waitlist conditions, etc.
- Each treatment step must be clearly defined and replicable.
- If the theoretical model differs from Shapiro's (2001) Adaptive Information Processing model, an explanation of the differences should be provided.

Data collected in the study:

- Administration of psychometric measures is expected (e.g., BDI, BAI, CAPS, PAI, IASC, TSI, BASC). Other data (e.g., behavioral, physiological, qualitative) may also be collected.
- Where appropriate, diagnostic assessment is recommended.
- Appropriate statistical analysis should be conducted.

Results:

- Claims for evidence arising must be framed according to standard scientific procedures.

Style:

- The paper should be written up as a research study: (1) Literature review, (2) Method (with subsections on participants, measures, treatment, procedure, etc), (3) Results, (4) Discussion, and (5) References.

FEELING STATE ADDICTION PROTOCOL – ORIGINAL FULL VERSION

By Robert Miller

PROCESSING THE FEELING STATE

- What is the most intense part of the addictive behavior? Euphoria/rush with substance abuse will usually be the first target
- The first time the drug / behavior is used is the best first target (but the most recent may be more potent, so use that first)
- What is the self referential positive feeling linked with the addictive behavior?
- How intense is the link between the feeling and the behavior on a scale of 1-10 (e.g. when you imagine yourself eating the cake, how cared for do you feel?)
- Locate the physical sensations created by the positive feeling
- Client visualizes performing addictive behavior + intensely experiencing the positive feeling + feeling physical sensations
- BLS until the positive feeling state drops to 0 or 1
- Scan body for any sensation
- Perform BLS until there is no sensation related to the Feeling State
- Process the hyper-need for the desired feeling. Obtain a SUDs level for the feeling as a general feeling not connected with the behaviour (Can you feel your general desire to be cared for? To be the winner? Etc.)
- Perform BLS until the SUDS are 0 or 1

PROCESSING THE NEGATIVE COGNITION underlying the FEELING STATE

- Identify the NC that underlies the feeling: “What is the negative belief you have about yourself that makes you feel you can’t belong? Can’t connect? Aren’t important?”
- Float-back to the feeder memory. If no event is identified, target the Negative cognition
- Use standard EMDR protocol

REEVALUATING THE FEELING STATE

- BLS till Positive Feeling State is 0 or 1
- In the next session, check the addictive behavior for the Feeling State you worked on. Check if Feeling State is still active and continue processing if needed
- Check if any other Feeling State is present in connection to this addiction

PROCESSING THE RELATIONSHIP TO SELF DUE TO ADDICTION & RELAPSING

- Process the Negative cognition caused by the Feeling State
- Determine the negative belief that was created as a result of the addictive behavior and have the client choose a positive belief
- Use the EMDR standard protocol
- Process memories around relapse
- Use standard protocol

FEELING STATE ADDICTION PROTOCOL – ADAPTED VERISON

by Sanja Oakley

Identify the behavior/addiction

- When you think about doing x, what is the most intense, most wonderful moment?
- What is the lovely feeling you are feeling at that moment (what is the thought, the feeling and the sensation?)
- When you think about doing x or taking y, how much do you feel [the Feeling State]? 0-10
- Where do you feel that in your body?
- BL (fast)
- In between sets, ask “Has the intensity gone up, down or stayed the same”? (*Do not ask, what did you notice?*)

GOING BACK TO THE TOP

- Can you bring up again that lovely feeling of [feeling state] as you do the behavior / take the substance identified?
- How much do you feel [the feeling state] now when you think about doing the behavior or taking the substance? 0-10
- Where do you feel that in your body?
- BLS (fast)
- Has the intensity gone up, down or stayed the same? *NOT (what did you notice?)*

Etc... until the Feeling State and the behaviour/substance use are uncoupled

Eye Movement (BLS) Condition (example from week 1, chocolate)
FEELING STATE ADDICTION PROTOCOL FOR USE IN THE PRESENT STUDY
– adapted by Dr Sophie Rushbrook

Today we are going to look at a target behaviour in an effort to reduce food craving. This is not about deprivation or shame, but is a fun exercise to do. Throughout, just be curious of your responses, light up your imagination, and follow my guidance.

During today's session you will be required to perform some eye movements. Before we start, let's do a practice run. So, whilst keeping your head still, I want you to find two points, one to your left and one to your right. These points need to be far enough apart to stretch your eyes when looking at them, without causing discomfort. Now practice keeping your head still, moving only your eyes from side to side to each of these points. The idea is to stretch your eyes as far as you can without being uncomfortable.

I will demonstrate the speed of eye movement from side to side like this.

If you're finding eye movements are causing you discomfort or distress then you can tap each thigh in turn at the same pace as the eye movements. So let's practice the eye movements, side to side as fast as you can – go.

Pause - time 15 seconds

Now let's think about the target food for today which is CHOCOLATE. And really bring to mind as best as you can your favourite CHOCOLATE. If you have any guilty thoughts that you shouldn't eat CHOCOLATE, thank your mind and let it go. For this exercise, I'm just really inviting you to enjoy the moment and think of what is so lovely about it.

And when you think about your favourite CHOCOLATE, what is the most intense, most wonderful moment that you enjoy in relation to that? This could be the anticipation, it could be the moment you have the sensation in your mouth, it could be the feeling after. Take a moment to think about what it is for you, what that most delightful moment is.

Pause

Think about what this moment offers you that is so wonderful. There may be a thought, an emotion, or a sensation attached to it. I'm trying to capture the feeling sense of what it offers you. For some people it may be a reward, a treat, a sense of calm. For others it may be comfort or the feeling of being loved. So really try to capture the essence of what that delightful moment offers you. We are going to call that the feeling state.

Pause

So, once you've decided on your feeling state, please switch back to your Qualtrics page and click through to the next page where you should be able to enter your feeling state, this can be a word or phrase in your Qualtrics web page so you can remember what your feeling state is.

Pause

Once you have your feeling state and you have entered this into Qualtrics, please raise your hand, using the function on teams and make sure you can see me again.

Pause for hands to go up (Alice / Imogen to lower all hands once everyone has completed this)

So, when you think about eating that CHOCOLATE, how much do you feel that feeling state out of 10? 0 would be that the feeling is not present at all and 10 would be as strong as that feeling could be.

Please enter this number in the **pre-score** box in the table provided in Qualtrics. Please make sure that you are switching between Qualtrics and me, so that you can always see me once you have entered your number.

Pause

And how strong is the craving in the moment to eat that CHOCOLATE out of 10. 0 would be that you are not craving it at all and 10 would be the most intense craving it could be. Please also enter this number in the table.

Pause

As you continue to bring to mind your best moment, how vivid is the CHOCOLATE in your imagination out of 10. 0 would be not vivid it at all and 10 would be the most vivid it could be. Please enter this number.

Pause

And lastly, I'd like you to think about how pleasant this moment is out of 10. 0 would be not pleasant at all and 10 would be the most pleasant it could be. Please enter this number in the **pre-score** box in Qualtrics.

Once you've entered this, please submit your answer and make sure that you can see me.

Pause

When you experience the feeling state that you have written down, where do you feel that in your body? Bring your attention to where you feel it in your body and continue to bring to mind that most intense, most wonderful moment that you enjoy in relation to that CHOCOLATE.

Pause

SET 1

Now, whilst keeping your feeling state in mind whether that be a reward, a treat, a sense of calm, comfort or the feeling of being loved, or something entirely different, keep your head still and when I say 'go' quickly move your eyes from side to side to each of the points you identified before. I'd like you to do this until I tell you to stop.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same"? (**Do not ask 'what did you notice?'**).

Pause

How much do you feel that feeling state out of 10? Again, 0 would be that the feeling is not present at all and 10 would be as strong as that feeling could be. Please enter this number in the Set-1 box in the table provided in Qualtrics and once you have entered this, make sure you can see me again.

Pause

SET 2

Again, bring that feeling state to mind, whether that be a thought, an emotion or a sensation. What is the most intense, most wonderful moment associated with that CHOCOLATE when you think about it. In this moment now, imagine how it smells and how it feels to take that first bite.

Whilst holding that feeling state in mind, when I say 'go' quickly move your eyes from side to side until I tell you to stop. Make sure to keep your head still and stretch your eyes as far as is comfortably possible.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

How much do you feel that feeling state out of 10? Please enter this number in the Set-2 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 3:

And again, bringing your focus back to that feeling state, really thinking about where you feel it in your body. Imagining that most wonderful moment, the smell and the taste...

Keeping your head still, when I say 'go' repeat the fast eye movements until I tell you to stop.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-3 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 4:

Can you fire up your imagination and again bring up that lovely feeling state you identified earlier as you engage in your best moment associated with that CHOCOLATE.

How much do you feel the feeling state now when you think about eating that CHOCOLATE?

Pause

Where do you feel that in your body?

Pause

You may notice your mind wandering, which is fine. Really dig and find that feeling state again. Try and bring that feeling state back to mind.

Appendix J

Like before, when I say 'go' quickly move your eyes from side to side whilst keeping your head still. Repeat this until I tell you to stop.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-4 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 5:

Again, when you think about that CHOCOLATE in this moment now, can you bring that lovely feeling state to mind. Think about what this moment offers you that is so wonderful. Really bring this feeling state to mind.

Again, when I say 'go' quickly move your eyes from side to side whilst keeping your head still until I tell you to stop.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-5 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 6:

And again, bringing your focus back to that feeling state, really thinking about where you feel it in your body. Imagining that most wonderful moment, the smell and the taste...

Again, when I say 'go' move your eyes from side to side until I tell you to stop.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-6 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 7: (Post-Score)

Appendix J

One more time, can you fire up your imagination and again bring up that lovely feeling state you identified at the beginning as you engage in your best moment associated with that CHOCOLATE.

And once more, when I say 'go' I'd like you to move your eyes from side to side until I tell you to stop, keeping your head still and stretching your eyes as far as comfortably possible.

Okay, now GO.

Time 15 seconds

Now STOP.

So, now when you think about eating that CHOCOLATE, how much do you feel that feeling state out of 10.

Pause

Please enter this number in the post-score box in the table provided in Qualtrics.

And how strong is the craving in the moment to eat that CHOCOLATE out of 10.

Pause

Please also enter this number in the table, in the cravings box.

How vivid is the CHOCOLATE in your imagination out of 10.

Pause

Please enter this number in the vividness box.

And how pleasant is this moment out of 10.

Pause

Please enter this number in the post-score box, in the table in Qualtrics. And when you're finished, please submit your sand then make sure that you can see me again.

Now that we've done that, I'm going to hand over to Alice/Imogen.

Working Memory (WM) Condition (example from week 1, chocolate)
FEELING STATE ADDICTION PROTOCOL FOR USE IN THE PRESENT STUDY
– adapted by Dr Sophie Rushbrook

Today we are going to look at a target behaviour in an effort to reduce food craving. This is not about deprivation or shame, but is a fun exercise to do. Throughout, just be curious of your responses, light up your imagination, and follow my guidance.

During today's session you will be required to perform some simple subtractions. It isn't about getting the maths right or wrong, it is about the process of doing the subtraction.

Before we start, let's do a practice run. If you lose track of the number you have got to, do not worry, just keep subtracting from the last number you remember.

So, whilst keeping your head and eyes still, by looking at my nose, I want you to subtract 5 from 100. Do the subtraction in your head, without writing this down.

Now practice keeping your head and eyes still, and continue to subtract 5 from each of your answers until I tell you to stop.

Pause - time 15 seconds

Now let's think about the target food for today which is CHOCOLATE. And really bring to mind as best as you can your favourite CHOCOLATE. If you have any guilty thoughts that you shouldn't eat CHOCOLATE, thank your mind and let it go. For this exercise, I'm just really inviting you to enjoy the moment and think of what is so lovely about it.

And when you think about your favourite CHOCOLATE, what is the most intense, most wonderful moment that you enjoy in relation to that? This could be the anticipation, it could be the moment you have the sensation in your mouth, it could be the feeling after. Take a moment to think about what it is for you, what that most delightful moment is.

Pause

Think about what this moment offers you that is so wonderful. There may be a thought, an emotion, or a sensation attached to it. I'm trying to capture the feeling sense of what it offers you. For some people it may be a reward, a treat, a sense of calm. For others it may be comfort or the feeling of being loved. So really try to capture the essence of what that delightful moment offers you. We are going to call that the feeling state.

Pause

So, once you've decided on your feeling state, please switch back to your Qualtrics page and click through to the next page where you should be able to enter your feeling state, this can be a word or phrase in your Qualtrics web page so you can remember what your feeling state is.

Pause

Once you have your feeling state and you have entered this into Qualtrics, please raise your hand, using the function on teams and make sure you can see me again.

Pause for hands to go up (Alice / Imogen to lower all hands once everyone has completed this)

So, when you think about eating that CHOCOLATE, how much do you feel that feeling state out of 10? 0 would be that the feeling is not present at all and 10 would be as strong as that feeling could be.

Please enter this number in the **pre-score** box in the table provided in Qualtrics. Please make sure that you are switching between Qualtrics and me, so that you can always see me once you have entered your number.

Pause

And how strong is the craving in the moment to eat that CHOCOLATE out of 10. 0 would be that you are not craving it at all and 10 would be the most intense craving it could be. Please also enter this number in the table.

Pause

As you continue to bring to mind your best moment, how vivid is the CHOCOLATE in your imagination out of 10. 0 would be not vivid it at all and 10 would be the most vivid it could be. Please enter this number.

Pause

And lastly, I'd like you to think about how pleasant this moment is out of 10. 0 would be not pleasant at all and 10 would be the most pleasant it could be. Please enter this number in the **pre-score** box in Qualtrics.

Once you've entered this, please submit your answer and make sure that you can see me.

Pause

When you experience the feeling state that you have written down, where do you feel that in your body? Bring your attention to where you feel it in your body and continue to bring to mind that most intense, most wonderful moment that you enjoy in relation to that CHOCOLATE.

Pause

SET 1

Now, whilst keeping your feeling state in mind whether that be a reward, a treat, a sense of calm, comfort or the feeling of being loved, or something entirely different, keep your head and eyes still by looking at my nose, and when I say 'go', I want you to subtract 3 from 1000 and keep subtracting 3 from each of your answers until I tell you to stop.

If you lose track of the number you have got to, do not worry, just keep subtracting from the last number you remember.

So now subtract 3 from 1000 – GO

Time 15 seconds

Now STOP

Has the intensity of the feeling state gone up, down or stayed the same"? (**Do not ask 'what did you notice?'**)

Pause

How much do you feel that feeling state out of 10? Again, 0 would be that the feeling is not present at all and 10 would be as strong as that feeling could be. Please enter this number in the

Set-1 box in the table provided in Qualtrics and once you have entered this, make sure you can see me again.

Pause

SET 2

Again, bring that feeling state to mind, whether that be a thought, an emotion or a sensation. What is the most intense, most wonderful moment associated with that CHOCOLATE when you think about it. In this moment now, imagine how it smells and how it feels to take that first bite.

Whilst holding that feeling state in mind, when I say 'go' subtract 3 from 998 and keep subtracting 3 from each of your answers until I tell you to stop. Make sure to keep your head and eyes still and do the subtractions in your head, without writing them down. So now subtract 3 from 998 – GO

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

How much do you feel that feeling state out of 10? Please enter this number in the Set-2 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 3:

And again, bringing your focus back to that feeling state, really thinking about where you feel it in your body. Imagining that most wonderful moment, the smell and the taste...

Keeping your head and eyes still by looking at my nose, when I say 'go', subtract 3 from 887 and keep subtracting 3 from each of your answers until I tell you to stop. Okay, now subtract 3 from 887 - GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-3 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 4:

Can you fire up your imagination and again bring up that lovely feeling state you identified earlier as you engage in your best moment associated with CHOCOLATE.

How much do you feel the feeling state now when you think about eating CHOCOLATE?

Pause

Where do you feel that in your body?

Pause

You may notice your mind wandering, which is fine. Really dig and find that feeling state again. Try and bring that feeling state back to mind.

Like before, when I say 'go', subtract 3 from 775 and keep subtracting 3 from each of your answers, keeping your head and eyes still, until I tell you to stop.

Okay, now subtract 3 from 775 - GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-4 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 5:

Again, when you think about that CHOCOLATE in this moment now, can you bring that lovely feeling state to mind. Think about what this moment offers you that is so wonderful. Really bring this feeling state to mind.

Again, when I say 'go', keeping your head and eyes still, subtract 3 from 664 and keep subtracting 3 from each of your answers until I tell you to stop.

Okay, now subtract 3 from 664- GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-5 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 6:

And again, bringing your focus back to that feeling state, really thinking about where you feel it in your body. Imagining that most wonderful moment, the smell and the taste...

Again, when I say 'go', subtract 3 from 552 and keep subtracting 3 from each of your answers until I tell you to stop.

Okay, now subtract 3 from 552- GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-6 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 7: (Post-Score)

One more time, can you fire up your imagination and again bring up that lovely feeling state you identified at the beginning as you engage in your best moment associated with that CHOCOLATE.

And once more, when I say ‘go’, I’d like you to subtract 3 from 441 and keep subtracting 3 from each of your answers until I tell you to stop. Make sure to keep your head and eyes still by looking at my nose and do the subtractions in your head, without writing them down.

Okay, now subtract 3 from 441 - GO.

Time 15 seconds

Now STOP.

So, now when you think about eating that CHOCOLATE, how much do you feel that feeling state out of 10.

Pause

Please enter this number in the post-score box in the table provided in Qualtrics.

And how strong is the craving in the moment to eat that CHOCOLATE out of 10.

Pause

Please also enter this number in the table, in the cravings box.

How vivid is the CHOCOLATE in your imagination out of 10.

Pause

Please enter this number in the vividness box.

And how pleasant is this moment out of 10.

Pause

Please enter this number in the post-score box, in the table in Qualtrics. And when you’re finished, please submit your answers and then make sure that you can see me again.

Now that we’ve done that, I’m going to hand over to Alice/Imogen.

Imagery Only (IO) Condition (example from week 1, chocolate)
FEELING STATE ADDICTION PROTOCOL FOR USE IN THE PRESENT STUDY
– adapted by Dr Sophie Rushbrook

Today we are going to look at a target behaviour in an effort to reduce food craving. This is not about deprivation or shame, but is a fun exercise to do. Throughout, just be curious of your responses, light up your imagination, and follow my guidance.

During today's session you will be required to bring to mind an image. Before we start, let's do a practice run. So, whilst keeping your head still, I want you to find a point straight ahead of you to focus on. The point needs to be stationary so you can focus on it without it moving. Now practice keeping your head still, and focusing on the point you have chosen ahead of you. The idea is to continue to focus your attention on the point in front of you.

Pause - time 15 seconds

Now let's think about the target food for today which is CHOCOLATE. And really bring to mind as best as you can your favourite CHOCOLATE. If you have any guilty thoughts that you shouldn't eat CHOCOLATE, thank your mind and let it go. For this exercise, I'm just really inviting you to enjoy the moment and think of what is so lovely about it.

And when you think about your favourite CHOCOLATE, what is the most intense, most wonderful moment that you enjoy in relation to that? This could be the anticipation, it could be the moment you have the sensation in your mouth, it could be the feeling after. Take a moment to think about what it is for you, what that most delightful moment is.

Pause

Think about what this moment offers you that is so wonderful. There may be a thought, an emotion, or a sensation attached to it. I'm trying to capture the feeling sense of what it offers you. For some people it may be a reward, a treat, a sense of calm. For others it may be comfort or the feeling of being loved. So really try to capture the essence of what that delightful moment offers you. We are going to call that the feeling state.

Pause

So, once you've decided on your feeling state, please switch back to your Qualtrics page and click through to the next page where you should be able to enter your feeling state, this can be a word or phrase in your Qualtrics web page so you can remember what your feeling state is.

Pause

Once you have your feeling state and you have entered this into Qualtrics, please raise your hand, using the function on teams and make sure you can see me again.

Pause for hands to go up (Alice / Imogen to lower all hands once everyone has completed this)

So, when you think about eating that CHOCOLATE, how much do you feel that feeling state out of 10? 0 would be that the feeling is not present at all and 10 would be as strong as that feeling could be.

Appendix L

Please enter this number in the **pre-score** box in the table provided in Qualtrics. Please make sure that you are switching between Qualtrics and me, so that you can always see me once you have entered your number.

Pause

And how strong is the craving in the moment to eat that CHOCOLATE out of 10. 0 would be that you are not craving it at all and 10 would be the most intense craving it could be. Please also enter this number in the table.

Pause

As you continue to bring to mind your best moment, how vivid is the CHOCOLATE in your imagination out of 10. 0 would be not vivid it at all and 10 would be the most vivid it could be. Please enter this number.

Pause

And lastly, I'd like you to think about how pleasant this moment is out of 10. 0 would be not pleasant at all and 10 would be the most pleasant it could be. Please enter this number in the **pre-score** box in Qualtrics.

Once you've entered this, please submit your answer and make sure that you can see me.

Pause

When you experience the feeling state that you have written down, where do you feel that in your body? Bring your attention to where you feel it in your body and continue to bring to mind that most intense, most wonderful moment that you enjoy in relation to that CHOCOLATE.

Pause

SET 1

Now, whilst keeping your feeling state in mind whether that be a reward, a treat, a sense of calm, comfort or the feeling of being loved, or something entirely different, keep your head still, focus your attention on your chosen point, until I tell you to stop.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same"? (**Do not ask 'what did you notice?'**).

Pause

How much do you feel that feeling state out of 10? Again, 0 would be that the feeling is not present at all and 10 would be as strong as that feeling could be. Please enter this number in the Set-1 box in the table provided in Qualtrics and once you have entered this, make sure you can see me again.

Pause

SET 2

Again, bring that feeling state to mind, whether that be a thought, an emotion or a sensation. What is the most intense, most wonderful moment associated with that CHOCOLATE when you think about it. In this moment now, imagine how it smells and how it feels to take that first bite. Whilst holding that feeling state in mind, when I say 'go', focus your attention on your chosen point, until I tell you to stop. Make sure to keep your head still and focus your attention on the point in front of you.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

How much do you feel that feeling state out of 10? Please enter this number in the Set-2 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 3:

And again, bringing your focus back to that feeling state, really thinking about where you feel it in your body. Imagining that most wonderful moment, the smell and the taste...

Keeping your head still, when I say 'go', focus your attention on your chosen point, until I tell you to stop.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-3 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 4:

Can you fire up your imagination and again bring up that lovely feeling state you identified earlier as you engage in your best moment associated with CHOCOLATE.

How much do you feel the feeling state now when you think about eating CHOCOLATE?

Pause

Where do you feel that in your body?

Pause

You may notice your mind wandering, which is fine. Really dig and find that feeling state again. Try and bring that feeling state back to mind.

Like before, when I say 'go', focus your attention on your chosen point, whilst keeping your head still, until I tell you to stop.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-4 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 5:

Again, when you think about that CHOCOLATE in this moment now, can you bring that lovely feeling state to mind. Think about what this moment offers you that is so wonderful. Really bring this feeling state to mind.

Again, when I say 'go', keeping your head still, focus your attention on your chosen point, until I tell you to stop.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-5 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 6:

And again, bringing your focus back to that feeling state, really thinking about where you feel it in your body. Imagining that most wonderful moment, the smell and the taste...

Again, when I say 'go', focus your attention on your chosen point, until I tell you to stop.

Okay, now GO.

Time 15 seconds

Now STOP.

Has the intensity of the feeling state gone up, down or stayed the same?

Pause

Please enter this number in the Set-6 box in the table provided in Qualtrics and then make sure that you can see me.

Pause

SET 7: (Post-Score)

Appendix L

One more time, can you fire up your imagination and again bring up that lovely feeling state you identified at the beginning as you engage in your best moment associated with that CHOCOLATE.

And once more, when I say 'go', I'd like you to focus your attention on your chosen point, until I tell you to stop. Make sure to keep your head still and focus your attention on the point in front of you.

Okay, now GO.

Time 15 seconds

Now STOP.

So, now when you think about eating that CHOCOLATE, how much do you feel that feeling state out of 10.

Pause

Please enter this number in the post-score box in the table provided in Qualtrics.

And how strong is the craving in the moment to eat that CHOCOLATE out of 10.

Pause

Please also enter this number in the table, in the cravings box.

How vivid is the CHOCOLATE in your imagination out of 10.

Pause

Please enter this number in the vividness box.

And how pleasant is this moment out of 10.

Pause

Please enter this number in the post-score box, in the table in Qualtrics. And when you're finished, please submit your answers and then make sure that you can see me again.

Now that we've done that, I'm going to hand over to Alice/Imogen.

Appendix M **Starting numbers for the immediate subtraction tasks**

Starting numbers for the intermediate subtraction tasks (subtract 53 from a given number) used in the WM condition

Week 1: 1,000, 998, 887, 775, 664, 552, 441.

Week 2: 997, 885, 774, 662, 551, 440, 338.

Week 3: 895, 784, 672, 561, 450, 348, 237.

Week 4: 794, 682, 571, 460, 358, 247, 135.

N.b. These were decided upon by the research team to ensure that the participants did not fall into a pattern of recall, rather than engaging in an active working memory task.

Appendix N

Table A3

The top four most craved foods of participants from recruitment phase 1 and 2

	Recruitment phase 1 <i>n</i> = 23	Recruitment phase 2 <i>n</i> = 29
Takeaway/Fast Food	14	12
Chocolate	13	20
Cake	12	11
Pastries – Sweet	12	10
Crisps	9	9
Biscuits	7	7
Pastries – Savoury	7	9
Ice-cream	6	10
Sweets/Candy	5	9
Bread/Toast	4	16
Other	3	3

Note. Other foods mentioned were leafy green vegetables, popcorn, spicy food and Asian food. Cake and biscuits, and pastries sweet and savoury, were pooled together as they were highly craved foods of a similar type.

Appendix O The EAT-26 questionnaire

A copy of the Eating Attitudes Test (EAT-26), which was used as screening questionnaire to screen-out participants who scored within the clinical range for disordered eating (a score of 20 or above)

"The EAT-26 has been reproduced with permission. Garner et al. (1982). The Eating Attitudes Test: Psychometric features and clinical correlates. Psychological Medicine, 12, 871-878."

Eating Attitudes Test (EAT-26)

Age: _____ Current Weight: _____ Highest weight (excluding pregnancy): _____
 Sex: _____
 Height: _____ Lowest Adult Weight: _____ Ideal Weight: _____

✓ Please choose one response by marking a check to the right for each of the following statements:	Always	Usually	Often	Some times	Rarely	Never	Score
1. Am terrified about being overweight.	—	—	—	—	—	—	
2. Avoid eating when I am hungry.	—	—	—	—	—	—	
3. Find myself preoccupied with food.	—	—	—	—	—	—	
4. Have gone on eating binges where I feel that I may not be able to stop.	—	—	—	—	—	—	
5. Cut my food into small pieces.	—	—	—	—	—	—	
6. Aware of the calorie content of foods that I eat.	—	—	—	—	—	—	
7. Particularly avoid food with a high carbohydrate content (i.e. bread, rice, potatoes, etc.)	—	—	—	—	—	—	
8. Feel that others would prefer if I ate more.	—	—	—	—	—	—	
9. Vomit after I have eaten.	—	—	—	—	—	—	
10. Feel extremely guilty after eating.	—	—	—	—	—	—	
11. Am preoccupied with a desire to be thinner.	—	—	—	—	—	—	
12. Think about burning up calories when I exercise.	—	—	—	—	—	—	
13. Other people think that I am too thin.	—	—	—	—	—	—	
14. Am preoccupied with the thought of having fat on my body.	—	—	—	—	—	—	
15. Take longer than others to eat my meals.	—	—	—	—	—	—	
16. Avoid foods with sugar in them.	—	—	—	—	—	—	
17. Eat diet foods.	—	—	—	—	—	—	
18. Feel that food controls my life.	—	—	—	—	—	—	
19. Display self-control around food.	—	—	—	—	—	—	
20. Feel that others pressure me to eat.	—	—	—	—	—	—	
21. Give too much time and thought to food.	—	—	—	—	—	—	
22. Feel uncomfortable after eating sweets.	—	—	—	—	—	—	
23. Engage in dieting behavior.	—	—	—	—	—	—	
24. Like my stomach to be empty.	—	—	—	—	—	—	
25. Have the impulse to vomit after meals.	—	—	—	—	—	—	
26. Enjoy trying new rich foods.	—	—	—	—	—	—	
Total Score =							

A copy of the FCQ-S (Food Craving Questionnaire-State), which was used to measure state food cravings

Table 2 Items of the Food Cravings Questionnaire–State

Items	Response categories				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. I have an intense desire to eat [one or more specific foods]. ^a	1	2	3	4	5
2. I'm craving [one or more specific foods]. ^a	1	2	3	4	5
3. I have an urge for [one or more specific foods]. ^a	1	2	3	4	5
4. Eating [one or more specific foods] would make things seem just perfect.	1	2	3	4	5
5. If I were to eat what I am craving, I am sure my mood would improve.	1	2	3	4	5
6. Eating [one or more specific foods] would feel wonderful.	1	2	3	4	5
7. If I ate something, I would not feel so sluggish and lethargic.	1	2	3	4	5
8. Satisfying my craving would make me feel less grouchy and irritable.	1	2	3	4	5
9. I would feel more alert if I could satisfy my craving.	1	2	3	4	5
10. If I had [one or more specific foods], I could not stop eating it.	1	2	3	4	5
11. My desire to eat [one or more specific foods] seems overpowering. ^a	1	2	3	4	5
12. I know I'm going to keep on thinking about [one or more specific foods] until I actually have it. ^a	1	2	3	4	5
13. I am hungry.	1	2	3	4	5
14. If I ate right now, my stomach would not feel as empty.	1	2	3	4	5
15. I feel weak because of not eating.	1	2	3	4	5

Participants are instructed to indicate the extent to which they agree with each statement right now, at this very moment ^a Items included in the abbreviated Food Cravings Questionnaire–State by Maranhão et al. [22]

Appendix Q The FCQ-T-r questionnaire

A copy of the FCQ-T-r (Food Craving Questionnaire-Trait-reduced), which was used to measure trait food cravings

Table 1 | Factor loadings and item statistics of the Food Cravings Questionnaire—Trait—reduced in study 1.

Item	Original item no. ^a	Factor loading	M (SD)	r _{Itc}
1. When I crave something, I know I won't be able to stop eating once I start. [Wenn ich ein starkes Verlangen nach etwas verspüre, weiß ich, dass ich nicht mehr aufhören kann zu essen, wenn ich erst mal angefangen habe.]	2.	0.76	2.81 (1.19)	0.72
2. If I eat what I am craving, I often lose control and eat too much. [Wenn ich das esse, wonach ich ein starkes Verlangen verspüre, verliere ich oft die Kontrolle und esse zu viel.]	3.	0.77	2.86 (1.20)	0.73
3. Food cravings invariably make me think of ways to get what I want to eat. [Wenn ich ein starkes Verlangen nach bestimmten Nahrungsmitteln verspüre, denke ich ausnahmslos darüber nach, wie ich das bekomme, was ich essen will.]	5.	0.73	2.52 (1.19)	0.68
4. I feel like I have food on my mind all the time. [Ich habe das Gefühl, dass ich die ganze Zeit nur Essen im Kopf habe.]	6.	0.74	2.28 (1.15)	0.69
5. I find myself preoccupied with food. [Ich ertappe mich dabei, wie ich mich gedanklich ständig mit Essen beschäftige.]	8.	0.75	2.30 (1.19)	0.70
6. Whenever I have cravings, I find myself making plans to eat. [Immer wenn ich ein starkes Verlangen nach bestimmten Nahrungsmitteln verspüre, merke ich, dass ich gleich plane etwas zu essen.]	18.	0.70	3.08 (1.14)	0.66
7. I crave foods when I feel bored, angry, or sad. [Ich verspüre ein starkes Verlangen nach bestimmten Nahrungsmitteln, wenn ich mich gelangweilt, wütend oder traurig fühle.]	20.	0.68	3.15 (1.34)	0.64
8. I have no will power to resist my food crave. [Ich habe nicht die Willensstärke, um meinen Essensgelüsten widerstehen zu können.]	25.	0.68	2.87 (1.21)	0.63
9. Once I start eating, I have trouble stopping. [Wenn ich einmal anfangen zu essen, fällt es mir schwer wieder aufzuhören.]	26.	0.81	2.54 (1.19)	0.77
10. I can't stop thinking about eating no matter how hard I try. [Ich kann nicht aufhören über Essen nachzudenken, wie sehr ich mich auch bemühe.]	27.	0.81	1.82 (1.04)	0.76
11. If I give in to a food craving, all control is lost. [Wenn ich dem starken Verlangen nach bestimmten Nahrungsmitteln nachgebe, verliere ich jegliche Kontrolle.]	29.	0.84	1.87 (1.12)	0.80
12. Whenever I have a food craving, I keep on thinking about eating until I actually eat the food. [Immer wenn ich ein starkes Verlangen nach bestimmten Nahrungsmitteln verspüre, denke ich so lange weiter ans Essen bis ich diese tatsächlich esse.]	32.	0.79	2.35 (1.17)	0.75
13. If I am craving something, thoughts of eating it consume me. [Wenn ich ein starkes Verlangen nach bestimmten Nahrungsmitteln verspüre, verzehren mich die Gedanken daran diese zu essen geradezu.]	33.	0.76	1.90 (1.09)	0.71
14. My emotions often make me want to eat. [Meine Emotionen bringen mich oft dazu etwas essen zu wollen.]	34.	0.73	2.61 (1.23)	0.70
15. It is hard for me to resist the temptation to eat appetizing foods that are in my reach. [Wenn sich appetitliche Nahrungsmittel in meiner Reichweite befinden, fällt es mir schwer der Versuchung zu widerstehen sie zu essen.]	36.	0.63	3.50 (1.17)	0.58

Appendix R The formula used to calculate reliable change

The following calculations for reliable change were taken from Bauer et al. (2004). Standard error was calculated using the following formula:

$$S_E = SD \sqrt{1 - r_{xx}}$$

And then, reliable change was calculated using the following formula:

$$\frac{(x_{post} - x_{pre})}{\sqrt{2S_E^2}}$$

For the FCQ-T-r the $SD = 14.6$ and coefficient $\alpha = 0.953$, this was taken from a sample of people without 'food addiction' from a study by Meule et al., 2018.

Appendix S The VAS measures

A copy of the visual analogue scale measures (VAS) used to measure feeling state, as well as vividness, pleasantness and image-specific craving.

Please put a rating from 0 - 10 for each of the following when you are instructed to do so by the facilitator.

	Pre-score
Feeling State (0 = not present, 10 = as strong as that feeling could be)	<input type="text"/>
Craving (0 = not craving it at all, 10 = the most intense craving it could be)	<input type="text"/>
Vividness (0 = not vivid at all, 10 = the most vivid it could be)	<input type="text"/>
Pleasantness (0 = not pleasant at all, 10 = the most pleasant it could be)	<input type="text"/>

Appendix T Participant information sheet (PIS)

A copy of the participant information sheet used in the screening questionnaire

Participant Information Sheet

Study Title: An experimental study looking at the effectiveness of a group-based Eye Movement Desensitisation and Reprocessing (EMDR) intervention, on food cravings, restriction and self-regulatory behaviours, in relation to target foods, in a sample of people who struggle with food cravings.

Researchers: Alice Coulson, Imogen Flack, Catherine Brignell, Lisa Cant, Sophie Rushbrook and Lily Rudd

ERGO number: 82200 [11/12/2023] [Version number: 5]

You are being invited to take part in the above research study. To help you decide whether you would like to take part or not, it is important that you understand why the research is being done and what it will involve. Please read the information below carefully and ask questions if anything is not clear or you would like more information before you decide to take part in this research. You may like to discuss it with others but it is up to you to decide whether or not to take part. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

Alice Coulson and Imogen Flack are both students at the University of Southampton, and this project will form part of their Doctorate in Clinical Psychology. The aim of the project is to add to the evidence base for effective psychological treatments for food cravings. We will be asking questions about your experience of food cravings, and if you ever try and restrict yourself from eating these foods as a result. During the sessions you will be asked to bring a food you crave to mind and will be guided through different tasks by the facilitator.

Why have I been asked to participate? You have been chosen to participate as you have identified yourself as someone who struggles with food cravings. There will be roughly 80 people taking part in the study.

What will happen to me if I take part? You will be invited to take part in 4 online sessions which will last up to 1 hour and take place once a week for 4 weeks. You will need to attend all 4 sessions. Each session will take place on the same day of the week (Monday) and at the same time. You will need a private, quiet space to attend and a laptop with access to the internet. You will be asked to complete some screening questionnaires and then further questionnaires at each online session and one week after the final session. You may also be contacted, with your consent, after the sessions to complete follow up questionnaires. It is a requirement of the study that the online sessions will be video and audio recorded to help with data analysis. An outline of the session and what you will be expected to do will be discussed at the start of each session. As part of the sessions, you will be asked to bring to mind a food that you crave and follow the instructions of the facilitator who will be a Clinical Psychologist. You may be asked to provide feedback during the sessions. There will be a chance to ask any questions at the end.

Are there any benefits in my taking part?

Participation in this study may help reduce your struggles with food cravings, although this cannot be guaranteed. Your participation will also help us understand what interventions might help other people who struggle with food cravings, and particularly those who would like to lose weight. You are able to opt in to be entered into a draw to win 1 of 6 Love2shop vouchers worth £50 each.

Will my participation be confidential?

Your participation and the information we collect about you during the course of the research will be kept strictly confidential. Only members of the research team and responsible members of the University of Southampton may be given access to data about you for monitoring purposes and/or to carry out an audit of the study to ensure that the research is complying with applicable regulations. Individuals from regulatory authorities (people who check that we are carrying out the study correctly) may require access to your data. All of these people have a duty to keep your information, as a research participant, strictly confidential.

Data will be stored and accessed using only a University of Southampton laptop and data will be backed up using the University of Southampton One-drive system. Data will initially be collected in Qualtrics and then downloaded anonymously and saved on the university system and laptops. Data will be in line with GDPR and the Data Protection Act 2018. Anonymised data will be archived with the thesis and may be shared with others for legitimate research purposes. The data archived will be an anonymised SPSS data sheet. Once analysis is complete personal data and session recordings will be able to be destroyed. These recordings will be held securely on the University of Southampton One-drive system.

With consent you will be asked for your contact details to be retained for future research and for you to be contacted monthly, for up to 9 months after the study has ended. This is so follow up data could be collected to help inform long term benefits from the original study. If you do not wish to consent to being contacted after the study, this will not affect your participation in the current research. If you do consent to be contacted for a follow-up study, but nearer the time you choose not to participate it will still be interesting for us to know why you have chosen not to participate.

Do I have to take part?

No, it is entirely up to you to decide whether or not to take part. If you decide you want to take part, you will need to sign a consent form to show you have agreed to take part, this can be found in the link provided.

What happens if I change my mind?

You have the right to change your mind and withdraw at any time without giving a reason and without your participant rights being affected. However, the information collected about you up to this point may still be used for the purposes of achieving the objectives of the study only.

If you wish to withdraw from the study please contact Imogen Flack (i.flack@soton.ac.uk) or Alice Coulson (a.e.j.coulson@soton.ac.uk).

What will happen to the results of the research?

Your personal details will remain strictly confidential. Research findings made available in any reports or publications will not include information that can directly identify you without your specific consent.

The results of the study will be written up for two thesis projects, and it is intended that they will be published. You are able to request a copy of the thesis projects by contacting Imogen Flack (i.flack@soton.ac.uk) or Alice Coulson (a.e.j.coulson@soton.ac.uk).

Appendix T

Are there any risks involved?

Due to the nature of the group setting participants will be able to see each other via video. Therefore, your identity will not remain anonymous amongst the other participants. However, all participants will need to sign an agreement that they will keep the content of the sessions and the names of those who attend confidential.

Due to the nature of the study focusing on foods you crave, there could be the possibility of some psychological discomfort or distress when exploring this. There will be a member of the study team available to speak to at the end of the session if you are finding it difficult to participate in the study. They may signpost you to the following organisations which may be able to support you:

BEAT - the UK's eating disorder charity Website:

<http://www.beateatingdisorders.org.uk>

Obesity UK Website : <https://www.obesityuk.org.uk/>

Samaritans Website:

<https://www.samaritans.org>

Telephone : 116 123

Mind Website:

<https://www.mind.org.uk>

Telephone: 0300 123 3393

NHS 111 Website:

<https://111.nhs.uk>

Telephone: 111 Or contact your GP practice.

What data will be collected?

Personal information including your name, email address, telephone number and demographic information (age, gender, ethnicity, and employment status) will be collected. In addition to the answers you provide in the questionnaires. This data will be collected online using Qualtrics and then downloaded and saved. You will receive a unique participant number to access Qualtrics. Personal data will only be stored and accessed using a University of Southampton password protected laptop and only by the researchers involved in the project. Consent forms will be stored separately to the anonymised data. Data will be backed up using the University of Southampton OneDrive system. The sessions will be recorded on Microsoft Teams and the recordings held in the same way.

If you choose to consent for your data to be used in future projects, your data will remain stored securely on the University of Southampton One-drive system, in line with the GDPR and the Data Protection Act 2018.

Where can I get more information?

If you have questions about participating in this research project after reading this information sheet you are able to contact Imogen Flack (i.flack@soton.ac.uk) or Alice Coulson (a.e.j.coulson@soton.ac.uk).

What happens if there is a problem?

If you have a concern about any aspect of this study, you should speak to the researchers who will do their best to answer your questions.

If you remain unhappy or have a complaint about any aspect of this study, please contact the University of Southampton Research Integrity and Governance Manager (023 8059 5058, rgoinfo@soton.ac.uk).

Details of the research team:

Imogen Flack (i.flack@soton.ac.uk)

Alice Coulson (a.e.j.coulson@soton.ac.uk)

A copy of the participant debrief information sent to participants who screened, but were not eligible to take part.



Debriefing Form (Screening)

Study Title: An experimental study looking at the effectiveness of a group-based Eye Movement Desensitisation and Reprocessing (EMDR) intervention, on food cravings, restriction and self-regulatory behaviours, in relation to target foods, in a sample of people who struggle with food cravings.

Ethics/ERGO number: 82200

Researcher(s): Alice Coulson, Imogen Flack, Catherine Brignell, Lisa Cant, Sophie Rushbrook, Lindsey Rouse, Lily Rudd

University email(s): i.flack@soton.ac.uk, a.e.j.coulson@soton.ac.uk

Version and date: Version 1, 13/10/2023

Thank you for completing our screening questionnaire. Your contribution is very valuable and greatly appreciated. However, you have not met our screening criteria for this study.

It is common for people to experience food cravings from time to time. If completing the screening questionnaire has highlighted any discomfort or distress, and you feel like you would like some professional support, you could contact the following organisations:

BEAT

Website: <http://www.beateatingdisorders.org.uk>

Obesity UK

Website : <https://www.obesityuk.org.uk/>

Samaritans

Website : <https://www.samaritans.org>

Appendix U

Telephone : 116 123

Mind

Website: <https://www.mind.org.uk>

Telephone: 0300 123 3393

NHS 111

Website : <https://111.nhs.uk>

Telephone: 111

Or contact your GP practice.

Further reading

If you would like to learn more about this area of research, you can refer to the following resources:

- Littel, M., van den Hout, M. A., & Engelhard, I. M. (2016). Desensitizing addiction: Using eye movements to reduce the intensity of substance-related mental imagery and craving. *Frontiers in Psychiatry*, 7, 14. <https://www.frontiersin.org/articles/10.3389/fpsy.2016.00014/full>
- Polivy, J., Coleman, J., & Herman, C. P. (2005). The effect of deprivation on food cravings and eating behavior in restrained and unrestrained eaters. *International Journal of Eating Disorders*, 38(4), 301-309. https://onlinelibrary.wiley.com/doi/pdf/10.1002/eat.20195?casa_token=vv--c0C2yvcAAAAA:tD_dn1201njwmk5VRvbtP189gc-IDTlhvQfEvZTH1ynfRL0bABt2FjRn_WybQN8fOkXrj4H8UCdQ
- van den Hout, M. A., & Engelhard, I. M. (2012). How does EMDR work?. *Journal of Experimental Psychopathology*, 3(5), 724-738. <https://journals.sagepub.com/doi/pdf/10.5127/jep.028212>

Further information

If you have any concerns or questions about this study, please contact Alice Coulson at a.e.j.coulson@soton.ac.uk who will do their best to help.

If you remain unhappy or would like to make a formal complaint, please contact the Head of Research Integrity and Governance, University of Southampton, by emailing: rgoinfo@soton.ac.uk, or calling: + 44 2380 595058. Please quote the Ethics/ERGO number which can be found at the top of this form. Please note that if you participated in an anonymous survey, by making a complaint, you might be no longer anonymous.

A copy of the participant debrief information sent to participants who took part in the intervention



Debriefing Form (Taking Part)

Study Title: An experimental study looking at the effectiveness of a group-based Eye Movement Desensitisation and Reprocessing (EMDR) intervention, on food cravings, restriction and self-regulatory behaviours, in relation to target foods, in a sample of people who struggle with food cravings.

Ethics/ERGO number: 82200

Researcher(s): Alice Coulson, Imogen Flack, Catherine Brignell, Lisa Cant, Sophie Rushbrook, Lindsey Rouse, Lily Rudd
University email(s): i.flack@soton.ac.uk, a.e.j.coulson@soton.ac.uk

Version and date: Version 1, 09/12/22

Thank you for taking part in our research project. Your contribution is very valuable and greatly appreciated.

Purpose of the study

The aim of this research was to evaluate the effectiveness of EMDR for cravings and to see if this reduced cravings, increased self-regulation and decreased the need to restrict target foods.

You were split into 3 groups. One group participated in EMDR (moving your eyes), one group participated a working memory task (subtracting) and one group participated in only recalling an image of the target food. We were to see if there would be a difference between the groups.

It is expected that the group that participated in the EMDR will have the greatest reduction in cravings, greatest increase in self-regulation and greatest reduction in the need to restrict the target food, compared to the other two groups. Your data will help us understand if EMDR is effective at reducing food cravings and the reasons behind why it might work.

Use of deception

Because of the study design, there was some information about this research that could not be shared with you prior to the study, as doing so probably would have impacted your actions and responses.

We hope that this form clarifies the purpose of the research, and the reason why we could not tell you all the study details prior to your participation. We hope that you understand the reason for the use of deception in not telling you the group you were assigned to.

Please do not discuss this study, or show this debriefing form, to anyone until the study is complete, as this could affect the study results.

Confidentiality

Results of this study will not include your name or any other identifying characteristics.

As this study involved meeting as a group, your confidentiality cannot be guaranteed. We kindly ask you to respect the privacy of other participants and not to disclose what was said and by whom during the sessions.

Study results

If you would like to receive a copy of the final thesis when it is completed, please let us know by using the contact details provided on this form.

Appendix V

Further support

If taking part in this study has caused you discomfort or distress, you can contact the following organisations for support:

BEAT

Website: <https://www.beateatingdisorders.org.uk/>

Obesity UK

Website: <https://www.obesityuk.org.uk/>

Samaritans

Website: <https://www.samaritans.org>

Telephone: 116 123

Mind

Website: <https://www.mind.org.uk>

Telephone: 0300 123 3393

NHS 111

Website: <https://111.nhs.uk>

Telephone: 111

Or contact your GP practice.

Further reading

If you would like to learn more about this area of research, you can refer to the following resources:

- Littel, M., van den Hout, M. A., & Engelhard, I. M. (2016). Desensitizing addiction: Using eye movements to reduce the intensity of substance-related mental imagery and craving. *Frontiers in Psychiatry*, 7, 14. <https://www.frontiersin.org/articles/10.3389/fpsy.2016.00014/full>
- Polivy, J., Coleman, J., & Herman, C. P. (2005). The effect of deprivation on food cravings and eating behavior in restrained and unrestrained eaters. *International Journal of Eating Disorders*, 38(4), 301-309. https://onlinelibrary.wiley.com/doi/pdf/10.1002/eat.20195?casa_token=vv--c0C2yvcAAAAA:tD_dn1201njwmk5VRvbtP189qo-IDTlhvQfEvZTH1ynfRL0bABti2FjRn_WybQN8fOkXrj4H8UCdQ
- van den Hout, M. A., & Engelhard, I. M. (2012). How does EMDR work?. *Journal of Experimental Psychopathology*, 3(5), 724-738. <https://journals.sagepub.com/doi/pdf/10.5127/jep.028212>

Further information

If you have any concerns or questions about this study, please contact Alice Coulson at a.e.j.coulson@soton.ac.uk who will do their best to help.

If you remain unhappy or would like to make a formal complaint, please contact the Head of Research Integrity and Governance, University of Southampton, by emailing: rgoinfo@soton.ac.uk, or calling: +44 2380 595058. Please quote the Ethics/ERGO number which can be found at the top of this form. Please note that if you participated in an anonymous survey, by making a complaint, you might be no longer anonymous.

Thank you again for your participation in this research.

Appendix W

Appendix W **Table A4 and Table A5**

Table A4

Weekly means and SD for VAS pre and post session by condition

	BLS condition		WM condition		IO condition		Full sample		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Week 1									
Feeling state pre-session	6.86	2.41	6.00	1.83	4.67	4.51	6.14	2.71	
Feeling state post-session	4.14	2.61	4.75	3.86	2.67	.58	4.00	2.69	
Craving pre-session	5.86	2.55	7.00	2.83	4.00	2.65	5.79	2.67	
Craving post-session	3.86	3.08	4.75	4.92	2.33	2.08	3.79	3.38	
Vividness pre-session	6.86	2.55	7.00	2.16	6.67	1.53	6.86	2.11	
Vividness post-session	4.43	2.82	4.75	4.99	5.00	1.73	4.64	3.15	
Pleasantness pre-session	6.14	3.39	8.25	1.71	6.67	2.08	6.86	2.74	
Pleasantness post-session	4.57	2.70	6.00	4.08	4.33	.58	4.93	2.79	
Week 2									
Feeling state pre-session	8.00	.89	5.75	1.26	7.67	2.08	7.23	1.59	
Feeling state post-session	4.83	2.32	5.00	3.367	3.67	3.06	4.62	2.63	
Craving pre-session	6.83	.75	6.00	2.16	4.67	4.04	6.08	2.22	
Craving post-session	4.50	2.67	4.50	4.12	3.33	3.51	4.23	3.09	
Vividness pre-session	6.67	1.21	3.50	1.73	7.33	2.52	5.85	2.27	
Vividness post-session	5.00	2.83	5.00	3.16	5.33	4.51	5.08	3.04	
Pleasantness pre-session	7.67	1.03	7.00	.816	7.33	.58	7.38	.87	
Pleasantness post-session	5.67	2.34	7.25	2.22	4.67	1.53	5.92	2.22	
Week 3									
Feeling state pre-session	6.00	2.12	7.33	.58	7.00	.	6.56	1.67	
Feeling state post-session	3.80	2.28	5.67	2.52	7.00	.	4.78	2.39	
Craving pre-session	5.00	2.55	7.00	1.73	7.00	.	5.89	2.26	
Craving post-session	3.20	3.11	5.67	3.22	5.00	.	4.22	2.99	
Vividness pre-session	6.00	2.00	8.67	1.16	10.00	.	7.33	2.24	
Vividness post-session	4.00	2.55	4.33	1.53	10.00	.	4.78	2.77	
Pleasantness pre-session	6.00	2.45	8.00	.00	9.00	.	7.00	2.12	
Pleasantness post-session	4.40	2.70	7.00	1.73	6.00	.	5.44	2.46	
Week 4									
Feeling state pre-session	6.86	1.35	5.75	1.89	8.33	.58	6.86	1.61	
Feeling state post-session	4.57	2.30	5.75	4.35	5.00	.00	5.00	2.66	
Craving pre-session	7.29	.95	5.50	.58	5.00	.00	6.29	1.27	
Craving post-session	5.29	2.430	6.25	4.35	4.00	2.65	5.29	2.97	
Vividness pre-session	7.14	1.22	6.00	1.83	8.33	1.53	7.07	1.59	
Vividness post-session	5.43	2.51	5.75	3.30	5.33	1.53	5.50	2.41	
Pleasantness pre-session	7.86	.69	5.00	2.94	7.67	1.16	7.00	2.04	
Pleasantness post-session	6.43	2.30	6.50	1.29	6.00	2.00	6.36	1.87	

Note. Insufficient data for *SD* in week 3, IO condition, due to only 1 participant in this condition this week.

Appendix W

Table A5

Weekly FCQ-S, VAS and FCQ-T-r change scores (means, SD) by condition

Measures change scores	BLS condition		WM condition		IO condition		Full sample		
	M	SD	M	SD	M	SD	M	SD	
Week 1									
Feeling state change	2.71	3.86	1.25	4.27	2.00	5.00	2.14	3.92	
Craving change	2.00	1.73	2.25	2.87	1.67	1.15	2.00	1.88	
Vividness change	2.43	4.24	2.25	3.95	1.67	.577	2.21	3.47	
Pleasantness change	1.57	4.47	2.25	2.87	2.33	2.31	1.93	3.47	
FCQ-S change	5.14	8.91	-5.75	3.59	2.00	6.25	1.36	8.31	
Week 2									
Feeling state change	3.17	1.94	.75	2.87	4.00	1.00	7.23	2.36	
Craving change	2.33	2.25	1.50	2.38	1.33	2.31	4.62	2.15	
Vividness change	1.67	1.86	-1.50	4.04	2.00	2.00	6.08	2.95	
Pleasantness change	2.00	2.53	-.25	2.63	2.67	1.53	4.23	2.50	
FCQ-S change	2.00	12.31	-7.25	9.84	4.00	5.20	5.08	10.74	
Week 3									
Feeling state change	2.20	1.10	1.67	3.06	.00	.	1.78	1.86	
Craving change	1.80	1.10	1.33	2.52	2.00	.	1.67	1.50	
Vividness change	2.00	1.58	4.33	.58	.00	.	2.56	1.88	
Pleasantness change	1.60	.55	1.00	1.73	3.00	.	1.56	1.13	
FCQ-S change	1.00	4.74	-4.33	1.15	-2.00	.	-1.11	4.28	
Week 4									
Feeling state change	2.29	2.69	.00	5.60	3.33	.58	1.86	3.51	
Craving change	2.00	2.45	-.75	4.35	1.00	.2.65	1.00	3.11	
Vividness change	1.71	3.15	.25	4.11	3.00	1.00	1.58	3.11	
Pleasantness change	1.43	2.23	-1.50	3.42	1.67	2.31	.64	2.80	
FCQ-S change	.29	3.35	-8.50	17.48	6.67	8.50	-.86	10.89	
Baseline to post-intervention									
FCQ-T-r change	1.86	7.15	6.75	7.23	8.00	4.58	4.57	6.86	

Note. Insufficient data for SD in week 3, IO condition, due to only 1 participant in this condition this week.

Appendix X

Appendix X

Table A6

One-way Analysis of Variance results to assess change in VAS between conditions

Visual Analogue Scale (VAS)	<i>F</i>	<i>p</i>	η_p^2
Week 1	<i>F</i> (2, 11)		
Feeling State	.16	.857	.03
Craving	.07	.932	.01
Vividness	.04	.958	.01
Pleasantness	.06	.939	.01
Week 2	<i>F</i> (2, 10)		
Feeling State	2.36	.145	.32
Craving	.25	.781	.06
Vividness	2.02	.184	.29
Pleasantness	1.55	.259	.24
Week 3	<i>F</i> (2, 6)		
Feeling State	.52	.618	.16
Craving	.09	.914	.03
Vividness	4.94	.054	.62
Pleasantness	1.26	.349	.30
Week 4	<i>F</i> (2, 11)		
Feeling State	.86	.449	.14
Craving	.99	.402	.15
Vividness	.65	.541	.11
Pleasantness	1.89	.198	.26