

Brief Remote Intervention to Manage Food Cravings and Emotions during the COVID-19 Pandemic: A Pilot Study

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest

Author contribution statement

TJD, C-HC-W and MCR: conceptualization and methodology; C-HC-W: data management; C-HC-W and MCR: data curation; CR and MCR: formal analysis; TJD, C-HC-W, WN, and MCR: writing - original draft; TJD, C-HC-W, WN, JYC, CR, JF-M, YC, and MCR: writing - review and editing. All authors contributed to the article and approved the submitted version.

Keywords

LockDown, Confinement, Mindful eating, diary, emotion

Abstract

Word count: 263

As a result of the COVID-19 pandemic people have endured potentially stressful challenges which have influenced behaviours such as eating. This pilot study examined the effectiveness of two brief interventions aimed to help individuals deal with food cravings and associated emotional experiences. Participants were 165 individuals residing in United Kingdom, Finland, Philippines, Spain, Italy, Brazil, North America, South Korea, and China. The study was implemented remotely, thus without any contact with researchers, and involved two groups. Group one participants were requested to use daily diaries for seven consecutive days to assess the frequency of experience of their food cravings, frequency of giving in to cravings, and difficulty resisting cravings, as well as emotional states associated with their cravings. In addition to completing daily food diaries, participants in group two were asked to engage in mindful eating practice and forming implementation intentions. Participants assessed their perceived changes in eating, wellbeing, and health at the beginning and end of the intervention. Repeated measures MANOVAs indicated that participants experienced significantly less food cravings (i.e., craving experience, acting on cravings, difficulty resisting), as well as lower intensities of unpleasant states associated with cravings across time (T1 vs. T7). In contrast to our hypothesis, the main effects of the group (food craving diary vs. food craving diary and mindful eating practice) were not significant. Participants reported less eating and enhanced wellbeing at the end of the study (T7 vs. T1). Our findings can be used to inform future remote interventions to manage food cravings and associated emotions and highlight the need for alternative solutions to increase participant engagement.

Contribution to the field

In this pilot study we report the results from two brief remote interventions aimed to help individuals deal with food cravings and associated emotional experiences during containment measures to minimise the spread of COVID-19. Findings suggest that these interventions may help participants to raise awareness of associations between emotions and food cravings and provide a strategy for managing emotional eating. We believe that the study, contributes to the literature on eating behaviours by informing future intervention-based studies aiming to help participants manage their food cravings and emotional states associated with cravings.

Ethics statements

Studies involving animal subjects

Generated Statement: No animal studies are presented in this manuscript.

Studies involving human subjects

Generated Statement: The studies involving human participants were reviewed and approved by University of Wolverhampton ethics committee (Unique code: 01/20/AF1/UOW). The patients/participants provided their written informed consent to participate in this study.

Inclusion of identifiable human data

Generated Statement: No potentially identifiable human images or data is presented in this study.

Data availability statement

Generated Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

In review

Manuscript ID: 903096

Manuscript title: A Brief Remote Intervention to Manage Food Cravings and Emotions during the COVID-19

As we cannot include our responses on the Frontiers system and to facilitate the review process we include the point-by-point response to both reviewers here. We have highlighted the revised text in the manuscript in blue.

Reviewer 1

Introduction:

1. Is it the case that increased stress causes everyone to overeat? Are there moderators of the relationship, or cases where it leads to undereating?

Response: This information has now been deleted addressing a point raised by the second reviewer.

2. Intuitive eating needs a more in-depth explanation, including how it is similar/different from mindful eating

Response: We have deleted intuitive eating from the introduction, as that was not the target of the intervention. This is also in accordance with the suggestions of the second reviewer.

3. A discussion on how mindful eating is related to mindfulness is also needed

Response: We have expanded the introduction about mindful eating.

4. Please justify the basis for your hypothesis

Response: We have now included two references to justify our hypothesis

Methods

1. Is there a typo in the measure of "I feel that I currently eat"?

Response: That was the stem question that was asked to the participants.

2. Where the items for changes in eating and well-being constructed by the authors?

Response: No. As we have indicated in the manuscript, these two items were developed for another study that explored changes in working situation, health routines, and wellbeing in a larger sample.

3. All internal consistencies need to be included for all measures

Response: We have included alphas and omegas for the items in the food craving questionnaire. The rest of measures were single items or included separately in the analysis (i.e., emotional states). We have justified in the manuscript the use of single-item measures. In addition, we have included information pertaining reliability of the food diary questions across the seven assessments in the Results section.

4. Can you give more details on intervention dosage/format? How often were these instructions provided?

Response: We have now elaborated on the procedures and include the mindful eating guidelines provided to the participants.

Results:

1. Can you provide stats for BMI for the participants? Did you measure disordered eating status?

Response: We did not measure BMI. We have deleted the information about BMI in the introduction. We did not measure disordered eating status either.

2. How were the qualitative data analyzed? A thematic analysis would be helpful.

Response: We did not have qualitative data from all participants thus, it was not deemed appropriate to use thematic analysis. Moreover, in response to a point raised by the second reviewer we are now presenting this study as a pilot study. Finally, we have moved the qualitative information to the Results section, as we provided participants' comments.

Discussion

1. Another possibility is that lack of general mindfulness training may have made it difficult for participants to properly engage in mindful eating practices

Response: Thank you for this suggestion. We have included this point in the discussion.

Reviewer 2

General Comments

This manuscript describes a study designed to compare two online exercises which aimed to reduce the frequency of food cravings and intensity of simultaneous negative emotions. One group completed a daily food craving diary (FCD group), and the second group completed this diary and a mindful eating exercise (FCDM group). Both groups completed these exercises and measures of over a seven-day period. Authors hypothesised that the FCDM group would have greater reductions in food cravings and intensity of emotions than the FCD group. Reported findings indicate significant effects of measurement (T1 vs T7) on food cravings and emotional states, but no significant effects of group (FCD vs FCDM) nor of the interaction between these variables.

Attrition over the course of the seven-day data collection period was high, but a relatively large sample size (n=165) was reported in final analyses which is a strength of the study. However, the intervention is somewhat short at only seven-days. It may be more appropriate to frame the present study as a pilot study involving a short-term record, aiming to inform future intervention development.

The manuscript would benefit from being proofread, as there are several minor typos and formatting errors. There needs to be some caution towards conflating constructs, e.g. mindful eating and intuitive eating (introduction), and tiredness/boredom and fatigue (discussion).

Many parts of this manuscript are well written and clearly communicate what the author is aiming to do. However, further consideration is required in the details within the reporting and clearer focus on relevant research and theory would enhance the rationale for the study. Inclusion of key

authors and research in these areas (i.e. mindful eating) is necessary to evidence that these constructs were fully understood and engaged with to justify their inclusion in this study.

In its current state, this manuscript is not ready for publication. It first requires stronger rationale for the study and materials used, and clearer reporting of findings.

Response: Thank you for taking the time to review the paper and thank you for the positive comments regarding the manuscript. We appreciate your comments and suggestions and have revised the manuscript addressing all comments and providing additional justification.

Detailed Comments

Abstract:

This abstract would benefit from the provision of a brief background to the study, to help the reader understand the need for conducting the study, along with the overall remit (e.g. information about the efficacy of mindfulness practice on the outcome, and how this study would add to our knowledge).

Some consideration should be given to the terms used – the first sentence refers to how the individuals ‘deal with food cravings’ and ‘associated emotional experiences’. Similarly, it is not clear what ‘measurement’ refers to – this could more clearly refer to time/day. It would also help to clarify what is meant by ‘significantly less eating’ and ‘enhanced wellbeing’. Clarifying the precise variables (IVs/DVs) measured may help to effectively communicate what the study is looking at. This would also in part address the limited methodological information included within the abstract. It would benefit the reader to understand what is meant by ‘remote’ intervention, and some further detail about the food craving diary.

It is not clear why intuitive eating is a keyword for this manuscript.

Response: The abstract has been revised and extended.

Contribution to the field:

This section currently reads as an extension of the abstract. It should clearly provide a summary of the key contributions to the field. The final sentence attempts to address this, but is vague. How does this contribute to literature on eating behaviours?

Response: We have revised this section aligning with the body of work this study contributes to.

Introduction:

Relevant works have been cited, but the development of the rationale needs attention. There is a lot of detail around the reasons for an online study design, but greater focus on the justification for the study and theoretical background would be beneficial. The inclusion of research around obesity is not clear, when it states the aim is to encourage healthy eating behaviours. This study doesn't appear to be a weight management intervention, as doesn't report any inclusion criteria related to weight or recording of anthropometric data/BMI. This doesn't add to the introduction, and the space would be better used to address research justifying aspects related to the study. For example, there is scope to better address the concept of mindful eating and a need to refer to key authors/studies in the field. The methods section refers to if-then planning, but the psychological theories and research underpinning this are not addressed in the introduction.

Greater focus on relevant research and theory in the field of mindful eating would enhance this section, and is vital for a full justification of the study and methods used.

Towards the end of the introduction, the idea of intuitive eating is introduced which it is important to note is not the same construct as mindful eating. This is not measured or explored in the current study, so it is not clear why this is included in the introduction.

Response: The introduction has been revised. As per your suggestions we now focus on mindful eating and provide information about if-then planning.

Methods:

Study design - As aforementioned, the timeframe of the study is relatively short at only seven days. It may be more appropriate to frame this as a pilot study which aims to inform future interventions, rather than framing this as an intervention itself.

Response: We have adopted your suggestion and now refer to this study as a pilot study.

Recruitment – Were there any other inclusion/exclusion criteria beyond being 18+ years of age?

Response: The only criterion for participation in the study was being over 18 years of age.

Measures – Information on the development of the measures is a little vague. The stem of the perceived changes in eating measure is included, but it is not clear what the stem for the wellbeing measure was.

Response: Thank you for spotting this. We have now revised this section and included the stem question

It is not clear what the response items for ‘How often have you experienced a food craving today?’ are for the FCD.

Response: We have now revised the questions and ratings for all questions included in the diary.

Attention to validity and reliability for all measures would strengthen this section.

Response: We have included reliability values for the food craving diary data on the large sample for the first assessment. We have justified the use of single-item measures. In addition, we have now provided information about the translation of the measures and guidelines.

Intervention – The guidelines for the mindful eating practice is not clear to the reader – how often were they expected to use this over the day? When were participants asked to complete the FCD?

Response: To improve replicability we have now included the guidelines provided to the FCDM. We have also elaborated on the timeframe for both groups.

Procedure – The materials were translated into 7 further languages, attention to psychometric validity and reliability would be useful.

Response: We used back translation procedures (Brislin, 1986). We have now expanded on how these were carried out. We have included reliability information when appropriate and justified the use of single-item measures.

The process for assignment to conditions is not clear – ‘based on gender within each country’ does not provide an entirely clear explanation of how groups were assigned. Were males and females

assigned to different groups, or evenly split across groups? What about the participant who identified as other gender? It is not clear which measures participants completed at each timepoint.

Response: We have extensively revised the Methods section providing information about the randomization based on three gender categories (male, female, other) and the measures that completed at each timepoint.

Participant Evaluation and Experience - The qualitative section exploring participant evaluation and experience appears to be more relevant for the results section, although it would need justification and clarification prior to reporting. There is no mention of how this data will be analysed or used to address the aims of the study. Overall, it is not clear how this contributes to the paper. The evaluation and experience may have a clearer role if this study is framed as a pilot?

Response: We have now moved the information pertaining to participant feedback to the Results section. Indeed, participant information was requested to inform future interventions. Thanks for this suggestion.

Statistical Analysis – This section demonstrates some understanding of data analysis, but needs attention to conform to standards for publication purposes. This section would benefit from a clear statement of how each hypothesis will be tested.

Response: We have revised the data analysis section to align with the hypothesis.

Results:

The first paragraph provides a summary that would be more relevant for inclusion within the methods (under Participants).

Response: We have moved that information as suggested

This section should simply report the results of the statistical analyses in relation each of the hypotheses. As there were participants from 10 countries included in this study, it would be useful to comment on whether there were lockdown measures in place across these countries and consider the differences in lockdown levels during the period of data collection.

Response: At the time of data collection there were different restrictions put into place in different countries, with some countries not adopting lockdown measures at all. In addition, the measures within the same country changed while the study was still available. Thus, it was not appropriate to control for lockdown. We include this as a study limitation.

This results section includes both quantitative and qualitative information and extends the qualitative summary in one of the methods sub-sections. Organisation of these sections needs more attention – the quantitative and qualitative aims, justification, and reporting would need to be clearer for consideration for publication.

It is not clear how or why the quantitative or qualitative evaluation and experience feedback has been analysed, as this was not mentioned in the methods section pertaining to this.

Response: Quantitative data from participant evaluation was examined via MANOVA, as we have now indicated in the manuscript.

Discussion:

It is difficult to assess given the others aspects which will first need addressing in the manuscript. However, is it good to see that the limitations of the study are addressed. Addressing each of the

hypotheses in turn, and whether the findings support or reject them, would be a clearer way to begin the discussion. There needs to be some caution in applying the evaluation and experience feedback, i.e. current claims in the discussion that these findings ‘suggest that increasing awareness of emotions and associated eating prompts the use of strategies other than food to regulate emotions’. The discussion would need to be addressed following changes to the above sections.

Response: We have revised the discussion to align with the aims and results of this study.

Conclusions:

The conclusion states that the results support the use of remote interventions to encourage healthy eating behaviours. The outcomes measured were about the experience of food cravings and intensity of unpleasant emotions. To apply this to the general construct of ‘healthy’ eating behaviours is broad. This issue applies across the manuscript.

Response: We have deleted such sentences and revised the manuscript to make references to the specific purpose of this study.

In review

- 1 **Brief Remote Intervention to Manage Food Cravings and Emotions during the COVID-19**
- 2 **Pandemic: [A Pilot Study](#)**

In review

3 Abstract

4 As a result of the COVID-19 pandemic people have endured potentially stressful challenges which
5 have influenced behaviours such as eating. This pilot study examined the effectiveness of two brief
6 interventions aimed to help individuals deal with food cravings and associated emotional experiences.
7 Participants were 165 individuals residing in United Kingdom, Finland, Philippines, Spain, Italy,
8 Brazil, North America, South Korea, and China. The study was implemented remotely, thus without
9 any contact with researchers, and involved two groups. Group one participants were requested to use
10 daily diaries for seven consecutive days to assess the frequency of experience of their food cravings,
11 frequency of giving in to cravings, and difficulty resisting cravings, as well as emotional states
12 associated with their cravings. In addition to completing daily food diaries, participants in group two
13 were asked to engage in mindful eating practice and forming implementation intentions. Participants
14 assessed their perceived changes in eating, wellbeing, and health at the beginning and end of the
15 intervention. Repeated measures MANOVAs indicated that participants experienced significantly less
16 food cravings (i.e., craving experience, acting on cravings, difficulty resisting), as well as lower
17 intensities of unpleasant states associated with cravings across time (T1 vs. T7). In contrast to our
18 hypothesis, the main effects of the group (food craving diary vs. food craving diary and mindful eating
19 practice) were not significant. Participants reported less eating and enhanced wellbeing at the end of the
20 study (T7 vs. T1).-Our findings can be used to inform future remote interventions to manage food
21 cravings and associated emotions and highlight the need for alternative solutions to increase participant
22 engagement.

23 **Keywords:** Lockdown; Confinement; Emotion; Mindful Eating; Diary

24

25 **Brief Remote Intervention to Manage Food Cravings and Emotions during the COVID-19**

26 **Pandemic: A Pilot Study**

27 **1 INTRODUCTION**

28 On March 11th 2020, the World Health Organisation declared COVID-19 a pandemic, and by
29 September 22nd 2021 there have been nearly 230 million cases and over 4.7 million deaths worldwide
30 (WHO, 2021). Being highly contagious, a common containment measure adopted by many nations
31 during the pandemic was a mandated “lockdown”. This resulted in the closure of schools, businesses
32 and places of congregation, and travel restrictions. During this time, people were allowed to leave their
33 homes only to purchase essential items (e.g., food, medicines), seek essential treatment, go to work
34 (only for jobs considered essential), or to assist and care for dependents. Adjusting to life during the
35 COVID-19 pandemic presented considerable challenges such as home-schooling, learning new ways of
36 working, reduced opportunity to pursue hobbies dependent on congregating, and lost time spent with
37 friends and family.

38 An increase in stress, depression, anxiety, and other unpleasant emotions was reported as a
39 consequence of the COVID-19 pandemic (Salari et al., 2020). Also evidenced has been the experience
40 of anxiety due to poor eating habits with individuals reporting using food to feel better (Di Renzo et al.,
41 2020). Notably, increased calorie consumption derived largely from foods high in fats and sugars, thus
42 leading to weight gain (Shen et al., 2020). Increasing calorie intake via unhealthy food choices when
43 experiencing unpleasant emotions in the absence of internal hunger cues is termed emotional eating
44 (van Strien et al., 2007). However, whilst emotional eating was originally defined as eating in response
45 to unpleasant emotions, a number of studies show that pleasant emotions can also elicit increased food
46 intake (Devonport et al., 2019; Nicholls et al., 2016). Therefore, in the present study we considered
47 both unpleasant and pleasant emotions.

48 Exposure to stress during the pandemic, and the subsequent potential for unpleasant emotions
49 and associated weight gain, increases risk of adverse outcomes from COVID-19. Results from a survey
50 administered to 1,140 individuals residing in different countries showed an increase in reported eating
51 and weight, especially for those reporting highest decrease in physical activity as a consequence of the
52 COVID-19 pandemic (Ruiz et al., 2021). Targeting eating behaviour through provision of remote
53 interventions that could be easily administered and would not require the presence of a practitioner is,
54 therefore, a critical strategy to ameliorate the impact of COVID-19 and is the focus of the proposed
55 research.

56 Traditional calorie-controlled diets can lead to individuals feeling deprived of food, which can
57 result in food cravings and decreased sensitivity to sensations of hunger and fullness (Meule, 2020).
58 Interventions that take account of the psychological processes underpinning eating behaviour may have
59 greater long-term success than nutritional only interventions (Braden et al., 2016). For example, a food
60 craving is an intense desire for specific foods that are difficult to resist, and a leading cause of dieting
61 failure (Meule, 2020). Cravings present a non-hunger cue relevant to the COVID-19 pandemic
62 situation. Eating behaviour interventions typically address cravings through the avoidance or removal
63 of cues or situations which are known triggers (Nannt et al., 2019). However, during lockdown, people
64 have been purchasing high quantities of long-life food high in sugar, trans fat, and salt content, which
65 contribute to obesity (Rundle et al., 2020). Such changes in food purchasing make it difficult to address
66 food cravings through cue avoidance, as individuals are living with larger quantities of unhealthy food
67 within their immediate environment.

68 In selecting interventions for use in the present study, there was a need to be sensitive to
69 considerations of participant need and participant burden. The term 'zoom fatigue', which gained
70 momentum during COVID-19, reflects increased personal, professional, and psychological demands
71 resulting from higher use of technology for work and social purposes (Brown et al., 2021). The

72 ongoing pandemic necessitated the use of online means for facilitating remote interventions. Cognisant
73 of a need to account for the possibilities of zoom fatigue and increased demands resulting from home
74 working, schooling, carer responsibilities, etc., we sought to deliver brief interventions previously
75 established as effective in regulating unpleasant emotions and resisting food cravings when delivered
76 remotely. Specifically, in our remote intervention we implemented food craving diaries and mindful
77 eating techniques and recorded the type of food individuals gave into after cravings.

78 Evidence suggests that maintaining a daily eating diary is associated with significantly more
79 weight loss than an inconsistent recording (Berkowitz et al., 2003). This is because a daily diary
80 increases awareness of eating habits, and when the focus is on emotional antecedents of food cravings,
81 self-monitoring can provide a more complete understanding of eating behaviours. Not only can this
82 help in targeting eating interventions appropriately, but the diary in itself also presents an intervention
83 due to its role in increasing awareness (Jimoh et al., 2018).

84 Mindful eating is based on the construct of mindfulness, which refers to paying attention on
85 purpose, nonjudgmentally, and in the present moment (Kabat Zinn, 1990). While some scholars
86 consider mindfulness a skill that can be practised (e.g., Bishop et al., 2004), others consider it a
87 dispositional trait present in every person (Brown & Ryan, 2003). Mindful eating is viewed as a
88 process that involves three aspects: (1) bringing attention to present moment experience, that is, the
89 process of eating, taste, smells, thoughts, and feelings that arise during a meal, as well as internal cues
90 of hunger and fullness; (2) considering one's thoughts and emotions as separate from oneself, also
91 called decentering; and (3), acceptance of one's experiences, also called non-reactivity (Tapper, 2022).

92 Most common mindful eating practices include present moment awareness of the sensory
93 properties of food, internal bodily sensations or cues that elicit eating or the urge to eat, and
94 decentering from or acceptance of cravings or food-related thoughts (Tapper, 2022). Because
95 awareness of one's emotions is necessary for successful emotion regulation, mindful eating would

96 appear suitable in facilitating the management of emotionally elicited eating. Support for this
97 contention comes from research demonstrating that mindfulness treatment is linked to anatomical
98 changes in areas associated with cortical regulation and emotion regulation (Hölzel et al., 2011).

99 Research also suggests that mindful eating reduces impulsive eating in response to emotional stressors
100 and re-engages intuitive processes of eating regulation (Kristeller & Wolever, 2010). Focusing on
101 sensory experiences (e.g., taste and texture), increases awareness of satiety resulting in reduced
102 consumption of sweet foods (Mason et al., 2016) and lower calorie intake (Arch et al., 2016).

103 Forming implementation intentions is a self-regulation strategy that involves a volitional
104 process, and is thus concerned with filling the gap between intention and behaviour by planning the
105 action to achieve a certain goal (Bieleke et al., 2020; Gollwitzer, 1990). Such strategy, which takes the
106 if-then format - "*If* (situation), *then* I will do (behaviour)", helps individuals specify when, where, and
107 how to perform goal-directed responses. Research has shown that forming implementation intentions is
108 an effective strategy in the reduction of fat consumption (Vilà et al., 2017) and in modifying emotional
109 outcomes (Webb et al., 2012).

110 Widespread use of the internet, smartphones, and mobile technology (Roberts et al., 2017) have
111 enabled the rapid growth of brief online health and mental health programmes, including mindful
112 eating training (Mason et al., 2018) and food craving diaries (Schumacher et al., 2018). Implementing
113 interventions online not only circumnavigates the challenges of intervention delivery whilst social
114 distancing measures are in place, but also presents scope for reaching a wider audience (Moller et al.,
115 2017). Previous research shows that remote interventions can reduce unhelpful eating behaviours
116 (Mason et al., 2018; Schumacher et al., 2018). A consideration in delivering remote intervention
117 studies is that participants are truly volunteers. There is no associative incentive for participation, or
118 power differentials influencing participation that are omnipresent in research undertaken by academics
119 using student populations. The implication being that they have given thought to their circumstances,

120 their emotions and eating, and made a commitment to attempt change. Thus, this presents an
121 opportunity to evaluate the acceptability of interventions provided and establish impact.

122 1.1 Study Purpose

123 The purpose of this pilot study was to explore the effectiveness of a seven-day remote
124 intervention to manage food cravings during the COVID-19 pandemic. The intervention included two
125 conditions, (a) completion of a food craving diary and (b) completion of diary and mindful eating
126 practice. Food craving diaries and emotional states assessments were provided with the intention of
127 helping individuals identify emotional antecedents of food cravings. Mindful eating guidelines were
128 provided to better manage food cravings when they inevitably did occur. Both conditions sought to
129 challenge eating in response to non-hunger cues, specifically emotions, known to be associated with
130 snacking on highly fatty and sugary food (Summerbell et al., 1995). Differences in food cravings,
131 emotional states associated with cravings, changes in eating, perceived wellbeing, and physical and
132 mental health were examined. Based on previous experimental evidence on the effectiveness of
133 mindful eating on energy intake (Tapper, 2022) and implementation intentions (Bieleke et al., 2020), it
134 was hypothesised that a mindful eating practice combined with the completion of a food-craving diary
135 would be more effective in helping individuals manage their food cravings and related emotional
136 experiences than the completion of the food-craving diary alone, which would result in decreased
137 eating and increased perceptions of wellbeing, physical and mental health.

138 2 MATERIALS AND METHODS

139 2.1 Participants and Procedures

140 An a priori sample size calculation for repeated measures MANOVA design with an anticipated
141 medium effect size of .30, power level of .80, and $P < .05$ for two groups and seven measurement
142 times, suggested a minimum sample size of 158 participants (G*Power 3.1.9.6 software; Faul et al.,
143 2007). The recommended sample for the between-subjects main effect (correlation among repeated

144 measures = 0.5) was 52 participants, and for the within-subjects main effect 20 participants. The only
145 criterion for participation in the study was being over 18 years of age.

146 Up to 3262 participants started the initial assessments. Of the 2075 who completed the initial
147 assessments, 171 completed the study (see Figure 1). Data screening suggested the removal of six cases
148 identified as outliers using the Mahalanobis' distance criterion. The final sample consisted of 165
149 participants including women ($n = 132$), men ($n = 32$), and one person who identified as other gender.
150 Participants were aged 18 to 72 years ($M = 33.64$, $SD = 12.42$) and resided in different countries (i.e.,
151 UK 24%, Finland 23%, Philippines 22%, Spain 12%, Italy 8%, Brazil or Portugal 4%, North America
152 4%, South Korea 2%, and China 1%).

153 The study was conducted between May and November 2020, completely online; thus, there was
154 no contact between participants and researchers. The study was implemented using Qualtrics. Links to
155 the study were distributed via social media (e.g., Twitter, Facebook, LinkedIn), and other public
156 channels (e.g., Universities). Participants were presented details about the purpose and protocol, and
157 assurances of anonymity and confidentiality, after which they provided informed consent, which was
158 granted electronically. Participation was voluntary and no compensation for taking part in the study
159 was given. Participants could exercise their right to withdraw from the study by exiting the browsing
160 window. Ethics approval was granted by the University of Wolverhampton (01/20/AF1/UOW).

161 Separate Qualtrics projects were developed to include information in the respective languages
162 of the participants. Instructions, measures, and guidelines were translated from English into other
163 languages (i.e., Finnish, Filipino, Spanish, Italian, Portuguese, Korean, and Chinese) using back
164 translation procedures (Brislin, 1986). This comprised (a) translation into the respective languages by
165 bilingual individuals with efforts made to include most common or used language, (b) back-translation
166 into English, (c) comparison of translated and original versions by experts with the focus on
167 maintaining the meaning of the original texts.

168 This randomized pilot study was a pre-test post-test research design, including two conditions,
169 and seven consecutive assessments (T1 through T7) divided in three phases: (1) initial assessment, (2)
170 follow up assessments, and (3) evaluation.

171 2.2 Measures

172 2.2.1 Phase 1: Initial assessment

173 Participants provided demographic information such as age, gender, country of residence, and
174 ethnicity. In addition, they completed the following measures at the beginning and at the end of the
175 study.

176 2.2.1.1 Perceived changes in eating and wellbeing

177 Two single items were used to assess participants' changes in their eating and wellbeing respectively,
178 as consequence of the COVID-19 pandemic. Participants were asked to rate changes in eating by
179 answering to the stem question "I feel that I currently eat..." on a 11-point scale ranging from -5 (*less*)
180 to +5 (*more*), with 0 indicating *no change*. Participants' assessed their perceptions of wellbeing by
181 responding to the question "I feel that my wellbeing is..." on an 11-point scale ranging from -5
182 (*significantly decreased*) to +5 (*significantly increased*), with 0 indicating *not changed*. These two
183 items were developed for another study that explored changes in working situation, health routines, and
184 wellbeing in a larger sample (Ruiz et al., 2021). Single items were used as a viable alternative to reduce
185 burden and increase willingness to complete the measures (Allen et al., 2022).

186 2.2.1.2 Physical and mental health

187 Two items from the SF-8 Health Survey (Ware et al., 2001) measured participants' physical and mental
188 health. Specifically, physical health was measured by the following item "Overall, how would you rate
189 your health during the past week?", which was rated on a six-point scale ranging from 1 (*very poor*) to
190 6 (*excellent*). As an indicator of mental health, using the same timeframe of "during the past week", a
191 second item asked participants to assess "How much did personal or emotional problems keep you

192 from doing your usual work, school or other daily activities?”. The following anchors were used: 1 (*not*
193 *at all*), 2 (*very little*), 3 (*somewhat*), 4 (*quite a lot*), and 5 (*could not do daily activities*).

194 **2.2.1.3 Food craving diary**

195 A food craving diary was developed including three questions. The first question assessed the
196 frequency of food cravings experienced (i.e., “How often have you experienced a food craving
197 today?”) and was rated using the following anchors: 0 (*never*), 1 (*rarely*), 2 (*sometimes*), 3 (*often*), 4
198 (*always*). The second question measured the frequency of participants giving in to cravings (i.e., “How
199 often did you give in to cravings and eat the food today?”) and was rated using the following anchors: 0
200 (*never*), 1 (*rarely*), 2 (*sometimes*), 3 (*often*), 4 (*almost every time*). The third question assessed
201 participants’ difficulty resisting the craving (i.e., “How difficult was it to resist temptation?”) which
202 was rated on the following anchors: 0 (*easy*), 1 (*a bit difficult*), 2 (*difficult*), 3 (*very difficult*), 4 (*so*
203 *difficult that I gave in*). In addition, participants were asked to indicate whether the most common type
204 of food ingested following cravings were sweet foods (e.g., *cake, biscuits, confectionary, sweets*) or
205 savoury foods (e.g., *crisps, popcorn, pretzels, meat snacks*). In the current study, acceptable reliability
206 was found for the three first questions for participants who completed the first assessment ($n = 2075$)
207 with a Cronbach alpha value (α) of .789, and McDonalds’ omega (ω) value of .792.

208 **2.2.1.4 Emotional states associated with food cravings**

209 Participants were requested to rate the intensity of nine emotional states (i.e., energetic, angry, anxious,
210 happy, relaxed, miserable, tired, bored, and frustrated) to indicate their experiences at the time of the
211 strongest food craving. These emotions represent the hedonic valence (pleasure-displeasure) and
212 activation (high-low) described in Russell’s (1980) circumplex model of affective experiences. The
213 intensity of these emotional states was rated on a 6-point Likert scale: 0 (*none at all*), 1 (*a little*), 2
214 (*moderately*), 3 (*quite a bit*), 4 (*a lot*), 5 (*a great deal*). If the emotion they experienced at the time of
215 the strongest craving was not included in the list, they could indicate their own.

216 2.2.2 Phase 2: Follow up assessments

217 After participants indicated their gender (male, female, other), they were randomly assigned to either
218 food craving diary (FCD) group ($n = 88$) or food craving diary and mindful eating (FCDM) group ($n =$
219 77) within their chosen gender category (see Figure 1). This was done for each participating country.

220 FCD group participants completed the food craving diary and assessed their emotional states
221 associated with food cravings for six consecutive days. In addition to doing this, FCDM group
222 participants were provided guidelines (see 2.2.2.1 and 2.2.2.2) to follow before and during eating for
223 mindful eating practice. Participants were requested to provide their email address to receive daily
224 project reminders and a link to follow-up surveys for the duration of the study. To ensure anonymity,
225 automatic reminders were created within the Qualtrics platform and were sent out at the end of the
226 following day. Follow-up surveys were sent at around 8pm and included the food diary for FCD group,
227 and food diary and mindful eating guidelines for FCDM group. Mindful eating guidelines, which
228 participants were encouraged to follow every day, were available to download each day.

229 *2.2.2.1 Mindful guidelines before eating*

230 One aspect of mindful eating is to recognise and accept the ebb and flow of different emotions that
231 might lead to emotional eating. Having completed the food craving diary, think about the connections
232 between your emotions and a desire to eat. For example, did you experience food cravings when
233 feeling lonely, sad, angry, disappointed, excited, anxious, bored, or guilty/ashamed? It might help you
234 to understand emotional triggers for eating if you think about how you want to feel during/after eating.
235 For example: If you want to feel more energised, this might indicate the trigger is tiredness; if you want
236 to feel soothed/calm/relaxed, this might indicate the trigger is some kind of anxiety or anger; if you
237 want to feel distracted, this might indicate the trigger is frustration, disappointment, loneliness, anger,
238 or anxiety; if you want to feel entertained, this might indicate the trigger is boredom or loneliness.
239 Sometimes understanding why you have experienced a food craving is enough to resist the craving.

240 Sometimes understanding why you have experienced a food craving gives you the information you
241 need to pick a different coping response that's a better match to the problem you're trying to solve.
242 Think of different ways that you can manage emotions other than eating. For example, you are bored so
243 call a friend. For common triggers for emotional eating, develop a plan that says... when I feel X,
244 doing A, B, C, or D is likely to help. For example, if I feel anxious, then I can listen to music, watch a
245 favourite film, speak with a close friend...

246 ***2.2.2.2 Mindful guidelines during eating***

247 The development of mindful eating involves bringing full attention to the process of eating, to taste,
248 smells, thoughts, and feelings that arise during a meal, as well as internal cues of hunger and fullness.
249 To practice mindful eating: (a) focus on noticing food and your body's response to eating; (b) slow
250 down when you are eating; and (c) take time to savour and enjoy your food and notice textures and
251 flavours.

252 **2.2.3 Phase 3: Evaluation**

253 Participants were asked to assess their perceived changes in eating and wellbeing and their physical and
254 mental health. In addition, they assessed perceived easiness and effectiveness.

255 ***2.2.3.1 Perceived easiness***

256 Participants were asked to rate the ease of completing the food craving diary. In addition, FCDM
257 participants were also asked to rate the ease of undertaking mindful eating practice. Easiness was rated
258 on a 7-point scale ranging from -3 (*I found it hard to do*) to +3 (*I found it very easy to do*), or 0 (*I did*
259 *not do it*).

260 ***2.2.3.2 Perceived effectiveness***

261 Participants were requested to assess the effectiveness of the food craving diary, and for FCDM
262 participants also the mindful eating practice in helping them to manage food cravings. Effectiveness

263 was rated on a 7-point scale ranging from -3 (*not at all effective*) to +3 (*very effective*), or 0 (*hard to*
264 *say*).

265 **2.3 Statistical Analysis**

266 Prior to conducting the main analysis, potential differences in mean scores in the study variables at
267 Time 1 (T1) across groups (FCD vs. FCDM) were examined through multivariate analysis of variance
268 (MANOVA). The main analysis comprised four repeated measures MANOVAs to examine: (1)
269 differences in food cravings, (2) emotional states associated with cravings, (3) perceived changes in
270 eating and wellbeing, and physical and mental health, and (4) easiness to follow intervention and
271 intervention effectiveness. The first repeated measures MANOVA examined differences in food
272 cravings data with Time (T1, T2, T3, T4, T5, T6, T7) as a within-subjects factor and Group (FCD,
273 FCDM) as a between-subjects factor, and experience of food cravings, frequency in eating after
274 cravings, and difficulty resisting cravings as outcome variables. A second repeated measures
275 MANOVA was conducted to examine differences in the emotional states (i.e., energetic, angry,
276 anxious, happy, relaxed, miserable, tired, bored, and frustrated) experienced at the time of strongest
277 cravings. Emotional states were included in the analysis separately. A third repeated measures
278 MANOVA was performed to examine differences in perceived changes in eating and wellbeing, and
279 physical and mental health across intervention (T1 vs. T7) and groups. A fourth repeated measures
280 MANOVA was conducted to examine the differences in perceived easiness as well as effectiveness of
281 the food diary across groups.

282 **3 RESULTS**

283 **3.1 Preliminary Analysis**

284 Regarding potential differences in mean scores in the study variables at Time 1, MANOVA
285 demonstrated equivalence between groups indicating no significant differences across groups for food

286 cravings experienced, frequency of giving in to cravings, difficulty resisting cravings, or any of the
287 emotional states experienced at T1 Wilk's $\lambda = .926$, $F(12, 152) = 1.014$, $P = .439$, $\eta_p^2 = .074$.

288 Adequate reliability for food cravings experience, frequency of giving in to cravings, and
289 difficulty resisting cravings from T1 through T7 was found with $\alpha > .799$ and $\omega > .813$. The most
290 common types of food consumed after giving into cravings were sweet foods (e.g., cake, biscuits,
291 confectionary, sweets) prior to the intervention (71% of participants) and at the end of the intervention
292 (64%).

293 There were significant differences in the completion rate for gender (women, men) by group
294 (food craving diary, food craving diary + mindful eating) across the seven days, $\chi^2(1, 2048) = 12.55$, P
295 $< .001$, with men withdrawing from the study at higher rates than women for both groups (see also
296 Figure 1).

297 3.2 Food Cravings and Emotional States

298 Descriptive statistics for food cravings and emotional states by experimental groups (FCD vs. FCDM)
299 are presented in Table 1 (Pearson product-moment correlation coefficients at T1 are presented in
300 Supplementary Table S1).

301 Regarding differences in food cravings, as expected, repeated measures MANOVA yielded
302 significant main effects of Time, Wilk's $\lambda = .465$, $F(18, 146) = 9.334$, $P < .001$, $\eta_p^2 = .535$ for food
303 cravings (i.e., cravings experienced, giving in to cravings, and difficulty resisting the cravings).
304 Contrary to our hypothesis, the effect of Group was not significant, Wilk's $\lambda = .993$, $F(3, 161) = .376$,
305 $P = .770$, $\eta_p^2 = .007$. The effect of Time by Group interaction was also not significant. Ratings of the
306 three craving aspects for each group across the seven days are depicted in Figure 2. Post hoc analysis
307 on the main effects of Time revealed significantly lower values at the end of the intervention in the
308 frequency of cravings experienced, $F(1, 163) = 46.268$, $P < .001$, $\eta_p^2 = .221$, in giving in to cravings,

309 $F(1, 163) = 38.975, P < .001, \eta_p^2 = .193$, and in the difficulty in resisting the cravings, $F(1, 163) =$
 310 $10.174, P = .002, \eta_p^2 = .059$ (see Supplementary Table S2 for pairwise comparisons).

311 In regards to the emotions experienced at the time of the highest food cravings, a repeated
 312 measures MANOVA yielded significant main effects of **Time**, Wilk's $\lambda = .374, F(54, 110) = 3.404, P$
 313 $< .001, \eta_p^2 = .626$. No significant differences were observed for Group main effect, Wilk's $\lambda = .978,$
 314 $F(9, 155) = 3.384, P = .941, \eta_p^2 = .022$, and **Time** by Group interaction, Wilk's $\lambda = .622, F(54, 110) =$
 315 $1.240, P = .171, \eta_p^2 = .378$. Reported emotional states intensities for each group are presented in Figure
 316 3. Post hoc analysis on the main effects of **Time** indicated that individuals reported significantly lower
 317 intensities for all unpleasant states (i.e., angry, anxious, miserable, tired, bored, frustrated) across time.
 318 Differences in the intensities of pleasant states reported across the intervention were not significant (see
 319 Supplementary Table S3 for significant pairwise comparisons).

3.3 Perceived Changes in Eating and Wellbeing, Physical and Mental Health

321 Descriptive statistics for **perceived** changes in eating, wellbeing, physical health, and emotional health
 322 **reported pre-intervention (T1) and post-intervention (T7)** are presented in Table 2. MANOVA yielded
 323 significant **main effects of the Intervention (pre-, post)**, Wilk's $\lambda = .603, F(4, 155) = 25.530, P < .001,$
 324 $\eta_p^2 = .397$. **The main effects of Group**, Wilk's $\lambda = .994, F(4, 155) = .226, P = .923, \eta_p^2 = .006$ or the
 325 **Intervention by Group interaction**, Wilk's $\lambda = .972, F(4, 155) = 1.129, P = .345, \eta_p^2 = .028$ **were not**
 326 **significant**. Post hoc analysis indicated **that participants reported eating** significantly less, $F(1, 158) =$
 327 $76.428, P < .001, \eta_p^2 = .326$, and **perceived enhanced wellbeing**, $F(1, 158) = 57.239, P < .001, \eta_p^2 =$
 328 $.266$ **at the end of the study**.

3.4 Perceived Easiness and Effectiveness

330 Regarding the food craving diary, perceptions of easiness in completing it were positive for participants
 331 in both FCD ($M = 1.87, SD = 1.35$), and FCDM ($M = 1.62, SD = 1.61$) groups. Participants'
 332 perceptions of its effectiveness in helping them manage food cravings ranged from -3 to +3 ($M = -0.22,$

333 $SD = 1.58$) for FCD group participants, and from -3 to +3 ($M = 0.18$, $SD = 1.34$) for FCDM group
 334 participants. MANOVAs did not yield significant main effects of Group in easiness and effectiveness
 335 of the food craving diary, Wilk's $\lambda = .969$, $F(2, 158) = 2.555$, $P = .081$, $\eta_p^2 = .505$. Regarding mindful
 336 eating practice, FCDM group participants' perceptions of easiness in carrying it out ranged from -3 to
 337 +3 ($M = 0.89$, $SD = 1.62$). FCDM participants felt diary completion to be easier compared to the
 338 practice of mindful eating, $t(73) = 3.595$, $P < .001$. Moreover, mindful eating practice was perceived as
 339 more effective than diary completion, $t(73) = -2.945$, $P = .004$.

340 3.5 Participant Feedback

341 Participants, who provided comments at the end of the study, indicated that they perceived completion
 342 of the food craving diary to be an easy task, as the following comment exemplifies:

343 *The diary was very easy to complete- bit wary as it is an area that I have work to do however I*
 344 *am also conscious that it could produce very difficult emotions and which is why I have avoided*
 345 *it. This was a gentle and non-invasive way to start looking at these issues- bringing attention to*
 346 *them without judgement or action plan etc.*

347 They also noted how the food craving diary helped raise their awareness of emotionally elicited
 348 eating prompting them to initiate strategies for healthier eating, illustrated as follows: *"It allowed me to*
 349 *identify negative eating behaviours. I now have fruit at hand always so I eat that instead of finding*
 350 *chocolate if I'm hungry or stressed or bored. So feel like it actually helped"*, *"During lockdown we*
 351 *have managed the stress with food and the study has been good to help control the cravings"*, and:

352 *I had already decided to log my food intake and this study made me think more about when I*
 353 *want to snack and why. Boredom and relaxation really impact my food intake. Keeping busy*
 354 *helps me manage my food consumption. Thank you for helping me with this insight.*

355 Some participants reported the mindful eating practice to be *"very easy to follow and*
 356 *understand"* and *"not very time-consuming"*. However, feedback also described a need to feel

357 confident in using the strategy: “*Becoming aware of the emotions experienced every time we have a*
358 *craving and how to manage the feelings in those situations is easier than actually doing it*” and:

359 *Personally, I think this study has helped me to see the link between emotions and the “need” of*
360 *snacking. To become aware of this link is a very good first step, however, I have found the*
361 *mindfulness input very low, especially if someone is not familiar with this concept.*

362 Mindful eating practice was perceived by some to be a strategy they could, and indeed would
363 like to continue to implement after the completion of the study “*...it helped me to eat more*
364 *consciously, with more attention. I will continue practicing mindful eating.*” Indeed, several
365 participants expressed a desire to continue using the interventions provided:

366 *Interesting study that drew attention to the influence of one’s own emotions. It felt like the week*
367 *was just getting started - I would like to continue filling out the diary for a longer period of*
368 *time, or to take part in a longer study.*

369 *This was brilliant!! Having ‘let myself go’ during the lockdown it was just what I needed to kick*
370 *start healthy eating again. I have lost a total of 5lb this week, and have downloaded an app to*
371 *track my eating habits to continue progress.*

372 **4 DISCUSSION**

373 This was a randomized pilot study with two conditions (i.e., completion of a food craving diary and
374 completion of food craving diary and mindful eating practice) that examined the feasibility of
375 implementing a remote intervention aimed to manage food cravings and associated emotional
376 experiences during the COVID-19 pandemic. This seven-day remote study was implemented fully
377 online with no contact between participants and researchers. Although limited by the lack of a control
378 group, the study results indicated significant changes in some of the targeted variables. Contrary to our
379 hypothesis, no significant differences were observed due to following mindful eating practice
380 guidelines in addition to completion of a food craving diary.

381 Descriptive data indicate that tired and bored were the two most intensely experienced
382 unpleasant emotions for participants in both groups at T1. In seeking to explain this finding, it is widely
383 reported that containment measures applied during the pandemic reduced the number of accessible
384 daily activities and enforced changed routines. For example, congregating or mixing with others was no
385 longer permissible, clubs and organised face-to-face activities ceased. As a result, research suggests
386 that time was perceived as slowing down for many when containment measures were in effect, and this
387 conscious experience of time increased feelings of boredom and sadness (Droit-Volet et al., 2020).

388 Whilst there were no significant between group differences in emotions, there was a significant
389 reduction in the intensity of all unpleasant emotions experienced associated with cravings from T1 to
390 T7 (Figure 3). This suggests that the act of completing a daily diary to identify emotional states
391 associated with food cravings may have increased participants' awareness of felt emotions, thereby
392 triggering emotion regulation. When experiencing unpleasant emotions, individuals typically engage in
393 hedonic emotion regulation, characterised by trying to increase the intensity of pleasant emotions and
394 reduce the intensity of unpleasant emotions, unless they believe unpleasant emotions are useful,
395 thereby accommodating utilitarian considerations in emotion regulation (Tamir et al., 2007). The
396 present study suggests that regulation efforts among participants were driven by hedonic motives
397 towards reducing the intensity of unpleasant emotions.

398 Whilst there was no overall difference between groups in terms of food craving reduction, it is
399 informative to examine patterns in the data, as the reported craving outcomes follow a different pattern
400 over time for each group. Observing these patterns may be helpful in hypothesising about the function
401 of a combined diary and mindful eating intervention in bringing about behavioural change over time.
402 Observing FCD group participants who received the food craving diary only, there is a significant
403 reduction in the frequency of cravings, giving in to cravings and difficulty in resisting cravings at T2.
404 By contrast, FCDM group participants who received the food craving diary plus mindful eating

405 intervention evidenced a steadier reduction over time. Participants reported greater ease in using the
406 craving diary as compared to the mindful eating intervention. Most participants providing feedback on
407 their experiences with diary completion noted how it increased their awareness of emotions that elicit
408 cravings. Many participants then detailed strategies they used to help manage this. FCD group
409 participants, having no guidance on strategies to manage emotionally elicited cravings, likely self-
410 selected strategies they felt confident in utilising. As such, they did not have the need to learn a
411 researcher prescribed and potentially novel strategy.

412 FCDM group participants were asked to use mindful eating as a strategy to help manage
413 emotional eating. Whilst we did not evaluate previous experience with mindful eating, we can
414 speculate that for many participants this presented a novel intervention. This novelty might explain the
415 difficulties in [complying with this practice, which was](#) reported by some participants and may also
416 account for differences at T2. T2 data suggests that participants [in the craving diary only condition](#)
417 showed greater reductions in cravings, acting on cravings, and difficulties in resisting cravings. They
418 also experienced greater reductions in unpleasant emotion. People often struggle to adhere to
419 psychological skills training programmes (Shambrook & Bull, 1999); notably where they find the
420 intervention difficult to follow. This alludes to the possibility that the intervention process is effortful
421 and so might not lead to immediate benefits. Furthermore, where an intervention is perceived as more
422 difficult to follow, an individual may perceive effort invested as producing insufficient benefits. This
423 highlights the importance of setting expectations for intervention use, and setting realistic outcome
424 expectancies, in particular during the early stages of the intervention. It also suggests that for mindful
425 eating, guided practice by an experienced trainer may be necessary to initiate and facilitate practice,
426 rather than the exclusive use of remote online means of intervention delivery and support. Irrespective
427 of intervention condition, unpleasant emotions were stronger triggers for cravings at the beginning but
428 decreased over the week. Happiness as a trigger for food cravings remained the same.

429 A final point of discussion relates to participant attrition. A high dropout rate (76%) was
430 observed from the initial assessment ($n = 2075$) to the first follow-up food craving diary ($n = 488$). The
431 rate of attrition decreased across the latter stages of the intervention (see Figure 1). Analysis also
432 indicate that recruitment of male participants was lower, and attrition higher. This is in line with
433 previous research undertaken on emotional eating where significant differences in the recruitment and
434 retention of male and female participants have been reported. A systematic review of 14 studies on
435 mindfulness-based interventions for emotional eating (Katterman et al., 2014) included 5 studies who
436 recruited exclusively female samples, and of the 9 remaining, males only represented between 10%-
437 37% of the total sample. A similar pattern is observed in studies of related concepts such as weight
438 management. For example, a systematic review of 244 randomised controlled trials of weight loss
439 programmes ($n = 95,207$) found that only 27% of participants were men (Pagoto et al., 2012). Research
440 indicates that men perceive weight loss services to be feminised spaces, in which they feel self-
441 conscious and out of place (Elliott et al., 2020). When the contexts of weight and emotion combine, as
442 with emotional eating, then perceptions of this as a 'feminised space' may intensify. Emotion is a term
443 that has long been associated with the personal and the feminine (Åhäll, 2018). Thus, interventions
444 based around these concepts may be met with resistance from men due to mismatch with ideologies of
445 masculinity (Isacco, 2015).

446 Previous research has evidenced high rates of study attrition when delivering remote online
447 interventions (Christensen et al., 2009). Existing explanations for high attrition with remote
448 interventions include a need to provide brief support that supplements remote self-help (Richards &
449 Richardson, 2012) and the ease of access to online interventions which invite browsing and curiosity
450 (Mason et al., 2018). There is qualitative evidence to suggest that some participants found the mindful
451 eating intervention to be the more challenging of the two interventions and would have appreciated
452 additional guidance for its use. As such, for these individuals, perceived difficulty of use may have

453 contributed to a decision to cease participation. However, we propose two further plausible
454 explanations. The first explanation is informed by data from the present study. Figures 2 and 3
455 respectively show the greatest decrease in food cravings (experiencing, giving in to, and difficulty
456 resisting), and unpleasant emotions (anxious, angry, miserable, tired, and frustrated) from T1 to T2. At
457 this point, participants had experienced the craving diary or craving diary plus mindful eating
458 intervention. Qualitative data indicate that most participants found the interventions easy to follow, and
459 experienced early benefit, in particular for the food craving diary. It is plausible that facilitated by the
460 remote nature of the research, some participants felt under no obligation to continue with the research
461 once they fulfilled their goals for participation. In other words, where participants perceived they had
462 adequately (by their own self-referenced standards) recognised and regulated unpleasant emotion and
463 associated unwanted food cravings, some may have perceived no further incentive for ongoing
464 participation. The second explanation is informed by the context of the present study, in particular,
465 experiences of ‘zoom fatigue’ commonly reported during COVID-19. It is likely that for some
466 participants, a requirement for daily online diary and survey completion was de-incentivising due to
467 high levels of online fatigue, with priorities for screen time allocated to work and social activities.
468 Likely a combination of all the aforementioned explanations contributed to participant attrition, and
469 consideration should be given to each in designing remote interventions and recruiting participants. For
470 example, by incorporating measures associated with adherence (e.g., motivation for change),
471 establishing means to differentiate curious browsers from those with true interest in the study, and
472 keeping screen time brief and informative. It is worth noting that in the present study participant
473 attrition from [day 3 assessment](#) onwards reduced dramatically ([Figure 1](#)). This suggests that following
474 initial curiosity, where participants were able to establish congruence with their own goals for
475 involvement this was sufficient to ensure ongoing adherence. Indeed, [some](#) participants reported that

476 they intended to continue with the interventions provided after the cessation of participatory
477 requirements.

478 4.1 Limitations and Future Research Directions

479 One aim of this study was to provide participants with brief and easy strategies to regulate their
480 emotions and associated food cravings, which seemed to be appropriate considering the reported
481 changes in eating behaviours during the COVID-19 pandemic (Ruiz et al., 2021). There are several
482 advantages related to the remote format of delivery, which allowed access to geographically dispersed
483 participants with different backgrounds and ages. In this study, the use of technology also facilitated
484 sending daily reminders to participants. However, one of the limitations of daily retrospective
485 assessments is recall bias, where participants may recall more intense experiences rather than those that
486 endure for longer time (Gunthert & Wenze, 2012). Future interventions could use ecological
487 momentary assessment (EMA) (Shiffman, 2009) in which participants are sent repeated cues for self-
488 reporting across the day. This is one of the most advanced methods of recording self-monitoring, and
489 **has been** advocated for in a systematic review on emotional eating in normal and overweight
490 individuals (Devonport et al., 2019).

491 The lack of significant differences in food cravings between the two groups may be explained
492 by the individuals' prior experiences of and current engagement **in mindfulness practice** or with
493 mindful eating practice outside of the study, which was not captured, and thus equivalence across
494 groups cannot be assumed. We recommend that future research captures prior **mindfulness training or**
495 **practice and** experience with mindful eating to account for this potential confounding factor.

496 A further limitation of the present study is that we did not ask participants to report on their
497 perceived need to manage emotionally elicited cravings, or their compliance with the **mindful eating**
498 **guidelines**. The extent to which people engaged with the **guidelines** provided would likely **vary and**
499 **may largely depend on their previous experience**. Whilst we did not complete a manipulation check, we

500 can draw on participant feedback which points to a difference in experience between the two groups.
501 Participants found mindful eating a harder intervention to follow. Whilst we provided written
502 instructions for the use of mindful eating, it may be that a more immersive experience (e.g., video or
503 audio recordings) with opportunities for question and answers, would have increased the ease of
504 intervention use.

505 The use of a web-based intervention meant reliance on individuals coming across recruitment
506 information via social media, then completing the baseline survey on a voluntary basis. With COVID-
507 19 related restrictions, this was the only viable form of administration. However, there are groups with
508 known issues regarding digital literacy and accessibility to web-based research including some older
509 adults, people with long-term health conditions or disabilities, and those without internet access. These
510 groups are therefore likely to be under-represented in the present study. Furthermore, the present study
511 recruited few male participants, which mirrors the pattern in weight management studies generally,
512 where typically less than 30% of participants are male (Tsai & Wadden, 2005). Caution must therefore
513 be exercised in generalising findings of the present study to these groups, and consideration should be
514 given as to how future research could recruit male participants, and therefore better account for the
515 male experience. Male-only support groups seem to be effective (Young et al., 2012), especially those
516 delivered virtually (Azar et al., 2015).

517 The results provide initial support for the use of remote interventions to help manage food
518 cravings and associated emotional experiences. Participants reported that the food craving diary was
519 easy to complete. Knowing that this is an accessible, easy, and effective intervention for the reduction
520 of food cravings and related eating behaviour could have wide reaching applications in the provision of
521 remote healthcare. The need for healthcare to move to a blended form and better utilise technological
522 resources is being increasingly recognised (Nicholls et al., 2016). The delivery of effective remote
523 interventions such as those used in the present study has potential to expedite the provision of

524 healthcare interventions. This is especially critical at a time when healthcare services worldwide are
525 under pressure due to pandemic related reductions in service provisions (Brown et al., 2021).

526 4.2 Conclusions

527 Significantly less eating and better wellbeing were reported after both intervention conditions. The
528 completion of a 7-day food **craving** diary was effective in reducing food cravings (i.e., frequency of
529 craving experienced, giving into craving, and difficulty resisting), as well as the intensities of
530 unpleasant emotions experienced at the time of the highest food cravings. Following mindful eating
531 guidelines alongside a food diary for the same time period was no more effective than completion of
532 the diary alone. Our findings highlight the need to consider ways to increase participant involvement
533 and retention.

In review

534 Conflict of Interest

535 The authors declare that they have no known competing financial interests or personal relationships
536 that could have appeared to influence the work reported in this paper.

537

538 Author Contributions

539 Authors' contributions: TJD, C-HC-W and MCR: conceptualization and methodology; C-HC-W: data
540 management; C-HC-W and MCR: data curation; CR and MCR: formal analysis; TJD, C-HC-W, WN,
541 and MCR: writing – original draft; TJD, C-HC-W, WN, JYC, CR, JF-M, YC, and MCR: writing –
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In review

Table 1.

Descriptive Statistics of Food Cravings Emotions for Participants in FCD Group (n = 88) and FCDM Group (n = 77).

	T1	T2	T3	T4	T5	T6	T7
	<i>M (SD)</i>						
FCD group							
Food cravings							
Craving							
frequency	3.2 (0.9)	2.5 (0.9)	2.5 (1.0)	2.4 (1.0)	2.5 (1.1)	2.4 (1.0)	2.5 (1.0)
Give into craving	3.1 (1.1)	2.4 (1.1)	2.6 (1.2)	2.4 (1.2)	2.3 (1.4)	2.4 (1.3)	2.3 (1.3)
Difficulty							
resisting	2.7 (1.2)	2.1 (1.2)	2.3 (1.4)	2.2 (1.3)	2.2 (1.3)	2.3 (1.3)	2.2 (1.3)
Emotional states							
Energetic	1.1 (1.3)	1.2 (1.3)	1.0 (1.2)	1.1 (1.4)	1.0 (1.3)	1.0 (1.3)	1.2 (1.3)
Angry	0.7 (1.0)	0.4 (0.8)	0.5 (1.0)	0.4 (1.0)	0.3 (0.7)	0.4 (0.8)	0.5 (0.9)
Anxious	1.3 (1.6)	1.1 (1.4)	0.8 (1.4)	0.8 (1.3)	0.9 (1.5)	0.9 (1.4)	0.9 (1.4)
Happy	1.3 (1.4)	1.4 (1.4)	1.3 (1.2)	1.5 (1.5)	1.3 (1.3)	1.2 (1.4)	1.2 (1.3)
Relaxed	1.2 (1.3)	1.4 (1.3)	1.3 (1.3)	1.4 (1.3)	1.1 (1.2)	1.2 (1.3)	1.1 (1.3)
Miserable	1.1 (1.5)	0.7 (1.3)	0.7 (1.2)	0.6 (1.2)	0.8 (1.4)	0.7 (1.3)	0.7 (1.2)
Tired	1.7 (1.7)	1.5 (1.6)	1.6 (1.6)	1.5 (1.6)	1.6 (1.7)	1.5 (1.6)	1.5 (1.6)
Bored	1.9 (1.7)	1.5 (1.6)	1.3 (1.6)	1.2 (1.6)	1.0 (1.4)	1.0 (1.4)	0.9 (1.3)
Frustrated	1.3 (1.6)	0.9 (1.4)	1.0 (1.5)	0.7 (1.3)	0.8 (1.3)	0.7 (1.3)	0.9 (1.4)
FCDM group							
Food cravings							
Craving							
frequency	3.2 (1.0)	2.8 (1.0)	2.6 (1.1)	2.3 (0.9)	2.2 (0.9)	2.4 (1.0)	2.3 (1.0)
Give into craving	3.0 (1.1)	2.7 (1.2)	2.3 (1.3)	2.2 (1.2)	2.2 (1.2)	2.3 (1.2)	2.2 (1.2)
Difficulty							
resisting	2.6 (1.1)	2.4 (1.2)	2.1 (1.3)	2.0 (1.2)	2.1 (1.2)	2.2 (1.2)	2.1 (1.3)
Emotional states							

Energetic	1.1 (1.3)	0.9 (1.1)	0.9 (1.2)	1.2 (1.2)	0.9 (1.1)	1.0 (1.2)	0.9 (1.1)
Relaxed	1.6 (1.4)	1.2 (1.3)	1.4 (1.6)	1.2 (1.3)	1.2 (1.2)	1.3 (1.3)	1.1 (1.2)
Happy	1.2 (1.3)	1.1 (1.4)	1.4 (1.3)	1.2 (1.4)	1.1 (1.2)	1.3 (1.3)	1.1 (1.4)
Anxious	1.5 (1.7)	1.3 (1.5)	0.9 (1.2)	0.7 (1.1)	0.8 (1.2)	0.7 (1.1)	0.9 (1.3)
Angry	0.7 (1.1)	0.7 (1.1)	0.5 (1.0)	0.4 (0.7)	0.4 (1.0)	0.4 (0.8)	0.4 (0.8)
Frustrated	1.4 (1.6)	1.3 (1.6)	1.0 (1.5)	0.7 (1.2)	0.6 (1.1)	0.6 (1.0)	0.7 (1.2)
Miserable	1.2 (1.3)	1.0 (1.4)	0.7 (1.2)	0.5 (1.0)	0.6 (1.2)	0.5 (1.0)	0.6 (1.1)
Tired	2.0 (1.6)	1.9 (1.4)	1.4 (1.6)	1.4 (1.5)	1.3 (1.4)	1.3 (1.4)	1.2 (1.4)
Bored	2.2 (1.6)	1.3 (1.6)	1.3 (1.6)	1.1 (1.4)	1.1 (1.4)	1.0 (1.4)	0.9 (1.3)

Table 2. Reported Changes in Eating, Wellbeing, Physical and Emotional Health at T1 and T7 for FCD and FCDM Group Participants.

Variable	Group	T1	T7
		<i>M (SD)</i>	<i>M (SD)</i>
Eating (-5, +5)	FCD	1.06 (2.1)	-0.2 (1.2)
	FCDM	1.49 (1.7)	-0.4 (1.4)
Wellbeing (-5, +5)	FCD	-0.64 (2.2)	0.7 (1.1)
	FCDM	-0.71 (2.0)	0.7 (1.2)
Physical health (1-6)	FCD	3.80 (1.1)	3.7 (0.9)
	FCDM	3.79 (1.1)	3.9 (1.1)
Emotional health (1-5)	FCD	2.47 (1.2)	2.5 (1.1)
	FCDM	2.55 (1.1)	2.5 (1.0)

In review

Figure Captions

Figure 1

Flow diagram representing participants' attrition from the survey and follow-up assessments

Figure 2

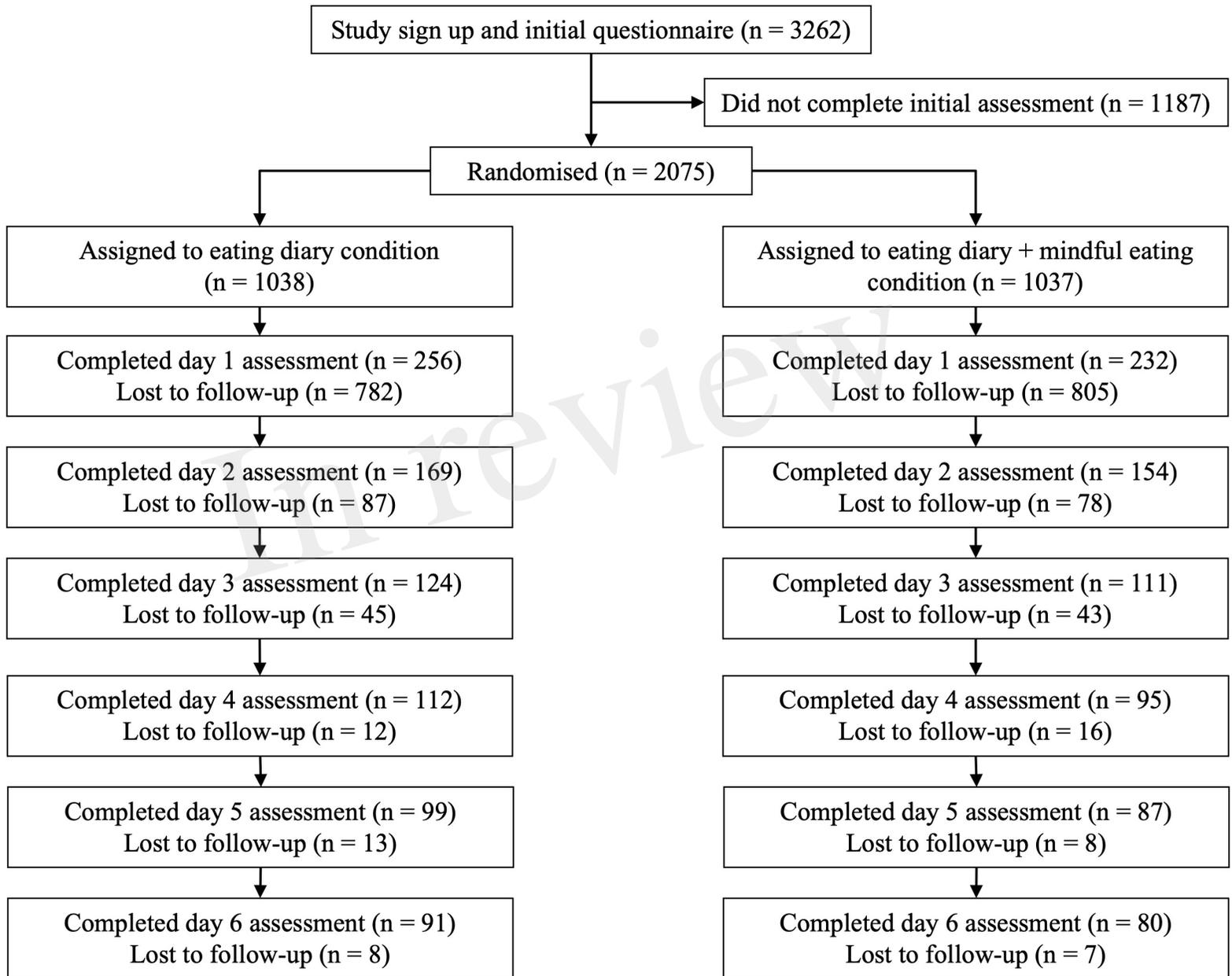
Food cravings across seven-day intervention (FCD, $n = 88$; FCDM, $n = 77$).

Figure 3.

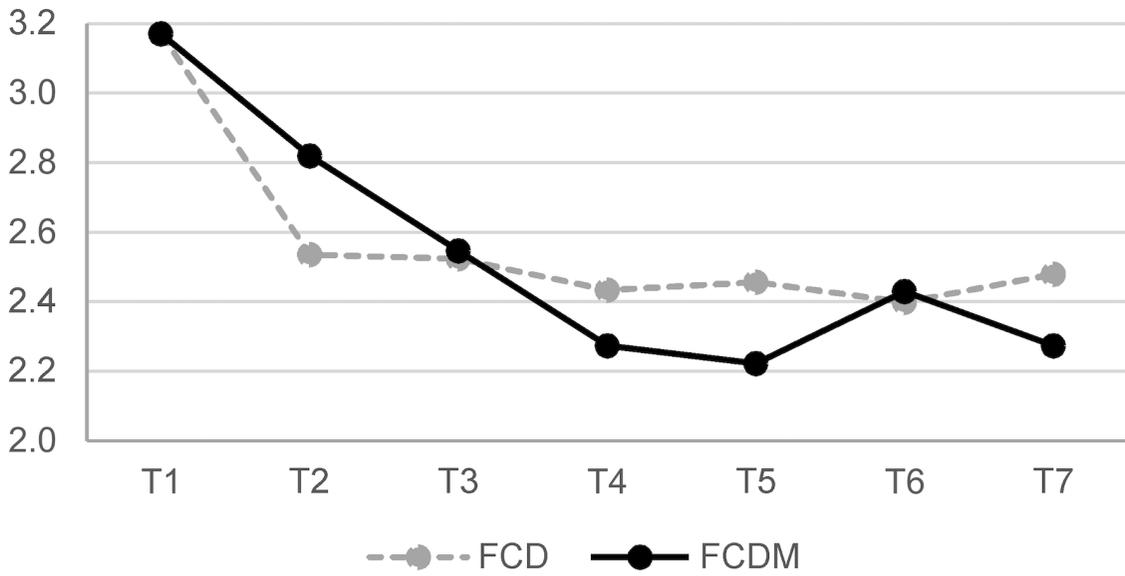
Intensity of emotional states associated with strongest food cravings across a 7-day intervention (FCD, $n = 88$; FCDM, $n = 77$).

In review

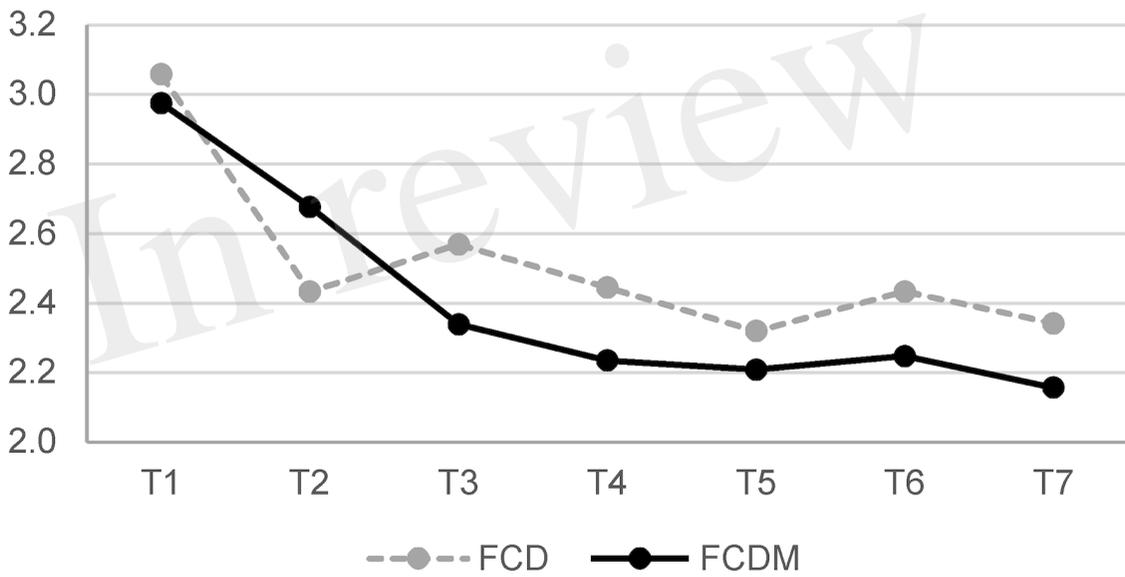
Figure 1.JPEG



Food Craving Experience



Give in to Food Cravings



Difficulty Resisting Food Cravings

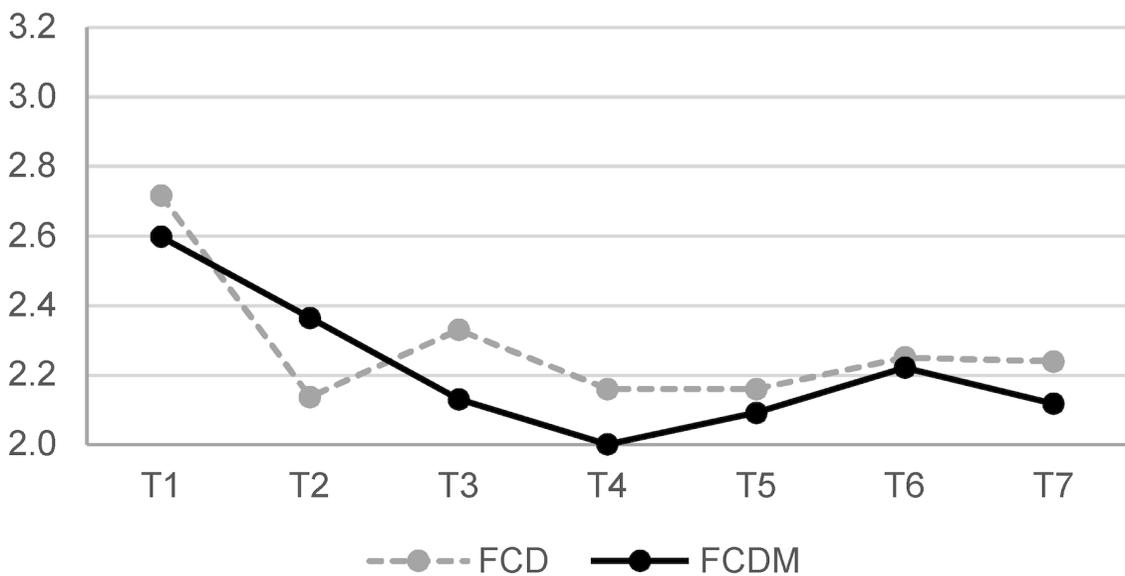


Figure 3.TIF

