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TITLE PAGE

A CASE SERIES TO INVESTIGATE FOOD-RELATED FEAR LEARNING AND
EXTINCTION USING *IN-VIVO* FOOD EXPOSURE IN ANOREXIA NERVOSA: A
CLINICAL APPLICATION OF THE INHIBITORY LEARNING FRAMEWORK.

Running Title

FOOD EXPOSURE IN ANOREXIA NERVOSA

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22 **ABSTRACT**

23 Objective: Anorexia nervosa is characterized by severe malnutrition. This study tested the
24 hypothesis that fear of food is a learned behavior and evaluated the feasibility and
25 effectiveness of gradual exposure to food to improve eating behavior in people with anorexia
26 nervosa. Methods: Eighteen women were recruited and completed baseline self-reports. They
27 were interviewed regarding early experiences of eating and the development of food-related
28 anxiety. Participants received eight sessions of in vivo food exposure. Results: Findings
29 indicated that fear of food is a learned behavior, associated with catastrophic thoughts around
30 the consequences of eating and safety behaviors. Patients consumed at least half of the food
31 item selected in all, but one session. Body mass index increased and food restriction, eating
32 concern, eating disorder-related preoccupations and overall anxiety reduced (medium/large
33 ES). Conclusion: Findings corroborate an anxiety-based model of anorexia nervosa and
34 support the relevance of targeting food-related fears using exposure-based protocols.

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40 *Key words* Anorexia Nervosa, Exposure, Food, Fear, Anxiety.

41 Trial name: A fMRI Pilot Study of the Effects of Meal-support in Eating Disorders

42

Highlights

- Fear of food is a core symptom of anorexia nervosa
- Patients report early experiences of learned fear of food.
- Food exposure based on inhibitory learning is acceptable and associated with clinical benefit.

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52 relation to the work described.

53 **INTRODUCTION**

54 Anorexia nervosa is a serious mental illness (Klump, Bulik, Kaye, Treasure, 2009) and
55 has the highest mortality rates amongst psychiatric disorders (Chesney, Goodwin, Fazel, 2014).
56 Given the health-threatening consequences of starvation, improving nutrition and restoring
57 weight are of key importance in the first stages of treatment (American Psychiatric Association,
58 2006). Fear of food is probably the most challenging obstacle to successful weight restoration
59 (e.g. Steinglass et al., 2010; McFarlane, Olmsted, Trottier, 2008) and predicts the desire to
60 maintain low weight after discharge above and beyond negative affect and general anxiety
61 sensitivity (Levison, Brosf, Fewell, Lenze, 2017). The therapeutic strategies to tackle food-
62 related anxiety vary. Empowering parents to provide meal support is successful in adolescent,
63 short onset cases (Couturier, Kimber, Szatmari, 2013), but is more difficult in older patients.
64 Inpatient care with nursing meal support ensures the most rapid weight gain (American
65 Psychiatric Association, 2006; National Institute of Clinical Excellence, 2004), but patients
66 report fear and negative emotions in relation to eating (Steinglass et al., 2010; Soussignan,
67 Schaal, Rigaud, Royet, Jiang, 2011) and experience refeeding as a battle (Long, Wallis, Leung,
68 Meyer, 2012). Accordingly, the high rates of relapse and readmission after inpatient treatment
69 (Wallier, Vibert, Berthoz, Huas, Hubert, Godart, 2009; Castro, Gila, Puig, Rodriguez, Toro,
70 2004) are suggestive of treatment iatrogenic effects in relation to eating-related anxiety.

71 The importance of targeting anxiety in anorexia nervosa is supported by the genetic
72 correlation with the neuroticism trait (Duncan et al., 2017) and by the phenotypical overlap
73 with phobic and obsessive-compulsive disorders (Steinglass, et al., 2011). This overlap
74 includes a hypothesized increased tendency to learn fear associations (Strober, 2004) and the
75 development of compulsive behaviors, avoidance and irrational beliefs around the phobic
76 stimulus (Steinglass et al., 2011). In line with an anxiety-based model of anorexia nervosa,
77 abnormal eating behaviors might develop from direct associations between food and traumatic

78 experiences (classical conditioning), vicarious learning of food-related avoidance and aversion
79 (learning of attitudes and behaviors through observing these in close others) and operant
80 conditioning based on learning that eating is followed by aversive consequences (e.g. negative
81 judgment from others, shame and criticism) (Treasure, Cardi, Kan, 2012). These hypotheses
82 are supported by evidence that critical comments and teasing about eating, weight and
83 appearance are risk factors for disordered eating (e.g. Fairweather-Schmidt and Wade, 2017;
84 Menzel, Schaefer, Burke, Mayhew, Brannick, Thompson, 2010), and that pressures from
85 parents, peers and the media on losing weight predict the use of extreme weight loss strategies
86 over time (McCabe & Ricciardelli, 2005). Likewise, parental coercive control over eating has
87 been associated with the development of disordered eating over time (e.g. Ellis, Galloway,
88 Webb, Martz, Farrow, 2016).

89 Based on the proposition that fear of food is a key symptom in anorexia nervosa and
90 that it might be underlined by some of the basic mechanisms of learning, exposure-based
91 treatments might hold promise in the treatment of food-related anxiety and avoidance
92 (Steinglass et al., 2011). Exposure-based treatments are evidence-based, first-line interventions
93 for anxiety disorders and involve gradual exposure to the phobic stimulus. The first well
94 established hypothesis regarding the mechanisms of effect of these interventions was that
95 repeated exposure to the feared stimulus would allow habituation to anxiety and therefore fear
96 extinction (e.g. Foa & Kozak, 1986). Recent advances in the science of learning and extinction
97 have led to refinements of this hypothesis introducing the concept of inhibitory learning
98 (Craske et al., 2014). The theory of inhibitory learning proposes that successful exposure
99 therapy operates through new learning about the threatened stimulus (e.g. learning that the
100 stimulus is not associated with aversive consequences as previously thought) rather than
101 habituation to anxiety. Based on the inhibitory learning hypothesis, strategies such as
102 maximizing the violation of expectancies regarding the intensity or frequency of the threatened

103 outcomes, exposure to multiple threatened cues at the same time, variability of the contexts in
104 which exposure takes place and use of retrieval cues to strengthen new learning have been
105 suggested to improve the efficacy of exposure-based therapies (Craske et al., 2014).

106 The potential of this rationale and strategies to enhance exposure treatment in anorexia
107 nervosa has also been proposed (Murray, Treanor, Liao, Loeb, Griffiths, Le Grange, 2016;
108 Reilly, Anderson, Gorrell, Schaumberg, Anderson, 2017). To date, only a handful of studies
109 have tested the use of food exposure in anorexia nervosa and findings have indicated that it is
110 associated with increased caloric intake and reduced anxiety (Steinglass, Albano, Simpson,
111 Wang, Zou, Attia, Walsh, 2014; Steinglass, Sysko, Schebendach, Broft, Strober, Walsh, 2007)
112 and also with increased body mass index when used in conjunction with D-cycloserine (an N-
113 methyl-d-aspartate receptor modulator thought to augment glutamatergic function and increase
114 fear extinction; Levinson et al., 2015). These studies have looked at the use of food exposure
115 during or towards the end of inpatient treatment, have mostly involved weight recovered
116 participants and have reported on the use of a protocol based on anxiety habituation rather than
117 inhibition learning.

118 Based on the urgent need to implement and improve strategies for aftercare (Berends,
119 et al., 2016; Cardi et al., 2017) and on the evidence-based framework of inhibition learning,
120 the aim of this study is to test the feasibility, acceptability and preliminary effectiveness of food
121 exposure-based therapy in a case series of women with anorexia nervosa who were not
122 receiving hospital treatment at the time they participated. The main outcomes were:
123 intervention adherence (i.e. number of sessions attended and amount of food consumed during
124 each session), participants' willingness to continue with the intervention beyond the set time
125 and changes in body mass index. A secondary aim was to validate an anxiety-based model of
126 anorexia nervosa encompassing the following hypotheses: i) fear of food is a learned behavior,

127 ii) patients have catastrophic expectations regarding the implications of eating and iii) patients
128 use a range of safety-behaviors to cope with the anxiety of eating.

129

130 **METHODS AND MATERIALS**

131 *Study design and outcome measures*

132 This study employed a longitudinal design. Eighteen patients with anorexia nervosa
133 recruited from the community completed self-report assessments before and at the end of
134 eight sessions of *in vivo* exposure to food. Number of sessions attended, whether participants
135 brought to the session and consumed the food item that they had decided to be exposed to
136 during each session and willingness to continue with the intervention beyond the sessions
137 offered were recorded and interpreted as an index of feasibility. Body mass index was
138 measured by the researcher at baseline and end of treatment. At these same two-time points,
139 eating disorders symptoms, mood and confidence to change were assessed using self-report
140 measures. In each session, participants were asked to rate their anxiety on a visual analogue
141 scale during food consumption.

142

143 *Participants*

144 Women (19 to 60 years) with a diagnosis of anorexia nervosa according to the
145 Diagnostic and Statistical Manual of Mental Disorders (5th edition; American Psychiatric
146 Association, 2013) who were not receiving inpatient or outpatient treatment at the time of
147 recruitment and who were proficient in English and right-handed were eligible to take part in
148 the study. A tailored version of the SCID-I (First et al., 2002) (i.e. overview, screening and
149 eating disorder modules, open questions on past or present history of anxiety and mood
150 disorders) was used to ascertain that participants met the inclusion criteria. Twenty subjects
151 with anorexia nervosa were assessed. Two patients did not start the intervention due to

152 difficulty in attending weekly appointments (N=1) and an unexpected admission to hospital
153 (N=1). All patients were receiving regular physical monitoring by their general practitioners.

154 Participants were recruited from the community through advertisements posted on
155 eating disorder charities websites (i.e. Beating Eating Disorders and SUCCEED), circular
156 emails to students and staff at King's College London (KCL) and emails sent to individuals
157 from the volunteer database of the Eating Disorders Research Unit at KCL. After complete
158 description of the study, written informed consent was obtained. The study was approved by
159 a National Research Ethics Service (NRES) committee (i.e. South West London Research
160 Ethics Committee; approval number: 11/LO/0373). The authors assert that all procedures
161 contributing to this work comply with the ethical standards of the relevant national and
162 institutional committees on human experimentation and with the Helsinki Declaration of
163 1975, as revised in 2008.

164

165 *Intervention*

166 Participants received two assessment and psycho-education sessions and eight, 60-
167 minute sessions of food exposure-based therapy. The assessment sessions consisted in: i)
168 completion of the baseline questionnaires, ii) description of the study rationale (i.e. learning
169 processes involved in food-related fears, role of food-related fears in the maintenance of
170 anorexia nervosa, anxiety and its time course, role of avoidance, irrational fears and safety
171 behaviors, fear learning and inhibition) and iii) case formulation to assess traumatic
172 experiences related to food, eating disordered behaviors in the family, family's eating
173 attitudes, imagined worst consequences associated with eating "scary" foods (i.e. irrational
174 beliefs around eating), safety behaviors currently used to manage food-related anxiety and
175 threatening foods to tackle. The intervention was developed by the study team (VC, JT,
176 DMC) with supervision from an expert trainer (DMC) and it was based on the clinical

177 recommendations derived from the inhibitory learning framework (Craske, Hermans,
178 Vervliet, 2018). The sessions were delivered by a clinical psychologist with experience in
179 eating disorders (VC) and occurred on average twice/week. Based on the inhibitory learning
180 framework, particular emphasis was given to: paying attention to the feared stimulus,
181 maximizing the mismatch between frequency and intensity of expected negative
182 consequences of exposure to the threatening stimulus and actual consequences, affect
183 labelling, exposure to different food items during each session, supportive and non-
184 judgmental attitude from the therapist and encouragement to undertake self-exposure sessions
185 in own environments to generalize the learning occurred during the sessions. The last therapy
186 session included a summary of skills learned and included a plan for maintaining the changes
187 made.

188

189 *Assessment measures*

190 The following questionnaires were administered at baseline and end of intervention:

- 191 • Eating disorder symptoms (Eating Disorders Examination – Questionnaire; EDE-Q;
192 Fairburn & Beglin, 1994).
- 193 • Depression, anxiety and stress (Depression Anxiety and Stress Scale; DASS 21;
194 Lovibond & Lovibond, 1995). Only anxiety subscale considered in the study.
- 195 • Confidence to change: (visual analogue scale ranging from 0 - not at all - to 10 - very
196 much).
- 197 • Preoccupations and rituals around eating (Yale-Brown-Cornell Eating Disorder Scale;
198 YBC-EDS; Mazure, Halmi, Sunday, Romano, Einhorn, 1994).

199 At baseline and after the end of the intervention, the researcher measured participant's
200 body mass index. Anxiety during food consumption was measured in each session on a scale
201 ranging from 0 ("not anxious at all") to 10 ("extremely anxious"). At the end of the final

202 session, participants were asked the question: “If given the opportunity, would you choose to
203 continue with this intervention?”. Finally, the therapist recorded the number of sessions
204 attended and whether participants brought in and ate the food item chosen during each
205 exposure session.

206

207 *Data Analyses*

208 Statistical analyses were conducted using SPSS version 20. Mean and standard
209 deviations of demographic and clinical characteristics were calculated. Paired *t*-tests were
210 used to compare pre- and post-intervention scores for the primary and secondary outcomes in
211 the patient group. A *p* value of 0.05 was considered to be significant. Cohen’s *d* effect sizes
212 (*ES*) (Cohen, 1992) were calculated and described as negligible ($= 0$ and < 0.15), small (\geq
213 0.15 and < 0.40), medium (≥ 0.40 and < 0.75), large (≥ 0.75 and < 1.10), very large (≥ 1.10
214 and < 1.45) and huge (> 1.45).

215 **RESULTS**216 *Sample description*

217 Patients' mean age was 32.83 ($SD=12.67$). The mean body mass index was "severely
 218 low" (Mean=15.98, $SD=1.28$) (American Psychiatric Association, 2013) and they reported
 219 clinically significant levels of eating disorder symptoms, anxiety, depression and stress. Six
 220 patients had a comorbid diagnosis of anxiety disorders (i.e. social anxiety disorder, or panic
 221 disorder, or generalized anxiety disorder or obsessive-compulsive disorder) and nine of major
 222 depression. Ten people were using antidepressants at the time of their participation. The
 223 mean duration of illness was 15.88 years ($SD=11.07$; min = 1; max = 36; N = 15 patients > 3
 224 years). Patients did not change the dose of medication or receive any other psychological or
 225 nutritional treatment for the duration of their participation in the project. The baseline clinical
 226 data are reported in Table 1.

227

228 -----Table 1-----

229

230 *Experiences of fear learning, expectations and safety behaviors*

231 The following areas were investigated during the assessment sessions: 1) traumatic
 232 experiences related to food, eating disordered behaviors in the family, family's eating
 233 attitudes; 2) imagined worst consequences associated with eating "scary" foods (i.e. expected
 234 outcomes of eating); 3) safety behaviors currently used to manage food-related anxiety.
 235 None of the patients reported traumatic experiences involving food and eating prior to illness
 236 onset. However, 14 reported witnessing fear and anxiety around eating in at least one of their
 237 primary carers and 13 reported having experienced the use of rigid rules about food intake in
 238 their family prior to illness onset. The most frequent responses to the question "what is the
 239 worst consequence of eating?" were: 'fear of losing control', 'fear of changing shape

240 immediately after eating', 'fear of feeling distressed', 'fear of feeling disgusted' and 'fear of
241 being disgusting' (figure 1a). These expectations were discussed and disconfirmed during the
242 sessions. Finally, when participants were asked about the types of safety behaviors used, a
243 broad range of behaviors was identified (figure 1b).

244 -----Figures 1a, 1b here-----

245

246 *Exposure sessions: attendance, food consumption, anxiety ratings and acceptability*

247 All participants completed eight sessions of therapist-guided exposure to food stimuli
248 and one exposure session/week at home. None dropped-out from the intervention and all
249 expressed an interest in continuing beyond the agreed timeline. Over the sessions,
250 participants were encouraged to eat always a different food item listed on their threatening
251 foods' hierarchy. All patients consumed at least half of the food item selected during the
252 sessions, except for one participant who did not consume any food in session two. Patients
253 did not habituate to eating-related anxiety over time, as demonstrated by the average anxiety
254 scores reported during food consumption (figure 2).

255 In response to the question "If given the opportunity, would you choose to continue
256 with this intervention?", all participants, but one reported that they would. The one person
257 who said they wouldn't, mentioned that travelling to the sessions was physically exhausting.

258 -----Figure 2-----

259

260 *Clinical change associated with the treatment*

261 Baseline-to-end of treatment changes associated with the intervention are reported in
262 table 1. Overall, a significant increase in body mass index was found. A significant reduction
263 in food restriction and eating concern, eating disorder-related preoccupations and anxiety
264 (medium *ES*) were found. Increased confidence to change was also observed (large *ES*).

265 **DISCUSSION**266 *Summary of findings*

267 The aim of the current study was to provide evidence for the feasibility, acceptability
268 and preliminary effectiveness of an *in vivo* food exposure intervention in patients with
269 anorexia nervosa. Overall, the findings supported the acceptability of the intervention, in that
270 none of the patients dropped-out and that in all but one session, patients consumed at least
271 half of the food item selected. The quantitative data demonstrated that body mass index
272 increased and that food restriction, eating concern, eating disorder-related preoccupations and
273 overall anxiety reduced (medium to large *ES*). Confidence to change also improved from the
274 beginning to the end of the sessions (large *ES*). The latter finding is particularly relevant to
275 explain the mechanisms of effect of exposure therapy, suggesting the potential involvement
276 of complex cognitive processes, such as self-efficacy (i.e. belief about own' ability to cope
277 with the feared stimulus) (e.g. Craske, Kircanski, Zelikowsky, Mystkowski, Chowdhury,
278 Baker, 2008). The data collected during the assessment phase further validates the use of
279 food exposure therapy in anorexia nervosa. Premorbid experiences of abnormal (vicarious)
280 learning associated with eating were recalled by the majority of the patients and might
281 contribute to the development of food-related anxiety and avoidance. Patients also reported
282 catastrophic consequences about the consequences of eating and a large number of safety
283 behaviors to manage the anxiety related to food.

284 These findings overall align to the literature regarding the phenotypic overlap
285 between anorexia nervosa and anxiety disorders (Steinglass et al., 2011) and suggest the
286 possibility to treat food-related fears and anxiety using *in vivo* exposure based on inhibitory
287 learning (Craske et al. 2014). Participants in this study reported that they felt empowered and
288 in control of the therapy, as probably reflected in the significant increase in confidence to
289 change obtained at the end of it. Throughout the intervention, they were encouraged to take

290 responsibility of the sessions, by selecting which food to buy, buying it and deciding how
291 much to eat. On the other hand, the role of the therapist was to encourage them to keep the
292 focus on the food, label the difficult emotions experienced and to highlight the mismatch
293 between feared and actual outcomes of the exposure. In anorexia nervosa, this could
294 represent a potential conundrum, considering that weight gain is often the most threatening
295 consequence of eating, as well as one of the most important treatment goals. A successful
296 approach to this was to highlight the mismatch between the *specific* characteristics of the
297 expected weight gain (e.g. how much, how quickly and what implications it would have),
298 rather than weight gain as such, and the actual outcomes of eating during the sessions. Fear of
299 losing control over food was also very often reported by participants and disconfirmed when
300 reflecting on the actual amount of food consumed during each session.

301 The results obtained in this study are particularly relevant because they indicate that
302 new learning can develop despite the aversive consequences of starvation and malnutrition
303 and that patients are willing to take controlled risks when confronting eating-related fears and
304 breaking habits. The use of an experimental approach to clarify who might benefit the most
305 from the use of food exposure protocols, based on idiosyncratic differences in fear learning
306 and extinction might further contribute to strengthen the rationale and clinical effectiveness
307 of this approach to psychopathology.

308

309 *Clinical implications*

310 Several studies highlight the importance of weight gain in the early phase of treatment
311 for long term recovery in anorexia nervosa (Madden, Miskovic-Wheatley, Wallis, Kohn,
312 Hay, Touyz, 2015; Nazar, Gregor, Albano, Marchica, Lo Coco, Cardi, Treasure, 2017). The
313 subjective implications that this has for patients have been less described. It is likely that
314 rapid weight gain in the early phase of treatment will need to be balanced with the

315 consequences of patient's perceived (or actual) coercion, such as feelings of depression and
316 suicidality (Norrington, Stanley, Tremlett, Birrell, 2012) and also with the sustainability of
317 change after discharge (Garber et al., 2016), a time when discontinuous care jeopardizes
318 treatments gains. The tension between early, effective weight gain and acceptable, sustainable
319 refeeding practices posits a challenge for those involved in the treatment of anorexia nervosa.
320 Teaching patients, carers and hospital staff members the principles of inhibition learning and
321 techniques of food exposure to better manage mealtimes could maximize clinical change both
322 in the early phase of treatment and aftercare, to ensure that changes are maintained over time.

323 The use of novel technologies, such as virtual reality, holds great promise in
324 delivering exposure therapy. In eating disorders, virtual cue exposure to target urge to binge
325 and anxiety associated with binge cues has been successfully used in the treatment of patients
326 with binge eating (bulimia nervosa or binge eating disorders) who did not respond to standard
327 CBT (Ferrer-Garcia, et al., 2017). Furthermore, the use of virtual reality to "update" negative
328 body representations stored in memory has been shown to improve the efficacy of CBT at
329 one year in obese patients with binge eating disorder (Cesa et al., 2013; Manzoni et al.,
330 2016).

331 The use of virtual reality in anorexia nervosa hasn't been researched as much. Two
332 early case studies indicated that the use of virtual reality to enhance outcomes from standard
333 treatment for anorexia nervosa, was associated with weight gain, decreased eating disorder
334 symptoms and psychological distress (Cardi, Krug, Perpiñá, Mataix-Cols, Roncero, Treasure,
335 2012) and with increased body awareness and reduced body dissatisfaction (Riva, Bacchetta,
336 Baruffi, Rinaldi, Molinari, 1999). Two recent studies indicated that one session of immersive
337 virtual reality jogging led to a reduction of the urge to exercise (Paslakis, Fauck, Röder,
338 Rauh, Rauh, Erim, 2017) and that one session of full body illusion reduced body size
339 estimation up to 2-3 hours after exposure (Keizer, van Elburg, Helms, Dijkerman, 2016).

340 Based on the inhibitory learning framework (Craske et al., 2014), virtual exposure to food
341 would be particularly advantageous considering the potential of using multiple different cues
342 and environments over time to favor new learning, whilst ensuring high controllability of the
343 variables in an experimental setting.

344

345 *Strengths and limitations*

346 The main strength of this study is the investigation of a non-standard and yet illness-
347 specific treatment approach in a sample of patients with anorexia nervosa who were not
348 receiving any other treatments at the time of recruitment. A limitation of this study is the lack
349 of a comparison group of patients who did not receive the intervention. In the preparation
350 phase for this study, we tested the possibility of randomizing patients to either receiving the
351 intervention or being on a waiting list. The first three patients randomized to the waiting list
352 condition declined to participate further and we decided to proceed with a case series,
353 feasibility study. Patients with eating disorders seem to have strong treatment preferences
354 (Halmi et al., 2005). Indeed, different forms of interventions such as cognitive-behavioral
355 therapy, specialist supportive clinical management (SSCM), the Maudsley Anorexia Nervosa
356 Treatment for Adults (MANTRA) and psychodynamic therapies have been used as
357 comparators in treatment trials of anorexia nervosa, rather than waiting lists (Hay, Claudino,
358 Touyz, Abd Elbaky, 2015). A possibility to test food exposure in anorexia nervosa using a
359 randomized controlled trial design, would be to identify patients characterized by abnormal
360 food-related fear learning and inhibition and randomize them to either treatment as usual
361 enhanced by food exposure or treatment as usual alone.

362

363 *Conclusion*

364 Fear and anxiety around of food are the core psychopathological feature of anorexia
365 nervosa and the greatest obstacle to successful refeeding. Gradual exposure to food is
366 feasible, acceptable and associated with preliminary clinical change in patients with anorexia
367 nervosa who are living in the community. The use of translational research to increase the
368 understanding of individual differences in fear learning and extinction, and the employment
369 of novel technologies such as virtual reality to deliver exposure therapy are promising
370 approaches to improve current treatments for eating disorders.

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522 **AUTHOR CONTRIBUTIONS**

523 VC designed the study under the supervision of JT and IC. DMM and JT provided clinical
524 guidance in the development and delivery of the intervention. JL, MS, AS and OOD provided
525 guidance in the development of the methods and conducted the statistical analyses of
526 neuroimaging data. JT, IC, OOD revised the manuscript and provided expert guidance during
527 manuscript preparation. VC conducted the assessments and clinical sessions with the patients.

528

529

530 **ADDITIONAL INFORMATION**

531 The authors report no competing financial interests.

532 **TABLES**

533 Table 1 Pre and post-intervention clinical scores
 534 Pre- (t1) and post- (t2) intervention scores on body mass index, subscales and total score of
 535 the Eating Disorder Examination Questionnaire (EDE-Q), anxiety subscale of the Depression,
 536 Anxiety and Stress Scales (DASS), eating disorders (ED)-related preoccupations and rituals
 537 and confidence to change ruler. Data expressed as means and standard deviations (SD).
 538 Statistics for paired samples *t*-tests and effect sizes are reported. Bonferroni correction
 539 applied ($p < .01$ for the EDE-Q subscales; $p < .025$ and ED-related preoccupations and
 540 rituals). Significances surviving Bonferroni correction marked with *.

	Mean t1	SD t1	Mean t2	SD t2	Statistics	<i>p</i> values	Effect size
Body Mass Index	15.98	1.28	16.47	1.54	$t(17) = -2.8$	.001*	0.70
EDE-Q Eating Concern	3.90	1.01	3.30	1.25	$t(17) = 2.80$	.001*	0.67
EDE-Q Restraint	4.27	1.60	3.53	1.61	$t(17) = 2.76$	.001*	0.63
EDE-Q Shape Concern	4.53	1.26	4.15	1.46	$t(17) = 1.25$	.22	0.29
EDE-Q Weight Concern	3.97	1.58	3.52	1.58	$t(17) = 1.14$	.26	0.26
EDE-Q Total score	4.17	1.19	3.62	1.31	$t(17) = 2.39$	.002*	0.56
ED-related preoccupations	11.76	2.79	10.11	3.73	$t(17) = 2.61$	.02*	0.67
ED-related rituals	10.17	3.66	9.64	3.46	$t(17) = .90$	.37	0.22
DASS Anxiety	17.88	7.74	13.66	7.67	$t(17) = 3.49$	.003	0.80
Confidence to change	5.31	1.85	6.68	2.27	$t(17) = -3.22$	.006	0.81

541 **FIGURES LEGEND**

542 Figure 1 Feared consequences of eating and use of safety behaviours

543 (a) Number of participants reporting specific feared consequences of eating (“fear of
544 appearing disgusting”, “fear of experiencing disgust”, “fear of experiencing intense distress”,
545 “fear of changing shape very quickly” and “fear of losing control”) and (b) number of
546 participants reporting the use of safety-behaviours to manage food-related anxiety.

547

548 Figure 2 Anxiety associated with eating during the sessions

549 Participants’ anxiety ratings during food consumption in each session.

550