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1 It's not how much you crave but what you do with it that counts: behavioural responses to  
2 food craving during weight management

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8 Short title: Food craving during weight management

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25 authors declare no other conflict of interest.

26

27 **ABSTRACT**

28 **Background/Objectives:** The relationship between food craving and dieting is mixed and  
29 uncertain, with little evidence during active weight management. Accordingly, the  
30 frequency and nature of food cravings were investigated in people attending a commercial  
31 weight management programme.

32 **Methods:** An online survey was completed by 2932 participants (97% female, mean  
33 age=43.0yrs, mean BMI=31.6kg/m<sup>2</sup>). Assessments included the Control of Eating  
34 Questionnaire, measuring the frequency, intensity, specificity, and behaviour following food  
35 cravings. Others included body weight, dietary restraint, perceived success of dieting, and  
36 mood. Forty two per cent of the sample completed a second survey 7 weeks later.

37 **Results:** Cross-sectional analysis showed those currently dieting to lose weight (55% of  
38 sample) had significantly fewer, less intense, and more resisted food cravings than those  
39 watching what they ate so as not to gain weight (35% of sample). Cravings were fewer for  
40 chocolate and other sweet foods. Longitudinally, food cravings decreased over the period  
41 of weight loss (2.0kg). Fewer foods were craved and the cravings were less intense, easier  
42 to resist and to control. Eating in response to food cravings was a significant predictor of  
43 weight change.

44 **Conclusions:** People with obesity and recent experience of resisting eating in response to  
45 food cravings lost more weight over the next 7 weeks. Feeling in control of eating was also  
46 associated with greater weight loss. This suggests it is the behaviour that follows food  
47 cravings rather than simply their frequency or intensity that contributes to successful weight  
48 management. This has implications for interventions to help address food cravings.

49

50 **KEYWORDS:** Obesity; Weight management; Dieting; Food craving; Weight loss

51

52

53 **INTRODUCTION**

54 There is sustained interest in the relationship between dieting, weight management, and  
55 food cravings.<sup>1-3</sup> That cravings may act to undermine dieting is based on parallels with  
56 withdrawal or being abstinent from addictive substances, and given further credibility by  
57 accounts of 'hedonic hunger' and the psychological deprivation experienced by some while  
58 denying themselves rewarding food.<sup>4</sup> It is however, a mixed and confusing empirical  
59 literature.<sup>5</sup> The majority of studies are reports of cross-sectional associations between  
60 questionnaire measures, samples are not representative of those active in weight reduction  
61 (often without obesity), sample sizes are often small, and there is variation in how both  
62 craving and dieting are assessed. There is certainly a current lack of consistency in this  
63 evidence from which to develop practical advice for those with obesity.

64

65 Evidence from longer-term weight management trials may be more helpful. For example,  
66 food cravings have been investigated during the course of very low calorie diets (VLCDs).  
67 Intriguingly, cravings for nearly all food types have been observed to decrease over a 3-  
68 month period and to a greater extent than during a LCD.<sup>6-7</sup> In addition, food cravings have  
69 been assessed during a pharmacological weight loss intervention thought to impact on  
70 reward pathways.<sup>8</sup> Food cravings reduced and control of eating improved early in  
71 treatment; this persisted over the 52-week trial period. Food cravings have also been the  
72 subject of secondary analysis to understand the drivers of lifestyle interventions for weight  
73 loss. Batra et al<sup>9</sup> observed a greater reduction on most of the food craving questionnaire  
74 (trait) subscales over a 6-month worksite intervention in participants compared with  
75 controls.

76

77 While food cravings may reduce over longer-term interventions not all studies report on the  
78 associations between weight loss and craving reduction, and there are mixed findings in  
79 those that do. One failed to find any association.<sup>6</sup> In another, food craving and weight loss  
80 were correlated but craving was not an independent predictor of weight change when  
81 hunger was included in the statistical model.<sup>9</sup> In a third, it was eating in response to food  
82 cravings that was related to weight loss.<sup>7</sup> One reason for this inconsistency may be the  
83 need to assess more than just the frequency or intensity of food cravings. For example, it  
84 has been observed that unsuccessful dieters differed from those more successful in dieting  
85 not in the number of food cravings but in the reduced sense of control over eating that  
86 accompanied these experiences.<sup>10</sup>

87

88 It follows that further research is required in people who are overweight or with obesity and  
89 actively involved in weight management. Accordingly, the present study investigated the  
90 frequency and nature of food craving in people attending a group-based weight  
91 management programme. It was hypothesised that food craving would be lower in those  
92 currently dieting to lose weight, would further reduce over time, and be related to future  
93 weight loss.

94

## 95 **METHODS**

### 96 Participants

97 Participants were all members of a group-based weight management programme  
98 (Slimming World (SW)). Of the 3433 who initiated survey completion at Time 1, currently  
99 measured weight data were available for 95%, of which 90% completed all baseline  
100 questionnaire measures. These 2932 participants with complete baseline data were  
101 predominantly female (97%) with mean age=43.0 yrs (range 18 to 91 yrs) and mean

102 BMI=31.6 kg/m<sup>2</sup> (range 20 to 73 BMI units). They had been SW members for an average  
103 of 39 weeks and had lost a mean of 9.5 kg (range 15 to -79 kg) and 3.5 kg/m<sup>2</sup> (range 5 to -  
104 27 BMI units) in this time. The mean Index of Multiple Deprivation score for the sample (an  
105 indication of socio-economic deprivation based on home postcodes<sup>11</sup>) was 20.37 and  
106 comparable to the English national average of 21.67.

107 Some 54% of Time 1 participants completed the second survey, of which 82% provided  
108 valid SW membership numbers to link the two surveys. A further 82 participants were  
109 excluded as no weight data within 3 weeks of survey completion were available, which  
110 meant 1224 paired surveys were entered into the longitudinal analysis. Ethical permission  
111 for the study was granted by the University of Leeds Faculty of Medicine and Health  
112 Research Ethics Committee.

113

#### 114 Measures

115 In addition to providing demographic information (SW membership number, date of birth,  
116 gender, health conditions for current medication, and postcode), participants completed the  
117 following assessments:

118 The Control of Eating Questionnaire (CoEQ).<sup>12</sup> This is a 21-item measure of the frequency,  
119 intensity, specificity, and behaviour following food cravings, together with information on  
120 appetite and affective state. These are assessed over the past 7-days and rated on an  
121 eleven-point scale (from 0 (not at all) to 10 (extremely/all the time)). The CoEQ items are  
122 organized into five sections addressing the craving experience, specificity (targets) of  
123 cravings, general appetite, mood, and a nominated problem food (not reported here). The  
124 measure has previously been used in clinical trials of drug therapy in obesity.<sup>8</sup>

125 Psychometric and validation analysis<sup>12</sup> has yielded the following 4 factors: craving control

126 (present study internal consistency  $\alpha=0.89$ ), craving for savoury (0.69), craving for sweet  
127 (0.81), positive mood (0.75).

128 Three Factor Eating Questionnaire (TFEQ-R18).<sup>13</sup> The 6-item cognitive restraint scale was  
129 used. It has a 4-point response format and an internal consistency of 0.66 in the present  
130 study. In line with previous research,<sup>2</sup> an additional question was included asking  
131 participants to self-classify as either currently 'dieting to lose weight', 'watching what I eat  
132 so I don't gain weight', or 'not dieting'.

133 Perceived Self-Regulatory Success of Dieting Questionnaire (PSRS).<sup>14</sup> Three questions  
134 asked participants how successful they have been in watching their weight, in losing extra  
135 weight, and how difficult they have found it to stay in shape. These were rated on 7-point  
136 scales. Psychometrically the scale has discriminant validity and internal consistency of 0.73  
137 in the present study.

138 The Depression Anxiety and Stress Scale (DASS).<sup>15</sup> This 21 item self-report measure of  
139 anxiety, stress and depression with a 4-point response format has been widely used in  
140 obese and dieting populations. This short form is a robust measure of depression and  
141 anxiety with a clear factor structure in both clinical and community samples. Present study  
142 internal consistency was 0.91 for depression and 0.76 for anxiety.

143

#### 144 Procedure

145 Participants were recruited through the SW members-only website. A link to the first online  
146 survey (Time 1) was embedded in an advertisement made available on the website for a  
147 period of fifteen days. The second page of the online survey concerned participant  
148 understanding and consent, and included the statement, "By clicking on 'Continue' I agree  
149 to take part in the research project". The last page allowed participants to provide their

150 email address if they consented to completing the survey at Time 2. The survey web-link  
151 remained live for four weeks.

152

153 Seven weeks after the first survey was launched, participants who had provided contact  
154 information were sent an email containing a web-link to the second online survey.

155 Provision of the link by email was in order to ensure that only those participants completing  
156 the first survey provided data. A reminder email was sent out a week after the first  
157 invitation.

158

159 Body weight data were obtained by providing SW with the membership numbers of  
160 participants who completed the first survey. SW members use smart cards that upload and  
161 store weight data measured at group meetings onto a centralised system. Membership  
162 numbers were cross-referenced by the company and data from each participant's smart  
163 card were returned. These included postcode, membership start date, and body weight  
164 data held for participants at the time of joining the programme, at the start of the study, and  
165 weekly weight data thereafter.

166

167 Data analysis

168 Data were analysed using IBM SPSS (v.20). Responses retrieved from the survey were  
169 checked against stored information (date of birth, membership number, gender) to verify  
170 respondents and remove duplicates. Respondents were excluded if they did not have  
171 weight data within 3 weeks of survey completion or failed to complete the survey  
172 assessments. All variables were examined using histograms, estimations of skewness,  
173 kurtosis and the Kolmogorov-Smirnov test to check for accuracy of data, missing values,  
174 and fit between variable distributions and the assumptions of multivariate analysis. Results

175 were checked and considered not to violate the assumptions of normality. Dieting status  
176 self-classification (dieting to lose weight, watching, not dieting) was used to define current  
177 dieting group and ANOVA and MANOVA were used to examine differences between dieting  
178 groups at Time 1, without and with BMI, gender, and age as covariates. Student–Neuman–  
179 Keuls post hoc tests compared mean differences. Repeated measures MANOVA  
180 examined craving experiences over time. Linear regression analyses examined whether  
181 baseline craving features predicted changes in weight across the period of study, and  
182 whether change in craving ratings across the study period were associated with change in  
183 weight across the study period.

184

## 185 **RESULTS**

186 There were group differences in BMI on starting the programme and in weight loss over the  
187 period from when they first joined (Table 1). Those watching their weight (35% of sample)  
188 had a lower BMI on joining ( $F(2, 2926) = 24.83, p < .001$ ). Current dieters and watchers lost  
189 more weight than those self-classified as currently not dieting ( $F(2, 2926) = 20.91, p < .001$ ).  
190 Those currently dieting to lose weight (55% of sample) had a shorter organisation  
191 membership duration than the other groups

192 - Table 1 near here –

193

194 The 3 groups differed in dietary restraint and in perceived success of dieting ( $F(2, 2924) =$   
195  $109.8, p < .001$ ;  $364.03, p < .001$ , respectively). Post hoc analysis showed those currently  
196 dieting for weight loss scored higher than those watching their weight. The groups also  
197 differed in their reported levels of depression and anxiety at Time 1 ( $F(2, 2924) = 98.87,$   
198  $p < .001$ ;  $34.44, p < .001$ ), such that those engaged in active weight management reported  
199 lower levels of mood problems than those currently not dieting.

200

201 Food craving at baseline (Time 1)

202 There was a significant main effect of dieting group on the ratings of food craving  
203 experiences in the craving control factor ( $F(10, 5838)=50.83, p<.001$ ), with univariate tests  
204 showing significant differences on all five ratings (smallest univariate  $F(2, 2922)=35.79,$   
205  $p<.001$ , Table 2). Post hoc analysis showed groups to fall into three distinct homogenous  
206 subsets on all five items. The currently dieting group reported significantly fewer, less  
207 intense, and more easily controlled craving experiences. This was reflected in the foods  
208 craved. A main effect of group on the type of food craved ( $F(12, 5836)=9.17, p<.001$ )  
209 reflected differences in the frequency of cravings for chocolate, other sweet, starchy, and  
210 savoury food groups ( $F(2, 2922)=23.43, p<.001$ ;  $30.93, p<.001$ ;  $11.93, p<.001$ ; and  $15.59,$   
211  $p<.001$ , respectively), but not dairy or fruit/fruit juices. Post hoc analysis showed that the  
212 three dieting groups formed distinct subsets such that the dieting to lose weight group  
213 experienced fewest cravings for these foods.

214 - Table 2 near here -

215

216 There was a main effect of group on rated appetite ( $F(8, 5840)=15.84, p<.001$ ) that was  
217 apparent on all measures (smallest univariate  $F(2, 2922)=7.19, p=.001$ ). Those in active  
218 weight management differed from those not dieting on all ratings with the exception of  
219 desire to eat sweet foods on which all 3 groups differed. Ratings of mood differed  
220 significantly between groups ( $F(8, 5800)=7.51, p<.001$ ), with univariate analyses finding  
221 significant differences on reported happiness, and how alert and content participants felt at  
222 Time 1 ( $F(2,2902)=12.08, p<.001$ ;  $19.35, p<.001$ ; and  $21.47, p<.001$ , respectively). Post  
223 hoc analysis revealed two subsets, with the weight management groups reporting a  
224 consistently more positive mood state than those in the not dieting group. None of the

225 differences in food craving experience were removed by including BMI, gender, and age as  
226 covariates.

227

### 228 Changes over time

229 Participants who completed the second survey did not differ from non-completers in Time 1  
230 BMI, frequency of cravings, or psychological well-being. They were slightly older than  
231 those not included ( $M=44.9$  vs  $42.1$ ,  $t(2930)=6.02$ ,  $p<.001$ ). Participants weighed  $84.9$  kg at  
232 Time 1 and  $82.9$  kg at Time 2, amounting to a mean weight loss of  $2.0$  kg over the 7-week  
233 period ( $t(1223)=26.1$ ,  $p<.001$ ) or reduction in BMI of  $0.74$  kg/m<sup>2</sup>.

234

235 There was a significant change in participants' experience of craving control over these 7  
236 weeks ( $F(5, 1219)=27.72$ ,  $p<.001$ ). Food cravings were rated as less frequent, intense,  
237 easier to resist and control, and less likely to lead to eating in response (Table 3). Craving  
238 for savoury decreased ( $F(4, 1220)=4.54$ ,  $p=.001$ ), with significant reductions in reported  
239 cravings for savoury and starchy foods. Likewise, craving for sweet decreased ( $F(4,$   
240  $1220)=19.24$ ,  $p<.001$ ). Desire to eat sweet foods reduced as did cravings for chocolate and  
241 other sweet foods. Mood improved ( $F(4, 1220)=3.93$ ,  $p=.004$ ); participants rated  
242 themselves more content and less anxious in the context of food craving at Time 2.  
243 Changes were also observed in dietary restraint, perceived success of dieting and  
244 psychological wellbeing ( $F(5, 1217)=9.81$ ,  $p<.001$ ), with dietary restraint and perceived  
245 success of dieting reducing modestly ( $p<.04$  and  $<.03$  respectively), and a decrease in  
246 DASS assessed depression ( $p<.001$ ) but not anxiety.

247

- Table 3 near here -

248

249 Relationship between food craving experiences and weight loss

250 Of the craving items significantly correlated with weight change, baseline scores on the item  
251 'How often have you eaten in response to food cravings' had a significant negative  
252 association with weight change in the regression analyses ( $t= 6.13, p<.001$ ). Participant  
253 age, baseline BMI, and baseline anxiety were also significantly related to weight change  
254 over the study period. The regression model explained 13.2% of the variance in weight  
255 change across the study period ( $F(4,1218)=46.33, p<.001$ ; Table 4). Examination of  
256 regression coefficients indicated that a higher BMI, lower anxiety, and being younger was  
257 predictive of losing more weight during the study period. After adjusting for the contribution  
258 of baseline BMI, anxiety, and age, the frequency in which a person ate in response to food  
259 cravings explained 7.1% of the variance in overall weight change. Participants who less  
260 frequently ate in response to food cravings at Time 1 showed greater weight loss over the  
261 next 7 weeks.

262 - Table 4 near here -

263  
264 Of the significant correlations between changes in craving experience and weight change,  
265 one item was significantly related to weight change in the regression model (Generally, how  
266 difficult has it been to control your eating;  $t= 2.78, p=.005$ ). Results showed that, after  
267 controlling for baseline BMI and age, changes in weight across the study period were  
268 accompanied by changes in craving experience, such that those who lost more weight also  
269 reported a decrease in difficulty in eating control ( $\beta=.119, t=4.24, p<.001$ ). The model was  
270 statistically significant ( $F(3, 1227)=22.00, p<.001$ ) and explained 4.9% of the variance in  
271 weight change.

272

273 **DISCUSSION**

274 The study aim was to investigate the frequency and nature of food craving in a sample of  
275 people who were overweight or with obesity and actively engaged in weight management.  
276 The study outcome provided two perspectives on the relationship between weight  
277 management (or dieting) and food cravings; cross-sectional associations at baseline, and  
278 longitudinal associations. As hypothesised, individuals who self-classified as dieting to lose  
279 weight reported fewer and less intense craving experiences than those 'watching' their  
280 weight. In addition, food cravings decreased over a period of weight loss. This weight loss  
281 was unrelated to the frequency, intensity, or specificity of food cravings, but was related to  
282 participant's behaviour in response to cravings. Specifically, those whose recent  
283 experience was of being less likely to eat in response to food cravings lost more weight  
284 over the next 7 weeks; conversely, those who did eat in response to food cravings gained  
285 more weight. In line with this, feeling in control of eating during this 7-week period was also  
286 associated with greater weight loss.

287

288 The food craving experience of dieters differed from that of those 'watching' what they ate  
289 so as not to gain weight. Those currently dieting to lose weight scored lower on all  
290 measures of craving features and had fewer cravings for chocolate and other sweet foods,  
291 consistent with their lower ratings of desire to eat sweet foods. These findings are in  
292 contrast to the observation of higher craving frequency and intensity in dieters compared  
293 with 'watchers' by Massey & Hill.<sup>2</sup> Several differences between the studies are of note,  
294 including a much smaller sample size and the critical incident methodology used. Most  
295 importantly perhaps, in the study by Massey & Hill<sup>2</sup> the group of women watching their  
296 weight were of healthy weight and those currently dieting were overweight. In other words,  
297 the groups differed in weight and were of much lower BMI than the present sample (with a  
298 likely different weight management history). Those self-classified as dieting to lose weight

299 in this study scored higher in dietary restraint and perceived success in dieting, had a  
300 higher current BMI, and had been programme members for a shorter period. This  
301 consistency across measures confirms the meaningfulness of the distinction from  
302 'watchers'. It is not clear how this relates to other characterisations of dieting e.g., flexible  
303 vs rigid.<sup>16</sup> But it does have affinity with the distinction between current dieting, past  
304 frequency of dieting, and current weight suppression by Witt et al.<sup>17</sup> What is clear is that  
305 future research of food cravings in people with obesity should consider more elaborated  
306 conceptualizations of dieting or weight control.

307

308 The lower frequency and intensity of food cravings observed here contrast with studies that  
309 have imposed deprivation of a specific food such as chocolate.<sup>18,19</sup> Denial of access tends  
310 to be for a period of a few days and cravings (or wanting and liking) for the restricted food  
311 increase. While these studies do not focus on people with obesity engaged in weight  
312 management, recognising the differences in methodology, characterization of dieting, and  
313 participant characteristics may help to resolve some of the contradictions in the dieting and  
314 food craving literature referred to earlier.

315

316 It would be reasonable to expect that all members of a commercial (i.e., fee-paying) weight  
317 management programme would be currently engaged in dieting to lose weight. Indeed,  
318 some 90% of survey participants were either dieting or 'watching'. The 10% of participants  
319 who reported not dieting scored lower in dietary restraint and perceived success in dieting,  
320 assessments that were congruent with their self-classification. This group included no  
321 greater proportion of participants who had achieved their target weight (and so eligible for  
322 free membership while they maintained this) than those currently engaged in weight  
323 management. Their more frequent, intense, and consummated food cravings occurred

324 against a background of greater appetite, lower mood, and symptoms of depression and  
325 anxiety. This pattern of affect and eating in a group with a mean BMI of 33 kg/m<sup>2</sup> suggests  
326 the need for additional assistance in their attempts at weight management.

327

328 The longitudinal analysis adds to the emerging evidence from weight management trials.<sup>6-9</sup>  
329 There is consistency in showing a decrease in food craving frequency over time. By  
330 considering other features of craving, in particular the behavioural consequences of food  
331 craving, this study adds importantly to what is known about the relationship with weight  
332 change. So, recent experience of resisting eating in response to a craving was predictive of  
333 future weight loss and feeling in control of eating was predictive of weight loss over the  
334 period of weight change. This not only makes intuitive sense, it reinforces the value of the  
335 food craving assessment used, the control of eating questionnaire (CoEQ). This measure  
336 derives from the food craving record.<sup>20</sup> It is directed at the phenomenology of the food  
337 craving experience and so differs from other established measures such as the food  
338 craving inventory<sup>21</sup> and the state and trait food craving questionnaires.<sup>22</sup> Using the  
339 individual scales of the CoEQ<sup>8</sup> rather than the factorial structure<sup>11</sup> allowed us to document  
340 the distinction between craving frequency/intensity and the behavioural consequences of  
341 craving.

342

343 Additional study strengths were the nature of the study sample (people with obesity  
344 engaged in weight management) and the number of participants who returned the survey.  
345 Body weight was measured rather than self-reported and we applied strict rules to match  
346 the timing of survey completion to being weighed. Being an account of what happens  
347 during a commercial weight loss programme, the study findings should be generalizable to  
348 large sections of the population. However, there are limitations to generalizability.

349 Although the number of participants was large this represented only a proportion of the  
350 overall programme membership. All had to have computer or smartphone access to  
351 complete the online survey. While information on membership duration, weight loss, and  
352 deprivation confirm that the sample were representative of programme membership (and  
353 deprivation in England) the findings may not describe non-UK populations. The loss of  
354 participants to follow-up is also a weakness.

355

356 The majority of participants had been members of the weight loss programme for some  
357 time before joining the study. It would therefore be interesting to track the trajectory of food  
358 craving experience from the start of an intervention in a future study. This is reinforced by  
359 the suggestion that early success in managing food cravings and feeling in control of eating  
360 is an indicator of better long-term weight loss.<sup>8</sup> In turn, this suggests that for those  
361 struggling early with food cravings there is need for additional early intervention. In terms of  
362 practical implications then food cravings should be expected and planned for during weight  
363 management. Food cravings are experienced 12 months and more after bariatric surgery  
364 although no more frequently than in others who are overweight.<sup>23</sup> But group means hide  
365 considerable individual variation in the frequency of food cravings. This is pertinent to  
366 those who have problems with binge eating and for whom food cravings may trigger binge  
367 episodes.<sup>24,25</sup>

368

369 In conclusion, these findings suggest that it is the behaviour that follows the food craving  
370 and the attendant feeling of control over eating that is related to successful weight  
371 management. There are several possibilities proposed for managing food cravings,  
372 including targeting the intensity of the mental imagery experience<sup>26</sup> or assisting the  
373 cognitive management of craving through reappraisal or mindfulness.<sup>27,28</sup> It is almost

374 inevitable that these will be differently effective for different people. What is currently  
375 lacking is strong evidence for managing food cravings in people with obesity and who are in  
376 weight management. It remains to be seen whether these interventions should include  
377 strategies to manage the behavioural consequences of craving alongside those directed at  
378 moderating the intensity of food craving.

379

380

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385 approved the final version.

386

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388 authors declare no other conflict of interest.

389

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- 459

460 Table 1. Participant characteristics and baseline psychological measures (means  $\pm$ SE)

	Dieting (N=1603)	Watching (N=1033)	Not dieting (N=296)	All (N=2932)
Age (yrs)	43.0 (0.30)	43.6 (0.4)	43.4 (0.7)	43.3 (0.2)
Membership duration (weeks)	33.0 (1.2) <sup>a</sup>	47.6 (2.0) <sup>b</sup>	42.7 (3.2) <sup>b</sup>	39.0 (1.0)
BMI on joining programme (kg/m <sup>2</sup> )	35.8 (0.2) <sup>a</sup>	33.7 (0.2) <sup>b</sup>	35.4 (0.4) <sup>a</sup>	35.0 (0.1)
Weight loss up to study start (kg)	9.6 (0.2) <sup>a</sup>	10.2 (0.3) <sup>a</sup>	6.3 (0.5) <sup>b</sup>	9.5 (0.2)
BMI at first survey (Time 1; kg/m <sup>2</sup> )	32.3 (0.2) <sup>a</sup>	30.0 (0.2) <sup>b</sup>	33.1 (0.4) <sup>c</sup>	31.6 (0.1)
Dietary restraint	13.3 (0.1) <sup>a</sup>	12.5 (0.1) <sup>b</sup>	10.6 (0.2) <sup>c</sup>	12.7 (0.1)
Perceived success in dieting	18.8 (0.1) <sup>a</sup>	16.8 (0.2) <sup>b</sup>	10.6 (0.3) <sup>c</sup>	17.3 (0.1)
Depression	6.8 (0.2) <sup>a</sup>	7.5 (0.3) <sup>a</sup>	14.4 (0.6) <sup>b</sup>	7.8 (0.2)
Anxiety	3.8 (0.1) <sup>a</sup>	4.1 (0.2) <sup>a</sup>	6.7 (0.4) <sup>b</sup>	4.2 (0.1)

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463 Means with different superscripts are significantly different to each other ( $p < .05$ )

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465 Table 2. Baseline ratings of food craving characteristics from the Control of Eating  
 466 Questionnaire (means  $\pm$ SE)

	Dieting (N=1603)	Watching (N=1033)	Not Dieting (N=296)	All (N=2932)
<u>Craving control</u>				
Food craving frequency	5.20 (0.06) <sup>a</sup>	5.60 (0.08) <sup>b</sup>	6.92 (0.13) <sup>c</sup>	5.52 (0.05)
Food craving strength	5.90 (0.06) <sup>a</sup>	6.34 (0.08) <sup>b</sup>	7.56 (0.12) <sup>c</sup>	6.22 (0.05)
Difficulty in resisting food cravings	5.72 (0.07) <sup>a</sup>	6.45 (0.09) <sup>b</sup>	7.98 (0.12) <sup>c</sup>	6.20 (0.05)
Frequency of eating in response to cravings	3.67 (0.07) <sup>a</sup>	5.12 (0.09) <sup>b</sup>	7.54 (0.14) <sup>c</sup>	4.57 (0.06)
Difficulty in controlling eating	4.40 (0.06) <sup>a</sup>	5.21 (0.08) <sup>b</sup>	7.82 (0.12) <sup>c</sup>	5.04 (0.05)
<u>Craving for savoury</u>				
Desire to eat savoury foods	5.12 (0.07) <sup>a</sup>	5.07 (0.09) <sup>a</sup>	6.10 (0.17) <sup>b</sup>	5.20 (0.05)
Savoury foods	3.79 (0.08) <sup>a</sup>	3.80 (0.10) <sup>a</sup>	5.18 (0.20) <sup>b</sup>	3.93 (0.06)
Starchy foods	3.68 (0.08) <sup>a</sup>	3.67 (0.10) <sup>a</sup>	4.87 (0.19) <sup>b</sup>	3.80 (0.06)
Dairy	2.98 (0.08)	2.99 (0.09)	3.06 (0.17)	3.00 (0.06)
<u>Craving for sweet</u>				
Desire to eat sweet foods	5.95 (0.07) <sup>a</sup>	6.53 (0.09) <sup>b</sup>	7.75 (0.14) <sup>c</sup>	6.33 (0.05)
Chocolate	5.05 (0.09) <sup>a</sup>	5.70 (0.11) <sup>b</sup>	6.92 (0.18) <sup>c</sup>	5.47 (0.06)
Other sweet foods	5.07 (0.08) <sup>a</sup>	5.78 (0.11) <sup>b</sup>	7.08 (0.18) <sup>c</sup>	5.53 (0.06)
Fruit/fruit juice	2.14 (0.07)	2.13 (0.09)	2.04 (0.15)	2.20 (0.05)

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469 Means with different superscripts are significantly different to each other ( $p < .05$ )

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Table 3. Changes in food craving characteristics over time (N=1224; means  $\pm$ SE)

	Baseline	7 weeks	Univariate F (1,1223)	p
<u>Craving control</u>				
Food craving frequency	5.42 (0.07)	4.83 (0.08)	53.15	<.001
Food craving strength	6.19 (0.07)	5.31 (0.08)	112.44	<.001
Difficulty in resisting food cravings	6.13 (0.08)	5.43 (0.09)	52.53	<.001
Frequency of eating in response to cravings	4.49 (0.09)	4.28 (0.09)	4.74	.030
Difficulty in controlling eating	4.88 (0.08)	4.70 (0.08)	4.10	.043
<u>Craving for savoury</u>				
Desire to eat savoury foods	5.05 (0.08)	4.80 (0.08)	8.52	.004
Savoury foods	3.67 (0.09)	3.41 (0.09)	8.17	.004
Starchy foods	3.68 (0.09)	3.36 (0.09)	11.45	.001
Dairy	3.11 (0.09)	2.96 (0.08)	3.02	.082
<u>Craving for sweet</u>				
Desire to eat sweet foods	6.18 (0.08)	5.65 (0.08)	43.95	<.001
Chocolate	5.42 (0.10)	4.71 (0.10)	62.01	<.001
Other sweet foods	4.43 (0.10)	4.09 (0.09)	13.66	<.001
Fruit/fruit juices	2.25 (0.08)	2.41 (0.08)	3.93	.075
<u>Positive mood</u>				
Happiness	6.65 (0.06)	6.78 (0.07)	3.69	.055
Anxiety	3.85 (0.08)	3.64 (0.08)	5.67	.017
Alertness	6.45 (0.06)	6.61 (0.06)	5.37	.021
Contentment	6.41 (0.06)	6.62 (0.07)	12.18	.001

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474 Table 4. Association between baseline eating in response to food cravings and weight  
 475 change over the study period

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Regression Model <sup>a</sup>	$\beta$	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	F change	sig F change
1	--	.219	.048	.046	30.61	<.001
2	--	.247	.061	.059	17.01	<.001
3	-.247	.363	.132	.129	99.90	<.001

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478 <sup>a</sup> Using participants' behavioural response to cravings at baseline (Time 1) to explain  
 479 variance in weight change after adjusting for baseline BMI, age and baseline anxiety; 1  
 480 (baseline BMI & age), 2 (baseline anxiety), 3 ('how often eaten in response to food  
 481 cravings')

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