Abstract

Despite the proposal that biased perceptions of food may be contributing to disordered eating, investigations of the link between disordered eating and perceptions of foods' 'healthiness/unhealthiness' are scarce. The present studies (*N* Study 1 = 371; *N* Study 2 = 298) explored this link in a community sample by exploring cognitive biases previously associated with disordered eating; namely, dichotomous thinking, negative evaluations of foods, and biases in knowledge. In Study 1, participants rated foods from extremely unhealthy to extremely healthy. In Study 2, participants completed a nutrition knowledge questionnaire assessing knowledge of the 'healthiness/unhealthiness' of foods. Findings from Study 1 indicated that disordered eating was associated with an increased appraisal of foods as unhealthy, but not with dichotomous thinking applied to evaluations of foods' healthiness. Findings from Study 2 revealed no association between disordered eating and knowledge of foods' healthiness. Overall, our findings suggest that disordered eating is associated with increased evaluations of foods as unhealthy despite intact knowledge of foods' nutritional content and their effects on health, and that the construct of dichotomous thinking is not sufficient for the understanding of maladaptive perceptions of foods' healthiness in disordered eating. If replicated in clinical samples, our findings highlight the need for clinical interventions, including those targeting nutritional education, to focus on deconstructing negative views of foods as unhealthy.

Keywords: Disordered Eating, Cognitive Biases, Nutritional Knowledge, Dichotomous Thinking, Eating Disorders

Public Significance Statement

This study suggests that disordered eating in the community is associated with negative views of foods as unhealthy, despite intact knowledge of foods' nutritional content and the effects of foods and nutrients on health. This may be problematic because negative views of foods

may be used to sustain dietary efforts, behaviors aimed at compensating caloric intake (e.g., purging), or binge eating.

Introduction

Eating disorders (EDs) are complex medical and psychiatric conditions, with high morbidity and mortality rates (Vos & Mathers, 2000). While several risk and maintenance factors have been identified, their ability to improve prognosis and recovery has been limited (Turner et al., 2015). A concerning trend is the high prevalence of subthreshold and partial EDs in the community (Wade et al., 2012), rendering disordered eating in the general population a topic of increasing research interest (Hilbert et al., 2014). Moreover, it has been suggested that EDs and disordered eating may exist along a continuum (Neumark-Stzeiner et al., 2006) and that investigations of disordered eating in community samples may improve our understanding of underlying psychopathology, while also providing valuable knowledge for the early targeting of such conditions (Machado et al., 2013).

Particular cognitive styles and attitudes have been identified as predisposing and maintaining factors in EDs (Williamson et al., 1999). For example, maladaptive schemas associated with weight and shape are thought to trigger extreme concerns about dieting and eating, in turn influencing eating behaviour (Vitousek & Hollon, 1990). Different types of cognitive bias have also been found in relation to food-related stimuli (Williamson et al., 1999), and have been linked to the development and maintenance of eating disorders – for example, selective attention towards foods is seen as maintaining preoccupations around body shape/size (Fairburn et al., 1997; Fairburn et al., 1998), while misinterpretations of food intake as overeating are thought to lead to purging behaviours (Wiliamson et al., 1999).

Given the increasing emphasis placed on the healthiness or unhealthiness of foods in our societies (Petrescu et al., 2019), particularly salient may be biases related to such food properties. In support of this, research found that individuals with EDs avoid 'fattening' foods (Lethbridge et al., 2011), that non-clinical groups assign high significance to 'harmful'

nutrients (Gomez, 2013) and that anorexia patients rate foods as more 'unhealthy' or less 'healthy' compared to healthy individuals (Foerde et al., 2015; Steinglass et al., 2015).

The perception of food in polar opposites of 'good/bad' or 'acceptable/ unacceptable' - namely, dichotomous thinking - is one form of cognitive bias that has been repeatedly associated with EDs (Fairburn et al., 2003). However, it remains unclear whether dichotomous thinking is also applied to evaluations of foods as healthy/unhealthy, and if so, whether this is associated with disordered eating. Furthermore, we are yet to know whether disordered eating in the community is associated with a negative bias towards food perceived as more unhealthy, similarly to what observed in patients (Foerde et al., 2015).

Biases in nutritional knowledge have also been reported among individuals with EDs, who may possess particular knowledge in order to maximize their dieting efforts (Soh et al., 2009). Whilst one study has not evidenced greater nutritional knowledge within sub-clinical ED populations (Breen & Espelage, 2004), others have found that, in cases where greater knowledge is present, it is focused on specific topics that sustain the eating disorder, such as the energy content of foods, macronutrients, and roughage (Laessle et al., 1988). As such, nutritional knowledge may be skewed towards dysfunctional beliefs, which in turn maintain the disorder (Laessle et al., 1998). However, to date, no study has investigated the association between disordered eating and knowledge of the effects of foods and their nutrients on health in a community sample. It would therefore be critical to explore whether those with disordered eating displayed increased such knowledge, as the latter may be used to sustain forms of disordered eating (Breen & Espelage, 2004).

With an attempt to understand the relationship between cognitive biases towards a specific property of foods, namely their healthiness/unhealthiness, and disordered eating in the general population, we hypothesised that those exhibiting higher disordered eating would show: i) a negative bias towards food perceived as more unhealthy, as evidenced by both

increased and more extreme categorisation of food as unhealthy (Study 1); *ii)* increased dichotomous thinking within ratings of healthiness and unhealthiness of foods (Study 1); and *iii)* increased knowledge of the effects of foods and their nutrients on health (Study 2).

Study 1

Methods

Participants

Participants (N = 371) were recruited through social media, email, face-to-face, and a software (www.sona-systems.com) limited to internal undergraduate and postgraduate psychology students. Eligibility criteria included: age above eighteen, and no medical condition directly impacting eating behaviour or requiring medical nutrition therapy.

Participants were invited to take part in a study on the role of attitudes and beliefs in eating behaviour, they were informed they would be asked to rate images of food and answer questions about themselves and their eating habits. Participation was entirely voluntary and no compensation was offered.

Sample Size

An a-priori sample size calculation was conducted using G*Power3 (Faul et al., 2007). With an alpha level of 0.05 and power of 0.80, the sample size required for a minimal effect size (d = 0.2) was 193 participants. The total number of participants recruited exceeded what required for the primary hypothesis in order to increase power for secondary and exploratory analyses.

Measures

Demographic questionnaire. A demographic questionnaire was used to gather general and eating-related information. BMI categories were computed on the basis of self-reported height and weight and classified according to recommendations by the World Health

Organisation (WHO, 2000). The eating-related questions included: *Are you currently on a diet?, Have you ever been on a diet for a minimum of two consecutive weeks?, Would you say that you are someone who struggles with eating?, and Have you ever been diagnosed with an eating disorder?* Dichotomous responses were provided (i.e. Yes/No).

Eating Disorder Examination Questionnaire (EDE-Q). The EDE-Q (Fairburn, 2008) is a 28-item self-report measure, regarded by both clinicians and researchers as the gold standard of ED assessment (Berg et al., 2012). It assesses eating disorder behaviour and related cognitions within the past 28 days and comprises four subscales: dietary restraint (DR), eating concern (EC), weight concern (WC), and shape concern (SC), each yielding a subscale score. A global score can be computed by averaging the four subscale scores.

The EDE-Q has been widely used in both clinical (e.g., Mond et al., 2008) and non-clinical samples (e.g., Bardone-Cone & Boyde, 2007), and has been shown to have high internal consistency (e.g., Peterson et al., 2007, [α = 0.90]), test-retest reliability (e.g., Rose et al., 2013, [r = 0.92]), and convergent validity (e.g., Reas et al., 2011, [r = 0.85]), as well as good discriminative validity (e.g., Aardoom et al., 2012, [AUC = 0.72]). In this study, the reliability of the EDE-Q was high (α = 0.94).

Please note that the EDE-Q is here used as a measure of self-reported disordered eating and attitudes – for readability purposes, we will use the shorter term 'disordered eating' throughout the manuscript.

Categorisation task. To investigate foods' evaluations along the healthiness dimension, participants were asked to rate food images using a 7-point Likert scale ranging from 'extremely unhealthy' to 'extremely healthy', with higher scores indicating higher healthiness (see Supplementary Information for task details).

Images were derived from the FRIDa dataset (Foroni et al., 2013; https://foodcast.sissa.it/neuroscience/), comprising 877 images representing different

categories of items (e.g., food, animals, scenes, objects, etc.). The dataset has been validated on a sample of healthy participants (Foroni et al., 2013), who rated the images on standard variables (i.e., valence, arousal, typicality, ambiguity, and familiarity of images), and on food-related variables for the food images (i.e., perceived caloric content, perceived distance from eatability, and perceived level of transformation). Images were matched for resolution, dimension, background, and visual size of items depicted.

For the purpose of the current study, 32 food images were selected, as this number was deemed to ensure sufficient stimuli variability, while limiting undesirable effects associated with lengthy task duration. Moreover, we selected images to represent an equal number of sweet and savoury foods (16 per category), while also including foods of ranging caloric content.

To investigate whether participants with higher disordered eating have a bias towards food, perceived as more unhealthy, we used the image ratings from the Categorisation Task to compute two main indexes: 1) the number of unhealthy responses, corresponding to the sum of 'slightly unhealthy', 'very unhealthy' and 'extremely unhealthy' responses (the same index was also computed for 'healthy' responses), and 2) the extremity of food ratings for 'unhealthy' responses, created by firstly recoding 'extremely unhealthy' as '3', 'very unhealthy' as '2', 'slightly unhealthy' as '1', and the remaining responses as '0', and secondly summing the scores and dividing them by the number of 'unhealthy' responses given by each participant (the latter was done to capture the extremity of 'unhealthy' ratings regardless of their frequency). To create a score that represented extremity of food ratings for 'healthy' responses, the same process was followed on 'healthy' responses given.

Given that dichotomous thinking reflects a tendency to evaluate stimuli in polar opposites, we expected to observe a correlation between disordered eating and the extremity of food ratings for both unhealthy and healthy responses.

Procedure

Participants accessed the information sheet, provided consent, completed the demographic sheet, the categorisation task and the EDE-Q, and were debriefed on an online survey platform called Qualtrics (Qualtrics, Provo, UT). The study was ethically approved by an internal committee.

Statistical Analyses

Statistical analyses were conducted using SPSS 24 (IBM Corp., 2016).

For primary outcome analyses, bivariate correlations were used to explore the relationships between continuous variables. For exploratory outcome analyses, bivariate correlations were used to explore the relationships between BMI and continuous variables. Independent-samples t-tests were used to explore differences in key variables between participants who self-reported dieting and those who did not.

Results

Demographic and Clinical Characteristics

Descriptive and frequency statistics representing demographic and clinical characteristics of the participants (N = 371) can be found in Table 1.

----------Table 1----------

Disordered eating and biases in the evaluation of foods' healthiness

Eighteen participants did not provide a rating for image 19 (i.e., Hazelnut) and 8 failed to provide their self-reported weight. There were no other missed values in any of the other measures. Given that the missing data in the Categorisation Task was confined to one image, and therefore not random, we decided to exclude such image from the analyses. Listwise deletion was applied to the remaining missing data (Allison, 2010).

On average, participants categorised images as 'healthy' (i.e., including 'slightly healthy', 'very healthy' and 'extremely healthy') 35.94% of the times (M = 11.14, SD = 3.09) and as 'unhealthy' (i.e., including 'slightly unhealthy', 'very unhealthy' and 'extremely unhealthy') 52.78% of the times (M = 16.36, SD = 3.93). There was a significant difference between the number of 'healthy' and 'unhealthy' responses, $t(370) = -15.64$, $p < .001$, d = 0.81, indicating that overall the sample gave more 'unhealthy' responses. See Supplementary Material for summary statistics on single response type per food image presented.

There was a positive correlation between the frequency of the 'unhealthy' ratings and the EDE-Q global score, $r(371) = .244$ $p < .001$, as well as all the EDE-Q subscales, DR: $r(371) = .191$, $p < .001$; EC: $r(371) = .160$, $p < .001$; WC: $r(371) = .230$, $p < .001$; SC: $r(371) = .258$, $p < .001$, suggesting that those with higher disordered eating provided more frequent ratings of food as 'unhealthy'. There also was a positive correlation between the extremity of the 'unhealthy' ratings and the EDE-Q global score, $r(371) = .225$; $p < .001$, as well as all the EDE-Q subscales, DR: $r(371) = .202$, $p < .001$; EC: $r(371) = .175$, $p < .001$; WC: $r(371) = .198$, $p < .001$; SC: $r(371) = .205$, $p < .001$, suggesting that those with higher disordered eating provided more extreme ratings of foods as 'unhealthy'.

To explore whether disordered eating correlated with dichotomous thinking we also investigated the relationship between the extremity of ratings for healthy responses and the EDE-Q global, $r(371) = -.039$, $p = .449$, and subscale scores, DR: $r(371) = .046$, $p = .379$; WC: $r(371) = -.069$, $p = .187$; EC: $r(371) = -.068$, $p = .191$; SC: $r(371) = -.057$, $p = .275$. We found no correlation between our measures of disordered eating and the extremity of ratings for healthy responses.

Exploratory Outcomes – BMI, dieting, and biased evaluation of foods' healthiness

Relationships with BMI. BMI did not significantly correlate with the extremity of ratings for healthy, $r(363) = -.049$, $p = .357$ or unhealthy responses, $r(363) = .015$, $p = .775$.

However, we observed a positive correlation between BMI and the frequency of unhealthy ratings, $r(363) = .147$, $p = .005$.

Relationships with dieting. Independent samples t-tests revealed a significant difference in the frequency of the 'unhealthy' ratings between current dieters ($M = 17.97$, $SD = 3.87$) and non-current dieters ($M = 16.01$, $SD = 3.86$), $t(369) = -3.81$, $p < .001$, $d = 0.51$, a significant difference in the extremity of the ratings for 'unhealthy' responses between current dieters ($M = 2.01$, $SD = .37$) and non-current dieters ($M = 1.82$, $SD = .37$), $t(369) = -3.81$, $p < .001$, $d = 0.51$, but no significant difference in the extremity of ratings for 'healthy' responses between current dieters and non-dieters, $t(369) = -.517$, $p = .605$.

Independent samples t-tests revealed a significant difference in the extremity of ratings for 'unhealthy' responses between lifetime dieters ($M = 1.9$, $SD = .38$) and non-dieters ($M = 1.8$, $SD = .37$), $t(369) = -2.583$, $p = .01$, $d = 0.27$, but not in the frequency of the 'unhealthy' ratings, $t(369) = -1.607$, $p = .109$. Furthermore, the two groups did not significantly differ in the extremity of ratings for 'healthy' responses, $t(369) = -2.583$, $p = .581$.

Study 2

Methods

Participants

Participants ($N = 298$) were recruited following the same strategy as Study 1.

Sample Size

The sample size strategy used in Study 1 was replicated in Study 2.

Measures

Demographic questionnaire. See description above.

Eating Disorder Examination Questionnaire (EDE-Q). See description above.

General Nutrition Knowledge Questionnaire-Revised (GNKQ-R). The GNKQ-R (Kliemann et al., 2016) is a measure of nutritional knowledge comprising of four scales assessing knowledge of experts' nutritional recommendations, foods nutrients, foods choices and the effects of foods on health. The measure has shown good internal and external reliability, good convergent validity, and adequate to good construct validity, each scale has shown good internal consistency and test–retest reliability (Kliemann et al., 2016). In the current study, we selected 6 items from Scale 2, focusing on the sources of nutrients in food, to obtain a measure of nutritional knowledge – this will here be named the 'Food Nutrients Scale'. The information contained in scale 4, focusing on the association between diet and health, was used to obtain a measure of participants' knowledge of the effects of foods and their nutrients on health. Further items were added following the nutrition guidelines from the World Health Organisation, UK Scientific Advisory Committee on Nutrition and British Nutrition Foundation – this will be named the 'Food Nutrients & Health Scale' (see Supplementary Materials for details).

Within the Food Nutrients Scale, participants were presented with 6 main questions regarding the nutritional content of food (e.g. '*Do you think these foods and drinks are typically high or low in added sugar?'*). Each question was followed by 4-7 food names and participants were required to dichotomously rate a total of 30 foods. A sum variable was computed for all correct responses, to gain a measure of nutritional knowledge.

Within the Food Nutrients & Health Scale, participants were presented with 24 nutritional statements and were required to respond dichotomously (true vs. false; e.g. *'Low intake of calcium may increase the risk of osteoporosis'*). Items were counterbalanced for correct response type and sentence format and were presented in a random order. A sum variable was computed for all correct responses, to reflect knowledge of the effects of foods on health.

Procedure

Procedure of Study 2 followed the same format of Study 1. However, instead of engaging with the categorisation task, participants completed the two scales adapted from the GNKQ-R. This study also received ethical approval from an internal ethical committee.

Statistical Methods

For primary analyses, bivariate correlations were used to explore the relationships between EDE-Q global score and nutritional knowledge outcomes.

For secondary outcome analyses, bivariate correlations were used to explore the relationships between BMI and nutritional knowledge outcomes. Independent-samples t-tests were used to explore differences in knowledge about foods' healthiness between participants who self-report dieting behaviour and those who do not.

Results

Demographic and Eating-Related Characteristics

Descriptive and frequency statistics representing demographic and clinical characteristics of the participants (N = 298) can be found in Table 2.

----------Table 2----------

Disordered eating, nutritional knowledge and knowledge regarding the effects of foods and their nutrients on health.

Three participants did not provide their self-reported weight, therefore BMI could not be calculated for them. There were no other missed values in any of the other measures. Listwide deletion was applied for the missing data when using the BMI variable (Allison, 2010).

EDE-Q global score was not significantly correlated with nutritional knowledge, as measured by correct responses on the Food Nutrients Scale, $r(298) = -.077$, $p = .185$,

suggesting that increased disordered eating does not correlate with increased nutritional knowledge in the general population.

When investigating accuracy of knowledge regarding foods' healthiness specifically, as indexed by the number of correct responses on the Food Nutrients & Health Scale, we found no correlation between the latter and the EDE-Q global scores, $r(298) = -.09$, $p = .120$, nor any of the EDE-Q subscales, DR: $r(298) = -.046$, $p = .425$; EC: $r(298) = -.088$, $p < .128$; WC: $r(298) = -.110$, $p < .058$; SC: $r(298) = -.067$, $p < .247$. These findings suggest that increased disordered eating does not correlate with increased knowledge of foods' healthiness.

Secondary Outcomes

BMI and nutritional knowledge. BMI was not significantly correlated with nutritional knowledge, $r(295) = .075$, $p = .199$ or with knowledge of foods' healthiness, $r(295) = -.047$, $p = 425$.

Dieting and nutritional knowledge. Independent samples t-tests did not detect any significant difference in nutritional knowledge between lifetime dieters ($M = 21.23$, $SD = 3.12$) and non-dieters ($M = 20.65$, $SD = 3.11$), $t(296) = 1.587$, $p = .114$, $d = .186$, or current dieters ($M = 21.42$, $SD = 3.06$) and non-current dieters ($M = 20.85$, $SD = 3.14$), $t(296) = 1.31$, $p = .191$, $d = .183$. Similarly, knowledge of foods' healthiness did not differ between lifetime dieters ($M = 17.56$, $SD = 3.13$) and non-dieters ($M = 17.65$, $SD = 2.86$), $t(296) = -.251$, $p = .802$, $d = .03$, or between current dieters ($M = 17.63$, $SD = 3.07$) and non-current dieters ($M = 17.59$, $SD = 3$), $t(269) = .099$, $p = .922$, $d = .0131$.

Discussion

Despite the proposal that biased perceptions of food are contributing to disordered eating in both clinical (Faunce, 2002; Brooks et al., 2011) and non-clinical groups

(Kakoschke et al., 2015), maladaptive perceptions of foods on the basis of their healthiness and/or unhealthiness are surprisingly understudied in relation to disordered eating. This area is nevertheless important, as biases in relation to this specific food property are likely to fuel disordered eating and dieting (Carels et al., 2007), especially in current societies, where healthiness and unhealthiness of foods and their nutrients is often overly emphasised (Petrescu et al., 2019). For example, people who believe foods are largely unhealthy may use this 'notion' as a guide for their dieting efforts, or compensatory behaviours, resulting in a very small range of foods that are considered acceptable (Steinglass et al., 2015). Similarly, excessive knowledge regarding the effects of foods on health may be instrumentally used to support restricting efforts and related behaviours (Breen & Espelage, 2004).

In two studies, we here investigated the relationship between disordered eating in the general population and subjective evaluations of foods as healthy/unhealthy (Study 1) and knowledge regarding the effects of foods and their nutrients on health (Study 2). The novelty of our research is threefold, as this is the first study investigating the relationship between disordered eating in a community sample and: i) a negative bias in the perception of foods as more unhealthy, ii) dichotomous thinking in relation to foods' healthiness, and iii) knowledge of the effects of foods on health.

In line with evidence that people affected by an ED tend to evaluate foods as more unhealthy/less healthy (e.g., Foerde et al., 2015), Study 1 indicated that those with higher disordered eating, as measured by the EDE-Q scales, rated foods as unhealthy more frequently and more extremely than those with lower disordered eating. This suggests the presence of a negative bias towards foods, perceived as more unhealthy, in those with higher disordered eating. Please note that we here differentiated between healthy and unhealthy responses and were therefore able to conclude that higher disordered eating is associated with more extreme ratings for unhealthy responses, as opposed to providing less extreme ratings

for healthy responses. Furthermore, in addition to previous literature, we here also provide a measure of frequency of unhealthy versus healthy responses, thus obtaining a more comprehensive picture of the nature of the bias exhibited by those with higher disordered eating.

Given the relevance assigned to the construct of dichotomous thinking in EDs (e.g., Cohen & Petrie, 2005; Lethbridge et al., 2011), we here set out to also investigate whether disordered eating in the general population was associated with dichotomous thinking applied to the healthiness of foods. Our findings did not support such relationship, in that we did not observe a relationship between disordered eating and the extremity of ratings for healthy responses – a pattern evident for both general and subscales scores of the EDE-Q. Taken together, these findings suggest that dichotomous thinking per se may not be sufficient for the understanding of the mechanisms implicated in biased perceptions of foods' healthiness in disordered eating. Instead, it is the tendency to appraise foods as more frequently and extremely unhealthy that seems to characterise disordered eating in the general population. This pattern was also found for participants who were currently dieting, or had dieted at some point in their life, suggesting that a negative bias towards foods increasingly rated as unhealthy may contribute to dieting behaviour.

Interventions aimed at addressing biased evaluations of foods in disordered eating would require an understanding of how such evaluations are made. However, it is hard to establish which strategy participants used to approach the Categorisation Task in our study. Dimensional views of categorisation (Brosch et al., 2010) would suggest that participants first categorised foods as healthy or unhealthy, and then provided more precise ratings within the chosen category. This approach would fit with the format of the task, as participants were explicitly asked to rate images on a continuum, ranging from extremely unhealthy to extremely healthy, thus considering all points of the scale. However, it may also be that those

with higher disordered eating assigned increased salience to the negative features of foods to the point of neglecting the positive ones. For example, evidence of selective attention towards negative features of foods in people with an eating disorder (Williamson, 1999) would suggest that those with higher disordered eating primarily focussed on the unhealthy side of the scale when engaging with the task. Future studies may seek to assess participants' approach to the task by engaging in either explicit or implicit investigations of participants' strategies used.

Regardless of which strategy participants used, it is important to emphasise that dichotomous thinking is defined as a cognitive distortion characterised by polar opposites, therefore only when viewing the world/events/stimuli in 'black and white' terms one can be said to be engaging in dichotomous thinking (Byrne et al., 2004; Rigoli & Martinelli, 2021). At such, our study does not support the notion that disordered eating in the general population is associated with dichotomous thinking applied to evaluations of foods along the healthiness dimension.

Our findings are not the first ones to cast doubt on the generalizability of the dichotomous thinking construct in relation to disordered eating. Indeed, there is mixed evidence regarding whether general dichotomous thinking, over and above eating-specific dichotomous thinking, is associated with disordered eating. For instance, while several studies found that general dichotomous thinking was predictive of dieting behaviour (Tiggemann, 2000) and weight regain (Byrne et al., 2004), other studies comparing general to eating-specific dichotomous thinking evidenced that only the latter was responsible for high levels of dietary restraint and weight regain (Palascha et al., 2015). Furthermore, eating-specific dichotomous thinking is usually investigated with the use of inventories that combine statements on different aspects of eating, dieting and foods – e.g., 'I think food is either good or bad', 'I view my attempts at dieting as either failures or successes', etc. (e.g., Byrne et al.,

2008). Future research should attempt to tease out which specific properties of foods are subject to dichotomous thinking, or negative appraisal, and how this relates to disordered eating, so as to aid the development of targeted interventions.

Contrary to our predictions, Study 2 found no correlation between disordered eating and knowledge of the effects of foods and their nutrients on health. The null relationship between disordered eating and knowledge of foods' effects on health mirrors previous research exploring general nutritional knowledge in sub-clinical ED groups (Breen & Espelage, 2004). Studies that had evidenced nutritional knowledge disparities between clinical and non-clinical groups had found increased knowledge of ED-relevant information that tend to maintain the EDs (e.g. calories and roughage in anorexia nervosa and bulimia nervosa; Laessle et al., 1988), as opposed to knowledge of food processing or medical nutritional issues (Soh et al., 2009). Taken together, these findings may indicate that knowledge of the effects of foods and their nutrients on health may not be a key factor contributing to disordered eating in either clinical or non-clinical populations.

Overall, the current study provides preliminary evidence of an association between disordered eating in the community and a negative appraisal of foods as unhealthy, despite intact knowledge of foods' nutrients and their effects on health. It is interesting to reflect on how such pattern may inform interventions tackling biased evaluations of foods in disordered eating. Current guidelines for EDs recommend the use of some form of nutrition intervention to correct nutritional deficiencies, improve nutrition status and challenge inaccurate beliefs about food (McMaster et al., 2021). However, it is unclear to what extent such beliefs derive from lack of or biased knowledge, as studies either report increased (e.g., Castillo et al., 2015) or equal knowledge between EDs groups and other groups (Ho et al., 2011). One possibility is that the bias does not lie in the knowledge held per se, but rather in how this is applied to foods evaluations and consequent food choices. People with an ED may

instrumentally use specific knowledge to sustain predetermined views about foods and their intake in their judgments. There is indeed evidence that in EDs, some properties (e.g., caloric or fat content) are deemed more salient than others (Ruiz-Prieto et al., 2013), thus it is possible that knowledge of these properties may prevail in determining how 'acceptable' a given food is. Some evidence is in line with what speculated here, in that EDs sufferers have been found to distort interpretations in line with their prior beliefs or concerns (Matheson et al., 2018). Overall, this pattern may suggest that nutrition education would need to focus on how knowledge is selectively used to uphold prior beliefs, and thus distort current food judgments and choices.

Our findings must be interpreted in light of some limitations. First, food stimuli used in Study 1 could not easily be categorised as healthy or unhealthy, preventing the investigation of our results in the context of the accuracy of such ratings (i.e., how much they reflect objective categorisation of foods as healthy/unhealthy). However, this limitation is difficult to overcome, in that each food is composed of multiple macro and micro nutrients, making it hard to establish which one should prevail in determining its overall healthiness (Paquette, 2005). Furthermore, it may be argued that no food is inherently healthy or unhealthy *tout court* and that it is the overall diet that can be considered healthy or unhealthy on the basis of how much the nutrition intake is varied, balanced and in line with one's needs (Grunert, 2006). More importantly, we believe this limitation does not undermine the relevance of our results, in that it is the subjective appraisal of foods as healthy/unhealthy that is relevant to disordered eating, regardless of whether this reflects a true or meaningful classification.

Second, we here exclusively focused on one property of foods, healthiness, whereas several others are known to influence eating related attitudes and behaviours (Paquette, 2005). Future studies could explore the relationship between disordered eating and subjective

evaluations of foods on the basis of other food features, such as fat content, caloric content, and nutritional value, etc. Furthermore, in Study 1 we grouped images in sweet and savoury, while also providing a varied range of caloric content - it would have been relevant to explore how perceived foods' healthiness varies on the basis of some of the foods' properties mentioned above and for each, to also distinguish between perceived and actual content. Likewise, future studies investigating the link between disordered eating and knowledge of foods' effects on health may wish to focus on how this knowledge may be related to specific food properties - in light of research evidencing particular nutritional knowledge within ED populations, this may be deemed critical (Beaumont et al., 1981).

Third, in Study 1, the sample gave more unhealthy responses overall, raising the possibility that the absence of a correlation between disordered eating and the extremity of healthy responses was due to diminished power, compared to the unhealthy counterpart. Although future studies may wish to address this point, we believe this is unlikely as the statistical value for the correlation between the EDE-Q and the extremity of ratings for healthy responses was extremely low and the associated p value was large, suggesting the two are not correlated.

Another important aspect concerns the way evaluations of foods are linked to eating behaviours – future studies should include more data on participants' eating behaviours in order to provide further support to the relevance of foods' healthiness evaluations in disordered eating. Of note is that the current study is relying on associations, which do not imply causation, hence the results are limited in how they may inform interventions. Furthermore, given the recruitment of a non-clinical community sample, the findings cannot directly translate into implications for clinical samples. Instead, our findings represent preliminary evidence of cognitive biases in relation to evaluation of foods' healthiness/unhealthiness, which may have been confounded in previous investigations.

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Table 1

Demographic and Clinical Characteristics of the Sample – Study 1

		N (%) or M (SD)
Age	18-24	247 (66.6)
	25-34	70 (18.9)
	35-44	28 (7.5)
	45-54	19 (5.1)
	55-64	5 (1.3)
	65-74	2 (0.5)
Biological Sex	Female	309 (83.3)
	Male	62 (16.7)
BMI (kg/m^2)		25.34 (7.67)
BMI Category	Underweight	29 (8)
	Healthy	187 (51.5)
	Overweight	95 (26.2)
	Obese	52 (14.3)
Current Dieting	Yes	67 (18.1)

	No	304 (81.9)
Lifetime Dieting	Yes	195 (52.6)
	No	176 (47.4)
Struggle with Eating	Yes	173 (46.6)
	No	198 (53.4)
Eating Disorder Diagnosis	Yes	13 (3.5)
	No	358 (96.5)
Disordered Eating (EDE-Q)	EDEQ-Global	1.59 (1.25)
	EDEQ-Restraint	1.60 (1.54)
	EDEQ-Shape Concern	2.09 (1.54)
	EDEQ-Weight Concern	1.78 (1.47)
	EDEQ-Eating Concern	0.90 (1.17)

		N (%) or M (SD)
Age		27.76 (10.71)
Biological Sex	Female	248 (83.2)
	Male	50 (16.8)
BMI (kg/m^2)		24.42 (5.34)
BMI Category	Underweight	15 (5.1)
	Healthy	171 (58)
	Overweight	79 (26.8)
	Obese	30 (10.2)

Table 2

Demographic and Clinical Characteristics of the the Sample – Study 2

Current Dieting	Yes	66 (22.1)
	No	232 (77.9)
Lifetime Dieting	Yes	168 (56.4)
	No	130 (43.6)
Struggle with Eating	Yes	138 (46.3)
	No	160 (53.7)
Eating Disorder Diagnosis	Yes	11 (3.7)
	No	287 (96.3)
Eating Disorder Psychopathology (EDE-Q)	EDEQ-Global	1.88 (1.35)
	EDEQ-Restraint	1.64 (1.50)
	EDEQ-Shape Concern	2.62 (1.77)
	EDEQ-Weight Concern	2.28 (1.71)
	EDEQ-Eating Concern	0.97 (1.25)