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**Citation:** Tapper, K. and Pothos, E. M. (2010). Development and validation of a Food Preoccupation Questionnaire. *Eating Behaviors*, 11(1), pp. 45-53. doi: 10.1016/j.eatbeh.2009.09.003

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## Development and Validation of a Food Preoccupation Questionnaire

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Word count: 6,033

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## Abstract

**Objective:** Existing food preoccupation questionnaires do not take account of food-related thoughts that have a positive emotional valence. We report on the development and validation of a questionnaire that provides independent assessments of thought frequency and emotional valence (positive, negative or neutral).

**Method:** In Study 1 questionnaire items were validated against a three-day diary measure with 40 males and females. In Study 2 the questionnaire was administered to 130 males and females alongside a range of other measures.

**Results:** The questionnaire showed good construct validity, internal reliability, and test-retest reliability. Dieters and females scored higher on frequency and negativity subscales. There was also a significant interaction between sex and diet status on thought frequency, with females showing a stronger relationship between the two.

**Discussion:** The questionnaire should be useful for exploring the cognitive impact of dieting and relationships between food preoccupation, food processing biases and overeating.

**Keywords:** food preoccupation; diet; sex differences; food schema; cognition, overeating

## Development and Validation of a Food Preoccupation Questionnaire

### 1. Introduction

Preoccupation with food is characteristic of those dieting to lose weight (Jones & Rogers, 2003; Rogers and Green, 1993; Warren & Cooper, 1998). It is important for several reasons. First, it is believed to impair performance on a range of cognitive tasks. Compared to non-dieters, dieters have been shown to display impaired performance on tests of reaction time, sustained attention and immediate free recall (Green, Elliman & Rogers, 1997; Green, Rogers, Elliman & Gattenby, 1994; Rogers & Green, 1993). Such differences appear to stem from psychological factors associated with being on a diet rather than any physiological effects (Green & Rogers, 1998; Green, Elliman & Rogers, 1995; Green et al., 2003). More recent work has confirmed that these impairments are specific to the central executive component of working memory and are at least in part mediated by preoccupation with food, body and diet-related thoughts (Green et al., 2003; Green, Elliman & Rogers, 1997; Green & Rogers, 1998; Jones & Rogers, 2003; Kemps & Tiggemann, 2005; Kemps, Tiggemann & Marshall, 2005; Shaw & Tiggemann, 2004; Vreugdenburg, Bryan & Kemps, 2003).

Second, preoccupation with food may correspond to knowledge structures (schemas) that bias information processing (Vitousek & Hollon, 1990). There is a large literature demonstrating the existence of processing biases among individuals with clinical conditions such as eating disorders and addictions (e.g. see Dobson & Dozois, 2004; Cox, Fadardi & Pothos, 2006). Such biases have been found for attentional, memory and learning processes as assessed by a range of different tasks including the

emotional Stroop task (e.g. see Dobson & Dozois, 2004; Cox, Fadardi & Pothos, 2006), the visual dot probe task (e.g., Shafran, Lee, Cooper, Palmer & Fairburn, 2007), recall and recognition tasks (e.g., Hermans, Pieters & Eelen, 1998) and Artificial Grammar Learning tasks (Pothos & Cox, 2002). Biases have also been found amongst restrained eaters (i.e. those attempting to limit their food intake; e.g., Boon, Vogelzang & Jansen, 2000; Israeli & Stewart, 2001; Tapper, Pothos, Fadardi & Ziori, 2008). Such biases are important since research suggests that they may contribute to and maintain relevant behaviours (e.g., Calitri, Pothos, Tapper, Brunstrom & Rogers, under review; Cox, Pothos & Hosier, 2007; Field & Eastwood, 2005). However, our understanding of the causal influences underlying these biases is still limited and a range of different explanations have been put forward (e.g. see Cox et al., 2006; Pothos & Tapper, 2009). One possibility is that they are influenced by the automatic activation of knowledge schemas. If preoccupation reflects these knowledge schemas we should find associations between food preoccupation and food-related processing biases.. Additionally, since research suggests that certain eating behaviours, such as going on a diet, can *lead* to preoccupation with food (Jones & Rogers, 2003; Rogers and Green, 1993; Warren & Cooper, 1998), dieting may result in escalating cycles of preoccupation, processing biases and restraint/overeating.

The aim of the present study was to develop and validate a questionnaire measure of food preoccupation. Although researchers have previously assessed preoccupation in studies of cognitive impairment, they have tended to employ measures such as body shape concern (Green et al., 2003; Green & Rogers, 1998). More recently Vreugdenburg et al., (2003) developed a questionnaire specifically designed to assess food

preoccupation. However, items in this questionnaire are more relevant to those dieting to lose weight (e.g., 'I am aware of the sugar and fat content in foods'), as opposed to eating behaviour in general. In addition, whilst items do assess frequency of thoughts about food (e.g., 'I spend most of the day thinking about food'), they do not examine thoughts about food that may have a positive emotional valence, such as looking forward to a meal or enjoying selecting foods from a menu.

Why might food-related thoughts with a positive emotional valence be important? First, it is likely that they are commonplace. Many foods have a high reward value and research suggests that a substantial proportion of individuals value food as a positive force in their life (Rozin, Fischler, Imada, Sarubin & Wrzesniewski, 1999). Thus when an individual gets a lot of pleasure from food, and is not concerned about diet or attempting to limit food intake, his/her thoughts about food may be more likely to be positively rather than negatively valenced. Given that levels of dieting and restraint are much lower in males compared to females, and that males are less likely to associate food with health concerns, and more likely to associate it with pleasure (Rozin et al., 1999), positive thoughts about food may be more common amongst men. Thus a measure that examines thoughts about food that are both positive and negative in affect may be appropriate for men as well as women.

Second, it is possible that positively valenced thoughts about food contribute to cognitive impairments, particularly if the individual has been exposed to food-related cues (e.g., feelings of hunger, food in the environment, a colleague asking about lunch). Indeed, recent research by Higgs (2007) showed that cognitive impairments displayed by restrained females who had been asked to imagine eating cake, were *not* due to

interference from diet-related thoughts. One possibility is that these impairments occurred as a result of thoughts about the food itself. Such an interpretation is consistent with predictions from the Elaborated Intrusion Theory of Desire (EITD; Kavanagh, Andrade & May, 2005). According to this theory, when intrusive thoughts about desires elicit powerful affective reactions these thoughts are elaborated upon. This elaboration consists of retrieval of target-related information that is then retained in working memory. This process is controlled by executive processes and thus competes with concurrent cognitive tasks. The fact that unrestrained females in Higgs' study did not show such cognitive impairments may be because they were also lower in food reactivity; because of societal pressures on western females to be slim (e.g., Cogan, Bhalla, Sefsdedeh & Rothblum, 1996), in the case of females reactivity to food cues is likely to be confounded with restraint. According to EITD most episodes of elaboration elicit negative emotional reactions because of a sense of deficit (i.e. the desired object is not present). However, whilst this may often be the case, we would argue that in some instances such elaboration may actually elicit positive affect, particularly if elaboration is anticipatory (such as planning a meal). This may be more likely where individuals are not attempting to limit their intake.

Third, thoughts about food that elicit positive affect are important since they may reflect schemas relating to the pleasurable, rewarding aspects of food. These may in turn bias food-related information processing and lead to overeating (or indeed binge eating episodes following periods of restraint). Given rising levels of obesity (World Health Organisation, 2003), the identification of variables that contribute to overeating could have important implications for the design of obesity-related interventions. As noted

above, to date most work in the area of food preoccupation has related to eating disorders and to weight and dieting concerns. Widening our definition of food preoccupation to include thoughts that elicit positive, as well as negative affect, may increase the generalisability and utility of schema and preoccupation-related theories and make important contributions to our understanding of overeating.

The following studies describe the development and validation of a Food Preoccupation Questionnaire designed to assess frequency of thoughts about food and whether these thoughts are associated with positive, negative or neutral affect. We assume these to be relatively stable traits. In Study 1 a number of questionnaire items are initially selected from a larger pool, based on results of factor analysis and validation against a three-day diary measure. In Study 2 the new questionnaire is administered to a larger group of participants, alongside a range of other measures. Subscales are further refined and assessed for reliability and construct validity.

## 2. Study 1

The aim of Study 1 was to develop a Food Preoccupation Questionnaire by selecting appropriate items from a larger pool. These were selected by examining the results of both factor analysis and the relationship of individual items to corresponding measures collected during a three-day 'thoughts diary'. Due to the labour intensive nature of the thoughts diary, the sample size for this preliminary study was relatively small.

### *2.1. Method*



### 2.1.1. Participants

Participants were 20 male and 20 female undergraduate students at Swansea University (18 to 37 years, mean = 24 years, SD = 3.53) who responded to an email request for volunteers (sent to all Swansea University undergraduate students). Participants were paid 25 pounds sterling at the end of the study (or 35 if they provided additional data for reliability analysis). Ethical approval was granted by the Swansea University Psychology Department Ethics Committee.

### 2.1.2. Measures and Materials

*Food Preoccupation Questionnaire.* The Food Preoccupation Questionnaire began with a series of 39 statements, generated by the authors, relating to thoughts about food. Of these, 10 were designed to assess thought frequency, and 29 to assess emotional valence of thoughts, which could be either positive (11 items), negative (11 items) or neutral (7 items; see Table 1 for examples). These were followed by 27 similar filler items relating to thoughts about work. Participants were asked to rate the extent to which they agreed or disagreed with each statement on a 5 point scale (*'completely disagree'*, *'disagree a bit'*, *'neither agree nor disagree'*, *'agree a bit'*, *'completely agree'*). Four items were reverse scored.

*Thoughts diary.* The thoughts diary included questions about work (or study) as well as food. Work was selected as it was relatively easy to define and likely to be highly familiar to all participants. These data were not analysed; the corresponding questions were simply included to help limit participant reactivity (see section 2.1.3). The diary was

designed to be completed over a three-day period (two weekdays and one weekend day) whenever a small alarm sounded (see below). The alarm was set to sound six times per day (i.e. 18 occasions in total). On each occasion participants were asked to indicate the time the alarm had sounded and the time of diary completion. They were then asked to complete two sections about their thoughts; Section 1 related to thoughts at the exact moment the alarm sounded and Section 2 to thoughts during the previous half hour. For Section 1 (the moment the alarm sounded) participants were asked to indicate what they had been thinking about by ticking one of three boxes labelled '*work*', '*food*' and '*other*'. They were then asked to rate, on a 5-point scale ('*not at all*', '*a little*', '*moderately*', '*quite a bit*', '*extremely*'), the extent to which their thoughts had been enjoyable and, separately, the extent to which they had been stressful. For Section 2 (thoughts during the previous half hour) participants were asked to rate the extent to which they had been thinking about work ('*not at all*', '*a little*', '*a fair amount*', '*a lot*', '*most of the time*') and the extent to which they had been thinking about food. As in Section 1, they were also asked to rate the extent to which these thoughts were enjoyable and stressful (with an additional option labelled '*not applicable*'). In the instructions at the start of the diary, food was defined as all foods but no drinks. Enjoyable was defined as '*pleasurable, exciting or satisfying*' and appropriate examples provided (e.g., got pleasure from thinking about a particular food, looked forward to your next meal). Stressful was defined as '*worrying, irritating or depressing*' and, again, appropriate examples provided (e.g., worried about what you were going to eat next, been unhappy about food you had already eaten). Thinking about food was explained as follows: '*Such thoughts may include deciding what to eat, thinking about a food you feel like eating, or thinking about a food*

*whilst you are actually eating. It is possible to eat or prepare food whilst thinking about other things. So if you have been eating or preparing food in the last half hour you should try to assess how much you have also been thinking about the food.'* Equivalent examples and explanations were provided for work.

*Alarms.* Alarms (*Invisible Clock II*, Time Now Corporation) measured 55 x 40 x 15 mm and came with small belt clips. They could be programmed to sound up to 12 times per day, but could not be programmed to sound at different times on different days. A small switch changed the alarm from a beep to a vibration. The beep sounded three times and the vibration lasted for 10 seconds. The display was set to show the current time.

### *2.1.3. Procedure*

To help limit participant reactivity the study was titled '*Daily thoughts about work and food*' and the purpose described as examining the relationship between the types of thoughts an individual has on a daily basis and a range of other measures. Participants attended an initial appointment when they completed the thoughts questionnaire and were given a diary, pen and alarm. Instructions on diary completion were provided verbally as well as being printed at the start of the diary.

Participants were asked to wear the alarm every day for three days between the hours of 9am and 10pm, to carry the diary and pen with them and complete the relevant section of the diary as soon as the alarm sounded. Where this was not possible (for example if driving or in a lecture), they were asked to make a mental note of their thoughts and complete the diary as soon as possible. Participants were shown how to

switch the alarm to a vibration for situations where noise was inappropriate and were told that it would go off six times per day.

Alarms were set to sound at 10.05am, 12.22pm, 2.56pm, 5.37pm, 7.03pm and 9.07pm. These times were selected to try to maximise the representativeness of data collected but also to avoid participants guessing, and anticipating, the time the alarm would be likely to sound. Half the participants were asked to complete diaries on a Thursday, Friday and Saturday and half were asked to complete them on a Sunday, Monday and Tuesday. To assess test-retest reliability for the diaries, 10 participants (5 males and 5 females) were asked to complete a second diary one week after the first. Following diary completion participants returned to the laboratory to complete a number of other measures not reported here.

## *2.2. Results and Discussion*

There were some missing diary data due to alarm malfunctions and participants failing to hear, or forgetting to wear, the alarm. Of the 40 participants, 16 returned data for 18 eating occasions (i.e. they had no missing data), 11 returned data for 17 occasions, 12 for 14 to 16 occasions and 1 person returned data for 10 occasions (the overall proportion of missing data was 10%). Across these 649 eating occasions, in 55% participants recorded details of their thoughts immediately, in 28% they recorded them within 5 minutes, and in 13% within 30 minutes. For the remaining 4% the maximum time lag was 222 minutes. Across participants the *mean* time lag between alarm and diary completion was 5.96 minutes (SD = 8.89, min = 0.00, max = 49.80).

For Section 1 of the diary (thoughts the moment the alarm sounded), the percentage of occasions each participant reported thinking about food was calculated. Across participants this showed a mean of 23% (SD = 14%). Where participants had reported thinking about food, mean ratings of stress and enjoyment were also calculated. Across participants mean ratings were 3.29 for enjoyment (SD = 0.79) and 1.72 for stress (SD = 0.95). However, some of these data showed poor test-retest reliability ( $r = .63$  for frequency,  $-.59$  for enjoy,  $.49$  for stress). Clearly, even within individuals there is variation in the emotional valence attached to thoughts about food, to the extent that a sample of, on average, four or five ‘thoughts’ is insufficient to be representative. Data from this section of the diary were therefore excluded from subsequent analyses.

For Section 2 of the diary (thoughts during the previous half hour), mean ratings for frequency of thoughts about food, extent to which these thoughts were enjoyable, and extent to which they were stressful were calculated for each participant. Across participants the corresponding means were 2.36 (SD = 0.44), 3.00 (SD = 0.52) and 1.72 (SD = 0.53) respectively. Given that the majority of participants had thought about food to some degree during the previous half hour there were a larger number of ratings of enjoyment and stress per participant and analyses of test-retest reliability data showed better correlations for these data ( $r = .83$ ,  $p < .05$  for frequency,  $r = .75$ ,  $p < .05$  for enjoy,  $r = .51$ ,  $p = .13$  for stress).

For the Food Preoccupation Questionnaire means across all participants were first computed for each item. These ranged from 1.98 to 4.03 suggesting no items were resulting in consistently extreme scores. An initial factor analysis suggested that there were three main factors accounting for 19.76%, 15.51% and 9.44% of the variance. Items

showing high loadings on these factors tended to be related to negative thoughts, positive thoughts and frequency of thoughts respectively. Correlations between questionnaire items and diary data were then examined. Of the 10 frequency items, four showed positive correlations (ranging from .14 to .46) with diary frequency data whilst the remaining six showed near zero or negative correlations (ranging from .05 to -.27) and were therefore discarded. Of the 11 positive items, one showed a near zero correlation with diary enjoy (.01) and was discarded. The remaining 10 showed correlations between .13 and .35. Of the 11 negative items, 2 showed near zero correlations with diary stress (-.03 and .04) and were discarded. The remainder showed correlations between .16 and .45. Of the 7 neutral items, one showed no correlation with either diary enjoy (.03) or diary stress (.03) and one showed a positive correlation with diary enjoy (.27). These were both discarded. The remaining five showed no positive correlations with either diary enjoy or diary stress and showed at least one negative correlation (ranging from -.15 to -.41). The revised questionnaire thus consisted of 28 items (4 frequency, 10 positive, 9 negative, 5 neutral).

Factor analysis on this revised questionnaire suggested two main factors accounting for 21.99% and 18.02% of the variance. Items on the negative scale all showed positive loadings on the first factor (.44 to .73) whilst items on the frequency and positive scales loaded positively on the second factor (.52 to .64 and .28 to .58). Items on the neutral scale showed negative loadings on both these factors (-.19 to -.51 for factor1 and -.26 to -.71 for factor 2). Alphas for these revised scales were .64 for frequency, .80 for positive, .85 for negative and .74 for neutral. The factor analysis data suggest that frequency of thoughts about food, and level of enjoyment of thoughts about food, were

highly correlated. However, although this may be true at a population level, from a theoretical perspective these are important distinctions. For example, a chef or parent of young children may spend a lot of time thinking about food but find these thoughts neither particularly pleasurable or aversive. For the scale to be useful it needs to be able to distinguish such individuals from those who spend a lot of time thinking about food because they enjoy it. For this reason we decided not to combine the original subscales.

Mean scores for each of these scales were then computed for each participant and correlated with corresponding diary measures. There were significant positive correlations between questionnaire frequency and diary frequency ( $r = .44, p < .01$ ) between questionnaire positive and diary enjoy ( $r = .37, p < .05$ ), and between questionnaire negative and diary stress ( $r = .42, p < .01$ ). There was a significant negative correlation between questionnaire neutral and diary stress ( $r = -.35, p < .05$ ). Thus the scales showed a good correspondence with the equivalent measures collected via the diary methodology.

### 3. Study 2

The aims of Study 2 were to examine the internal reliability, test-retest reliability and construct validity of the Food Preoccupation Questionnaire. It was administered to participants alongside measures of (a) hunger, (b) diet- and psychopathology-related cognitions and behaviours (emotional eating, restraint, eating concern, shape concern, weight concern, binge eating), and (c) measures related to the extent to which individuals value food as something pleasurable (importance of food), their sensitivity to the

rewarding properties of food (food cravings, external eating) and their sensitivity to reward more generally (behavioural activation system; cf. Carver & White, 1994). Given that the Food Preoccupation Questionnaire was designed to measure relatively stable traits, we predicted no correlations with hunger. Measures of diet- and psychopathology-related cognitions and behaviours suggest some degree of concern or conflict over food and eating and we therefore predicted that such measures would be associated with a higher frequency of thoughts about food and with more negative thoughts about food. We also hypothesized that individuals who value food as something pleasurable would be more sensitive to the rewarding properties of food, or to reward more generally, and may get more pleasure from food. Therefore, we predicted for such individuals that these measures would be associated with a higher frequency of thoughts about food and with more positive thoughts about food. However, individuals who are sensitive to food reward, and to reward in general, but are also attempting to limit their food intake, may find it relatively more difficult to do (Davis & Fox, 2008; Davis et al., 2007). Such situations may lead to an increased frequency of negative thoughts about food. As such, we predicted interactions between these measures (i.e. food cravings, external eating, behavioural activation system) and restraint on both thought frequency and thought negativity.

In line with previous research (Jones & Rogers, 2003; Rogers & Green, 1993; Warren & Cooper, 1998) we predicted that participants who were currently dieting to lose weight would show a higher frequency of thoughts about food and that these would be more negative. Similarly, we predicted higher levels of negative thoughts about food among females and higher levels of positive thoughts about food among males (Rozin et



al., 1999). Overall, one can see that a wide range of predictions are possible on the basis of the Food Preoccupation Questionnaire, which relate well to corresponding theory about eating behaviour.

### *3.1. Method*

#### *3.1.1. Participants*

Participants were 65 male and 65 female undergraduate and postgraduate students at Swansea University (18 to 62 years, mean = 24 years, SD = 6.53) who were approached at the end of lectures and paid 2 pounds sterling for participation (or £4 if they provided additional data for reliability analysis). Self-reported BMI ranged from 16.18 to 50.31 (mean = 24.37, SD = 5.64). Ethical approval was granted by the Swansea University Psychology Department Ethics Committee.

#### *3.1.2. Measures*

*Grand hunger scale.* The Grand (1968) hunger scale was employed to assess level of hunger. This consists of items recording length of time since the participant last ate, length of time till they next expect to eat (both to the nearest 15 minutes) and two visual analogue scales asking participants how hungry they are at the moment (anchored by '*not hungry at all*' and '*extremely hungry*') and how much of their favourite food they would be able to eat at the moment (anchored by '*none at all*' and '*as much as I could get*'; both scales scored by measuring mm from the left). All sets of scores are standardised and total hunger computed as the sum of the analogue scales and time since last ate, minus

time until expects to next eat. Higher scores indicate higher levels of hunger. Although the Grand hunger scale has not undergone any formal validation, the items have been shown to distinguish between fasting and non-fasting participants (Channon & Hayward, 1990; Placanica, Faunce & Job, 2002; Stewart & Samoluk, 1997) and it has been employed in a number of food-related studies (e.g., Brignell, Griffiths, Bradley & Mogg, 2009; Tapper, Pothos, Fadardi & Ziori, 2008). *Food Preoccupation Questionnaire*. This was the modified questionnaire (i.e. 28 items) from Study 1 (see Table 1).

*Dutch Eating Behaviour Questionnaire (DEBQ)*. The DEBQ (Van Strien, Frijters, Bergers & Defares, 1986) assesses emotional, external and restrained eating. It contains 33 statements each rated by participants on a 5 point scale (*never* to *very often*). The DEBQ has been shown to have satisfactory to good reliability, excellent factorial validity and satisfactory concurrent and discriminant validity (Van Strien et al., 1986; Wardle, 1987). Responses are coded as 1 to 5 and subscales scored by computing the mean of the relevant items. Higher scores indicate higher levels of the relevant behaviour.

*Trait Food-Cravings Questionnaire*. The Trait Food-Cravings Questionnaire (Cepeda-Benito, Gleaves, Williams & Erath, 2000) measures features of food cravings that are stable across times and situations. It consists of 21 items scored on a scale of 1 to 6 according to the degree to which they are true for the individual (*'never / not applicable'* to *'always'*). It has been shown to have excellent internal consistency, construct validity and good 3-week test-retest reliability (Cepeda-Benito et al., 2000). The questionnaire is scored by computing an overall mean for the 21 items, with higher scores indicating higher levels of cravings.

*Food Attitudes Survey – Importance of Food subscale.* The Food Attitudes Survey (Rozin, Fischler, Imada, Sarubin & Wrzesniewski, 1999) measures the role of food in individuals' lives. We used the Importance of Food subscale that assesses the extent to which the individual values food as a positive force in their life. The scale consists of five statements rated by participants as 'true' or 'false' for them, and one statement asking the participant to select between two alternatives (a food option and a non-food option). The scale has been shown to have good construct validity (Rozin, Bauer & Catanese, 2003; Rozin et al., 1999). Responses are scored as '1' or '0' and scores summed. Higher scores indicate more importance placed on food.

*Diet history.* A brief questionnaire, designed for this study, was used to assess diet history. This consisted of questions on frequency of previous diet attempts (*'I haven't dieted before'*, *'about 1-5 times'*, *'about 6-24 times'*, *'25 times or more'*), whether the participant was currently dieting to lose weight, and, if so, when they began their current diet and how much weight they had lost on their current diet. Dieting was defined as *'...attempting to lose weight by trying to alter your normal eating habits.'*

*Eating Disorders Examination Questionnaire (EDE-Q).* The EDE-Q (Fairburn & Beglin, 1994) is a self-report version of the Eating Disorders Examination Interview (Fairburn & Cooper, 1993). It includes 17 items (rated on a scale of 0 to 6) used to assess the severity of restraint, eating concern, shape concern and weight concern. The questionnaire has been shown to have good internal consistency, two-week test-retest reliability and external validity (Luce & Crowther, 1999; Mond, Hay, Rodgers, Owen & Beumont, 2004; Peterson et al., 2007). Subscales are scored by computing the mean of relevant items, with higher scores indicating higher severity.

*Binge Eating Scale (BES).* The BES (Gormally, Black, Datson & Rardin, 1982) assesses severity of binge eating. It contains 16 items that describe behavioural manifestations and feelings/cognitions surrounding binge eating episodes. Each item consists of three or four alternatives that are weighted for scoring and summed to provide a total score on a range of 0 to 46. Higher scores indicate higher levels of binge eating. The questionnaire has shown good construct validity and internal consistency (Gormally et al., 1982).

*Behavioural Activation Scale (BAS).* The BAS scale assesses dispositional behavioural activation. It consists of 13 statements that are rated on a scale of 1 to 4 as disagreeing or agreeing with respectively. These can be further subdivided into three subscales relating to reward responsiveness (5 items), reward drive (4 items), and fun seeking (4 items). Ratings are summed to give total scores on the scale and subscales, with higher scores indicating higher levels of behavioural activation. The BAS was administered as part of the BIS (Behavioural Inhibition Scale)/BAS questionnaire, which has been shown to have good test-retest reliability and good convergent, discriminate and predictive validity (Carver & White, 1994).

### *3.1.3. Procedure*

Questionnaires were administered to groups of students in the order listed above. A subset of 10 males and 10 females met with the experimenter one week later when they completed the Food Preoccupation Questionnaire for a second time.

## *3.2. Results and Discussion*

For the Food Preoccupation Questionnaire, item means across all participants ranged from 1.84 to 3.87. Factor analysis suggested two main factors accounting for 21.56% and 18.89% of the variance. As shown in Table 1, items loading highly on factor 1 related to frequency of thoughts and negative thoughts. Positive and neutral thoughts showed low or negative loadings on this factor. Items loading highly on factor 2 related to frequency of thoughts and positive thoughts. Negative and neutral thoughts showed low or negative loadings on this factor. As discussed in Section 2.2, although results of the factor analysis suggested that frequency tended to correlate with emotional valence (negative as well as positive in this instance), for future research it is important that the questionnaire be able to distinguish between thought frequency and emotional valence. For this reason the four subscales were retained. Alphas for the four scales were .77 for frequency, .85 for negative, .80 for positive and .68 for neutral. Deletion of two items increased alphas to .83 for frequency and .83 for positive. (The positive item was one that showed a relatively low loading, .18, on factor 2.) The final scale thus consisted of 26 items (3 frequency, 9 positive, 9 negative, 5 neutral). Mean scores on each of these four subscales were then computed for each participant. Following the removal of one multivariate outlier, analysis of re-test data showed high correlations between time 1 and time 2 for all four scales ( $r = .87, p < .001$ ,  $r = .81, p < .001$ ,  $r = .80, p < .001$  and  $r = .73, p < .001$  for frequency, positive, negative and neutral respectively).

INSERT TABLE 1 HERE

Scores on the four subscales were correlated with one another and with the other questionnaire measures (see Table 2). As expected, positive thoughts and negative thoughts were inversely related to one another ( $r = -.23$ ) and to neutral thoughts ( $r = -.32$  and  $-.23$  respectively). Frequency of thoughts also showed significant positive correlations with both positive ( $r = .28$ ) and negative thoughts ( $r = .36$ ), and a negative correlation with neutral thoughts ( $r = -.57$ ).

INSERT TABLE 2 HERE

Correlations between the four subscales and other questionnaire measures (see Table 2) were as predicted for hunger (i.e. no significant correlations) and for measures related to diet and psychopathology (i.e. significant correlations with thought frequency and negativity). Correlations with the Importance of Food Scale were as predicted for positive thoughts (i.e. a significant positive correlation,  $r = .56$ ) but failed to show any correlation with frequency of thoughts ( $r = .02$ ). This scale also showed a significant negative correlation with negative thoughts ( $r = -.37$ ). As predicted, BAS, food cravings and external eating all showed significant positive correlations with frequency and positive thoughts. Food cravings also showed a significant correlation with negative thoughts ( $r = .37$ ) and a significantly negative correlation with neutral thoughts ( $r = -.42$ ).

Interaction terms were then computed between (i) the two measures of restraint (DEBQ and EDE-Q) and (ii) BAS, food cravings and external eating. Correlations between these interaction terms and thoughts about food were examined. As predicted there was a significant interaction between external eating and restraint on frequency of

thoughts about food and negative thoughts about food, with those who showed higher levels of external eating and restraint, reporting more frequent and more negative thoughts about food (see Table 2). However, contrary to predictions there were no interactions between restraint and BAS on thoughts or between restraint and food cravings on thoughts.

Sex and dieting status differences were explored by categorising participants as currently dieting, dieted previously, or never dieted. As shown in Table 3, a higher frequency of thoughts about food and more negative thoughts about food were reported by females and by those who were currently dieting or who had dieted previously. A 2-way MANOVA (with frequency, positive and negative as dependent variables) showed significant main effects of sex on frequency,  $F(1, 124) = 6.66, p < .05$  and negative,  $F(1, 124) = 8.34$  and significant main effects of diet status on frequency,  $F(2, 124) = 6.85, p < .01$ , positive,  $F(2, 124) = 3.13, p < .05$  and negative,  $F(2, 124) = 7.84, p < .001$ . There was also a significant interaction between sex and diet on frequency,  $F(2, 124) = 3.10, p < .05$  and a trend toward an interaction on negative,  $F(2, 124) = 2.53, p = .084$ . Figures 1 and 2 display these interactions and suggest that, for men, dieting has limited impact on thoughts but for women it increases their frequency and negativity. One possible explanation for this sex difference is that the women in our sample were dieting more intensely than the men. However, there were no significant differences between the length of time men and women had been on their diets, 17 weeks ( $SD = 21$ ) versus 11 weeks ( $SD = 26$ ) respectively,  $t(27) = 0.63$ , or between the percentage of body weight lost, 5.78kg ( $SD = 5.93$ ) versus 4.65kg ( $SD = 4.81$ ) respectively,  $t(21) = 0.45$ . These findings are consistent with previous studies showing a greater number of thoughts about

food amongst those who are dieting to lose weight (Jones & Rogers, 2003; Rogers and Green, 1993; Warren & Cooper, 1998). However they also extend this work by showing that such effects are more pronounced for women. It is possible that this is due to greater societal pressures on females to be slim (e.g., Cogan, Bhalla, Sefsdedeh & Rothblum, 1996) that make weight loss and food a more emotionally charged issue for women than for men.

INSERT TABLE 3 HERE

INSERT FIGURES 1 AND 2 HERE

Given the above interactions, moderating effects of sex were further explored by computing interaction terms for sex and the diet- and psychopathology-related measures in Table 2 (i.e. emotional eating, DEBQ restraint, EDE-Q restraint, eating concern, shape concern, weight concern and binge eating). These interaction terms all showed significant correlations with frequency of thoughts ( $r = .32$  to  $.48$ ) and with negative thoughts ( $r = .44$  to  $.59$ ), suggesting that sex significantly moderated the relationships displayed in Table 2. Subsequent analyses revealed that for females there were significant correlations between all diet- and psychopathology-related measures and (i) frequency of thoughts ( $r = .35$  to  $.51$ ) and (ii) negative thoughts ( $r = .40$  to  $.56$ ). However, for males there were significant correlations between frequency of thoughts and some measures (emotional eating, EDE-Q restraint, eating concern, binge eating), but not others (DEBQ restraint, shape concern, weight concern). There were significant correlations between negative



thoughts and all measures for males but these correlations tended to be lower than those for females ( $r = .27$  to  $.57$ ). These findings suggest that men and women have different relationships with food and highlight the importance of taking into account gender differences in food- and eating-related research.

Data from Study 1 were also revisited and new scales calculated using the items identified in Study 2 (i.e. 26 items in total, see Table 1). These scales were then correlated with corresponding diary measures of thoughts during the previous half hour. Consistently with predictions, these showed significant correlations between questionnaire frequency and diary frequency ( $r = .37$ ,  $p < .05$ ), between questionnaire positive and diary enjoy ( $r = .34$ ,  $p < .05$ ), between questionnaire negative and diary stress ( $r = .42$ ,  $p < .01$ ) and between questionnaire neutral and diary stress ( $r = -.35$ ,  $p < .05$ ). Contrary to predictions there was no relationship between questionnaire neutral and diary enjoy ( $r = -.01$ , NS).

#### 4. General Discussion

Results showed that the final version of the Food Preoccupation Questionnaire demonstrated good construct validity (including both convergent and discriminant validity), good internal reliability, and high test-retest reliability. The latter, together with the absence of correlations with hunger, provide evidence that the questionnaire assesses relatively stable traits.

As well as measure frequency of thoughts about food, results confirm that the questionnaire also taps into two distinct types of food preoccupation. The first relates to

thoughts about food that are associated with negative emotions and this correlates with psychopathology- and diet-related cognitions and behaviours, namely concern about eating, weight and shape, attempts to limit food intake, binge eating and emotional eating. The second relates to thoughts about food that are associated with positive emotions and this correlates with measures of trait reward sensitivity, food cravings, external eating and pleasure associated with food. The subscale measuring frequency of thoughts correlated with both the two subscales measuring emotional valence, suggesting that when thoughts about food are associated with strong positive or negative emotions they also tend to occur more frequently. Although the frequency subscale did not emerge as an independent factor in our factor analyses, as discussed in sections 2.2 and 3.2, for theoretical reasons we believe it is important to be able to distinguish between frequency and emotional valence and would therefore recommend retaining the independence of these scales.

In future work it may also be desirable to omit the neutral subscale. Although this scale was useful from a validation perspective (since our results supported predictions about the relationships of the other scales to this one) it is less clear what it might add from a research or clinical perspective and omitting this scale would have the advantage of reducing the overall length of the questionnaire.

In terms of interactions we predicted that where high levels of trait reward sensitivity, trait food cravings or external eating were combined with attempts to limit food intake, this would result in a higher frequency of negative thoughts about food as these individuals would be more easily distracted by food cues. These predictions were confirmed for external eating but not for food cravings or reward sensitivity. In relation to

food cravings, one possibility is that although the food cravings questionnaire was designed to assess trait cravings these cravings still tend to arise as a consequence of restraint and thus the measure does not represent an independent predictor. This interpretation is supported by the fact that trait cravings were significantly correlated with measures of restraint ( $r = 0.28$ ,  $p < .001$  and  $r = .37$ ,  $p < .001$  for DEBQ and EDE-Q measures respectively). In relation to reward sensitivity, the absence of an interaction with restraint is more difficult to explain, especially since this remained the case even when the reward drive subscale was employed in place of the total scale. (The reward drive subscale has been shown to uniquely predict neural activity to appetising foods, Beaver et al., 2006). One possibility is that restraint reduces the reward value of food relative to other rewards, such as weight loss, meaning that individuals with higher reward sensitivity are more able to redirect their thoughts towards their diet goals.

Our results support previous work showing that dieters display higher levels of preoccupation for food (Jones & Rogers, 2003; Rogers & Green, 1993; Warren & Cooper, 1998). Importantly our results also extend this work by showing that this preoccupation is specific to thoughts associated with negative emotions rather than positive or neutral emotions, and by showing a linear relationship between dieting status (currently dieting, dieted previously, never dieted) and both frequency of food thoughts and negativity of food thoughts (with those who were currently dieting showing the highest levels for both variables and those who had never dieted showing the lowest levels). There were also sex differences with females scoring significantly higher for both frequency and negativity. However, such sex differences were not apparent between males and females who had never previously dieted suggesting that they are primarily a

result of dietary restraint. These findings are in line with previous research (Rozin et al., 1999) suggesting that females have stronger associations between food and health (i.e. compared to men, food is more likely to make females think about health issues, such as the nutritional and caloric content of foods and their impact on weight and health status). Contrary to research indicating that males have stronger food-pleasure associations (Rozin et al., 1999), we found no sex difference in positive thoughts about food.

Additionally our results showed that the relationship between dieting status and food preoccupation was stronger for women than for men (reaching statistical significance for frequency of thoughts and showing a trend for negative thoughts). This was despite the fact that in our sample of dieters there were no sex differences in the length of time individuals had been on their diets or the percentage of body weight they had lost. These findings were echoed in further analyses of the relationships between both frequency and negative thoughts with measures of psychopathology- and diet-related cognitions and behaviours, since these also showed stronger relationships for women compared to men. It is unclear why these sex differences occur but they highlight the importance of taking account of gender in research examining cognitive processes associated with dieting.

The current study had various limitations.. The sample sizes were relatively small and restricted to student populations. Given these very promising validation results for the Food Preoccupation Questionnaire, our intention is to employ it in our experimental work in eating behaviour, and so obtain more insight into the relationships between the questionnaire subscales and (a) characteristics of eating behaviour (e.g., food processing biases) and (b) cognitive impairments. Should this line of research, prove fruitful we will

then conduct a more thorough examination of the questionnaire properties with a larger and more diverse sample. In particular, it would be important to collect data from participants who are overweight, obese, or have other eating disorders. A second limitation in the present study is the time sampling method employed in Study 1 for collection of the diary data. Since the time-points were not random, we cannot be sure of the extent to which the data collected were truly representative of the individual's daily thoughts. However, the correlations between these data and the Food Preoccupation Questionnaire, combined with the results from Study 2, make a convincing case for the appropriateness of the time-sampling approach.

With respect to future research, the Food Preoccupation Questionnaire should be a useful tool for exploring links between food-related cognitions and behaviour. Unlike previous attempts to assess food preoccupation (e.g., Vreugdenburg et al., 2003), it provides independent measures of frequency and emotional valence. This should help isolate the mechanisms by which cognition impacts upon behaviour. Importantly, as well as assessing aversive thoughts about food, it also measures pleasurable thoughts about food. The latter have not been carefully examined in previous studies of food preoccupation, but there is reason to believe that they may lead to food cravings and interfere with cognitive performance (Kavanagh et al., 2005). Thus future work may explore the extent to which such thoughts can account for impairments in cognitive performance, particularly when an individual is exposed to food cues (see Higgs, 2007).

It is also possible that pleasurable thoughts about food reflect food-related schemas that bias information processing (Vitousek & Hollon, 1990). To date, such work has been limited to the exploration of food-related concerns and eating disorders such as

anorexia and binge eating. The Food Preoccupation Questionnaire should help determine whether there are also links between more pleasurable thoughts about food, overeating and weight gain. For example, frequency of pleasurable thoughts about food may be linked to an attentional bias for palatable foods (which tend to be high in fat and/or sugar) which may in turn lead to a greater consumption of such foods and subsequent weight gain (see Calitri et al., under review; see also Hogarth, Dickinson, Austin, Brown & Duka, 2008; Tiffany, 1990). Such research may have important implications for the development of obesity-related interventions.

Additionally, in longitudinal research, the Food Preoccupation Questionnaire may help identify factors that influence food preoccupation. For example, such factors may include attempts to lose weight or a change in workplace or living environment to one in which highly palatable foods are more (or less) readily available. If food preoccupation is associated with cognitive impairments and processing biases then the identification of factors that increase or decrease food preoccupation could help in intervention.

The Food Preoccupation Questionnaire may also prove to have clinical uses. Research suggests that the brain reward mechanisms associated with overweight and obesity have a complex dependence with increased weight, so that, people at the lower end of the overweight/obesity continuum display high reward sensitivity and those at the top end display low reward sensitivity (Davis & Fox, 2008). The results of the present study suggest that pleasurable thoughts about food are associated with a higher reward sensitivity. If pleasurable thoughts about food reflect food-related schemas or processing biases, then it may be the case that certain overweight/obese individuals will be responsive to interventions targeting such processing biases ,whilst others are not.

Potentially the Food Preoccupation Questionnaire may help distinguish between these two types of individuals. Further work exploring the links between the Food Preoccupation Questionnaire and (a) food processing biases and (b) overweight and obesity would be helpful.

## 5. Acknowledgements

This work was partly supported by the Welsh Office of Research and Development (grant RFS 05-1-071). We thank Louise Cleobury and Rhian Worth for help with data collection.



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Table 1. Food Preoccupation Questionnaire items employed in Study 2 together with their loadings on factors 1 and 2.

<b>Item</b>	<b>Scale</b>	<b>Factor 1 loading</b>	<b>Factor 2 loading</b>
1. I spend a lot of time thinking about food.	Frequency	.57	.48
2. Planning meals can be quite stressful.	Negative	.59	-.23
3. I often find myself thinking about food.	Frequency	.62	.38
4. My thoughts about food don't tend to be particularly pleasant or unpleasant.	Neutral	-.11	-.34
5. I really enjoy myself thinking about food.	Positive	-.12	.69
6. I can get quite stressed if I start to think about food.	Negative	.75	-.24
7. I often struggle with thoughts about food.	Negative	.80	-.08
8. I like thinking about my favourite food.	Positive	-.18	.59
9. When I think about food it's not usually linked to any particular emotion.	Neutral	-.41	-.13
10. I often look forward to my next meal.	Positive	.11	.52
11. I hate being distracted with thoughts about food.	Negative	.51	-.19
12. I don't particularly enjoy or dislike thinking about food.	Neutral	-.18	-.44
13. I worry I spend too much time thinking about food.	Negative	.73	.11
14. I love thinking about food.	Positive	-.27	.71

Table 1 continued

15. Thinking about food can put me in a bad mood.	Negative	.66	-.21
16. Sometimes I think about food just for the fun of it.	Positive	-.04	.53
17. I don't think about food all that much.	Frequency (reversed)	.51	.47
18. Deciding what to eat can be quite stressful.	Negative	.65	-.22
19. I can get really excited thinking about food.	Positive	.07	.60
20. I don't pay much attention to thoughts about food.	Neutral	-.54	-.48
21. Thinking about food can put me in a good mood.	Positive	-.11	.65
22. I hate thinking about food.	Negative	.58	-.40
*23. I like looking through recipe books.	Positive	.04	.18
24. Thinking about food doesn't really excite or depress me.	Neutral	-.36	-.55
*25. I spend a lot of time planning meals.	Frequency	.42	.26
26. I enjoy deciding what to eat in a restaurant.	Positive	-.15	.49
27. Thinking about food can make me quite miserable.	Negative	.74	-.25
28. I enjoy planning what I'm going to eat.	Positive	.08	.60

\* Item deleted from final version.

Table 2. Correlations between questionnaire scales.

	<b>Frequency of thoughts</b>	<b>Positive thoughts</b>	<b>Negative thoughts</b>	<b>Neutral thoughts</b>
Frequency of thoughts	-			
Positive thoughts	.28**	-		
Negative thoughts	.36**	-.23**	-	
Neutral thoughts	-.57**	-.32**	-.23**	-
<b>Prediction of no relationship</b>				
Hunger	-.05	.09	-.12	.05
<b>Prediction of positive relationship with frequency and negative thoughts</b>				
Emotional eating (DEBQ)	.45**	.03	.44**	-.34**
Restraint (DEBQ)	.27**	-.08	.46**	-.11
Restraint (EDE-Q)	.35**	-.07	.35**	-.11
Eating concern (EDE-Q)	.46**	-.06	.55**	-.17*
Shape concern (EDE-Q)	.35**	-.05	.39**	-.17
Weight concern (EDE-Q)	.37**	-.09	.48**	-.20*
Binge eating	.44**	-.03	.47**	-.35**
<b>Prediction of positive relationship with frequency and positive thoughts</b>				
Importance of food	.02	.56**	-.37**	.00
BAS	.22**	.32**	.09	-.13
Food cravings	.55**	.28**	.37**	-.42**
External eating (DEBQ)	.37**	.36**	.03	-.18*

Table 2 continued

<b>Prediction of positive relationship with frequency and negative thoughts</b>				
BAS x restraint (DEBQ)	-.06	-.10	-.02	.18*
BAS x restraint (EDE-Q)	-.01	-.04	.01	.02
Food cravings x restraint (DEBQ)	-.08	-.15	.03	.06
Food cravings x restraint (EDE-Q)	.01	-.14	.13	-.02
External eating (DEBQ) x restraint (DEBQ)	.41**	.11	.44**	-.18*
External eating (DEBQ) x restraint (EDE-Q)	.32**	-.14	.43**	-.10

\*  $p < .05$ \*\*  $p < .001$

Table 3. Means (and SDs) on the Food Preoccupation subscales according to gender and dieting status.

<b>Questionnaire scale</b>	<b>Gender / dieting status</b>					
	Males (n=65)	Females (n=65)	Currently dieting (n=29)	Dieted previously (n=59)	Never dieted (n=42)	Overall (n=130)
Frequency	2.92 (0.99)	3.49 (1.07)	3.57 (1.01)	3.37 (1.04)	2.73 (0.99)	3.21 (1.07)
Positive	3.34 (0.65)	3.37 (0.86)	3.11 (0.86)	3.53 (0.69)	3.27 (0.73)	3.35 (0.76)
Negative	1.91 (0.70)	2.40 (0.94)	2.65 (0.99)	2.09 (0.80)	1.92 (0.71)	2.16 (0.86)
Neutral	3.06 (0.68)	2.88 (0.74)	2.79 (0.70)	2.88 (0.68)	3.21 (0.72)	2.97 (0.71)

Figure 1. Frequency of thoughts about food according to sex and dieting status. Error bars denote 1 SD. For clarity, we show only positive error bars for females and only negative error bars for males.

Figure 2. Extent to which thoughts about food are negative in emotional valence according to sex and dieting status. Error bars denote 1 SD. For clarity, we show only positive error bars for females and only negative error bars for males.