

DEVELOPMENT OF THE EATING HABITS QUESTIONNAIRE

A Thesis

by

ERIN COLLINS GRAHAM

Submitted to the Office of Graduate Studies of
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in partial fulfillment of the requirements for the degree of

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December 2003

Major Subject: Psychology

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ABSTRACT

Development of the Eating Habits Questionnaire. (December 2003)

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The purpose of the studies presented was to develop and examine the psychometric properties of the Eating Habits Questionnaire (EHQ). The author designed the 21-item self-report inventory to assess cognitions, behaviors, and feelings related to an extreme focus on healthy eating as a preliminary step in researching an alleged syndrome that has been labeled “orthorexia nervosa”, defined as a pathological fixation on healthy eating. Study 1 examined the factor structure of the EHQ and refined the instrument with exploratory factor analysis. A 3-factor solution was preferred, with subscales labeled: knowledge of healthy eating, problems associated with healthy eating, and feeling positively about healthy eating. In the Study 1 sample ($n = 174$) the subscales displayed good internal consistency (.87 to .91) and test-retest reliability (.74 to .87). Study 2 examined the fit of the 3-factor model in a new sample ($n = 213$) with confirmatory factor analysis. Poor initial fit became adequate after eliminating poorly fitting items. Internal consistency (.82 to .90) and test-retest reliability (.72 to .81) of the subscales remained good in the Study 2 sample. Examination of correlations between the EHQ subscales and a variety of other measures provided preliminary evidence for both convergent and discriminant validity in the Study 2 sample. As expected, the EHQ

subscales correlated more highly with measures of eating related pathology than with measures of general pathology, personality characteristics, or social desirability.

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INTRODUCTION

When an otherwise healthy behavior is taken to extremes, the potential arises for a myriad of problems to occur, sometimes meeting criteria for a psychological disorder. For example, the healthy behavior of hand washing, when engaged in excessively, may be a sign that a person has obsessive compulsive disorder (OCD) with a hand washing compulsion. This commonly healthy behavior done at an extreme rate can cause disruption in personal, occupational, and interpersonal areas due to its excessiveness. It is partly this disruption in normal functioning that makes a constellation of behaviors and cognitions a disorder (American Psychiatric Association, 1994).

A similar phenomenon appears to be seen in those who engage in obligatory exercise. Obligatory exercisers are people for whom exercise has become an overwhelming preoccupation that is the central focus of their lives. According to Brehm and Steffen (1998), obligatory exercisers are so obsessed with remaining active that they will compromise their health and relationships to exercise, and will become anxious and dysphoric if unable to do so. Research is ongoing into the correlates of obligatory exercising, but it does appear to co-exist, at least occasionally, with eating disorders (Brehm & Steffen, 1998).

Similar to going overboard on a healthy behavior like exercising, health related eating behaviors can also be taken to the extreme. To borrow from the above definition of obligatory exercisers, one can imagine people for whom eating healthfully has

This thesis follows the style and format of *American Psychologist*.

become an overwhelming preoccupation that is the central focus of their lives. The constellation of extreme behaviors and cognitions that will be the focus of this study has been termed “orthorexia nervosa”, as an obvious take-off on the term anorexia nervosa, but using the prefix ortho- meaning correct, straight, or true. Bratman and Knight (2000) described this conjectured disorder as a pathological fixation on eating healthy or “pure” food.

According to Bratman and Knight (2000) “ON” is characterized by: 1) spending large amounts of time (more than 3 hours per day) thinking about, shopping for, and preparing healthy food, 2) feeling superior to those with differing eating habits, 3) following a particular health-food diet rigidly and engaging in compensatory restriction to make up for any dietary indiscretions, 4) tying self-esteem to adherence to the diet (feeling guilt and self-loathing when straying and self-satisfaction when complying), and 5) turning eating “properly” into the central focus of life, at the expense of other personal values, relationships, previously enjoyed activities, and sometimes, ironically, physical health. Thus, “ON” is conceptualized as a mixture of behaviors and attitudes. However, these alleged criteria are apparently simply derived from the experiences of the author. They have not been identified empirically and it has not been established that they represent a co-occurring pattern of behaviors (i.e. a syndrome).

“Orthorexia Nervosa” and Anorexia Nervosa

“Orthorexia nervosa” has been compared to anorexia nervosa (AN) because many of the characteristics of ON are associated features of AN. “Orthorexics” and anorexics both tend to be overly preoccupied with food, may practice food-related

rituals, feel a sense of superiority over others based on their eating practices, have rigid or restrictive eating habits, increase restriction following consumption of forbidden foods, link their self-esteem to food-related behaviors, and make their eating-related issues the primary focus of their lives (Bratman & Knight, 2000; Haas & Clopton, 2001). Both “orthorexics” and anorexics also experience their symptoms as ego-syntonic, making it unlikely that they would seek help for their eating-related problems. Instead, family members or physicians may express their concern and attempt to refer them to treatment (APA, 1994; Bratman & Knight, 2000).

Another similarity may be in the types of diets followed by anorexics and “orthorexics”. A greater proportion of anorexics follow a vegetarian diet than people in the general population. One study found that 50% of anorexic patients were vegetarians, compared to 2-10% of the general population. While at first glance it may seem that following a vegetarian diet is another way to avoid eating, there were no significant differences in caloric intake between vegetarian anorexics and non-vegetarian anorexics. Although “orthorexics” are thought to be on diets more atypical in the Western world than vegetarianism (i.e. raw foods, macrobiotics), in studies on vegetarianism and anorexia any diet that involved avoiding red meat was categorized as vegetarian, including more restrictive or complex diets than vegetarianism (Bakan, Birmingham, Aeberhardt, & Goldner, 1993). Therefore, these studies may be capturing some “orthorexia”/anorexia overlap.

In spite of the alleged similarities between ON and AN, there are also allegedly important differences. According to Bratman and Knight (2000) “orthorexics” do not

have fears about gaining weight, distorted thoughts about their body weight or shape, and are unlikely (though it is possible) to have body weight less than 85% of expected or to experience amenorrhea. All of the above are required criteria for a diagnosis of AN (APA, 1994), so if none are typical of “ON” there would be evidence that the conditions are distinct; however the absence of these symptoms among “orthorexics” has not been empirically established.

The primary motivational difference between “ON” and AN appears to be that anorexics control their eating for the purpose of losing weight to improve body image satisfaction, whereas “orthorexics” allegedly control their eating in order to become what they view as healthier or more pure, though at times weight loss will occur as a side-effect (APA, 1994; Bratman & Knight, 2000). Rather than distorted perceptions about their body weight or shape, “orthorexics” may have distorted ideas about the properties of foods, what some have called magical beliefs about food (Bratman & Knight, 2000; Lindeman, Keski-Vaara, & Roschier, 2000).

“Orthorexia Nervosa” and Obsessive Compulsive Disorder

There are also many similarities between “ON” and OCD. This is not surprising given the strong relationship between AN and OCD. In 37% of AN cases OCD was found to be premorbid (Thornton & Russell, 1997). In addition, evidence over the past decade provides support for a neurochemical correspondence between AN and OCD (Davis, Kaptein, Kaplan, Olmsted, Woodside, 1998).

The relationship between “ON” and OCD is unclear, but it is possible that the alleged disorder is a subtype of OCD. More research on “ON” is necessary to examine

this question. Although “orthorexics” appear to exhibit time-consuming obsessions (thinking about eating in “correct” ways, planning detailed menus) and compulsions (spending excessive time selecting, preparing, and eating healthful foods in the “proper” manner) it is not clear that their obsessive thoughts cause them distress, or that their compulsive behaviors are aimed at reducing distress or preventing a catastrophic event, which are required at some point to meet criteria for “obsessions” or “compulsions” in OCD (APA, 1994).

It is possible that an “orthorexic” is plagued by intrusive thoughts such as, “If I don’t eat exactly correctly then I will get cancer”, followed by feelings of distress, which are reduced by giving in to the compulsion to eat in a particular manner. However, it is also conceivable that an “orthorexic” focuses on a different interpretation of the same statement, such as, “If I eat properly then I will prevent disease”, chooses to spend time and energy focused on working toward this goal, and feels motivated to eat correctly for this reward, rather than motivated to escape a feeling of distress. It’s a subtle difference, but may be important in conceptualizing the problem.

According to Bratman and Knight (2000), those with “ON” are also thought to feel smug and self-satisfied because of their focus on eating the “proper” foods. They are allegedly proud of their extreme behavior and often try to convince others to think and act the same way. In comparison, those with OCD, for example a germ obsession with hand-washing compulsion, do not feel superior to others for their hand-washing, and don’t proselytize about their condition or try to win OCD converts. They instead experience their thoughts as intrusive, feel distressed by their thoughts and behavior, and

not uncommonly feel abnormal and depressed about their disorder (APA, 1994; Bratman & Knight, 2000).

The similarities between “ON”, AN, and OCD may be driven by underlying associated features, such as neurotic perfectionism, by similar neurochemical conditions, or by factors that have not been presented here. However, because of the limited information on “ON”, including research on whether or not it can even be studied (i.e., it can be measured reliably), it is premature to draw any conclusions regarding its possible relationship with other disorders.

Summary, Unanswered Questions, and Purpose

“ON” has been described as a serious form of psychopathology, similar to an eating disorder or OCD. If this is the case, then it represents a significant health issue worthy of additional research. However, this conclusion, as well as virtually all that is known about this alleged condition comes from the anecdotal writing of Bratman. There are thus numerous unanswered empirical questions regarding ON. Does it even exist as it is described? Can it be reliably measured and discriminated from other related constructs? If so, how is it related to psychological adjustment and other eating-related problems? How common is it? None of these questions can be answered until it can be studied empirically, and to study it we need some way of measuring it. Thus, the purpose of this study was to design the Eating Habits Questionnaire (EHQ) as a research tool for the measurement of “ON”. This was seen as a preliminary step towards doing further research into this phenomenon and answering these unanswered questions.

STUDY 1

Method

Test Development

The author developed the EHQ to assess symptoms of “ON” as an initial method of studying the alleged construct. Bratman and Knight’s (2000) case studies provided a guide for the creation of the initial 160 items. The item pool covered the depth and breadth of content theorized to be essential to the construct of “ON”. No previous research suggested a particular factor structure of “ON”, therefore none was delineated at this stage. The first 150 items were scored on a 4-point Likert-type scale ranging from “False, Not At All True” to “Very True”. An additional 10 items required participants to rank-order the importance of 5 qualities, one of which was “healthy eating” (not defined for them). These items captured whether healthy eating was of primary importance to test-takers. Participants in Study 1 took this 160 item version of the EHQ. Subsequently four advanced graduate students, trained on the alleged symptoms of “ON”, assessed the degree to which the content surveyed by the EHQ accurately captured the construct of “ON”. Only items that all 4 raters agreed on were retained for analysis. This process resulted in the retention of 59 items.

Participants

Participants included those specifically recruited from nutrition classes to extend the range of reported attitudes and behaviors related to healthy eating. Overall, participants were 174 college students from introductory psychology classes (43%), introductory nutrition classes (29%), and upper-level nutrition classes (29%).

Participants returned 2-4 weeks later for test-retest reliability analysis of the EHQ (86% complied). They were compensated either by receiving course credit for their participation, or by being entered into a drawing for one of 3 cash prizes (\$50, \$25, \$25) and being allowed to request knowledge of their body fat percentage measurement. Sixty-eight percent of participants were female. Ages ranged from 18 to 38 years with a mean age of 20 years ($SD = 2.43$). Reported ethnicity of the sample was: 76.4% Caucasian, 14.9% Hispanic/Latino, 4.6% Asian-American, 3.4% African-American, and 0.6% other.

Materials

Participants completed an informed consent form, a demographic information sheet, the EHQ, and the Balanced Inventory of Desirable Responding (BIDR). The BIDR (as cited in Paulhus, 1991) measures two constructs: impression management (IM) and self-deceptive enhancement (SDE). Its 40 items are scored on a 7-point Likert-type format ranging from “not true” to “very true”. Paulhus reported good internal consistency across several studies (.75 to .86 for IM, .68 to .80 for SDE) and satisfactory 5-week test-retest reliability (.65 and .69 for IM and SDE respectively). In support of convergent validity, Paulhus reported an $r = .71$ correlation between the total BIDR score and the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960; as cited in Paulhus, 1991). In this sample, internal consistency was .70 for IM and .67 for SDE; 2- to 4-week test-retest reliability was .84 for IM and .76 for SDE. In the Study 2 sample (see below), internal consistency was .75 for IM and .64 for SDE.

The researchers measured height and weight with a tape measure and a digital scale. They assessed body fat percentage using the OMRON BodyLogic body fat analyzer, a hand-held device that uses the bioelectrical impedance method to calculate body fat percentage (Wolkodoff, 1999).

Procedures

Following the informed consent process, participants completed a demographics form, the EHQ, and the BIDR in random order. Afterwards they went into the hall for private measurement of height, weight, and body fat percentage. Participants then signed up for a follow-up data collection 2-4 weeks later. At the end of the follow-up session (identical in procedure to the initial session) participants from nutrition classes learned their body fat percentage and entered a cash prize drawing for their participation (at the completion of Study 1 one \$50 and two \$25 prizes were awarded by random drawing).

Results

Kaiser's measure of sampling adequacy (MSA; Kaiser, 1974) for the EHQ indicated the data were appropriate for exploratory factor analysis (EFA). MSA values of less than .50 are considered unacceptable, in the .50s "miserable", in the .60s "mediocre", and ideally should be in the .80s or .90s (Kaiser, 1974). The overall MSA for the EHQ was .89, which Kaiser (1974) described as "meritorious". MSAs for the individual items ranged from .61 to .93. Items with MSAs below .70 were deleted (2 items), yielding new individual MSAs ranging from .76 to .94, considered "middling to marvelous".

A series of EFAs using the maximum likelihood extraction method with oblimin rotation guided decision-making regarding the number of factors that appeared to best describe the data. Decision-making rules included the size and pattern (i.e. a scree plot) of the eigenvalues, the percentages of total and common variance explained, the number of sizable structure coefficients per factor, and the explanatory ability of the model. According to Guadagnoli and Velicer (1988), regardless of sample size, components may be considered stable if they each contain at least 4 variables with loadings over .60. If this criterion is not met a sample size of at least 300 should be used. Although they used principal-components analysis in their studies, they reported that principal-components generated solutions differ little from factor analysis solutions.

A 3-factor solution appeared to meet the above criteria somewhat better than a 4-factor solution. The 3-factor solution explained a similar amount of total variance (40% vs. 43%) and common variance (62% vs. 67%) compared to the 4-factor solution. All factors of the 3-factor solution contained at least 4 variables with structure coefficients greater than .60, whereas the last factor of the 4-factor solution did not meet this criterion. Additionally, the 3-factor solution appeared more easily interpretable. After evaluating item content it appeared that the factors from the 3-factor solution could be labeled: 1) knowledge of healthy eating, 2) problems associated with healthy eating, and 3) feeling positively about healthy eating (see Table 1).

Table 1
Factor Structure of the Eating Habits Questionnaire

Item number and content	Factor		
	K	P	F
1. My diet is more healthy than most diets.	.79	.30	.30
11. My diet is better than other people's diets.	.73	.30	.21
13. I am more informed than others about healthy eating.	.74	.32	.45
18. My eating habits are superior to others.	.64	.41	.27
26. I love eating healthily.	.61	.30	.45
27. I eat only healthy foods.	.67	.46	.21
30. I know more about healthy eating than other people.	.79	.41	.46
32. I prepare food in the most healthful way.	.66	.34	.40
33. It's important to me to eat healthily.	.74	.41	.60
2. I place more and more restrictions on the of foods I can eat.	.29	.64	.36
3. I turn down social offers that involve eating unhealthy food.	.29	.55	.13
5. My healthy eating is a significant source of stress in my relationships.	.08	.49	.13
8. My diet affects the type of employment I would take.	.27	.46	.24
9. I have difficulty finding restaurants that serve the foods I eat.	.39	.67	.21
10. I follow a health-food diet rigidly.	.54	.65	.26
14. I spend more than three hours a day thinking about healthy food.	.29	.70	.36
15. Few foods are healthy for me to eat.	.01	.44	.11
16. I follow a diet with many rules.	.43	.68	.18
17. I think about healthy food when engaged in other activities.	.41	.59	.33
20. I only eat what my diet allows.	.43	.73	.22
21. I daydream about healthy eating.	.22	.64	.39
23. I take my own food with me wherever I go.	.35	.56	.24
24. I avoid going out to eat with others because of my diet.	.35	.60	.17
25. The rules of my diet have increased in number.	.28	.57	.34
28. Most of my free time revolves around eating healthily.	.33	.65	.37
29. In the past year, friends or family members have told me that I'm overly concerned with eating healthily.	.29	.66	.27
31. I am distracted by thoughts of eating healthily.	.32	.75	.37
34. I go out less since I began eating healthily.	.41	.58	.28
35. I follow the perfect diet.	.37	.53	.22

(continued)

Table 1 (continued)

Item number and content	Factor		
	K	P	F
4. I feel peaceful when I eat healthily.	.20	.33	.70
6. Eating healthily brings me fulfillment.	.41	.32	.79
7. I have made efforts to eat more healthily over time.	.51	.34	.61
12. I feel in control when I eat healthily.	.39	.40	.77
19. Eating the way I do gives me a sense of satisfaction.	.55	.46	.60
<u>22. I feel great when I eat healthily.</u>	<u>.43</u>	<u>.26</u>	<u>.75</u>

Note. Coefficients in bold denote the items on each subscale.

K = Knowledge, P = Problems, F = Feelings.

The final version of the EHQ, based on the 3-factor model, contained 26 items that had factor loadings of at least .60 on any factor. Decision-making rules for deletion of the remaining 29 items included similar loadings on multiple factors, theoretical inconsistency of item content, and lack of ease of interpretation. Due to the lack of a truly “orthorexic” sample, I treated items on the problems factor with greater leniency than items on other factors. Consideration of these criteria resulted in the retention of an additional 9 items, for a total of 35 items retained, all scored on a Likert-type scale (no rank-order items remained). The knowledge factor contained 9 items, the problems factor contained 20 items, and the feelings factor contained 6 items. Subscale alphas and test-retest correlations for the Study 1 sample indicated good internal consistency and test-retest reliability in this sample (see Table 2). Correlations between the EHQ subscales and the BIDR IM and SDE subscales were nonsignificant, with the exception of a small ($r = .21$) correlation between the EHQ Knowledge subscale and IM. These small and nonsignificant correlations provided evidence that the EHQ data were not

overly affected by participants' intentional or unintentional attempts to respond in a socially desirable manner (see Table 3).

Table 2
Cronbach Alphas and Test-Retest Coefficients for Eating Habits Questionnaire Subscales from Study 1 Sample

<u>EHQ Subscale</u>	<u>Alpha</u>	<u>Test-Retest</u>
Knowledge	.91	.87
Problems	.92	.82
Feelings	.87	.74

Note. EHQ = Eating Habits Questionnaire.

Table 3
Correlations between Eating Habits Questionnaire and Balanced Inventory of Desirable Responding Subscales

<u>EHQ Subscale</u>	<u>BIDR Subscale</u>	
	<u>Impression Management</u>	<u>Self-Deceptive Enhancement</u>
Knowledge	.21*	.11
Problems	.11	-.02
Feelings	.02	.02

*Correlation is significant at $p < .05$ level.

Note. Abbreviated items are: EHQ = Eating Habits Questionnaire; BIDR = Balanced Inventory of Desirable Responding.

Discussion

The purpose of Study 1 was to design a self-report instrument that captured the construct of “ON” as described by Bratman and Knight (2000). As an initial step, the author created EHQ items through analysis of Bratman’s (2000) case studies. To determine whether these items represented “ON”, advanced graduate students trained on “ON” rated the degree to which each item was related to “ON”. Retention of only those

items that all four raters agreed were relevant provided some evidence that they captured “ON”. However, though the content included appears relevant, it cannot be determined at this time whether additional necessary content was inadvertently excluded.

The Study 1 data provided evidence of a 3-factor solution for the EHQ, with subscales labeled: knowledge of healthy eating, problems with healthy eating, and feeling positively about healthy eating. Internal consistency and test-retest reliability for the Study 1 sample were good (see Table 2). Correlations between the EHQ subscales and the BIDR IM and SDE subscales indicated the Study 1 sample were not overly influenced to respond, either consciously or unconsciously, in a socially desirable manner on the EHQ. All of the correlations were nonsignificant with the exception of a small correlation between the EHQ Knowledge subscale and the BIDR IM subscale, suggesting a slight tendency for the Study 1 sample to intentionally endorse items from this subscale in a socially desirable direction. Comparisons of student groups showed that none of the correlations between EHQ subscales and BIDR subscales were statistically significant when groups were considered separately, however the correlation between the EHQ Knowledge subscale and the BIDR IM subscale was higher for students of introductory nutrition classes ($r = .22$) than for introductory psychology students ($r = .15$) or nutrition majors ($r = .05$). Although the smallest correlation unexpectedly occurred among nutrition majors, all of the correlations were small enough to eliminate concern that the items of this subscale were *only* measuring desirable responding, rather than knowledge of healthy eating (see Table 3).

At the completion of Study 1 the EHQ consisted of 35 items scored on a Likert-type scale. The Knowledge factor contained 9 items, the Problems factor contained 20 items, and the Feelings factor contained 6 items. Although there was evidence of good internal consistency and test-retest reliability in this sample, the next step was to confirm the fit of the 3-factor solution, and to examine the convergent and discriminant validity of the EHQ.

STUDY 2

The purpose of Study 2 was to gather data from a new sample to confirm the 3-factor structure identified in Study 1. In addition, a variety of measures were used to examine the convergent and discriminant validity of the EHQ data. Predictions were as follows: 1) the EHQ Problems subscale would correlate highly with measures of eating pathology and moderately with obsessiveness; 2) there would be smaller but significant correlations between the Problems subscale and measures of depression, general psychopathology, neuroticism, and conscientiousness. Bratman and Knight's (2000) theoretical descriptions of "ON" did not give an indication of how the Knowledge and Feelings subscales would be related to other measures.

Method

Participants

Participants were 213 college students from introductory psychology classes (46%), introductory nutrition classes (34%), and upper-level nutrition classes (20%). Participants either received course credit for their participation, or competed in a drawing for one of 3 cash prizes (\$50, \$50, \$99) and received knowledge of their body fat percentage measurement. Sixty-five percent of participants were female. Ages ranged from 18 to 48 years with a mean age of 20 years ($SD = 2.64$). Reported ethnicity of the sample was: 85.9% Caucasian, 8.0% Hispanic/Latino, 3.3% Asian-American, 1.9% African-American, and 0.9% other.

Materials

Participants completed an informed consent form, a demographic information sheet, the 35-item EHQ, a variety of measures that were used to examine the validity of the EHQ (described below), and received a debriefing form. Researchers measured height, weight, and body fat percentage with the same materials used in Study 1.

Eating Attitudes Test-26 (EAT-26). The EAT-26 (Garner, Olmsted, Bohr, & Garfinkel, 1982) is a self-report inventory that assesses attitudes and behaviors related to AN. Its 26 items are scored on a 6-point Likert-type format ranging from “always” to “never”. Garner et al. (1982) reported internal consistency in a female college student sample to be high (.83). Carter and Moss (1984) reported adequate 2- to 3-week test-retest reliability (.84). EAT-26 scores correlated positively with other self-report measures of eating disorder symptoms (e.g. Gross, Rosen, Leitenberg, & Willmuth, 1986; Henderson & Freeman, 1987; Mizes, 1988), and distinguished clinical eating-disordered patients from normal participants and binge eating patients from anorexic and bulimic patients, however they failed to differentiate anorexic subjects from bulimic subjects (Williamson, Prather, McKenzie, & Blouin, 1990). In this sample internal consistency was .90.

Bulimia Test-Revised (BULIT-R). The BULIT-R (Thelen, Farmer, Wonderlich, & Smith, 1991) is a self-report inventory that assesses the symptoms of bulimia nervosa. Its 28 items are scored on a 5-point rating scale. Thelen et al. (1991) reported good internal consistency (.97) and 2-month test-retest reliability (.95) in samples of female bulimics and female college students. In support of its convergent validity, BULIT-R

scores correlated positively with both another measure of bingeing behavior and with a diagnosis of bulimia nervosa (Thelen et al., 1991). In this sample internal consistency was .93.

Center for Epidemiologic Studies—Depressed Mood Scale (CES-D). The CES-D (Radloff, 1977) measures current levels of depressive symptomatology in the general population with an emphasis on depressed mood. Its 20 items are scored on a 4-point Likert-type format ranging from “rarely or none of the time (less than 1 day)” to “most or all of the time (5-7 days)”. Radloff (1977) reported good internal consistency (.85 general population, .90 psychiatric population), fair 2- to 8-week test-retest reliability (.51 to .67), and significant correlations between the CES-D and a number of other depression and mood scales. CES-D scores discriminated well both between psychiatric inpatients and the general population, and between those in the general population who did or did not state that they “need help” (Radloff, 1977). In this sample internal consistency was .90.

Personality Assessment Screener (PAS). The PAS (Morey, 1997) rapidly screens for a broad range of clinical problems. Its 22 items are scored on a 4-point Likert-type format ranging from “False, Not At All True” to “Very True” and are drawn from its parent instrument, the Personality Assessment Inventory (PAI; Morey, 1991). The PAS items are organized hierarchically into a total score and 10 distinct element scores: Negative Affect, Acting Out, Health Problems, Psychotic Features, Social Withdrawal, Hostile Control, Suicidal Thinking, Alienation, Alcohol Problem, and Anger Control. Morey developed the PAS using a construct validation framework emphasizing item

sensitivity and breadth of content coverage and under the assumption that no single quantitative item parameter can be used as the sole criterion for item selection. The items capturing the separate elements were not chosen to be highly related and therefore internal consistency was neither expected nor intended to be high.

The Maudsley Obsessional Compulsive Inventory (MOCI). The MOCI (Hodgson & Rachman, 1977) measures the existence and extent of obsessional-compulsive complaints. Its 30 items are scored True/False. Hodgson & Rachman (1977) reported MOCI scores correlated positively with another measure of obsessionality and that 6-month post-treatment change scores on the MOCI correlated positively with both therapist and patient ratings of improvement. Internal consistency in this sample was .76.

The International Personality Item Pool Five Factor Personality Inventory (IPIP-41). The IPIP-41 (Buchanan, Goldberg, & Johnson, 1999), based on the original 50 item IPIP (Goldberg, 1999), assesses the domains of the Five Factor Model (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism). Its 41 items are scored on a 5-point Likert-type format ranging from “very inaccurate” to “very accurate”. Buchanan et al. (1999) reported acceptable subscale internal consistency in an online sample (.74 to .88), and positive correlations between scale scores and self-reports of relevant behaviors, providing preliminary support for convergent validity. Internal consistency in this sample ranged from .67 to .87.

Procedures

Procedure was similar to Study 1. Participants completed informed consent forms, followed by a packet containing a demographics form, the EHQ, and the inventories described above in random order. They then went into the hall to have height, weight, and body fat percentage measured privately. Afterwards participants learned their body fat percentage measurement and received a debriefing form. Students from nutrition classes entered a cash prize drawing for their participation (two \$50 and one \$99 prize were awarded by random drawing at the completion of Study 2).

Results

Confirmatory Factor Analysis

Kaiser's (1974) MSA for the entire instrument was .93, which Kaiser (1974) described as "marvelous". MSAs for the individual items ranged from .88 to .95, considered "meritorious to marvelous", and indicating the data were appropriate for confirmatory factor analysis (CFA).

Measures of goodness-of-fit for the 3-factor model were: the χ^2 statistic, the Goodness-of-Fit Index (GFI; Joreskog & Sorbom, 1993), the Normed-Fit Index (NFI; Bentler & Bonett, 1980), the Tucker-Lewis Index (TLI; Marsh, Balla, & McDonald, 1988), the Comparative Fit Index (CFI; Bentler, 1990), and the root mean square error of approximation (RMSEA; Browne & Cudeck, 1993). Values of the GFI, NFI, TLI, and CFI range from 0 to 1.00, with values closer to 1.00 indicating a better fit (e.g., Byrne, 1989; Mulaik et al., 1989). For the RMSEA, values of less than .05 are considered a close fit and less than .08 an adequate fit (Finch & West, 1997). The TLI and CFI are

largely unaffected by sample size (Bentler, 1990; Fan, Thompson, & Wang, 1999; Marsh et al., 1988).

Initial fit indices were poor (see Table 4). Large correlations between error terms indicated redundancy of some items. Items with non-zero loadings on multiple factors also contributed to the poor fit. Ferrando and Lorenzo-Seva (2000) reported that a CFA follow-up to an EFA will commonly result in a poor fit due to inclusion of factorially impure items. These items cause specification errors in which significant loadings are incorrectly omitted or fixed to zero. Most EHQ items had non-zero loadings on multiple factors in the exploratory analyses from Study 1. However, the fit of the CFA could be improved by using modification indices and standardized residual scores to eliminate items. By sequentially eliminating 14 items from the 35-item EHQ, many with content that highly overlapped that of other items the model fit improved substantially (see Table 4).

Table 4
*Goodness-of-Fit Indices for 35-Item and 21-Item
Eating Habits Questionnaires*

Fit Indices	35-item	21-item
χ^2	1651.83 (df=557)	380.52 (df=186)
GFI	0.66	0.85
NFI	0.68	0.84
TLI	0.74	0.90
CFI	0.76	0.91
RMSEA	0.10	0.07

Inter-factor correlations of the 21-item EHQ ranged from $r = .40$ to $r = .76$ (see Table 5), suggesting the presence of a general, underlying factor (“ON”). The fact that

none of the confidence intervals around factor correlations included 1.0 supported the discriminant validity of the model (see Anderson & Gerbing, 1988) as did the fact that fixing the largest correlation to 1.0 (see Bagozzi & Yi, 1988) led to a significant degradation in fit.

Table 5
Factor Correlation Matrix of the Eating Habits Questionnaire

	Problems	Knowledge	Feelings
Problems	1.00	0.76	0.40
Knowledge		1.00	0.59
Feelings			1.00

Reliability

Internal consistency of the final 21-item version of the EHQ in the Study 2 sample was good, with subscale alphas ranging from .82 to .90 (see Table 6). Test-retest reliability of the subscale scores for the 21-item EHQ using the Study 1 sample data (as Study 2 participants did not retake the instruments) was acceptable, with test-retest correlations ranging from .72 to .81 (see Table 6).

Table 6
Cronbach Alphas and Test-Retest Coefficients for Eating Habits Questionnaire Subscales

<u>EHQ</u> <u>Subscale</u>	<u>Alpha</u>	<u>Test-</u> <u>Retest</u>
Problems	.90	.81
Knowledge	.82	.81
Feelings	.86	.72

Note. EHQ = Eating Habits Questionnaire.

Validity

Table 7 shows the correlations between the EHQ subscale scores and the measures given to assess their convergent and discriminant validity. The EHQ Problems subscale, as expected, correlated highly with measures of eating pathology ($r = .79$ with EAT-26 and $r = .62$ with BULIT-R), and moderately with the MOCI ($r = .32$), a measure of obsessional-compulsive complaints. Also as expected, there were small correlations between the Problems subscale and measures of depression ($r = .22$ with the CES-D) and general psychopathology ($r = .21$ with the PAS). Correlations with neuroticism ($r = .31$), and conscientiousness ($r = .07$) were somewhat higher and lower than expected, respectively. The statistically significant correlation between the Problems subscale and the BIDR SDE subscale ($r = -.18$) was not anticipated.

Table 7
*Correlations between Eating Habits Questionnaire
Subscales and Validity Measures*

	EHQ Subscales		
	Problems	Knowledge	Feelings
EAT-26	.79**	.54**	.41**
EAT-26-DIET	.75**	.51**	.46**
EAT-26-BUL	.72**	.49**	.28**
EAT-26-ORAL	.42**	.30**	.07
BULIT-R	.62**	.34**	.34**
MOCI	.32**	.17*	.17*
CES-D	.22**	.09	.13
PAS	.21**	.11	.12
PAS-NA	.25**	.17*	.18*
PAS-AO	.06	-.11	.02
PAS-HP	.18*	.09	-.01
PAS-PF	.11	.11	.12
PAS-SW	-.05	-.05	-.09
PAS-HC	.05	.12	.10

(continued)

Table 7 (continued)

	EHQ Subscales		
	Problems	Knowledge	Feelings
PAS-ST	.14*	.07	.06
PAS-AN	.12	.11	.05
PAS-AP	.20**	.14*	.14
PAS-AC	.05	.02	.03
IPIP-41-O	.01	.01	.08
IPIP-41-C	.07	.17*	.20**
IPIP-41-E	.10	.10	.15*
IPIP-41-A	-.10	-.06	.06
IPIP-41-N	.31**	.14	.19**
BIDR-IM	-.11	-.01	.05
BIDR-SDE	-.18**	-.01	-.02

* Correlation is significant at $p < .05$ level.

**Correlation is significant at $p < .01$ level.

Note. Abbreviated items are: EHQ = Eating Habits Questionnaire; EAT-26 = Eating Attitudes Test-26, DIET = dieting, BUL = bulimia, ORAL = oral control; BULIT-R = Bulimia Test Revised; MOCI = Maudsley Obsessional Compulsive Inventory; CES-D = Center for Epidemiologic Studies—Depressed Mood Scale; PAS = Personality Assessment Screener, NA = Negative Affect, AO = Acting Out, HP = Health Problems, PF = Psychotic Features, SW = Social Withdrawal, HC = Hostile Control, ST = Suicidal Thinking, AN = Alienation, AP = Alcohol Problem, AC = Anger Control; IPIP-41 = International Personality Item Pool Five Factor Personality Inventory-41, O = Openness, C = Conscientiousness, E = Extraversion, A = Agreeableness, N = Neuroticism; BIDR = Balanced Inventory of Desirable Responding, IM = Impression Management, SDE = Self-Deceptive Enhancement.

The pattern of correlations between measures of eating pathology and obsessionality and the Knowledge and Feelings subscales were similar to those with the Problems subscale, only to lesser degree (see Table 7). For example, all subscales correlated positively with the EAT-26, BULIT-R, and MOCI, however the $r = .79$ correlation between the Problems subscale and the EAT-26 dropped to $r = .54$ with the Knowledge subscale and $r = .41$ with the Feelings subscale. Similarly the $r = .32$ correlation between the Problems subscale and the MOCI dropped to $r = .17$ with both

the Knowledge and Feelings subscales, but remained statistically significant.

Differences in the pattern of correlations with the Knowledge and Feelings subscales and the Problems subscale showed up in statistically nonsignificant correlations with general psychopathology ($r = .11$ to $r = .12$), depression ($r = .09$ to $r = .13$), and unintentional socially desirable responding ($r = -.02$ to $r = -.01$). In addition, unlike the Problems subscale, both the Knowledge and Feelings subscales had small positive correlations with conscientiousness ($r = .17$ and $r = .20$, respectively).

Consideration of partial correlations showed that after removing the influence of the other 2 EHQ subscales, most of the relationships between the validity measures and the EHQ subscales were accounted for by the Problems subscale alone (see Table 8). The Feelings subscale showed a positive partial correlation with the EAT-26 total score ($r = .20$), the EAT-26 Dieting subscale ($r = .32$), and the BULIT-R ($r = .22$), in addition to a small correlation with conscientiousness ($r = .14$). In contrast, the Knowledge subscale was unrelated to some measures of eating pathology and negatively related with other measures of eating pathology ($r = -.14$ with EAT-26 Dieting subscale, $r = -.21$ with BULIT-R) when the effect of all other EHQ subscales was removed. The Knowledge subscale showed a statistically significant but small positive partial correlation with the BIDR SDE subscale ($r = .17$).

Table 8
*Partial Correlations between Eating Habits Questionnaire
 Subscales and Validity Measures*

	EHQ Subscales		
	Problems	Knowledge	Feelings
EAT-26	.69**	-.08	.20**
EAT-26-DIET	.66**	-.14*	.32**
EAT-26-BUL	.60**	.01	.01
EAT-26-ORAL	.31**	.08	-.13
BULIT-R	.57**	-.21**	.22**
MOCI	.28**	-.09	.10
CES-D	.22**	-.11	.09
PAS	.18**	-.06	.07
PAS-NA	.21**	-.05	.09
PAS-AO	.19**	-.23**	.11
PAS-HP	.18**	-.02	-.09
PAS-PF	.10	-.01	.04
PAS-SW	-.03	.02	-.09
PAS-HC	-.02	.10	.04
PAS-ST	.13	-.04	.03
PAS-AN	.07	.03	-.03
PAS-AP	.15*	-.06	.09
PAS-AC	.04	-.02	.02
IPIP-41-O	.03	-.05	.11
IPIP-41-C	-.07	.12	.14*
IPIP-41-E	.07	.10	.15
IPIP-41-A	-.07	-.05	.10
IPIP-41-N	.29**	-.13	.13
BIDR-IM	-.14*	.03	.06
BIDR-SDE	-.26**	.17*	-.03

* Correlation is significant at $p < .05$ level.

**Correlation is significant at $p < .01$ level.

Note. Abbreviated items are: EHQ = Eating Habits Questionnaire; EAT-26 = Eating Attitudes Test-26, DIET = dieting, BUL = bulimia, ORAL = oral control; BULIT-R = Bulimia Test Revised; MOCI = Maudsley Obsessional Compulsive Inventory; CES-D = Center for Epidemiologic Studies—Depressed Mood Scale; PAS = Personality Assessment Screener, NA = Negative Affect, AO = Acting Out, HP = Health Problems, PF = Psychotic Features, SW = Social Withdrawal, HC = Hostile Control, ST = Suicidal Thinking, AN = Alienation, AP = Alcohol Problem, AC = Anger Control; IPIP-41 = International Personality Item Pool Five Factor Personality Inventory-41, O = Openness, C = Conscientiousness, E = Extraversion, A = Agreeableness, N = Neuroticism; BIDR = Balanced Inventory of Desirable Responding, IM = Impression Management, SDE = Self-Deceptive Enhancement.

The large zero-order and partial correlations between the Problems subscale and the EAT-26 total score ($r = .79$ and $r = .69$ respectively) called into question whether the Problems subscale was measuring the same construct as the EAT-26 and whether it provided any predictive power above the EAT-26. In an attempt to answer this question I performed a series of hierarchical regressions using EAT-26 scores to predict scores on the MOCI, CES-D, PAS, and IPIP-41, forcing in the Problems subscale as a secondary predictor. Statistically significant change in R^2 values would have indicated that the Problems subscale provided predictive power above that of EAT-26 scores. However, all of the change scores were statistically nonsignificant, indicating that in this sample the Problems subscale did not predict these variables above and beyond the EAT-26. Repeating the process with the Knowledge and Feelings subscales individually led to the same statistically nonsignificant results, with the exception of both subscales predicting conscientiousness above and beyond EAT-26 scores (R^2 change values = .03 and .04, respectively, and were statistically significant at the $p = .01$ level).

Comparison of student group means on EHQ subscales indicated the expected direction of results (see Table 9). On all subscales nutrition majors scored higher (more “orthorexic”) than students from introductory nutrition classes, who scored higher than students from introductory psychology classes. Examination of a One-Way Analysis of Variance (ANOVA) indicated statistically significant between group differences on each subscale (all p -values $< .001$). The majority of Tukey’s post-hoc t -tests on simple contrasts were statistically significant, and all had at least a small effect size as measured by Cohen’s d (see Table 10; Cohen, 1988). Cohen’s d is a standardized differences

effect size, computed by dividing the mean difference between 2 groups by the pooled standard deviation of the groups. Values greater than .2 are considered “small”, greater than .5 “medium”, and greater than .8 “large”.

Table 9
Eating Habits Questionnaire Subscale Means and Standard Deviations by Student Group

Student Group	EHQ Subscale					
	Knowledge		Problems		Feelings	
	Mean	SD	Mean	SD	Mean	SD
Intro. Psychology	7.38	2.45	14.18	3.42	13.92	3.94
Intro. Nutrition	8.81	3.11	16.03	5.89	15.13	3.41
Nutrition Major	11.05	2.69	18.47	7.26	16.98	3.00

Note. EHQ = Eating Habits Questionnaire.

Table 10
Post-Hoc Tukey's t-Tests on Simple Contrasts of Eating Habits Questionnaire Subscale Means by Student Group

EHQ Subscale	Contrast	Mean		
		Difference	<i>p</i> -value	Cohen's <i>d</i>
Knowledge	1-2	-1.44**	.00	.51
	1-3	-3.75**	.00	1.24
	2-3	-2.31**	.00	.74
Problems	1-2	-1.80	.08	.38
	1-3	-4.30**	.00	.81
	2-3	-2.50*	.04	.38
Feelings	1-2	-1.22	.08	.32
	1-3	-3.07**	.00	.78
	2-3	-1.85*	.02	.55

* Mean difference is significant at $p < .05$ level.

**Mean difference is significant at $p < .01$ level.

Note. EHQ = Eating Habits Questionnaire. Contrast groups are as follows: 1 = Introductory psychology students, 2 = Introductory nutrition students, 3 = Nutrition majors.

Discussion

One purpose of Study 2 was to test the 3-factor structure from Study 1 on a new sample. Initially, large correlations between error variances and items with non-zero loadings on multiple factors contributed to poor fit (see Table 4). According to Ferrando and Lorenzo-Seva (2000), EFA supported factor structures commonly fit poorly when tested with CFA due to inclusion of factorially impure items. EHQ items with non-zero loadings on multiple factors caused specification errors in which significant loadings were incorrectly omitted or fixed to zero. However, after eliminating items with redundant content or other indications of poor model fit, the fit of a final 21-item version of the EHQ was adequate (see Table 4). Confidence intervals around factor correlations did not contain 1.0, and constraining the highest correlation to equal 1.0 led to a significant loss in fit, supporting the discriminant validity of the factors. Subscale internal consistency for the Study 2 sample was good, as was 2- to 4-week test-retest reliability assessed for the Study 1 sample (see Table 6).

The second purpose of Study 2 was to examine the convergent and discriminant validity of the EHQ. As expected, the EHQ Problems subscale correlated more highly with measures of eating pathology than with measures of general pathology, personality, or social desirability, thus providing evidence of both convergent and discriminant validity (see Tables 7 and 8). A similar pattern of zero-order correlations existed between measures of eating pathology and obsessionality and the Knowledge and Feelings subscales, though the correlations were more moderate (see Table 7). Consideration of partial correlations provided a different picture of these relationships.

The Feelings subscale maintained significant, but smaller correlations with a few of the measures of eating pathology and with conscientiousness (see Table 8). The positive correlations between scores on these measures provide evidence that the Feelings subscale is related to pathological eating constructs, though it may not be obvious from its content (i.e. “I feel great when I eat healthily”). In contrast, when the effects of the other EHQ subscales were removed, the Knowledge subscale was unrelated to some measures of eating pathology and to obsessionality, and was negatively correlated with other measures of eating pathology. This differs from Bratman’s (2000) view that obsessive knowledge-seeking about healthy eating can be problematic. Future research in a population similar to Bratman’s (patients seeking advice about healthy eating from an alternative medicine physician), or in an eating disordered population may shed more light on this issue. The Knowledge subscale showed a statistically significant positive correlation with the BIDR SDE subscale ($r = .17$), however this relationship was not large enough to cause concern that the Knowledge subscale primarily measured unintentional socially desirable responding.

Knowledge and Feelings subscales differed from the Problems subscale in their pattern of statistically nonsignificant correlations with general psychopathology, depression, and self-deceptive enhancement. Unlike the Problems subscale, the Feelings subscale had a small positive correlation with conscientiousness. I had expected the Problems subscale to share this relationship to conscientiousness, due to a possible link to perfectionism; however, it is unclear why this was not so. Future research using specific measures of perfectionism may provide clearer evidence of these links.

The large correlation between the EHQ Problems subscale and EAT-26 scores caused a concern about the discriminant validity of EHQ scores in this sample. If the Problems subscale predicted obsessional-compulsive complaints, depression, general psychopathology, or personality characteristics above EAT-26 scores then there would be evidence that the Problems subscale contributed something different. However, the Problems subscale failed to achieve statistically significant change scores, also failing to provide support for the discriminant validity of EHQ data from EAT-26 scores in this sample. The Knowledge and Feelings subscales displayed similar statistically nonsignificant results from the same process, with the exception of both subscales being statistically significant predictors of conscientiousness over the EAT-26. Future research in a clinical population (though defining this for “orthorexics” would be a challenge) could shed more light on the discriminant validity of the EHQ from the EAT-26.

In spite of the need for more research on the predictive validity of the EHQ, it is interesting to note the high overlap with a measure of eating pathology, given that the item content of the EHQ did not explicitly assess eating “pathology”. Because of the correlational design of this study, all that can be concluded is that people who had elevated scores on the EHQ also generally had elevated scores on the EAT-26 (and to some degree the BULIT-R). This may mean that the EHQ is measuring the same construct as the EAT-26, but more poorly in regard to its predictive power, or alternatively may mean that “ON” is simply a sub-facet of AN. If “ON” and AN were distinct from one another, yet still related, then a sample of “orthorexics” would be

expected to score more highly than anorexics on the EHQ, and anorexics would be expected to score more highly than “orthorexics” on the EAT-26, while both groups would score more highly on both measures than people from the general population.

SUMMARY

The EHQ is a 21-item self-report inventory designed to measure a pathological fixation on healthy eating that has been labeled “orthorexia nervosa” (see Appendix). The subscales of the EHQ appear to capture: 1) problems associated with healthy eating, 2) knowledge of healthy eating, and 3) feeling positively about healthy eating. The EHQ displayed good internal consistency and test-retest reliability in a college student sample. Examination of correlations between the EHQ subscales and a variety of other measures provided preliminary evidence for both convergent and discriminant validity in this sample; however more research is needed, in particular on the validity of EHQ scores in other populations, and on the predictive value of the EHQ.

Limitations

Participants were all college students, with a mean age of 20 in each sample, therefore there is no evidence of the generalizability of these results to different age groups or socioeconomic status (SES) groups (as college students tend to be of higher SES than the general population). The samples were also largely Caucasian, further limiting generalizability to other ethnic or cultural groups.

Another limitation of the studies presented is that they were not conducted with an “orthorexic” population. However, defining and identifying such a population without established criteria for diagnosis would be impossible. Recruitment of nutrition majors increased the range of EHQ scores over those provided by psychology majors alone (as shown by larger interquartile ranges), however it is not clear that any of the participants in these studies would meet Dr. Bratman’s (2000) definition of “ON”.

Review of participants' answers to a question on the demographics form asking about health-food related diets followed in the past year did not indicate that any participants followed the extreme diets frequently discussed by Dr. Bratman (macrobiotics, raw foods, etc.). This may be a reflection of the community in which participants were recruited (there is only one small health-food store), or could mean that "ON", if it exists, is a rarely occurring phenomenon.

Future Directions

Future research on both "ON" and the EHQ is needed in many areas. As stated previously, research in an "orthorexic" population, if one could be identified, could provide further evidence of the convergent and discriminant validity of EHQ scores among "orthorexics", as could comparison research with an eating disordered population. Constructs of interest on which to compare "orthorexics" and anorexics include body image, magical beliefs about food, and perfectionism.

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APPENDIX

EATING HABITS QUESTIONNAIRE

Please answer the following questions by circling the response that best fits your current eating habits.

F = False, not at all true ST = Slightly true MT = Mainly true VT = Very true

- | | | | | |
|---|---|----|----|----|
| 1. I am more informed than others about healthy eating. | F | ST | MT | VT |
| 2. I turn down social offers that involve eating unhealthy food. | F | ST | MT | VT |
| 3. The way my food is prepared is important in my diet. | F | ST | MT | VT |
| 4. I follow a diet with many rules. | F | ST | MT | VT |
| 5. My eating habits are superior to others. | F | ST | MT | VT |
| 6. I am distracted by thoughts of eating healthily. | F | ST | MT | VT |
| 7. I only eat what my diet allows. | F | ST | MT | VT |
| 8. My healthy eating is a significant source of stress in my relationships. | F | ST | MT | VT |
| 9. I have made efforts to eat more healthily over time. | F | ST | MT | VT |
| 10. My diet affects the type of employment I would take. | F | ST | MT | VT |
| 11. My diet is better than other people's diets. | F | ST | MT | VT |
| 12. I feel in control when I eat healthily. | F | ST | MT | VT |
| 13. In the past year, friends or family members have told me that I'm overly concerned with eating healthily. | F | ST | MT | VT |
| 14. I have difficulty finding restaurants that serve the foods I eat. | F | ST | MT | VT |
| 15. Eating the way I do gives me a sense of satisfaction. | F | ST | MT | VT |
| 16. Few foods are healthy for me to eat. | F | ST | MT | VT |
| 17. I go out less since I began eating healthily. | F | ST | MT | VT |
| 18. I spend more than three hours a day thinking about healthy food. | F | ST | MT | VT |
| 19. I feel great when I eat healthily. | F | ST | MT | VT |
| 20. I follow a health-food diet rigidly. | F | ST | MT | VT |
| 21. I prepare food in the most healthful way. | F | ST | MT | VT |

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