

Eating Competence and Gender Identity are significantly associated with Weight-and-Body
Shame-and-Guilt, Eating Concerns, and Weight Satisfaction in Undergraduate Students

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Abstract

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Objectives: The aim of this study was to determine if Eating Competence in undergraduates is associated with Weight-and-Body Shame-and-Guilt (WEB-SG), weight satisfaction, and eating concerns, and whether these associations differ by gender identity. **Methods:** This cross-sectional study was a secondary analysis of data from a 127-item survey sent out to undergraduates at a public university in the U.S. in 2020. Participants were categorized as either “Eating Competent” (EC) or “Not Eating Competent” (non-EC) according to their responses on the validated Satter Eating Competence Inventory (ecSI 2.0™). Two-factor ANOVAs tested whether Eating Competence and gender identity were associated with total WEB-SG; total Weight-and-Body Shame (WEB-S); total Weight-and-Body Guilt (WEB-G); weight satisfaction; and eating concerns. Demographic characteristics were evaluated in relation to gender identity;

Body Trying categories were compared with gender, BMI, and body weight perception categories. **Results:** Of the 1996 student participants, 40.2% were EC. Of those who disclosed their gender identity, 72% identified as women, 23% identified as men, and 4% identified as trans or gender non-conforming (TGNC). Eating Competence was significantly associated with lower total WEB-SG, greater weight satisfaction, fewer eating concerns, and with not trying to lose body weight ($P < 0.001$ in all cases). In every outcome variable tested, those who were EC had more favorable mean scores than those who were non-EC. Men's mean ecSI 2.0™ scores were significantly higher than that of women's (32.8 vs. 27.6; $P < 0.001$). Men had more favorable mean scores than women in every outcome variable tested. TGNC participants had the lowest ecSI 2.0™ scores of all three gender identity groups (mean 24.7). They also had total WEB-SG scores, WEB-Shame subscale scores, weight satisfaction scores, and eating concerns scores that were not significantly different from those of women. TGNC participants also had WEB-Guilt subscale scores and Eating Concerns scores that were not significantly different from those of men. **Conclusion:** These associations demonstrate the underlying emotional components of food, eating behaviors, and body-related perceptions, and suggest that the Eating Competence Model (eSatter) may be a useful part of future interventions aimed at improving these characteristics in undergraduates.

Introduction

College-age students are overwhelmingly vulnerable to negative health outcomes brought on by body shame, eating concerns, and weight dissatisfaction. Eating disorders, for instance, are often diagnosed for the first time before a person's twenty-fifth birthday, with the initial insult concentrated in late adolescence and young adulthood.¹ For female college students, a significant inverse correlation has been found between body dissatisfaction and self-confidence.² Across the gender spectrum, many in this age group are not content with how much they weigh, often regardless of whether their weight is in a "normal" or "healthy" category.³⁻⁶ Such preoccupation with food and weight status has been shown to result in psychological and behavioral issues in this age group.^{7,8}

The Satter Eating Competence Model (ecSatter), developed by therapist and former dietitian Ellyn Satter, offers a unique lens through which to view eating behaviors. Instead of over-indexing on the specifics of servings and portion sizes, ecSatter encourages eaters to focus less on food and more on the feelings associated with food consumption. According to the tenants laid out in ecSatter, people who are Eating Competent (EC) employ a range of skills which allow them to be relaxed, flexible, and confident in the presence of food.⁹ Competent eaters are capable of, and reliable to, feeding themselves a variety of foods consistently and regularly, across a myriad of contexts. The central tenet of ecSatter is that, provided adequate support, a person can learn to trust their naturally occurring hunger cues, and follow them, regardless of pressure from external influences. Given freedom to exist, these inherent signals can help a person make appropriate decisions about consuming an array of foods that will satisfy and nourish them.⁹ The model is tested with the validated Satter Eating Competence Inventory (ecSI 2.0TM).^{10,11} The

ecSI 2.0TM has been used to assess Eating Competence in numerous contexts, across varying sexes, genders, ages, and socioeconomic statuses¹²⁻¹⁵ including college students.^{16,17}

The aim of this study was to expand the breadth of understanding around characteristics and traits associated with Eating Competence, especially as it pertains to college students. To that end, our objective was to determine if associations could be found between Eating Competence and the following: Weight-and-Body Shame-and-Guilt (WEB-SG), weight satisfaction, and eating concerns. We also wanted to understand whether any of these associations differed by gender identity. Based on the principles of ecSatter, we anticipated that those who were EC would have less WEB-SG, greater weight satisfaction, and fewer eating concerns than those who were non-EC. Considering current data on binary gender characteristics, it was hypothesized that those who identify as men would have more positive scores in every variable (including higher ecSI 2.0TM scores) than women.¹⁸ Because so little research on this topic has been done in non-binary gender communities, it was unclear what the outcomes might be for those who identify as other than man or woman. If the traits and outcomes associated with Eating Competence continually prove to be positive, ecSatter could become even more useful in the care, education, and treatment of college students with food-and-body troubles. Furthering our understanding of whether and how Eating Competence relates to an expanding definition of gender could make its usefulness more broadly applicable, and thus, helpful.

Literature Review

The benefits associated with Eating Competence are overwhelmingly positive. Previous studies have shown that college students who are Eating Competent are more likely to have more nutrient dense diets and higher scores on the Healthy Eating Index,¹⁹ higher self esteem,²⁰ more

positive attitudes about weight,¹⁷ and even better sleep quality.¹⁶ Adults who are EC have been shown to have lower BMIs,¹⁰ higher levels of physical activity,²¹ better food-related budgeting and planning skills,¹⁰ lower triglycerides and higher HDL-cholesterol levels,²² and are less likely to have metabolic syndrome.²¹ While some studies have assessed the relationship between Eating Competence and weight satisfaction,¹⁷ gaps remain regarding its association with WEB-SG and eating concerns. Demonstrating the existence of such relationships may ultimately offer more evidence for the benefits of ecSatter.

To the author's knowledge, this is the first study to consider an association between Eating Competence and WEB-SG. Although related, guilt and shame are distinctly unique. Guilt has been characterized as a feeling of remorse that a person has about something wrong that they've done; shame is a more intense negative emotion felt by a person who sees themselves as inherently wrong.²³⁻²⁵ An important difference lies in the seeming feasibility to change that which is driving the emotion. Feelings of guilt are often followed up by some measure of corrective action which is intended to address and eradicate the feelings.²³ In contrast, shame is more innate to a person's sense of self, and thus is less tangible and more difficult to eradicate. Previous studies on the topics of weight and/or body related shame or guilt have shown that these emotions are associated with negative health outcomes in the collegiate population. For instance, this kind of shame and guilt has been shown to be a strong predictor of disordered eating habits.²⁶ Body shame specifically is more strongly related to eating disorder pathology than generalized shame²⁷ and is predictive of eating disturbance in males and females with eating disorders.²⁵ Shame and guilt attributed to weight/body are associated with eating disorder symptoms in college females,^{26,28-30} and in women with past or current eating disorders, body-shame can predict an increase in anorexic symptoms.³¹ Young adults with elevated amounts of body-shame self-report

higher levels of body dissatisfaction and lower self-esteem.³⁰ Weight shame is also associated with depression in university students.³²

Another common trait associated with negative health outcomes in this population is weight dissatisfaction,³³⁻³⁵ which tends to increase as people develop from adolescence to young adulthood.³⁶ Lower body satisfaction is a predictor for the use of inadvisable methods to change weight, such as vomiting, laxatives, or diet pills.³⁴ Females have been shown more likely than males to engage in such behaviors,³⁷ and to experience general body dissatisfaction.^{5,38,39} Of note, while body dissatisfaction and weight dissatisfaction are not explicitly the same, studies on the topic of satisfaction often use the words “body,” “weight,” and “bodyweight” interchangeably.

Eating concerns also have implications in college-age students which go beyond simple social anxiety. Studies have demonstrated numerous downstream effects of these feelings, which play out both physically and mentally. High eating concerns scores are correlated with higher BMIs in undergraduate students.³³ College students with eating and weight concerns show a propensity towards internalizing the slender beauty ideal⁴⁰ and often choose not to seek help to address their concerns.^{41,42} Weight and eating concerns predict eating disorder risk in both young adult males and females.⁴³ Left unchecked, these concerns may become exacerbated and could result in Orthorexia Nervosa, an unhealthy obsession with “perfection” in eating.^{33,44}

Considering the additional stigma experienced by Trans and Gender Nonconforming (TGNC) individuals, these young adults may be at even greater risk for negative food-and body-related outcomes.⁴⁵⁻⁴⁹ However, much of the nutrition research done in this population primarily aims at understanding how gender non-conformity is associated with eating disorder symptomatology.

The research is additionally obscured by the inconsistencies in the definition of the population; where research is just beginning to expand to include a diversity of sexual orientation minorities, gender minorities are still mostly overlooked. It is particularly difficult to find data for these individuals that differentiates between weight dissatisfaction specifically, and body dissatisfaction related to body dysmorphia, which may be present especially for those identifying as transgender. To the author's knowledge, this is only the second study about Eating Competence which expands its scope to include data about gender identities other than male/female subgroups.¹³

Methods

Participants and Study Design

The present study is a secondary analysis of data from a cross-sectional study aimed at assessing factors associated with Eating Competence in undergraduate college students. The university Human Subjects Division determined that this study qualified for exempt status. Data were collected virtually, during the autumn quarter (October through December) 2020, when the university was closed due to the COVID-19 pandemic. Collection was done by way of an online questionnaire which was initially distributed via individual emails to 27,472 students who were enrolled at a large public university in the northwestern United States. A total of 2,548 students responded to the survey, representing 6.2% of the total undergraduate population enrolled at the three campuses of the university.⁵⁰ Of these, 2062 respondents met the inclusion criteria and agreed to the informed consent. Exclusion from participation was necessary if respondents were: younger than 18 years of age, not enrolled at the university in an undergraduate program, unable to read or comprehend English, or if they were pregnant or lactating since this could alter eating behaviors. Once 'non-completers' were removed (n=66), complete data was collected from 1996

undergraduate students ('completers') with a mean age of 20.11 (± 3.49). The final sample size exceeded the sampling requirements indicated by the power analysis. There were no significant differences between 'non-completers' and 'completers' on any of the demographic variables; therefore, eliminating the 66 highly incomplete surveys from the dataset (i.e., those who had answered < 20% of the survey items) did not alter the representativeness of the sample. As part of the overall survey, participants were asked about their gender identification, age, and their height and weight, which were used to calculate BMI.

Data were collected using REDCap (Research Electronic Data Capture), a secure, web-based software platform designed to support data capture for research studies^{51,52} hosted at the university. Data were collected anonymously; therefore, any part of the survey that was not completed in a single session could not be returned to later. Once it was closed or submitted, alterations to the responses could not be made. Respondents were informed of this fact, and other than the questions to determine eligibility, could skip any questions. The online survey took participants approximately 15 minutes to complete and consisted primarily of previously validated and/or published instruments; those that are relevant to this study are described below.

Measures

The data used in this study were primarily related to Eating Competence, gender, WEB-SG, weight satisfaction, and eating concerns. Other socio-demographic information was self-reported by the participants and included age (years) and BMI (weight (kg)/height (m²)).

Eating Competence was assessed using the 16-item Satter Eating Competence Inventory (ecSI 2.0™). The ecSI 2.0™ has been validated,^{10,11} and is test-retest reliable.⁵³ The test evaluates Eating Competence in four domains: eating attitudes (6 questions), food acceptance (3

questions), internal regulation (2 questions), and contextual skills for obtaining and preparing food (5 questions). Total scale scores can range from 0 to 48, with scores at or above 32 indicating EC, and scores at or below 31 indicating non-EC.

Gender identity was assessed using a single question: “What is your current gender identity?” Respondents could choose any of the following: Man, Woman, Transgender Man / Transmasculine, Transgender Woman / Transfeminine, Queer / Gender queer, Non-binary / Gender non-conforming, Different identity not specified above, Prefer not to answer.

Weight-and-Body Shame-and-Guilt (WEB-SG) was assessed using the 12-item WEB-SG scale.²³ Six of the items relate to Weight-and-Body Guilt (WEB-G), and six to Weight-and-Body Shame (WEB-S), in the context of body size, food consumption, and physical activity. This tool has been shown to be valid and reliable in university students.⁵⁴ Total scale scores can range from 0 to 24, with lower scores indicating less shame and guilt.

Weight Satisfaction was assessed using a single question: “What is your level of satisfaction with your current body weight, from 0 (not satisfied at all) to 10 (extremely satisfied)?” Responses ranged from 0 to 10 on a visual analog scale, and used as a continuous variable.^{17,55}

Eating concern was assessed using 5 statements chosen from the Health Concern Scale.^{56,57} The statements pertain to concerns about nutrient related intake in regard to energy, fat, cholesterol, sugar, and additives. Students were asked to respond to each statement using a 7-point Likert-type scale ranging from 1 (‘definitely not’) to 7 (‘definitely yes’). Total scale scores for eating concern can range from 5 to 35, with lower scores indicating lower concern. This tool has been shown to be valid and reliable in other samples of university students.⁵⁴

Body Weight Perception was assessed using a single question: “How would you describe your current body weight?” Respondents could choose any of the following options, which are in line with the CDC’s current definition of BMI categories: underweight, normal weight, overweight, obese (i.e., very overweight).⁶

What participants were trying to do about their body weight was assessed using a single question: “What are you currently trying to do about your body weight?” Four possible categorical responses were offered, including: “Trying to lose weight,” “Trying to maintain weight,” “Trying to gain weight,” and “Doing nothing.” This question has been used in previous studies on similar populations.⁵⁸ These responses will henceforth be referred to as “Body Trying” responses.

Statistical Analyses

In order to determine how to best approach the data analysis, tests of normality were run on the scores from each of three validated tests described above (WEB-SG, broken down into subscales of shame and guilt; weight satisfaction; eating concerns). For each set of scores, Z-scores were calculated for skewness and kurtosis by dividing the skewness and kurtosis values by their respective standard errors. A Shapiro-Wilk test was also run for each score set and histograms were visually inspected for normality. Independent samples *t*-tests were conducted to determine if there were statistically significant differences in scores between those who were EC and those who were not EC. Levene's Test for Equality of Variances was also run for each set of scores. Post-hoc analyses were carried out using Bonferroni for multiple comparisons (weight satisfaction and WEB-G scores) Dunnett C for heterogeneous variances (EC scores, Total WEB-SG scores, WEB-S scores).

Since the tests for normality of the outcome variables were significant, non-parametric tests were also run. The results of non-parametric tests (Mann-Whitney U, Kruskal-Wallis H, etc.) were similar to those of parametric procedures, showing significant differences between groups and demonstrating the robustness of the data. The 2-factor ANOVA was ultimately determined to be the best fit for assessment.

Eating Competence and gender identity were entered as independent variables. Outcome variables were: WEB-SG, WEB-S, WEB-G, weight satisfaction, and eating concerns. Due to low frequencies in some categories for gender identification, participants were recategorized into 3 groups for analyses: man, woman, or trans and gender non-conforming (TGNC). The TGNC group consisted of those who responded to the gender identity with any of the following responses: Transgender Man / Transmasculine, Transgender Woman / Transfeminine, Queer / Gender queer, Non-binary / Gender non-conforming, Different identity not specified above. The data of those who selected the Prefer not to Answer option on the original survey ($n= 13$) were not included in the analysis, since these individuals could not be correctly categorized into any of the options provided, and had too low a frequency to be their own gender identity group. Participants were also categorized as being either “Eating Competent” (EC) or “Not Eating Competent” (non-EC) as defined by their responses on the ecSI 2.0™.

A Pearson correlation analysis of BMI and ecSI 2.0™ scores demonstrated that there was not a significant relationship between BMI & EC in this sample. Therefore, BMI was not employed as a covariate in the analyses.

Post hoc chi-square tests of independence were conducted to evaluate the demographic

characteristics of the sample in relation to gender identity. Two-factor ANOVA with Bonferroni for multiple comparisons was conducted to evaluate ecSI 2.0TM total scores in relation to gender and Body Trying categories (i.e., losing, gaining, maintaining, or nothing), and Body Weight Perception categories (i.e., underweight, normal weight, overweight, obese). Chi square tests of independence were conducted to evaluate relative frequencies of Body Trying categories with gender, BMI categories,⁶ and Body Weight Perception categories.

Results

Statistical analysis was conducted using SPSS, version 28.⁵⁹ Demographic characteristics of the sample are shown in Table 1, and are categorized by gender identity. The majority of the sample self-identified as women (72%) and the average age of the participants was 20.1 years. Four percent of the sample identified as TGNC. The mean Body Mass Index (BMI) of the participants, which was calculated using self-reported weight (pounds), and height (inches), was 23.0 kg/m². This is defined as a “healthy weight” according to guidelines published by the Centers for Disease Control.⁶ In the total sample, the number of those with a “healthy weight” was $n= 1317$ (66.7%), while $n=152$ (7.7%) were “underweight” and $n= 426$ (24.8%) were in the combined “overweight”/“obese” categories.⁶

Table 1: Characteristics of the total sample (N= 1996) of undergraduate students at a public university in the Northwestern U.S. in 2020, categorized by gender identity.

Characteristic	Total Sample (N=1996)	Men	Women	Trans and gender non-conforming (TGNC) ^a	Prefer Not to Answer	P value
Total Sample <i>n</i> (%)	1996	462 (23.3)	1430 (72.0)	80 (4.0)	13 (0.7)	
<i>Mean (SD)^b</i>						
Age (years)	20.1 (3.5)	20.4 (3.6)	19.9 (3.2)	20.4 (0.4)	24.2 (13.4)	<0.001 ^d
Body Mass Index ^c	23.0 (4.3)	23.4 (4.4)	22.8 (4.1)	24.4 (6.3)	23.3 (3.5)	<0.001 ^d
<i>n (%)</i>						
Body Mass Index (<i>n</i> = 1906) ^e						0.008 ^f
Underweight (<18.5)	153 (7.7)	33 (21.6)	109 (71.2)	10 (6.5)	1 (0.7)	
Normal Weight (18.5-25)	1350 (68.0)	304 (22.5)	997 (73.9)	42 (3.1)	7 (0.5)	
Overweight (25-30)	321 (16.2)	87 (27.1)	213 (66.4)	17 (5.3)	4 (1.2)	
Obese (30+)	130 (6.6)	33 (25.4)	86 (66.2)	11 (8.5)	0 (0.0)	

Footnotes

- a. Trans and gender non-conforming (TGNC) includes: Transgender Man/Transmasculine, Transgender Woman/Transfeminine, Queer/Gender queer, Non-binary/Gender non-conforming, and Different Identity Not Specified.
- b. SD refers to Standard Deviation.
- c. Body Mass Index was calculated using self-reported weight (kg) divided by height (m²).
- d. P values calculated using one-way ANOVA with Bonferroni for multiple comparisons or Dunnett C for heterogeneous variances.
- e. N for Body Mass Index is different from n for the total sample, due to the fact that n=42 did not respond to this survey question.
- f. P value calculated using chi-square tests of independence. The “Prefer not to answer” subgroup was not included in the chi-square analyses due to extremely low frequencies.

Table 2 shows the results of the 2-factor ANOVA, organized by Eating Competence status and self-defined gender identity. In the total sample, 794 participants (40.2%) were EC. Those who were EC had a mean ecSI 2.0™ score of 38.8, while those who were non-EC had a mean ecSI 2.0™ score of 22.1 ($P<0.001$). The average ecSI 2.0™ score of the total sample was 28.69 ± 10.1 , which is considered not Eating Competent. The main effect of gender was significant ($F=12.7$, $P<0.001$). Men had ecSI 2.0™ scores that were significantly higher than women (32.8 vs. 27.6; $P<0.001$) and TGNC individuals (32.8 vs. 24.7; $P<0.001$).

Total Weight-and-Body Shame-and-Guilt (WEB-SG) Scores

There was no interaction between gender identity and Eating Competence for WEB-SG scores ($P=0.22$). The main effects of gender and Eating Competence were both significant ($P<0.001$). In the total sample, the average score for WEB-SG was 21.9, and those who were EC had significantly lower scores than those who were non-EC (16.37 vs. 25.82; $P<0.001$). Thus, lower Eating Competence is associated with higher WEB-SG. Men had, on average, the lowest scores (16.8), and women the highest (23.7), and this difference in scores was significant ($P<0.001$). The difference in scores between men (16.8) and TGNC (21.2) was also significant ($P=0.003$), but the difference between women and TGNC was not significant ($P=0.188$).

Weight-and-Body Guilt (WEB-G) Subscale Scores

There was no interaction between gender identity and EC for WEB-G subscale scores ($P=0.18$). The main effects of gender and Eating Competence were both significant ($P<0.001$). WEB-G scores were significantly lower in those who were non-EC (mean 9.6) compared to those who were EC (mean 14.3, $P<0.001$). Greater Eating Competence was associated with lesser feelings of weight-and-body guilt in this sample. Women, on average, had the highest WEB-G scores

(mean 13.3), men had the lowest (mean 9.9), and the difference in scores between these groups was significant ($P<0.001$). The difference in WEB-G scores between women and TGNC individuals was significant ($P=0.004$), but the difference between TGNC individuals and men was not significant.

Weight-and-Body Shame (WEB-S) Subscale Scores

There was no interaction between gender identity and EC for WEB-S subscale scores ($P=0.28$). The main effects of gender and Eating Competence were both significant ($P<0.001$). WEB-S scores were significantly lower in those who were EC (mean 7.6), compared to those who were non-EC (mean 13.2, $P<0.001$). Thus, greater Eating Competence was associated with lesser feelings of WEB-S in this sample. Men had the lowest WEB-S scores (mean 7.8); women and TGNC had identical, higher, scores (mean 11.9). The difference in scores between men and the other two gender categories was significant ($P<0.001$). The difference in scores between women and TGNC was not significant ($P=1.00$).

Weight Satisfaction Scores

There was no interaction between gender identity and Eating Competence for weight satisfaction scores ($P=0.050$). The main effects of gender and Eating Competence were both significant ($P=0.003$; $P<0.001$). Weight satisfaction scores were significantly higher in those who were EC (mean 6.1), compared to those who were non-EC (mean 13.2, $P<0.001$). Thus, Eating Competence was associated with greater weight satisfaction in this sample. Men had the highest weight satisfaction scores (mean 5.6), which was significant in relation to both the other gender categories ($P=0.003$). The mean scores for TGNC individuals were not significantly different from mean scores for women (4.88 vs 4.81; $P<0.256$).

Eating Concerns Scores

There was no interaction between gender identity and Eating Competence for eating concerns scores ($P=0.859$). The main effects of gender and Eating Competence were both significant ($P<0.001$). Eating concerns scores were significantly higher in those who were non-EC compared to those who were EC (mean 20.6 v. 16.9; $P<0.001$). Thus, greater Eating Competence was associated with fewer eating concerns in this sample. Men had the lowest eating concerns scores (mean 17.0) which were significantly lower than women (mean 19.9; $P<0.001$), but not from TGNC (mean 18.5; $P=0.13$). Women had the highest scores, which were not significantly different from TGNC ($P=0.878$).

Exploratory Analyses

A two-way ANOVA with Dunnett's C for heterogeneous variances showed that there was no interaction in ecSI 2.0™ scores between gender and Body Trying responses ($P=0.468$). The main effect of Body Trying responses on ecSI 2.0™ scores was significant ($P<0.001$). The main effect of gender was also significant, and this was discussed in a previous section. The average ecSI 2.0™ score for participants who said they were currently trying to lose weight was 26.6 ± 9.9 , and this group had the lowest average ecSI 2.0™ scores. This was significantly lower than the average ecSI 2.0™ score for participants who said they were trying to: maintain their weight (mean 31.2 ± 9.2 , $P<0.001$), gain weight (mean 30.49 ± 11.3 , $P<0.001$), and doing nothing about their weight (mean 30.64 ± 10.1 , $P<0.001$). Within the entire sample, 47% of participants reported that they were “currently trying to lose weight.”

Further post-hoc analyses revealed that in the total sample, 40.2% of the participants with a “normal” weight⁶ identified as currently trying to lose weight. 12% percent of those who are

“underweight”⁶ also identified as currently trying to lose weight. More nuanced interactions between gender identity and Body Trying responses were also realized. Of the participants who identified as women, 53.3% said they were currently trying to lose weight compared to 43.2% of TGNC individuals and to 29.9% of men. This difference was significant ($P<0.001$). Notably, only 20.6% of women, 35% of TGNC individuals, and 25.1% of men were calculated as being “overweight” or “obese.”⁶

Table 2: Mean scores (SD) for six validated tests collected from the total sample (N= 1996) of undergraduate students at a public university in the Northwestern U.S. in 2020, categorized by Eating Competence status and gender identity.

Survey Tool	Total Sample (N=1996)	Eating Competent ^a	Not Eating Competent ^a	P value ^b
<i>Mean (SD)</i>				
ecSI 2.0™ score ^a	28.7 (10.1)	38.8 (4.8)	22.1 (6.6)	<0.001
Man	32.8 (9.5) ^x	39.4 (4.9)	23.9 (6.4)	
Woman	27.6 (10.1) ^y	38.6 (4.7)	21.6 (6.6)	
TGNC ^c	24.7 (8.2) ^z	36.3 (3.6)	21.8 (6.6)	
Total Weight & Body Guilt/Shame ^d	21.9	16.4 (10.5)	25.8 (11.1)	<0.001
Man	16.8 (11.5) ^x	13.9 (10.6)	20.9 (11.4)	
Woman	23.7 (11.5) ^y	17.7 (10.2)	27.0 (10.7)	
TGNC ^c	21.2 (11.5) ^y	13.3 (7.2)	23.3 (11.5)	
Weight-and-Body Guilt Subscore ^d	12.4	9.6 (6.2)	14.3 (6.2)	<0.001
Man	9.9 (6.7) ^x	8.4 (6.5)	11.8 (6.6)	

Woman	13.3 (6.4) ^y	10.2 (6.0)	14.9 (5.9)	
TGNC ^c	10.9 (6.7) ^x	7.8 (4.6)	11.7 (6.9)	
Weight-and-Body Shame Subscore ^d	10.9	7.6 (6.0)	13.2 (6.9)	<0.001
Man	7.8 (6.7) ^x	5.9 (5.8)	10.3 (7.1)	
Woman	11.9 (7.0) ^y	8.5 (6.0)	13.8 (6.8)	
TGNC ^c	11.9 (7.0) ^y	6.5 (4.6)	13.3 (6.8)	
Weight Satisfaction ^e	5.0	6.1 (2.3)	4.3 (2.3)	<0.001
Man	5.6 (2.5) ^x	6.1 (2.4)	4.9 (2.4)	
Woman	4.8 (2.4) ^y	6.0 (2.3)	4.2 (2.2)	
TGNC ^c	4.9 (2.4) ^y	6.3 (1.9)	4.5 (2.4)	
Eating Concerns Score ^f	19.1	16.9 (7.5)	20.6 (7.1)	<0.001
Man	17.0 (7.6) ^x	15.6 (7.7)	18.8 (7.2)	
Woman	19.9 (7.3) ^y	17.6 (7.4)	21.1(7.0)	
TGNC ^c	18.5 (6.9) ^{x,y}	16.1 (6.3)	19.1 (7.0)	

Footnotes

- a. Eating Competence (EC) measured with the 16-item Satter Eating Competence Inventory (ecSI 2.0™); total scores range 0 to 48, with scores at or above 32 indicating EC, and scores at or below 31 indicating non-EC. [Godleski 2019, Lohse 2007].
 - b. *P* values reflect differences in Eating Competence status, calculated using two-factor ANOVA with Bonferroni post hoc test for multiple comparisons or Dunnett C for heterogeneous variances.
 - c. Trans and gender non-conforming (TGNC) includes: Transgender Man/Transmasculine, Transgender Woman/Transfeminine, Queer/Gender queer, Non-binary/Gender non-conforming, and Different Identity Not Specified. It does not include those who responded “prefer not to answer” on the initial survey.
 - d. Total score on the 12-item Weight- and Body-Related Shame and Guilt Scale (WEB-SG) [Conradt 2007] ranges from 0 to 24, with lower scores indicating less shame & guilt. The guilt score was a subscale of the 12-item Weight- and Body-Related Shame and Guilt Scale (WEB-SG) [Conradt 2007]. Total score ranged from 0 to 12, with lower scores indicating less guilt. The shame score was another subscale of the 12-item Weight- and Body-Related Shame and Guilt Scale (WEB-SG) [Conradt 2007]. Total score ranged from 0 to 12, with lower scores indicating less shame.
 - e. Weight satisfaction was assessed using a single item: “What is your level of satisfaction with your current body weight?” Total score for weight satisfaction ranges from 0 to 10, with higher scores indicating higher level of satisfaction, continuous variable [Clifford, 2010; Ahearn, 1997].
 - f. Total score on 5 statements chosen from the Health Concern Scale [Plichta 2019, Kähkönen 1999] ranges from 5 to 35, with lower scores indicating less concern.
- x,y,z. Different superscripts in the same column indicate significant differences between means of gender groups, $P < 0.01$. Calculated using 2-factor ANOVA.

Discussion

The present study demonstrates that both gender identity and Eating Competence are meaningfully associated with students' experiences with food and their bodies. This is in line with what was hypothesized. In every outcome variable tested, those who were EC had more favorable mean scores than students who were non-EC, in regards to positive health implications. Similarly, for each outcome variable, students who identified as men had more favorable mean scores than those who identified as women. More nuance was discovered regarding experiences of TGNC participants whose scores were only once different from both of

the other genders, and in many cases had scores not significantly different from men's or not significantly different from women's.

ecSI 2.0™ Scores

The majority of our sample (60%) was non-EC; this was not unlike results of previous studies of similar populations. Where we found a study-wide average score of 28.7, other studies have found average scores of 29.6¹⁷, 30.7¹⁸ and even 31.0.¹⁴ Average ecSI 2.0™ scores from these studies, in addition to ours, indicate that college students are generally not competent eaters, by the ecSatter definition.

Men in our sample were on average competent eaters, whereas women and TGNC individuals were, on average, not. Other studies have demonstrated similar findings between men and women.^{14,17,18,60} Ultimately, this suggests that men may be more likely than women or TGNC individuals to reap the associated benefits of Eating Competence (both those found in our study, but also, extrapolating to associations found in other studies as well). In the only other study to assess Eating Competence in non-binary gender identities, Murphy et al found that a very small portion, 0.2% of the total sample, identified as gender non-binary ($n=6$).¹³ Comparatively, 4% of participants in our sample identified as TGNC ($n=80$). ecSI 2.0™ scores in the Murphy, et. al study come from a combination of sexual and gender non-binary students, whereas ours only looked at a group of gender non-binary individuals. Thus, it is difficult to compare their results to ours, or to make broad generalizations about what the associations with TGNC individuals might represent. In our sample, average ecSI 2.0™ scores for participants who identify as TGNC were 24.7. Thus, the scores of TGNC are well below both men's and women's scores, making TGNC students significantly less Eating Competent than the other two genders.

Our data demonstrate notable associations between gender and Eating Competence, such that men are more likely than women or TGNC individuals to be EC. For women, this is somewhat unsurprising, considering the wealth of studies demonstrating that women are more likely than men to experience a myriad of negative food- and body-related issues. The literature has established that women experience significantly more body-checking,⁶¹ weight- and body-related shame and guilt,⁶¹ dissatisfaction with their body weight and shape,⁶² and long-term peer-influenced disordered eating behaviors,⁶³ than men. A recent meta-analysis also demonstrated that females have significantly less body appreciation than men do.⁶⁴ All of these variables likely factor into the reason that females are less likely to be EC than males. Even in previous studies where Eating Competence interventions were employed, females eating enjoyment was significantly lower, compared to males, in post-intervention assessment.⁶⁰ For women, these associations could go so deep as to interrupt eating attitudes, food acceptance, and likely, intake regulation, thus driving the ecSI 2.0™ scores lower.

Compared to studies of gender binary individuals, little research has been done to understand the eating and body attitudes held by TGNC individuals, which could help to explain their significantly lower ecSI 2.0™ scores. One study demonstrated that trans women may have higher levels of restrained eating; eating, weight, and shape concerns; and body dissatisfaction, compared to male controls.⁶⁵ These same individuals also had higher scores, compared to females for weight and shape concerns, body dissatisfaction, and body checking behaviors.⁶⁵ Drive for thinness and thin idealization have also been shown as hallmarks for trans women.^{65,66} Since our analysis did not differentiate between transfeminine or transmasculine individuals, we are unable to say whether the participants in our sample aligned exactly with these specific

characteristics in the same way. However, the insights may have applied to the portion of our sample who identified themselves as transfeminine. Similarly, a 2016 systematic review⁶⁷ demonstrated that body dissatisfaction was a primary stressor for all individuals who identify as transgender, and that this was related to disordered eating outcomes. For TGNC individuals, ecSI 2.0TM scores may also be influenced by a drive for thinness and body dissatisfaction which interrupts their food acceptance or ability to naturally regulate their intake.

Considering the implications of the ecSI 2.0TM score gap found between genders in this study, it is imperative that future research expand beyond oversimplified binary gender identities. As a conceptual model, Eating Competence is both weight and gender neutral in its approach.⁶⁸ Thus, it may be an ideal choice for attempting to mitigate poor health outcomes in college-age students, regardless of gender.

Total Weight-and-Body Shame-and-Guilt Scores

Students in our sample who were EC had lesser feelings of shame and guilt. This could be related to the fact that ecSatter is based on a person's ability to tune into natural bodily cues, rather than taking cues from external sources to judge what the body wants and needs. People who are EC have positive, relaxed attitudes about food and eating, and experience self-confidence and a sense of peace in regards to their food choices.⁹ Competent eaters have likely developed trust in their body cues and are confident about their choices,⁹ which has allowed them to fulfill the eating attitudes and food acceptance components of the model. It's possible that people with confidence in these areas are also more likely to be self-possessed about their weight and body. If one can be assured about their eating choices, considering the way that food and body are linked, it is possible that they are also able to be self-assured about their body in its

natural state.

In regards to the impact of gender on WEB-SG, women in our sample experienced significantly more shame and guilt than men; this was aligned with previous findings in similar studies.^{61,69} Guilt and shame subscale scores are often higher for young adult females than males, although males are not altogether exempt from these feelings.^{61,70} This may be due, in part, to the fact that females are more likely than males to perceive themselves as being larger bodied than they truly are.⁷⁰ It is also well documented that women are under an incredible amount of social and societal pressure to look a specific way,^{71,72} which may be at play in the scores for these variables. Thus, even women in the normal ⁶ BMI category may feel that their bodies need to be altered or reduced in some way. TGNC individuals experience significantly less guilt than women, and the amount of guilt they experience is not different from that which men experience.

Shame was a different story. TGNC participants exhibited nearly identical amounts of shame as women, and significantly more than that of men. These results were surprising in the context of our other results in which TGNC participants tended to have scores between the two other genders. These shame scores demonstrate that TGNC individuals may experience more shame than guilt about their physical self. Considering the routine stigma felt by those with TGNC gender identities,⁴⁵⁻⁴⁷ these individuals may be more prone to the feelings of inherent body-related wrongness experienced as shame; this may be stronger than body-related guilt. A qualitative analysis of transgender individuals showed that body dissatisfaction for these individuals may stem from a combination of gender dissociation, and body size.⁷³ This complex intersection may be weighing into the guilt and shame scores and the weight satisfaction scores for these individuals. Due to the incongruent methods of testing for these emotion-based

variables, as well as the overall lack of robust research done in TGNC populations, further research is needed to confirm this theory.

Weight Satisfaction

Participants in our sample who were non-EC had significantly less weight satisfaction than those who were EC, and this aligns with our hypothesis. *ecSatter* is intentionally devoid of commentary on a “normal” or “healthy” weight.⁶ Instead of considering food as something which should be controlled as a means of controlling body size, it emphasizes positive attitudes about eating and encourages joy and comfort of eating preferred foods, regardless of body size or shape. As such, it is unsurprising that those who are EC would be generally less concerned about their weight, since they are less fixated on what they eat.

Women surveyed had significantly lower weight satisfaction than men. This is in line with a multitude of studies in this population, in which females report significantly more weight and body dissatisfaction than males.^{34,62,74,75} This may be due to the fact that females experience unrelenting pressure from the media to conform to a specific Western beauty ideal.^{71,72,76,77}

Similar studies have revealed high amounts of weight dissatisfaction in undergraduate females, despite their position in a “normal” or “healthy” weight BMI category.^{6,58} These individuals are more likely to identify as “overweight” when, according to the definition set forth by the CDC, they are not.^{6,58,78} Women also demonstrate a larger gap between their current and ideal weight than men.⁴

TGNC students in our sample have significantly less weight satisfaction than men, and amounts which are nearly identical to that of women. Weight satisfaction scores of women were nearly identical to those for TGNC students. In general, TGNC college students (specifically trans

individuals) are more likely to be dissatisfied with their bodies compared to their gender binary peers.⁷⁹ In one study, body dissatisfaction was observed in 71.4% of trans men and 60.6% of trans women.⁷³ Though it has not been studied explicitly, it would be valuable to understand whether the implications for TGNC individuals are the same as they are for women, in regard to the outcomes of their weight and body dissatisfaction. That is, does depressed weight satisfaction result in significantly more negative health outcomes, as it does for women?

Eating Concerns Scores

Participants in our sample who were EC had significantly less concern about their eating than those who were non-EC, which also aligned with our hypothesis. This may be explained by the fact that two of the four pillars of ecSatter are related to an eater's feelings about the food they consume. The “attitude” component emphasizes that those who are EC will have cultivated positive attitudes about both eating and food.⁸⁰ Similarly, the “food acceptance” component stipulates that competent eaters are more likely to be comfortable and relaxed regarding what they eat.⁸⁰ It seems plausible that competent eaters, with positive, accepting attitudes towards a variety of foods, would naturally have fewer concerns about what they eat. These eaters are able to comprehend the short-lived aspect of any one meal; they know that not every meal must be perfect, and that the ultimate end of food is to nourish, even if it does not always pleasure. To the author’s knowledge, this study is the first of its kind to consider an association between Eating Competence and eating concerns for this age group.

Eating concerns scores in our sample were significantly higher for women than for men. These findings are consistent with other similar studies^{33,77} and are in line with our hypothesis. Women in some studies have shown as much as a ten-fold risk for disordered eating, compared to

men,^{56,81,82} and eating concerns have been associated with eating disorders, especially for those with orthorexia nervosa, but also for those with anorexia and bulimia.⁵⁶ Interestingly, eating concerns for TGNC individuals were between the scores of males and females and were not significantly different from either group. There is a paucity of literature in this area. Nuanced differences between trans individuals have been found, such that those who transition from male to female have higher eating concerns than male controls, but lower than those of females with eating disorders.⁶⁵

Body Trying Responses

We also found an association between Eating Competence and Body Trying responses. Nearly half of all respondents in our study said that they were trying to lose weight. Findings of this magnitude are not uncommon in collegiate populations, and, in fact, are often much higher. In a similarly-sized study about body satisfaction in undergraduates¹⁷ 58% of those sampled indicated that they were currently attempting to lose weight. In one much smaller study of university women in Australia, 94% of the sample expressed a desire to be thinner.⁸³

Our data showed a significant correlation between lower ecSI 2.0™ scores and a desire to lose weight. Those with the highest ecSI 2.0™ scores were significantly more likely to be trying to maintain their weight. This may be due to the fact that ecSatter is a weight-neutral model that discourages voluntary weight loss, and suggests that the ideal BMI is a stable one.⁶⁸ Considering other health outcomes associated with the weight-neutral approach offered by ecSatter, especially the fact that Eating Competence is associated with lower BMIs in university students,^{14,16,84} this kind of paradigm could be more beneficial than a weight-centric approach for people in this age group.

In the present study, significantly more women (just over half of those sampled) than men reported that they were trying to lose weight. This was in stark contrast to the fact that fewer than a quarter of women surveyed were in BMI categories above “normal”.⁶ In fact, more than half of all participants with a BMI at or below normal⁶ were trying to lose weight, including 12% of underweight participants.⁶ These alarming findings align with results from studies of similar populations.^{4,5,17,42}

A similar gap was found between a low number of those in higher BMI groups and a high number of students trying to lose weight for TGNC participants. The fact that so many students whose BMI fell in the normal range also self-identified as trying to lose weight may speak to the pressure that students in this age group feel to continue losing weight, despite already being categorized as healthy.⁸⁵ This pressure seems to be especially poignant for females, who commonly overestimate their BMI,⁷⁰ and who are more likely than males to engage in high-risk weight change behaviors³⁷ and to internalize the thin-ideal.⁸⁶ These findings further support the argument for weight-neutrality in all aspects of education and communication with university students.

Limitations & Strengths

Limitations of this study must be considered. Data were collected from a convenience sample of undergraduate students at a large public university in the Northwest, U.S. This may indicate some selection bias for socioeconomic status, and other factors associated with the ability to attend public universities. Students self-selected to participate, so our results may not be generalizable to similar populations. These findings may not apply directly to those of dissimilar age, gender identity, or otherwise. There may be biases in self-reports, especially where weight

and height (for the calculation of BMI) are concerned, and no follow-up was done to confirm the validity of the answers provided. Due to the cross-sectional design of the study, no conclusions can be drawn about cause-and-effect between the included variables. Results are limited only to conclusions regarding associations between variables and not the direction of causality.

These limitations were offset by several meaningful strengths which include its gender-diverse sample as well as the use of several previously validated measures (ecSI 2.0TM, WEB-SG, Health Concern Scale) that had been tested in similar populations. Students' ability to self-select to participate, in addition to the anonymity of the data collection method, helped to reduce bias in the sample.

Recommendations

These results reveal many interesting avenues for future study. Our results support the use of ecSatter as a model to develop tools for addressing food-and body-related issues in college-age populations. Considering the implications of these concerns for college students, further studies that use the model preventatively in this age group should be pursued in order to determine the extent of its protective capabilities across genders. Further studies should also assess Eating Competence in such a way that allows researchers to understand whether it is able to attenuate feelings of body-related shame and guilt, in addition to the aforementioned negative health outcomes, for university students across the gender spectrum.

More research is needed to establish the applicability and usefulness of Eating Competence as it pertains to a wider range of gender identities. Weight satisfaction in TGNC individuals should be assessed to determine how dissatisfaction impacts action to understand what interventions are needed specifically for people who identify as something other than man or woman. College

administrators should emphasize interventions that result in greater weight satisfaction (and ultimately more positive health outcomes) especially for women, and potentially for TGNC, undergraduates. More gender-nuanced study of food- and body-related adversities, as well as how to effectively prevent body image-related pathologies for TGNC individuals, is warranted. Longitudinal research to determine the direction of these associations would also be useful in the development of preventative curriculums and policy measures to avert disordered eating and eradicate weight bias. Experimental studies would be particularly helpful in understanding if tools based on the ecSatter model could be implemented as an intervention tactic for attenuating poor body related health outcomes for this age group.

Conclusion

In a cross-sectional study of university students, Eating Competence was associated with fewer eating concerns, greater weight satisfaction, less WEB-SG, and lower likelihood of trying to lose weight. Gender differences were also significantly associated with these variables insomuch that men had the most preferred outcomes, women generally had the least preferred, and TGNC students typically sided more strongly with one or the other gender categories. The newly studied relationships between Eating Competence and WEB-SG, and eating concerns bring to the forefront some of the emotional components of food, eating, and body image. These insights may be helpful in understanding, predicting, and preventing poor health outcomes for this population. They may also bring to light an arena for new health interventions for university students.

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