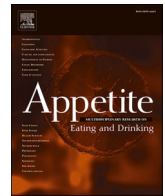




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Everyday discrimination is a stronger predictor of eating competence than food insecurity or perceived stress in college students amidst COVID-19

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ABSTRACT

Stress is a common experience of college students, which has been exacerbated by COVID-19. Perceived stress may help predict students' eating behaviors. Eating competence is an adaptive model of eating characterized as being flexible, comfortable, and positive with food and eating, and reliable about getting enough nourishing and enjoyable food to eat. Eating competence is associated with numerous health benefits and may be developing and/or disrupted as young adults transition to college. No prior research has explored the associations of everyday discrimination and food insecurity with eating competence, and there is limited research on the eating competence of trans and gender nonconforming (TGNC) college students. This cross-sectional study sought to examine the associations of everyday discrimination, food insecurity, and perceived stress with eating competence in a sample of 1996 undergraduate students. Participants completed an online survey comprised of validated tools assessing socio-demographics, eating competence, everyday discrimination, food insecurity, and perceived stress and stress management. After accounting for covariates (gender, stress management), multivariate regression analyses were conducted, and the coefficients of partial determination revealed that everyday discrimination was the strongest predictor of eating competence. Results demonstrated that lower experience of everyday discrimination, less stress, and being food secure were associated with greater likelihood of being eating competent (EC). Men were more likely to be EC than women or TGNC identities. Since the experience of everyday discrimination was the strongest, inverse predictor of eating competence, addressing discrimination must be considered in future efforts to improve eating competence.

1. Introduction

College life presents new stresses, anxieties, and challenges for young adults, which have been amplified throughout the COVID-19 pandemic. Perceived stress is associated with maladaptive eating behaviors that include skipping meals (Choi, 2020) stress-eating (Choi, 2020; Klatzkin et al., 2019), uncontrolled emotional eating (Wilson, Darling, Fahrenkamp, D'Auria, & Sato, 2015), and consuming higher energy portions (Lim, Sim, Forde, & Cheon, 2018). Female college students exhibit high levels of concern about their health, eating behaviors, body weight and shape (Plichta & Jezewska-Zychowicz, 2019; Sirang et al., 2013; Yu & Tan, 2016). Reports indicate that 9%–34% exhibit symptoms of eating disorders (Eisenberg, Nicklett, Roeder, & Kirz, 2011; Plichta & Jezewska-Zychowicz, 2019; Prouty, Protinsky, & Canady, 2002;

Tavolacci et al., 2015; Vijayalakshmi, Thimmaiah, Gandhi, & BadaMath, 2018; Yu & Tan, 2016) or dysfunctional eating behaviors (V. Quick et al., 2015). In contrast, college students identified as eating competent (EC) are less likely to have ever had an eating disorder (Brown, Larsen, Nyland, & Eggett, 2013), are more satisfied with their body weight (D. Clifford, Keeler, Gray, Steingrube, & Morris, 2010) and more likely to be “normal” weight (V. Quick, Byrd-Bredbenner, White, & Lohse, 2013; V. Quick et al., 2015).

Eating competence is an adaptive style of eating described by the Satter Eating Competence Model, ecSatter (Satter, 2007a), and measured by the Satter Eating Competence Inventory, ecSI 2.0™ (Godleski, Lohse, & Krall, 2019; Lohse, Satter, Horacek, Gebreselassie, & Oakland, 2007). Eating competence is characterized as being flexible, comfortable and positive with food and eating, and reliable about

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getting enough nourishing and enjoyable food to eat (Satter, 2007a). ecSatter is a size-inclusive model that emphasizes a foundation of providing oneself with consistent opportunities to eat, or the “when” of eating; “what” and “how much” a person eats is then determined by internal hunger, appetite, and satiety cues (Satter, 2007b). The consistent structure of meals and snacks in ecSatter contrasts with other adaptive eating models such as intuitive eating in which physical cues are also used to determine “when” to eat (Tylka & Kroon VanDiest, 2013; Yoon, Hazzard, Emery, Mason, & Neumark-Sztainer, 2021); this may be interpreted as an “on demand” style of eating that may be challenging for some populations. Eating consistently is an important aspect unique to ecSatter as it is associated with higher dietary quality (Lohse, Faulring, Mitchell, & Cunningham-Sabo, 2020), while intuitive eating is not related to diet quality in university students (Lopez, Hernandez, Bode, & Ledoux, 2021). Eating competence may still be developing and/or disrupted during college years when young adults experience greater autonomy from parents and/or caregivers, instability of relationships, and shifts in social roles (Auerbach et al., 2018); and many college students may be newly responsible for managing their own food. ecSatter is an encompassing model that provides an ideal framework in which to study eating behaviors of college students: It addresses the skills and resources necessary for managing the food environment to provide reliable and regular eating opportunities that, in turn, support dietary variety and internal cues and processes for regulating food intake (de Queiroz et al., 2022).

Being eating competent (EC) is beneficial for college students because it is associated with overall health. EC adults report higher quality diets (Lohse, Bailey, Krall, Wall, & Mitchell, 2012; Lohse et al., 2010; Tilles-Tirkkonen et al., 2019), are more likely to engage in beneficial lifestyle behaviors such as physical activity, fruit and vegetable consumption, and meal planning; are less likely to overeat in response to external or emotional stimuli (Krall & Lohse, 2011; Lohse et al., 2007); and have more favorable cardiovascular and metabolic factors (Lohse et al., 2010; Psota, Lohse, & West, 2007; Tilles-Tirkkonen et al., 2019). EC college students report better overall sleep quality and quantity, and less sleep disturbance and daytime dysfunction (V. Quick et al., 2015). Studies of college students indicate that only 33.6%–41.4% of females and 60.0%–66.4% of males are EC (Brown et al., 2013; V. Quick et al., 2015). To our knowledge, only one other study has examined predictors of eating competence in a university student population (D. Clifford et al., 2010).

Numerous stressors may interfere with college students' eating competence. The experience of discrimination is one such stressor associated with maladaptive eating behaviors (Lee et al., 2021; Yoon et al., 2021) and body image concerns (Lee et al., 2021; Mason, Mozdzierz, Wang, & Smith, 2021) among marginalized groups, particularly if food is used to cope with or avoid the stress from such experiences (Durso, Latner, & Hayashi, 2012). The chronic stress of everyday discrimination can have far-reaching impact on the physical and mental health of already struggling college students and may negatively influence their health behaviors (Dalton & Hammen, 2018). Food insecurity is another stressor (Myers, 2020) that may interfere with eating behaviors. Studies conducted prior to COVID-19 illustrated that food insecurity was experienced by more than one-third of college students (Bruening, Argo, Payne-Sturges, & Laska, 2017; Bruening, van Woerden, Todd, & Laska, 2018; Nikolaus, An, Ellison, & Nickols-Richardson, 2020). This is concerning given that food insecurity and worry about money for food are associated with poor diet quality (Leung & Tester, 2019), disinhibition (Lohse et al., 2007), and maladaptive eating (Hazzard, Loth, Hooper, & Becker, 2020; Lohse et al., 2007; Stinson et al., 2018).

Although several studies have reported associations between potential stressors and maladaptive eating in college students, few have explored the relationships between everyday discrimination or food insecurity and *adaptive* eating, and those published to date have used the intuitive eating model (Jackson, Sano, Parker, Cox, & Lanigan, 2022;

Yoon et al., 2021), mindful eating (Yoon et al., 2021), or dietary intake quality (Jackson et al., 2022; Lee et al., 2021) as an adaptive style rather than the ecSatter model. No studies have examined the predictive nature of both social stressors simultaneously, everyday discrimination and food insecurity, in relation to eating competence. Limited literature exists on the eating competence of college students who identify differently than man or woman (Murphy & Morwell, 2021). Additional knowledge about the predictor variables of eating competence may help guide future clinical and public health practice. Therefore, the primary aim of this study was to evaluate the associations of everyday discrimination, food insecurity, and perceived stress with eating competence in a convenience sample of undergraduate college students enrolled at a large public university in the U.S. It was hypothesized that higher everyday discrimination, higher perceived stress, and greater food insecurity would predict lower eating competence, but the contribution of each factor was not hypothesized. A secondary aim was to describe the eating competence of trans and gender non-conforming (TGNC) students. We did not hypothesize how the eating competence of TGNC students may compare to that of men or women since the only other study to date on eating competence that included nonbinary identities (Murphy & Morwell, 2021) combined “sex and gender minority” students into one group representing two constructs, sexual orientation and gender identity.

2. Methods

2.1. Participants and study design

For this cross-sectional study, an online survey was administered between October through December 2020 to undergraduate college students enrolled at the University of Washington while the university was closed to in-person classes due to the COVID-19 pandemic. Participants were recruited by sending individual e-mails to a Registrar-obtained sample of 27,472 undergraduate students enrolled at any of the three campuses during autumn quarter 2020. Students who voluntarily followed the link could review the informed consent and continue to the survey if they agreed to the consent statement. Respondents were excluded if they were younger than 18 years old, not currently enrolled at the university as an undergraduate student, unable to read or understand English, or were pregnant or lactating.

Data were collected using REDCap, a survey and database management system (Harris et al., 2019; Harris, Taylor, Theilke, Gonzalez, & Conde, 2009) hosted at the university through the Institute of Translational Health Sciences. The online anonymous survey took approximately 15 min to complete and was comprised of previously validated and/or published instruments including: the Satter Eating Competence Inventory (ecSI 2.0™) (Godleski et al., 2019), the USDA Household Food Security Survey short-form (U.S. Household Food Security Survey Module: Six-Item Short Form, 2012), the Everyday Discrimination Scale (Krieger, Smith, Naishadham, Hartman, & Barbeau, 2005; Williams & Mohammed, 2009), and perceived stress and stress management (Errisuriz, Pasch, & Perry, 2016). The university Human Subjects Division determined that this study qualified for exempt status. The analytic plan was pre-specified by one of the authors. A power analysis was conducted according to the power analysis of multiple linear regression developed by Cohen (Cohen, 1988) using the *F*-statistic provided by the multiple linear regression model with preliminary data (Zhang & Yuan, 2018).

2.1.1. Measures

Eating Competence. The ecSI 2.0™ is a 16-item instrument with demonstrated retest reliability (Stotts & Lohse, 2007) and construct validity in free-living adults (Godleski et al., 2019; Krall & Lohse, 2011; Lohse, 2015; Lohse et al., 2007). Sample items from this inventory include, “I am relaxed about eating” and “I trust myself to eat enough for me.” For each item, respondents selected from five response options scored on a 4-point scale: 0 (*never*), 0 (*rarely*), 1 (*sometimes*), 2 (*often*), or

3 (always). Total scores range 0–48, with a score of 32 or greater considered to be “Eating Competent” (EC); and used as a continuous variable, consistent with previous work in college students (Brown et al., 2013; D. Clifford et al., 2010; V. Quick et al., 2015). Four subscales comprise the dimensions of eating competence: Eating Attitudes (six items), Food Acceptance (three items), Internal Regulation two items), Contextual Skills (five items), but the subscales have not been normed (Godleski et al., 2019).

Everyday Discrimination. The 10-item, Everyday Discrimination Scale (EDS) was used to assess the frequency of routine, discriminatory experiences, in everyday social situations (Kessler, Mickelson, & Williams, 1999; Krieger et al., 2005; Williams, Yu, Jackson, & Anderson, 1997). First, participants were asked, “In your day-to-day life, how often do any of the following things happen to you?” Items include statements such as, “You are treated with less courtesy than other people” and “People act as if they think you are dishonest”. Responses were coded on a 6-point Likert scale ranging from 1 (never) to 6 (almost every day). Total scores ranged from 10 (“never”) to 60 (“almost every day”), with higher scores indicating greater experience of day-to-day discrimination (Kessler et al., 1999; Krieger et al., 2005; Michaels et al., 2019). Participants who responded affirmatively to any statement were asked, “What do you think is the main reason for this/these experiences?” The eight response options were: race or ethnicity, gender, age, body size, sexual orientation, education or income level, physical disability, or other.

Food Insecurity. This was assessed using the USDA six-item short form (U.S. Household Food Security Survey Module: Six-Item Short Form, 2012). Items include questions such as, “Did you ever eat less than you felt you should because there wasn’t enough money for food?” Participants were directed to respond based on the food eaten in their household in the months since March 2020 because this is the point at which the university remained closed for in-person instruction due to COVID-19. Food security status was used as a continuous variable, and classifications were considered as follows: 0–1 affirmative response is food secure, 2–4 affirmative responses indicate low food security, and 5–6 affirmative responses are very low food security (Fiese, Gunderson, Koester, & Jones, 2016).

Perceived Stress. Measured with a single item, “On a scale from 0 (not stressed at all) to 10 (extremely stressed), how would you rate your average level of stress in the past 30 days?” and used as a continuous variable, consistent with previous work in this population (Errisuriz et al., 2016).

Covariates. Gender (with eight response options) was included since previous studies have demonstrated that males have higher ecSI 2.0™ scores than females (Brown et al., 2013; D. Clifford et al., 2010; V. Quick et al., 2015). Perceived stress management was measured with a single item and entered as a continuous variable: “On a scale from 0 (completely ineffective) to 10 (completely effective), how would you rate your ability to manage stress in the past 30 days?” (Errisuriz et al., 2016).

Sociodemographic Characteristics. Age (years), race/ethnicity (with ten response options) gender identity (with seven response options), number of credits enrolled during autumn quarter 2020, grade point average, employment status, and living location (El Zein et al., 2019; Lipson & Sonnevile, 2017). Body mass index (BMI) was calculated from self-reported weight and height (Centers for Disease Control and Prevention, 2020) in order to consider its possible inclusion as a controlled variable (covariate) in the model due to previous literature demonstrating its association with eating competence in college students (D. Clifford et al., 2010; V. Quick et al., 2013).

2.1.2. Statistical analyses

Data were summarized as means and standard deviation for continuous variables or as frequencies and proportions for categorical variables. Continuous variables were tested for normality and appeared symmetric with no obvious outliers. Sociodemographic characteristics were collapsed into fewer categories when there were extremely low frequencies in the original categories, e.g., all gender identities that were

not “man” or “woman” were collapsed into a trans and gender non-conforming (TGNC) group, creating three gender categories. To evaluate group differences in ecSI 2.0™ scores, independent samples *t*-tests or ANOVAs were used; Pearson chi-square tests of independence were used to assess group frequencies. Single-sample *t* tests and goodness-of-fit chi square tests were used to assess differences in sociodemographic characteristics between the convenience sample and the student population enrolled during autumn quarter 2020. Post-descriptive analyses demonstrated that BMI was not significantly associated with ecSI 2.0™ total scores ($P = 0.053$), and so was not included in the model for further analyses. The mean ecSI 2.0™ score of those who preferred not to select their gender identity ($n = 13$) was the same as the TGNC group ($P = 1.00$), so this group was combined with TGNC in the regression model.

A multivariate linear regression model was used to determine which factors – everyday discrimination, food insecurity, or perceived stress – were most important in predicting ecSI 2.0™ scores, incorporating gender and stress management as covariates. Assumptions of the multiple linear regression were tested for normality, collinearity, and homoscedasticity. Specifically, the normal Q-Q plot confirmed normality. The plot of residuals vs. fitted values verified linearity and homoscedasticity. The scale-location plot (square rooted standardized residual vs. fitted value) further confirmed the assumption of homoscedasticity. Collinearity was tested by calculating generalized variance-inflation factors for each variable; all of them were less than 1.2, indicating that the variables were not colinear (Fox & Monette, 1992; Kock & Lynn, 2012). Multiple imputation was implemented to fill in missing values using the package “mice” in RStudio (van Buuren & Groothuis-Oudshoorn, 2011). The results of the fitted multivariate linear regression model remained almost invariant under multiple imputation of missing values and with the inclusion of those who preferred not to select gender identity with TGNC; therefore, it was appropriate to fit the selected multivariate linear model to this dataset.

The coefficient of partial determination was calculated individually for each factor to obtain a measure of the degree of linear association between ecSI 2.0™ score and each factor after accounting for the covariates in the model. A stepwise approach was used to establish a final model that included the covariates and any of the three factors that significantly improved the fit. Post hoc ANOVAs were conducted to describe the contribution of the three factors to the explanation of variance in ecSI 2.0™ score after controlling for covariates gender and stress management; residual means of squares estimated the variance of each observation that could not be explained by covariates and factors. Post hoc simple linear regression was used to evaluate differences in ecSI 2.0™ scores according to main reason for the experience of everyday discrimination, while chi-square goodness-of-fit was conducted to examine the relative frequencies of reasons cited. All analyses were conducted using RStudio version March 1, 1093 (RStudio, 2020) with a significance level of 0.05.

2.2. Results

2.2.1. Descriptive statistics

A total of 2548 students responded to the survey, representing a 9.3% response rate. Of these, 2062 respondents passed the inclusion criteria and agreed to the informed consent. Those who did not proceed beyond the demographics were identified as ‘non-completers’ ($n = 66$); there were no significant differences in demographic characteristics between ‘completers’ and ‘non-completers,’ which were removed for further analyses. The final dataset included 1996 ‘completers’ and 87% of them had no missing values. The final sample size exceeded the sampling requirements indicated by the power analysis. Compared to the available sociodemographic characteristics of the undergraduate student population enrolled at the university in autumn quarter 2020 (Washington, 2021), the sample was younger (20.1 years vs. 20.5, 22.1, and 23.2 years on the other three campuses, all $P > 0.001$) with a higher proportion identifying as female (72.0% vs. 54.3%, $P < 0.001$) and

white (52.5% vs. 39.1%, $P < 0.001$).

The sociodemographic characteristics are summarized in Table 1, and categorized by EC vs. Not-EC, based on ecSI 2.0™ total scores. Only 40.0% of the sample was considered EC. The mean (standard deviation) ecSI 2.0™ score of the entire sample was 28.7 (10.1) with EC participants exhibiting a higher mean score at 38.7 (4.8) than Not-EC participants at 22.0 (6.6), $P < 0.001$. There were no significant differences in ecSI 2.0™ total scores between those with low or very low food security ($P = 0.382$). The mean age of participants was 20.1 (3.5) years, with no difference between those who were EC 20.2 (3.9) or Not-EC 20.0 (3.2), $P = 0.272$. The majority identified as women (72.0%), experienced everyday discrimination (86.1%), were food secure (80.6%), white (52.5%), “normal” weight BMI (68.8%), living off-campus within the state (61.9%), unemployed (60.6%), and enrolled in fulltime academic credits (95.1%).

Table 1

Sociodemographic characteristics by eating competence (ecSI 2.0™)^a of undergraduate college students enrolled in a large public university in the U.S. in autumn quarter 2020.

Sociodemographic Characteristic (n if missing data)	Total Sample		EC ^a n (%)	Not EC ^a n (%)	P value ^b
	ecSI 2.0™ Total Score Mean (SD)	n (%)			
Total Sample	28.7 (10.1)	1996 (100.0)	799 (40.0)	1197 (60.0)	
Gender Identity (n = 1994) ^c					<0.001
Man	32.8 (9.5) ^x	462 (23.3)	266 (57.6)	196 (42.4)	
Woman	27.7 (10.1) ^y	1430 (72.0)	512 (35.8)	918 (64.2)	
TGNC	24.7 (8.2) ^z	80 (4.0)	21 (20.2)	83 (79.8)	
Prefer not to answer	25.4 (6.9) ^z	13 (0.7)	5 (38.5)	8 (61.5)	
Everyday Discrimination (n = 1882) ^d					<0.001
Never	33.1 (10.4) ^x	261 (13.9)	140 (53.7)	121 (46.3)	
Yes	28.2 (9.9) ^y	1621 (86.1)	621 (38.3)	1000 (61.7)	
Food Security Status (n = 1957) ^e					<0.001
Food secure	29.6 (10.1) ^x	1608 (82.1)	699 (43.5)	909 (56.5)	
Low food security	25.3 (9.6) ^y	251 (13.4)	70 (26.8)	191 (73.2)	
Very low food security	23.4 (9.4) ^y	88 (4.5)	15 (17.0)	73 (83.0)	
Race or Origin ^f					0.011
East or Southeast Asian	30.3 (10.5) ^x	454 (22.8)	209 (46.0)	245 (54.0)	
white	28.1 (10.0) ^y	1046 (52.5)	397 (38.0)	649 (62.0)	
All other races or origins	28.5 (10.0) ^y	494 (24.8)	193 (38.9)	303 (61.1)	
Body Mass Index (n = 1959) ^g					0.070
“Under” weight	27.4 (11.1)	154 (7.9)	62 (40.3)	92 (59.7)	
“Normal” weight	29.2 (10.1)	1348 (68.8)	564 (41.8)	784 (58.2)	
“Over” weight	28.0 (9.7)	326 (16.6)	114 (35.0)	212 (65.0)	
“Obese”	27.9 (9.6)	131 (6.7)	45 (34.4)	86 (65.6)	
Living Location (n = 1992)					0.092
On campus	28.5 (10.5)	586 (29.4)	231 (11.6)	355 (17.8)	
Off-campus, in Washington State	28.6 (10.0)	1235 (61.9)	486 (39.4)	749 (60.6)	
Off-campus, outside Washington, in U.S.	29.4 (9.7)	103 (5.2)	43 (41.7)	60 (58.3)	
Off-campus, outside the U.S.	31.9 (10.3)	72 (3.6)	39 (54.2)	33 (45.8)	
Employment Status (n = 1980)					0.039
Unemployed	29.1 (10.2)	1209 (60.6)	506 (41.9)	703 (58.1)	
Employed: part-time, full-time or other	28.1 (10.1)	787 (39.4)	293 (37.2)	494 (62.8)	
Number of Credits Enrolled					0.190
Less than 12	26.8 (10.3)	98 (4.9)	33 (33.7)	65 (66.3)	
12 or more	28.8 (10.1)	1890 (95.1)	762 (40.3)	1128 (59.7)	
Grade Point Average					0.013
3.50 to 4.00	29.3 (9.8)	1320 (66.1)	554 (42.0)	766 (58.0)	
Less than 3.5	27.6 (10.7)	676 (33.9)	245 (36.2)	431 (63.8)	

x,y,z Different superscripts in the same column grouping indicate significant differences, $P < 0.01$. ecSI 2.0™ scores between groups tested using independent samples t-test or ANOVA with Bonferroni post hoc for multiple comparisons or Dunnett’s C if heterogeneous variances.

^a Total score on the 16-item Satter Eating Competence Inventory (ecSI 2.0™) ranges 0 to 48, continuous variable; ≥ 32 considered Eating Competent (EC), < 32 considered Not EC.

^b P values of categorical variables obtained using Pearson chi-square tests of independence (two-sided).

^c Trans and Gender Non-Conforming (TGNC) includes transgender man or woman, gender queer, non-binary, different gender identity not specified.

^d Total score on the 10-item Everyday Discrimination Scale ranges 10 to 60, continuous variable, with higher scores indicating greater experience with everyday discrimination. A total score of 10 indicates “never” having experienced discrimination.

^e Food insecurity evaluated using the six-item USDA Household Food Security Survey short-form; 0 to 6 affirmative responses are possible with higher scores indicating greater food insecurity.

^f Race or Origin was collapsed from ten into three categories that were balanced with no extremely low number of observations. All Other Races or Origins included African American or Black; South Asian; Arab, West or Central Asian; Hispanic, Latinx or Spanish origin; Native American or Alaska Native; Native Hawaiian or other Pacific Islander; more than one race or origin; and some other race or origin.

^g Body mass index categorized according to the Centers for Disease Control guidelines.

2.2.2. Regression results

A multivariate regression was conducted with ecSI 2.0™ total scores as the continuous dependent variable (See Table 2). The coefficient of partial determination for everyday discrimination (0.185) was higher than that for food insecurity (0.178), and perceived stress (0.166), indicating that everyday discrimination explained the variation in eating competence more than the other two factors. A forward stepwise approach was used to obtain the best model for predicting ecSI 2.0™ scores after accounting for gender and stress management. Gender was significant in the regression ($P < 0.001$), and men were more likely to have a higher ecSI 2.0™ score than women and TGNC participants. Stress management was also important ($P < 0.001$) in that students with greater perceived stress management capabilities demonstrated higher ecSI 2.0™ scores. Residual analysis indicated no violations of the assumptions of linear regression. Adjusted R^2 for the regression model was

Table 2

Multivariate regression parameter estimates for predicting ecSI 2.0™ total scores ^a in 1996 undergraduate college students enrolled in a large public university in the U.S. in autumn quarter 2020.

Predictor Variable	Coefficient	SE	T	P value
Constant	28.472	1.678	16.973	<0.0001
Food Insecurity ^b	-0.874	0.153	-5.724	<0.0001
Perceived Stress ^c	-0.567	0.142	-4.004	<0.0001
Everyday Discrimination ^d	-0.194	0.028	-6.986	<0.0001
Gender – Man vs. TGNC ^e	5.161	1.021	5.052	<0.0001
Gender – Woman vs. TGNC ^e	1.115	0.958	1.163	0.245
Perceived Stress Management ^f	1.237	0.108	11.442	<0.0001

^a Total score on the 16-item Satter Eating Competence Inventory (ecSI 2.0™) ranges 0 to 48, continuous variable; ≥ 32 considered Eating Competent (EC), < 32 considered Not EC.

^b Food insecurity evaluated using the six-item USDA Household Food Security Survey short-form; 0 to 6 affirmative responses are possible with higher scores indicating greater food insecurity.

^c Perceived stress measured on a scale of 0 (*not at all stressed*) to 10 (*extremely stressed*), continuous variable.

^d Total score on the 10-item Everyday Discrimination Scale ranges 10 to 60, continuous variable, with higher scores indicating greater experience with everyday discrimination.

^e Trans and Gender Non-Conforming (TGNC) includes *transgender man* or *woman*, *gender queer*, *non-binary*, *different gender identity not specified*, and *prefer not to answer*. Results of the multivariate regression model were nearly identical with the inclusion or exclusion of respondents who preferred not to answer, so these responses were retained in all analyses.

^f Perceived stress management measured on a scale of 0 (*completely ineffective*) to 10 (*completely effective*), continuous variable.

20.5% and the standard error of the residuals was 9.06. Post hoc analyses revealed that 6.4% of the variance in eating competence was explained by the experience of discrimination, food insecurity, and perceived stress after controlling for gender and stress management ($P < 0.001$).

2.2.3. Post hoc analyses

Only 13.9% of the sample reportedly “never” experienced discrimination and the mean ecSI 2.0™ total score of this group was significantly higher than those who experienced everyday discrimination for any reason (Table 3). Of the 86.1% who routinely experienced discrimination ($n = 1621$), gender (43.6%) was the most frequent reason cited compared to race and/or ethnicity (20.0%), and all the other reasons combined (36.3%), $P < 0.001$; yet the mean ecSI 2.0™ score was not significantly different according to any of the main reasons named. Among those who reported gender discrimination ($n = 707$), 90.4% were women and 6.2% were TGNC. Overall, 47.6% of women and 44.0% of TGNC participants selected gender as the main reason for everyday discrimination.

Table 3

Mean ecSI 2.0™ total score ^a and frequencies of main reason cited for experience of everyday discrimination of 1882 ^b undergraduate college students enrolled in a large public university in the U.S. in autumn quarter 2020.

Main reason for everyday discrimination ^c	ecSI 2.0™ Total Score Mean (SD)	n (%)
Gender	27.3 (9.5) ^x	707 (37.6) ^x
Race and/or ethnicity	28.8 (10.5) ^x	325 (17.3) ^y
All other reasons combined: Age, size, sexual orientation, education or socioeconomic status, physical disability, or other reason.	28.8 (9.7) ^x	589 (31.2) ^y
“Never” experienced discrimination	33.1 (10.4) ^y	261 (13.9) ^y

^{x,y} Different subscripts indicate significant differences between groups, $P < 0.001$: Simple linear regression for continuous ecSI 2.0™ total scores and chi-square goodness-of-fit for frequencies that include the entire sample.

^a Total score on the 16-item Satter Eating Competence Inventory (ecSI 2.0™) ranges 0 to 48, continuous variable; ≥ 32 considered Eating Competent (EC), < 32 considered Not EC.

^b $N = 1996$ in study; $n = 114$ did not respond to this question on the survey.

^c Total score on the 10-item Everyday Discrimination Scale ranges 10 to 60, continuous variable, with higher scores indicating greater experience with everyday discrimination. A total score of 10 indicates “never” having experienced discrimination; $n = 1621$ experienced everyday discrimination.

3. Discussion

Findings from this cross-sectional study indicate that college students’ experience of everyday discrimination, food insecurity, and perceived stress predicted ecSI 2.0™ total scores while controlling for gender and stress management in context of the COVID-19 pandemic. Lower eating competence was associated with having more experience with everyday discrimination, being food insecure, greater perceived stress, lower perceived stress management, and being female or TGNC. With a mean ecSI 2.0™ score of 28.7 and only 40.0% of the sample identified as EC, participants exhibited low eating competence overall. This is not unlike results from previous studies of similar populations in which 40.6%–48.2% of participants were considered EC with sample mean ecSI scores of 29.6–30.7 (Brown et al., 2013; D. Clifford et al., 2010; V. Quick et al., 2015). The only subgroups identified as EC in the present study were men and those never experiencing discrimination. These findings add to the existing body of literature demonstrating that college students in general may struggle with attitudes and behaviors around food and eating, internal regulation of eating, meal planning, and food flexibility (Brown et al., 2013; Dawn Clifford & Keeler, 2009; D. Clifford et al., 2010; Greene et al., 2011; Murphy & Morwell, 2021; V. Quick et al., 2015).

Everyday discrimination was the strongest inverse predictor of ecSI 2.0™ scores, and this is the first study to examine this association. Alarming, 86.1% of our participants reported experiencing everyday discrimination, which is even higher than a previous finding of 60.9% in a study focusing on women, BIPOC, and young adults with disadvantaged status (Kessler et al., 1999). Stress from routine discriminatory experiences has been shown to be associated with binge-eating and uncontrolled emotional eating (Durso et al., 2012), and may cause harm by contributing to physiological “wear and tear” that negatively impacts long-term physical and mental health (Heise et al., 2019; Williams & Mohammed, 2009). No matter what main reason for discrimination was given, students in our study who reported discrimination were Not-EC and ecSI 2.0™ scores were not significantly different among the reasons cited. This result is corroborated by a meta-analysis in which effect sizes were similar across all types of discrimination in relation to eating disorder pathology (Mason et al., 2021), or low EC. Our results align with recent findings from “EAT 2018” demonstrating that everyday discrimination is associated with lower intuitive and mindful eating scores (Yoon et al., 2021), or adaptive eating behaviors that share characteristics with eating competence such as size-inclusivity and/or internally directed eating. Experience of discrimination is a social stressor that may act as a barrier to developing eating competence by triggering negative emotions (Ikram et al., 2016), reducing interoceptive awareness and internal regulation capabilities (Jackson et al., 2022) and contributing to overeating (Lee et al., 2021).

Food insecurity also predicted lower eating competence. This is consistent with other reports of the association between food insecurity

and disordered eating behaviors (i.e., low eating competence), among college students and young adults (Hazzard et al., 2020; Larson et al., 2021; Royer, Ojinnaka, & Bruening, 2021). Food insecure individuals have been shown to have lower intuitive eating scores, presumably due to the hindrance of interoceptive awareness (Jackson et al., 2022), which is also required for eating competence. Food insecurity contributes to both real and perceived scarcity of preferred foods when people struggle to get basic food needs met (Satter, 2007b). They may be driven by stress and anxiety about not getting enough to eat, which may decrease their attunement to internal drives of hunger and/or satiety. People experiencing food insecurity may also possess fewer skills related to food planning, meal preparation and management of resources (time, food, money) (Krall & Lohse, 2011), which reflects the contextual skills domain of eating competence. Such skills may be influenced by chaos or disruption, which has been implicated in food insecure households as a marker of how individuals respond to highly stressed environments (Fiese et al., 2016). Disruptions to daily routines in the context of food insecurity in COVID-19 may have contributed to an inability to maintain predictable mealtimes, which could have factored into the eating competence of the food insecure college students in our sample.

Perceived stress was a significant inverse predictor of ecSI 2.0™ scores. These findings corroborate others showing that higher perceived stress is associated with lower eating competence, including lower contextual skills and lower reliance on internal hunger/satiety cues (Jarvela-Reijonen et al., 2016). For the college students in our sample, the experience of everyday discrimination, food insecurity, being enrolled in courses fulltime, maintaining a high grade-point average, juggling work responsibilities, and other factors may have contributed to their stress. Since this study took place when the university was closed due to the pandemic, students' stresses may have been indirectly tied to situations or disruptions that included temporary shifts in residence location, accessibility of food, people they lived with, finances, etc. These shifts may have undermined capabilities related to food acquisition, preparation, planning, food management strategies, internal regulation, and attitudes towards food and eating that contributed to lower eating competence.

The men in this study scored significantly higher on the ecSI 2.0™ than women and TGNC participants. This finding aligns with previous observations that female college students have lower eating competence than males (Brown et al., 2013; D. Clifford et al., 2010; Hootman, Guertin, & Cassano, 2018; V. Quick et al., 2015), but conflicts with a study in which sexual- and gender-minority participants were EC (Murphy & Morwell, 2021). Most participants in that study were required to live in campus dorms, purchase meal plans, and utilize dining halls (Murphy & Morwell, 2021); in contrast to our participants who were surveyed while the university was closed which may have led to the disruptions described above. The lower ecSI 2.0™ scores among women and the TGNC group may also reflect gender differences in body satisfaction, a known predictor for eating competence (D. Clifford et al., 2010).

Our study demonstrated that perceived stress management was positively associated with eating competence. Perceived stress management has been shown to moderate the relationship between stress and maladaptive eating behaviors (Errisuriz et al., 2016). Young adults' ability to moderate stress in relation to eating may also be due to the family or shared meal environment. Routine meals (i.e., contextual skills domain) are foundational in supporting eating competence (Satter, 2007a). Other researchers (Berge et al., 2021) found that engaging in routine family/shared meals during COVID-19 had protective associations with dietary health and emotional well-being among young adults. Some students in the pandemic may have been living with friends or family members who may have helped facilitate food management responsibilities and/or routine meals that provided stress management benefits in the context of eating (Berge et al., 2021).

This study had several limitations. It was cross-sectional in nature and based on self-reported measures from a convenience sample during

shelter-in-place orders of COVID-19; thus, physical characteristics could not be validated. The response rate was low at 9.3% and the sample had a higher proportion of those identifying as woman and white compared to the university population. The lengthy nature of the survey may have contributed to non-response and selection biases since a high level of motivation may have been necessary to complete it. Gender bias may have been present as women may be more inclined to respond to surveys on health-related behaviors (Lallukka et al., 2020), which may help explain why the sample was majority women. This may also help explain why such a high proportion of the sample (86.1%) experienced everyday discrimination and gender discrimination was the most frequently reported reason given. The proportion of respondents identifying as TGNC was small (only 4%) and combined with those who preferred not to identify their gender (0.7%). Despite an imbalanced gender variable as a limitation to the analyses, we felt it was important to include all genders due to the paucity of literature on gender diverse populations. Generalizability to other undergraduate student or young adult populations is limited. Finally, data were collected during the COVID-19 pandemic so results must be considered in that context.

Strengths of this study include a suitable sample size to provide adequate statistical power for the analyses reported. The survey was comprised of previously validated measures that had been tested in similar populations. Data were collected anonymously which limited response bias. To our knowledge, this is the first study examining eating competence and everyday discrimination, which is a less studied form of discrimination than others such as weight stigma (Daly, Sutin, & Robinson, 2019; Dawn Clifford & Morris, 2015; Hunger, Dodd, & Smith, 2020) or racial discrimination (Cuevas, Ortiz, & Ransome, 2019; Durso et al., 2012; Kwan, Gordon, & Minnich, 2018; Lee et al., 2021). Our study contributes to the scant literature connecting chronic, everyday discrimination experienced by college students with an adaptive set of eating-related attitudes and behaviors based on ecSatter.

Our findings have implications for clinical and public health practice, programs, policies, and future research. Longitudinal studies are needed to determine if, how, when, and where eating competence can be improved and maintained among diverse college students. We need a better understanding of the policies and programs that are necessary to facilitate equity and inclusion, social and emotional supports, and improved access to acceptable and preferred foods on college campuses. Follow-up data could offer insight on whether improvements in eating competence contribute to positive and lasting health outcomes in this population. With such evidence, interventions to improve eating competence may be offered as part of student wellness programs or incorporated into college courses and curricula, as has been done with other size-inclusive approaches (Humphrey, Clifford, & Neyman Morris, 2015). The finding that everyday discrimination may interfere with eating competence suggests that trying to improve it by focusing on behavior change is inadequate. Efforts to improve eating competence must address chronic stressors such as everyday discrimination and food insecurity to help facilitate opportunities for positive eating experiences. Providing students with stress management skills and strategies could also prove to be beneficial.

Young adults outside of academia also experience major transitions and stress, and may be at even higher risk of developing food insecurity and poor eating competence due to intergenerational transmission of maladaptive eating behaviors (Berge, R., Larson, Miller, & Neumark-Sztainer, 2018). Although existing literature on eating competence includes various age groups and populations (Krall & Lohse, 2011; Lohse et al., 2012; Psota et al., 2007; Queiroz et al., 2021; Tilles-Tirkkonen et al., 2019), none to our knowledge have focused on young, non-student adults. This is another area ripe for future research.

Our findings offer unique insight into the associations of everyday discrimination, food insecurity, and perceived stress with eating competence among university students. Experiencing less discrimination, less stress, and being food secure were associated with greater likelihood of being EC. Men were more likely to be EC than any other

gender. Although stress management was protective, the experience of everyday discrimination was the strongest, inverse predictor of eating competence. Therefore, addressing discrimination may be considered in future efforts to improve eating competence.

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Author contributions

CLH conceptualized the research question, designed the study, supervised data collection, interpreted results, and drafted the manuscripts. SH assisted with literature review, data collection, data analysis, and display of results. ZM was responsible for statistical design and analysis, interpretation of data, and display of results. All authors reviewed, commented, and contributed to revisions of subsequent drafts and approved the final manuscript.

Ethical statement

The University of Washington Human Subjects Division determined that this study qualified for exempt status.

Declaration of competing interest

Cristen L. Harris is a volunteer faculty member of the Ellyn Satter Institute. No other potential conflicts of interest are reported by the authors.

Data availability

Data will be made available on request.

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