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A Confirmatory Factor Analysis of the Smoking and Weight Eating Episodes Test (SWEET)

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Abstract

Introduction The Smoking and Weight Eating Episodes Test (SWEET; Adams et al. 2011) is a self-report measure designed to assess multiple reasons why and when smokers use cigarettes for appetite, weight, and shape management, that was initially developed and validated in young female smokers.

Purpose The aim of the current study was to evaluate the factor structure and psychometric properties of the SWEET measure among both male and female daily cigarette smokers.

Method Participants ($n = 577$; $M_{\text{age}} = 44.42$; $SD = 13.80$; 52.7% female) were daily smokers recruited through Qualtrics Online Sample for an anonymous study on smoking and health. On average, participants reported smoking for 25.7 years ($SD = 14.35$), smoked 17.0 cigarettes per day ($SD = 8.38$), and had moderate levels of tobacco dependence.

Results Confirmatory factor analyses supported the initial factor structure found in the original SWEET measure suggesting a four-factor structure fit the data well, but not a one-factor structure. Factors included using cigarettes for appetite suppression, using cigarettes to prevent overeating, smoking to cope with body dissatisfaction, and using cigarettes to cope with appetite-related withdrawal symptoms. Tests of measurement invariance revealed no significant differences when evaluating SWEET scores by participant sex. The SWEET factor scores evidenced internal consistency, known groups validity, convergent validity with related constructs (compensatory eating behaviors, tobacco dependence) and cessation-relevant variables (smoking abstinence expectancies, prior withdrawal symptoms), and discriminant validity with physical activity and sedentary behavior.

Conclusions The present study provides evidence in support of the validity and reliability of scores on the SWEET as a multidimensional measure of smoking for appetite, weight, and body-related concerns in male and female daily cigarette smokers.

Keywords Weight · Body dissatisfaction · Psychometrics · Tobacco dependence

Introduction

There is a well-established link between smoking and weight concerns, including concerns specific to smoking (e.g., smoking to control weight, concern about weight gain after smoking

cessation) and general weight concerns non-specific to smoking (e.g., body dissatisfaction, general fear of gaining weight). Post-cessation weight gain concerns have received the most attention in the scholarly literature [1–4]. Data generally indicate that post-cessation weight gain concerns are common, especially in women [2], are associated with lower motivation and confidence for quitting [5–9], and predict poorer smoking cessation outcomes [2, 10–12]. General concerns about body weight/shape and body dissatisfaction are more common in smokers relative to non-smokers [13] and increase the risk for smoking initiation [14]. Additionally, although general concerns about body weight/shape are associated with lower motivation for abstinence [15], general body weight/shape concerns unlike smoking-specific weight concerns may actually aid in successful smoking cessation [3].

Generally, it is posited that smoking-specific weight concerns may be more functionally related to the maintenance of smoking, and therefore, the assessment of these concerns has received increased attention in recent

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literature [16]. However, existing measures of smoking-related weight concerns have not considered the functional link between smoking and weight concerns across *multiple* relevant dimensions, including use of cigarettes as a behavioral strategy to suppress appetite or to prevent overeating [7, 17, 18], to cope with body dissatisfaction, or to manage weight or appetite changes due to withdrawal symptoms [3, 19]. It is important to understand the nuanced reasons why smokers rely on cigarettes for weight-related concerns in order to tailor the specificity of weight-focused interventions for smokers. To address this gap, the *Smoking and Weight Eating Episodes Test* (SWEET) [16], a 10-item self-report questionnaire, was specifically developed to assess the extent to which, and reasons why, smokers utilize cigarettes for weight and shape management across multiple dimensions. The SWEET item content was informed in part by existing measures [7, 18], themes in clinical experience, and expert review. The initial validation of the measure was conducted using a sample of female college students in the USA who on average had normal body mass index (BMI), were light smokers ($M=7.9$ cigarettes/day), and about half were non-daily smokers [16]. An exploratory factor analysis revealed a four-factor structure that reflected: smoking to suppress appetite (three items), smoking to prevent overeating (three items), smoking to cope with body dissatisfaction (two items), and smoking to manage appetite-related withdrawal symptoms (two items). The SWEET items had high internal consistency ($\alpha=.94$), were found to correlate with measures of general and smoking-specific weight concerns and eating pathology, and demonstrated small positive associations to tobacco dependence and BMI [16].

The current study aimed to increase the generalizability of the utility of the SWEET measure by examining its psychometric properties in a broader sample of smokers from the USA (e.g., mixed-sex, non-college attending, older, broader BMI range, and higher daily cigarette use) using an online sample. We examined the factor structure, internal consistency, known groups validity, and convergent and discriminant validity of SWEET scores. With regard to convergent validity, it was hypothesized that SWEET scores would be positively associated with tobacco dependence, eating pathology, BMI, and associated with cessation-relevant variables including higher negative affect, more severe withdrawal severity, greater negative expectancies about smoking abstinence, and lower positive expectancies about abstinence. These hypotheses parallel and extend those posited and supported by Adams et al. [16]. In addition, it was hypothesized that SWEET scores would demonstrate non-significant associations with alternative health behaviors that are non-specific to weight concerns, including level of physical activity and

sedentary behavior. This test of discriminant validity would indicate the extent to which SWEET items tap weight/body-specific concerns, and not broader aspects of health behavior.

Method

Participants and Procedure

Participants ($n=619$; 50.9% female) were daily smokers in the USA recruited through Qualtrics Online Sample for an anonymous study on smoking and health. Participants were included if they met the following criteria: (a) ≥ 18 years of age, (b) daily smoking for ≥ 1 year, (c) smoking ≥ 5 cigarettes/day, and (d) cigarettes as primary tobacco product. Participants were excluded if they reduced their smoking rate by more than half in the past 6 months. The survey was approximately 40 min in length. The study protocol was approved by the Institutional Review Board where the study was conducted. Cases were retained based on accurately answering four embedded validity “check” questions. The following cases were also excluded due to providing invalid height/weight (i.e., incorrectly entered data/misunderstanding of instructions; $n=30$) and reporting $< 70\%$ accuracy of height and/or weight ($n=12$) (see BMI in Measures below). Thus, a total of 577 cases were included in the current analyses.

Measures

The *Smoking and Weight Eating Episodes Test* (SWEET) is a 10-item self-report measure used to assess the extent to which individuals smoke for specific reasons related to eating and weight concerns. Responses are rated on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*). Items have been previously summed to create subscale scores [16] and an overall total score [20].

Descriptive Measures The *Patient Health Questionnaire* (PHQ) [21] is a self-report assessment that was used to assess the presence/absence of common DSM-IV Axis I disorders, including binge eating and bulimia nervosa. Items from the *Smoking History Questionnaire* (SHQ) [22] were used to describe the sample in terms of smoking (e.g., onset of regular daily smoking), pattern (e.g., number of cigarettes consumed per day), and quit history.

Known Groups Validity The following items were utilized to assess responses on the SWEET across different subgroups of smokers: sex “What is your biological sex?” (M/F); diet “Are you currently on any kind of diet, either to lose weight or for some other health-related reason?” (Y/N); any probable

psychiatric disorder and eating disorder per the PHQ (Y/N); electronic cigarette use “Do you currently use electronic cigarettes?” (Y/N); and presence of moderate or severe withdrawal-related appetite increases “Increased appetite, hunger, or weight gain” [item 6 on the *Minnesota Nicotine Withdrawal Scale* (MNWS) [23] during the most recent quit attempt (recoded Y/N).

Convergent and Discriminant Validity The *Fagerström Test for Cigarette Dependence* (FTCD) [24] is a six-item scale that assesses gradations in tobacco dependence, with higher scores reflecting higher dependence (possible range 0–10). The eight-item MNWS was used to assess the severity of nicotine withdrawal symptoms during the most recent quit attempt. MNWS items are rated on a Likert-like scale from 1 (*none*) to 5 (*severe*). Items were summed to create a total severity score.

Body Mass Index (BMI) was calculated based on self-reported weight and height ($[\text{weight}(\text{lbs})/[\text{height}(\text{in})]^2 \times 703]$). Perceived accuracy in self-reported height and weight was rated on a 0–100% scale of accuracy confidence. Cases with accuracy confidence > 70% were retained; average accuracy ratings were very high for height ($M = 98.0\%$, $SD = 4.13\%$) and weight ($M = 96.6\%$, $SD = 5.16\%$).

The *Positive and Negative Affect Schedule* (PANAS) [25] was used to assess state negative affect via the 10-item subscale. Respondents rate the extent to which they currently feel each negative affect state (e.g., afraid, nervous) on a Likert-type scale from 1 (*very slight/not at all*) to 5 (*extremely*), and responses are summed to create a total index.

The *Smoking Abstinence Expectancies Questionnaire* (SAEQ) [26] is a 28-item scale of expected positive and negative short-term psychological and physiological consequences of acute (24 h) smoking abstinence. Items are rated on a 7-point Likert scale of how likely or unlikely each listed consequence would be experienced, ranging from 0 (*very unlikely*) to 6 (*very likely*). The SAEQ yields three factors of negative expectancies (negative mood, somatic symptoms, harmful consequences) and one positive expectancies factor that reflects positive expected outcomes of short-term abstinence (e.g., “I would feel calm”).

The *International Physical Activity Questionnaire-Short Form* (IPAQ-S) [27] was used to denote the average weekly number of moderate-to-vigorous physical activity minutes and daily sitting/sedentary time (in hours).

Data Analytic Procedures

The factor structure was examined using structural equation modeling (confirmatory factor analysis; CFA). Both a four- and one-factor model were analyzed, and tests of measurement invariance were tested with respect to participant sex. Analyses were conducted using Mplus version 8. Robust

maximum likelihood (MLR) was employed as the estimation method; indicators loaded on their underlying factors and inter-factor correlations were allowed. Their corresponding measurement errors were estimated as well. Based on the original measure validation, each item was constrained to load onto one factor. With respect to model fit, several tests were used to evaluate the models. First, the overall model Yuan-Bentler adjusted χ^2 [28] was used. Generally, a non-significant chi-square test, leading to non-rejection of the model, would suggest a relatively good approximation of the data. Second, the model fit was evaluated using the root mean square error of approximation (RMSEA) with values of .00 to .05 indicating excellent fit, values of .06–.08 indicating reasonable fit, and values about .10 suggesting poor fit [29]. The comparative fit index [30] and the Tucker-Lewis index were also used, with values greater than .90 as indicative of good fit [31]. Cronbach's alpha and McDonalds omega were used to document internal consistency of factor items. Inter-correlations were computed to assess the degree of association between factor scores. Zero-order correlations were computed between the SWEET factor scores in relation to the relevant measures to assess convergent and discriminant validity.

Results

Sample Characteristics

Participants ($n = 577$; $M_{\text{age}} = 44.42$; $SD = 13.80$; 52.7% female) identified race as White (90.1%), Black/African-American (4.2%), Asian (2.1%), American Indian/Alaska Native (1.6%), or other (2.1%), and 7.3% of participants identified ethnicity as Hispanic. Marital status was reported as married (49.2%), never married (27.7%), divorced/separated (20.8%), and widowed (3.6%). The majority of the sample completed at least some college (71.4%). Employment status was reported as employed full-time (50.1%), homemaker (12.1%), retired (10.6%), employed part-time (9.9%), unemployed (8.1%), disabled (6.9%), and student (2.3%).

On average, participants reported initiating smoking at age 16.0 years ($SD = 4.79$), were smoking for 25.7 years ($SD = 14.35$), smoked 17.0 cigarettes per day ($SD = 8.38$), and had moderate levels of tobacco dependence ($M_{\text{FTCD}} = 5.3$, $SD = 1.98$). Approximately one fourth of the sample reported current use of electronic cigarettes (27.4%). The majority of participants reported at least one prior quit attempt (80.9%), among which 37.9% reported moderate to severe increases in appetite, eating, or weight during their most recent quit attempt. Average BMI was in the overweight range ($M = 27.9$, $SD = 7.31$), and 29.5% had an obese BMI (≥ 30). Current dieting was reported in 18.4% of participants (of which 70.8% had an overweight BMI [≥ 25]) and specific diets with included low calorie (9.0%), sugar free/low sugar

(5.5%), low sodium (5.4%), low fat or cholesterol (5.2%), low carbohydrate (4.5%), high protein (3.3%), higher fiber (3.5%), diabetic (1.9%), or other (1.4%).

The presence of any probable psychiatric diagnosis on the PHQ was 31.4%, which included alcohol abuse (15.6%), panic attacks (14.0%), major depressive disorder (11.4%), and generalized anxiety disorder (10.6%), and 4.3% of the sample had a probable eating disorder (3.8% binge eating disorder; 0.5% bulimia nervosa). The presence of any compensatory eating behavior (to avoid gaining weight) in the past 3 months was 36.2%, which included restricting eating for at least 24 h (8.3%), self-induced vomiting (2.6%), using more than twice recommended dose of laxatives (2.3%), or exercising for more than an hour specifically to avoid gaining weight after binge eating (7.3%).

Confirmatory Factor Analysis

Consistent with the initial validation paper [16], a four-factor model was fit to the data. The model was statistically significant, $\chi^2(29, n = 577) = 124.80, p < .01$. Overall, the results indicated reasonable fit (RMSEA = .07, 90% confidence interval [CI .06, .09]; CFI = .98; TLI = .97). Please see Fig. 1 for

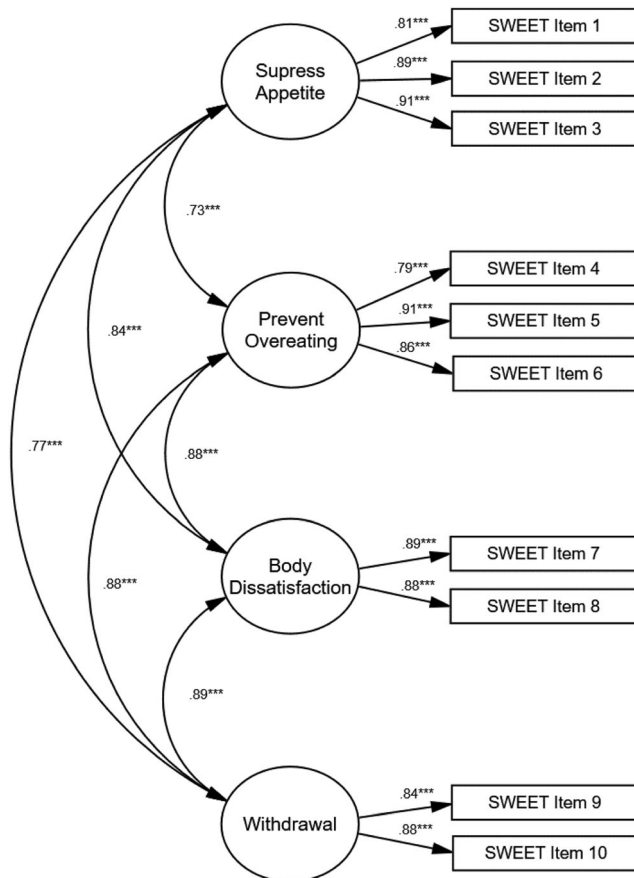


Fig. 1 Four-factor model for SWEET items. Note. All estimates reflect standardized regression weights. *** $p < .001$

a visual display of the model as well as all standardized factor loadings. These factors represent (1) smoking to suppress appetite, (2) smoking to prevent overeating, (3) smoking to cope with body dissatisfaction, and (4) smoking to cope with appetite-related withdrawal symptoms. In contrast, given the SWEET has been previously used as a total summed score [20], a single-factor model was fit to the data. The model was statistically significant, $\chi^2(35, n = 577) = 796.12, p < .01$. Overall, the results indicated poor fit (RMSEA = .19, 90% confidence interval [CI .18, .21]; CFI = .83; TLI = .78).

Tests for invariance with respect to sex were examined given the document sex differences in the literature and lack of psychometric evaluation in male smokers [16]. Model fit was evaluated when both groups were tested together and freely. A chi-square difference test was performed to ascertain if there was a statistically significant difference between the two models. Results showed that this test was not significant, $\chi^2 \text{ diff}(10) = 15.77, p > .10$; furthermore, the change in CFI was less .01 (.975 versus .973 respectively). Thus, there were no differences with respect to sex; the results suggest strong invariance, and a model using both men and women was fit to the data.

Internal Consistency

All subscale scores were significantly inter-correlated (r 's range .58–.71, see Table 1). Reliability tests are presented in Table 2. Results revealed high internal consistency for the all SWEET factor items.

Known Groups Validity

See Table 3 for the summary of results. Results indicated that one SWEET factor (smoking to suppress appetite) was significantly higher in female versus male smokers ($M = 2.52, SD = 1.12$ versus $M = 2.27, SD = 1.04, p = .005$). Smokers who reported being on any kind of current diet (versus not) had higher scores on all factors of the SWEET, with the largest mean difference observed in smoking to cope with body dissatisfaction ($M = 2.64, SD = 1.39$ versus $M = 1.93, SD = 1.19, p < .0001$). Smokers with any probable psychiatric diagnosis on the PHQ also had significantly higher scores on the SWEET

Table 1 Descriptive summary and inter-correlation between SWEET factor scores

	1.	2.	3.	4.	Mean (SD)
1. Appetite suppression	–	.706	.694	.635	2.4 (1.1)
2. Prevent overeating		–	.676	.668	2.3 (1.2)
3. Body dissatisfaction			–	.581	2.1 (1.3)
4. Cope with withdrawal				–	2.6 (1.3)

All inter-correlations are significant (p value $< .001$)

Table 2 Psychometric statistics for SWEET subscales

	Mean (SD)	SWEET factor			
		Appetite suppress	Prevent overeating	Body dissatisfaction	Cope with withdrawal
Internal consistency					
Cronbach's alpha (α)	–	.905	.885	.877	.848
McDonald's omega (ω)	–	.907	.891	.877	.849
Convergent validity (<i>r</i>)					
Tobacco dependence (FTCD)	5.3 (1.98)	.24***	.18***	.19***	.18***
Withdrawal severity (MNWS) ^a	23.9 (8.69)	.35***	.40***	.39***	.38***
Compensatory eating (PHQ)	0.2 (0.62)	.32***	.29***	.33***	.25***
Body mass index (BMI)	27.9 (7.32)	.16***	.18***	.21***	.07
Negative affect (PANAS)	14.5 (7.66)	.41***	.38***	.48***	.34***
Abstinence expectancies (SAEQ)					
Negative mood	22.6 (10.80)	.37***	.34***	.31***	.40***
Somatic symptoms	11.7 (10.39)	.44***	.43***	.48***	.40***
Harmful consequences	11.9 (11.05)	.49***	.46***	.53***	.43***
Positive consequences	28.1 (9.92)	–.14**	–.17***	–.16***	–.11**
Discriminant validity (<i>r</i>)					
Mod/vig physical activity (mins/week)	289.4 (613.88)	–.02	–.05	–.06	–.03
Sitting/sedentary time (mins/day)	7.3 (3.11)	.05	.04	.09*	.08

p* < .01; *p* < .001

^a Only among smokers who reported a history of ≥ 1 prior quit attempt (*n* = 467)

Table 3 Known groups validity

Variable	Appetite suppress	<i>t</i>	Prevent overeating	<i>t</i>	Body dissatisfaction	<i>t</i>	Cope with withdrawal	<i>t</i>
Sex								
Male (<i>n</i> = 273)	2.27 (1.04)	–2.81**	2.24 (1.14)	–1.65	1.96 (1.22)	–1.77	2.58 (1.29)	0.08
Female (<i>n</i> = 304)	2.52 (1.12)		2.40 (1.21)		2.14 (1.29)		2.58 (1.31)	
Diet								
No diet (<i>n</i> = 471)	2.32 (1.05)	–4.63***	2.25 (1.15)	–4.29***	1.93 (1.19)	–4.91***	2.48 (1.28)	–3.94***
Diet (<i>n</i> = 106)	2.84 (1.15)		2.76 (1.21)		2.64 (1.39)		3.02 (1.30)	
Any PHQ diagnosis								
No (<i>n</i> = 396)	2.23 (1.01)	–5.45***	2.16 (1.13)	–5.06***	1.86 (1.10)	–5.22***	2.36 (1.21)	–6.17***
Yes (<i>n</i> = 181)	2.78 (1.16)		2.68 (1.20)		2.49 (1.45)		3.06 (1.37)	
Any eating Dx								
No (<i>n</i> = 552)	2.39 (1.09)	–1.75	2.29 (1.18)	–2.95**	2.04 (1.25)	–1.64	2.56 (1.30)	–1.66
Yes (<i>n</i> = 25)	2.77 (1.00)		3.00 (1.08)		2.46 (1.36)		3.00 (1.11)	
E-cigarette use								
No (<i>n</i> = 419)	2.29 (1.05)	–4.10***	2.20 (1.14)	–4.08***	1.95 (1.21)	–3.21***	2.49 (1.28)	–2.70**
Yes (<i>n</i> = 158)	2.70 (1.14)		2.65 (1.22)		2.34 (1.35)		2.82 (1.32)	
Withdrawal-related hunger/weight increase ^a								
Mild or less (<i>n</i> = 290)	2.24 (0.98)	–6.20***	2.11 (1.03)	–7.14***	1.81 (1.09)	–6.90***	2.34 (1.17)	–8.89***
Moderate/severe (<i>n</i> = 177)	2.85 (1.11)		2.91 (1.27)		2.65 (1.38)		3.36 (1.24)	

p* < .05; *p* < .01; ****p* < .001

^a Only among smokers who reported a history of ≥ 1 prior quit attempt (*n* = 467)

relative to smokers without a probable diagnosis. In particular, smokers with a probable eating disorder, relative to those without, had significantly higher scores on the SWEET factor reflecting use of cigarettes to prevent overeating ($M = 3.00$, $SD = 1.08$ versus $M = 2.29$, $SD = 1.18$, $p = .003$). Smokers who reported current use of electronic cigarettes also had significantly higher scores on the SWEET factors. Additionally, among participants with ≥ 1 prior quit attempt ($n = 467$), those who reported having moderate-severe increases in appetite, hunger, or weight during their most recent quit attempt had significant highly scores on the SWEET factors relative to those who reported mild or no withdrawal-related changes. The largest sized mean differences were reflected in the factor reflecting smoking to cope with withdrawal-related appetite increases ($M = 3.36$, $SD = 1.24$ versus $M = 2.34$, $SD = 1.17$, $p < .0001$).

Convergent and Discriminant Validity

Tests of convergent and discriminant validity are presented in Table 2. All SWEET factor scores were positively associated with tobacco dependence (r 's = .18–.24). Small-sized significant positive associations were observed with BMI and SWEET factor scores (r 's = .16–.21), except for the factor reflecting smoking to cope with withdrawal-related appetite increases. Compensatory eating behavior symptoms were also positively correlated with all SWEET factor scores (r 's = .25–.34). Regarding cessation-relevant variables, SWEET factor scores were small-moderately correlated with negative affect (r 's = .34–.48), nicotine withdrawal severity during most recent quit attempt (r 's = .35–.44), negative expectancies about acute smoking abstinence (r 's = .31–.55), and negatively correlated (small size) with positive expectancies about smoking abstinence (r 's = –.11–.17).

Regarding discriminant validity, SWEET factor scores were not significantly related to indices of physical activity (minutes/week of moderate-vigorous physical activity) or sedentary behavior (hours/day of time spent sitting).

Discussion

The psychometric properties of the SWEET measure [16] were examined in sample of male and female daily smokers from the USA. The test of the factor structure of the SWEET measure supported the four-factor solution found by Adams and colleagues [16], reflecting smoking to suppress appetite, smoking to prevent overeating, smoking to cope with body dissatisfaction, and appetite-related withdrawal symptoms. Thus, in a non-college attending, mixed-sex sample of daily smokers with moderate levels of tobacco dependence ($M_{CPD} = 17.0$) and average overweight BMI ($M = 27.9$), the

originally proposed latent variables are reflected in this sample. In contrast, a single-factor model did not fit the data which further supports the multidimensional nature of SWEET measure. As a result, findings indicate the use of a total summed SWEET score has limited psychometric validity. In a test of measurement invariance, we found non-significant sex differences, suggesting that the SWEET scores have sound psychometric properties for both male and female smokers. Follow-up evaluation of reliability indicated that the SWEET scores had high internal consistency for the factor scores. Findings also support the convergent validity of the SWEET factor scores in relation to compensatory eating behaviors and to a lesser extent BMI and tobacco dependence, consistent with findings from the original measure validation [16]. Additionally, the current findings uniquely document the convergent validity of SWEET factors scores with cessation-relevant factors including negative affect, severity of nicotine withdrawal symptoms, negative smoking abstinence expectancies, and lower positive abstinence expectancies. Moreover, the current findings provide unique evidence of discriminant validity, evidenced by the lack of associations between the SWEET scores with levels of physical activity and sedentary behavior, which suggests that the SWEET measure is indeed tapping weight-specific concerns.

The SWEET measure also appears to be sensitive to differences in various relevant subgroups of smokers. Male and females did not differ in scores on the SWEET, with the exception of females reporting higher scores on items reflecting smoking for appetite suppression. Thus, the use of cigarettes to curb appetite may be more prominent among female relative to male smokers, consistent with literature indicating that women are especially likely to smoke for weight control [7, 32, 33, 34]. Smokers who reported moderate to severe increases in appetite, eating, and/or weight during their most recent quit attempt had significantly higher SWEET factor scores, compared to those without prior weight-related withdrawal experiences. As expected, the largest differences were observed in items that tap use of cigarettes for attenuation of appetite-related withdrawal symptoms, consistent with prior studies reporting that smokers attribute past relapses to anticipated or actual weight gain [9, 35, 36]. Additionally, smokers currently on a diet and those who use electronic cigarettes had significantly higher scores on the SWEET factors. Interestingly, one quarter of smokers on a diet were also current electronic cigarette users (28.3%). These findings highlight the potential relevance of considering the link between smoking and weight-related concerns among electronic cigarette users [37]. Recent studies indicate that some individuals report using electronic cigarettes for weight loss or maintenance or to suppress food cravings [38–40, 41].

Moreover, smokers with a probable psychiatric diagnosis had higher scores on the SWEET, compared to smokers without. Additionally, scores on SWEET items reflecting the use

of cigarettes to prevent overeating were higher in smokers with a probable binge eating disorder or bulimia nervosa, which parallels findings from the original validation study [16]. It is worth noting that the PHQ does not assess restrained eating behavior and related disorders (e.g., anorexia nervosa) and that the presence of probable eating disorders in this sample was low (4.3%, $n = 25$; 64.0% female). Regardless of whether binge eating and compensatory behaviors are of clinical threshold, findings suggest that these smokers may be at risk for reliance on cigarettes as a behavioral strategy to prevent overeating.

A few limitations should be considered. First, this study relied fully on self-reported assessments that were completed as part of an internet-based study. Although the study was anonymous and completed by participants in the privacy of their own home, we cannot rule out the possibility of response biases. Second, the study was cross-sectional in nature; thus, the temporal associations between variables cannot be ascertained. The cross-sectional nature of the data also limited our ability to evaluate the predictive validity of the SWEET scores and factor structure stability. Future psychometric examination of the SWEET scores is warranted, especially in order to examine the unique predictive validity of SWEET factors. Lastly, the sample was predominantly white and well-educated, thus, the generalizability of these findings to a more heterogeneous sample of smokers may be limited. Previous research has indicated smoking-related weight concerns are common regardless of race, ethnicity, and/or socioeconomic status [9, 42, 43].

This study provides evidence that, in a broad sample of male and female daily smokers with moderate levels of tobacco dependence, (1) there is variability among the sample on the SWEET across four inter-related domains (i.e., smoking for appetite suppression, to prevent overeating, to cope with body dissatisfaction, and to attenuate withdrawal-related increases in appetite); (2) the SWEET scores are psychometrically-sound; and (3) certain subgroups of smokers (e.g., those with probable psychiatric diagnoses, dieters, and e-cigarette users) may be more likely to rely on cigarettes for weight/appetite control reasons. The multidimensional nature of the SWEET measure can assist clinical intervention by facilitating a nuanced assessment of the functional links between smoking and various weight/appetite beliefs and behaviors. This measure can also aid researchers in the tailoring and development of interventions that target domains of greatest importance to various subgroups of smokers who report weight, body shape, or eating concerns as barriers to smoking cessation.

Author's Contributions Drs. Farris and Bloom reviewed the literature, and Dr. Farris wrote the first draft of the manuscript. Dr. DiBello conducted data analyses. All authors contributed and approved the final version of the manuscript.

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Compliance with Ethical Standards

Conflict of Interest Dr. Bloom has been a consultant for WayBetter, Inc. All other authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study, formal consent is not required. No identifying information was collected. This article does not contain any studies with animals performed by any of the authors.

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