

ORIGINAL

Spanish Validation of the Smoking-Related Weight and Eating Episodes Test (SWEET)

Validación Española del Cuestionario de Episodios de Consumo de Tabaco Relacionados con la Alimentación y el Peso (CECTRAP)

ANDREA KROTTER^{*,**}; COVADONGA GONZÁLEZ-NUOVO^{*}; CLAIRE A. SPEARS^{***}; GLORIA GARCIA-FERNANDEZ^{*}.

* Department of Psychology, University of Oviedo, Oviedo, Spain.

** Faculty of Health, International University of La Rioja (UNIR), La Rioja, Spain.

*** Department of Health Policy and Behavioral Sciences, Georgia State University School of Public Health, Atlanta, GA, USA.

Abstract

The use of tobacco for the purpose of weight management is a pervasive and detrimental practice among individuals with overweight or obesity. The Smoking-Related Weight and Eating Episodes Test (SWEET) assesses eating- and weight-related motivations for smoking. The goal of this study was to validate the SWEET in Spanish individuals with overweight or obesity. Adults seeking treatment for smoking cessation ($N = 123$; 54.47% female; $M_{BMI} = 31.71 \pm 4.27$) completed the SWEET and measures related to smoking, weight, eating, emotional symptoms, and physical activity. Reliability and validity were assessed based on internal structure, internal consistency, and relationships with other variables. A four-factor correlated model, as found in the original SWEET, exhibited an adequate fit. The reliability coefficients demonstrated adequate internal consistency across subscales ($\alpha = .68 - .88$), and the relationships with other measures were consistent, providing positive evidence of convergent and discriminant validity. The implementation of this valid and reliable instrument to assess eating- and weight-related motivations for smoking in individuals with overweight or obesity undergoing smoking cessation may contribute to the development of more effective treatment strategies tailored to the needs of this population.

Keywords: smoking, weight control, SWEET, validation, Spanish, overweight, obesity

Resumen

El consumo de tabaco con fines de control del peso constituye una práctica generalizada y nociva entre las personas con sobrepeso u obesidad. El Smoking-Related Weight and Eating Episodes Test (SWEET) evalúa las motivaciones relacionadas con la alimentación y el peso en el consumo de tabaco. El objetivo de este estudio fue validar el SWEET en personas españolas con sobrepeso u obesidad. Adultos que querían participar en un tratamiento para dejar de fumar ($N = 123$; 54,47% mujeres; $M_{IMC} = 31,71 \pm 4,27$) completaron el SWEET y otras medidas relacionadas con el tabaquismo, el peso, la alimentación, los síntomas emocionales y la actividad física. La fiabilidad y la validez se evaluaron en función de la estructura interna, la consistencia interna y las relaciones con otras variables. El modelo correlacional de cuatro factores mostró un ajuste adecuado tal y como se encontró en el SWEET original. Los coeficientes de fiabilidad evidenciaron una consistencia interna adecuada en las subescalas ($\alpha = ,68 - ,88$), y las relaciones con otras medidas fueron consistentes, aportando evidencia positiva de validez convergente y discriminante. La aplicación de este instrumento para evaluar las motivaciones relacionadas con la alimentación y el peso en el consumo de tabaco en personas con sobrepeso u obesidad que participan en programas de cesación tabáquica puede contribuir al desarrollo de estrategias de tratamiento más eficaces adaptadas a las necesidades de esta población.

Palabras clave: tabaquismo, control de peso, SWEET, validación, español, sobrepeso, obesidad

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■ Corresponding author:

Gloria Garcia-Fernandez. Department of Psychology, University of Oviedo. Plaza Feijoo s/n, 33003, Oviedo, Spain.
E-mail address: garciafgloria@uniovi.es

Individuals who smoke tend to have a lower body weight than individuals who do not smoke (Audrain-McGovern & Benowitz, 2011). However, the risk of developing obesity increases with the number of cigarettes smoked per day (Clair et al., 2011), which suggests a U-shaped relationship between body mass index (BMI) and intensity of tobacco use. Smoking cessation is associated with an average increase of 4.67 kilograms after one year of abstinence (Aubin et al., 2012). The mechanisms explaining the link between tobacco use and weight change are not completely understood. The literature underlines that the removal of nicotine, a stimulant that increases metabolic rate (i.e., the rate of energy expenditure per unit of time), may influence weight increase (Audrain-McGovern & Benowitz, 2011).

People may use tobacco for weight or shape control (Fahey et al., 2021; White, 2012). This potentially health-damaging method of weight control is associated with being female, having higher levels of disordered eating, lower levels of physical activity, and higher BMI (Kilmurray et al., 2023; Mason et al., 2022). Prior literature has shown that concerns about weight gain prior to quitting smoking are associated with smoking relapse (Siñol et al., 2013; Tuovinen et al., 2018).

Individuals with obesity are more likely to be concerned with post-cessation weight gain, showing less tolerance for weight gain and reporting less confidence in maintaining their weight after quitting (Levine et al., 2013). In addition, people with obesity evidence greater post-cessation weight gain than those with overweight or in the normal weight range (Lycett et al., 2011), and frequently exhibit disordered eating behaviors (e.g., eating ultra-processed foods, emotional eating) (Askari et al., 2020; Vasileiou & Abbott, 2023). Although obesity is generally associated with a higher risk profile than overweight, both conditions entail greater weight-related concerns and vulnerability compared to normal weight; therefore, smoking cessation interventions aimed at preventing post-cessation weight gain are commonly designed for both populations (BMI \geq 25; see e.g., Heggen et al., 2017; Hurt et al., 2022).

Several instruments have been developed with the purpose of assessing tobacco use as a strategy for weight control (Brandon & Baker, 1991; Copeland et al., 1995; Pomerleau & Snedecor, 2008; Rash & Copeland, 2008; Smith et al., 2010; Weekley et al., 1992). However, these instruments are not without limitations, particularly regarding their application in clinical practice, as they are unable to assess diverse forms of weight control through tobacco use. The Smoking Situations Questionnaire (Weekley et al., 1992), the Smoking Consequences Questionnaire (Brandon & Baker, 1991; Copeland et al., 1995; Rash & Copeland, 2008), the Weight Control Smoking Scale (Pomerleau & Snedecor, 2008), and the brief Wisconsin Inventory of Smoking Dependence Motives (Smith et al., 2010) rely on a single factor to assess

this construct; and only two of these instruments have been validated in a Spanish population (Cepeda-Benito & Reig Ferrer, 2000; López-Núñez et al., 2023). Furthermore, it is important to note that some studies employed non-validated measures (see e.g., White, 2012; Yong & Borland, 2008), which could potentially introduce biases to the results.

In contrast, the Smoking-Related Weight and Eating Episodes Test (SWEET) (Adams et al., 2011) assesses eating- and weight-related motivations for smoking through four subscales: smoking to suppress appetite when physically hungry, to avoid snacking and to satisfy food cravings when not physically hungry, to prevent overeating, and when “feeling fat” or weight concerns arise. This instrument was preliminarily validated with 280 female undergraduates in the USA and showed excellent psychometric properties in terms of internal consistency and validity (Adams et al., 2011). A subsequent study further supported the psychometric properties of the SWEET through a confirmatory factor analysis conducted with 577 men and women who smoked in the USA (Farris et al., 2018). Prior studies have demonstrated that SWEET scores are associated with following a low-calorie diet (Coniglio et al., 2020) or exhibiting higher levels of distress intolerance (Burr et al., 2020). To the best of our knowledge, the SWEET has not been published in languages other than English and its psychometric properties have not been examined in populations from countries other than the USA.

In summary, taking into account the clinical relevance of evaluating different domains of tobacco use as a method of weight control, the scarce instruments for its evaluation, the small number of psychometric studies on the SWEET and the absence of studies that analyze its psychometric properties in the Spanish population, the main objective of the study is validating the SWEET questionnaire in Spanish adults, specifically among individuals who smoke with overweight or obesity. The psychometric properties of the SWEET scores were examined, specifically evidence based on the factor structure of the questionnaire and its relationships with other relevant variables (i.e., related to sociodemographics, smoking behavior, body weight, eating behaviors, emotional symptoms, and physical activity), as well as reliability through internal consistency.

Method

Participants

The sample consisted of individuals with overweight or obesity who were interested in quitting smoking and participated in a clinical trial at the University of Oviedo. The trial was pre-registered (ID: NCT04332029) and the study protocol was approved by the Research Ethics Committee of the Principado de Asturias (n.º 329/19). Recruitment was conducted from September 2020 to October 2021 through various media outlets, including television, radio,

newspapers, social media, and poster advertisements. A total of 123 individuals completed an assessment prior to the initiation of a smoking cessation treatment, which included a weight gain prevention component (Krotter et al., 2024). Inclusion criteria consisted of (1) being at least 18 years of age; (2) smoking at least 10 cigarettes per day and not using electronic nicotine delivery devices over the past year; (3) meeting diagnostic criteria for tobacco use disorder and (4) having a BMI greater than or equal to 25. Exclusion criteria were (1) being pregnant, breastfeeding or in the six-month postpartum period; (2) having received another treatment for smoking cessation or weight control (either behavioral or pharmacological) in the previous 30 days; (3) presenting a diagnosis, during the previous year, of a severe psychiatric disorder (e.g., active psychotic disorder or suicidal ideation), eating disorder other than binge eating disorder, or substance use disorder other than tobacco use disorder; (4) having any health condition requiring a specialized diet or that affected eating, such as uncontrolled diabetes; (5) not being able to attend treatment; or (6) taking medication that affects weight. Regarding the participants' characteristics, the mean age was 52.23 years ($SD = 10.41$), with the majority being women (54.57%). Participants smoked an average of 21.31 cigarettes per day ($SD = 8.75$) and had been smoking for just over 30 years on average ($SD = 10.66$). Most participants (60.98%) fell within the obesity range for body weight. Additional participants characteristics are presented in Table 1.

Instruments

Participants were asked to provide information regarding their sociodemographic characteristics, including their sex and age, as well as details about their smoking habits (i.e., number of cigarettes they smoked per day and the number of years they had been regular smokers). Furthermore, the assessment encompassed a range of measures pertaining to smoking behavior, body weight, eating behavior, emotional symptoms, and physical activity.

Smoking Behavior

Smoking to Control Eating and Weight. The SWEET consists of 10 items on a five-point Likert scale (1 = *never*, 5 = *always*), with scores ranging from 10 to 50. It includes four subscales (i.e., smoking to suppress appetite, smoking to prevent overeating, smoking to cope with body dissatisfaction, and smoking due to withdrawal-induced appetite increase). Its reliability in the original version was .94 for the total score and ranged from .82 to .91 for the four subscales (Adams et al., 2011).

Nicotine Dependence. The Fagerström Test for Cigarette Dependence (FTDC) that has been validated in a Spanish sample (Becoña & Vázquez, 1998) assesses nicotine dependence through six items, with five established levels:

Table 1
Participants' Characteristics

Mean (standard deviation)	N = 123
Age	52.23 (10.41)
Female sex (n/%)	67 (54.47)
Cigarettes smoked per day	21.31 (8.75)
Years of regular smoking	30.60 (10.66)
SWEET	
Appetite suppression	6.58 (2.91)
Prevent overeating	5.43 (2.87)
Body dissatisfaction	3.65 (2.16)
Cope with withdrawal	4.8 (2.03)
Nicotine dependence (FTCD)	5.41 (2.06)
Smoking craving (QSU)	
Intention to smoke	19.11 (10.37)
Expectations of negative reinforcement	10.37 (5.89)
Post-cessation weight gain concerns (0-100)	64.23 (30.68)
Urine cotinine levels	2293.62 (1213.91)
Current motivation for weight control (n/%)	
Precontemplation	24 (19.51)
Contemplation	36 (29.27)
Preparation	26 (21.14)
Action	21 (17.07)
Maintenance	16 (13.01)
BMI	31.71 (4.27)
Overweight (n/%)	48 (39.02)
Obesity (n/%)	75 (60.98)
Severity of binge eating (BES)	10.24 (8.69)
DEBQ	
Emotional eating	24.28 (11.40)
External eating	26.05 (7.31)
Restrained eating	22.54 (8.52)
DASS-21	
Depression	8.62 (8.09)
Anxiety	8.18 (6.78)
Stress	11.32 (7.27)
REGICOR	
Light physical activity	528.41 (762.54)
Moderate physical activity	456.80 (846.30)
Vigorous physical activity	424.98 (899.30)

Note. SWEET = Smoking-Related Weight and Eating Episodes Test; FTCD = Fagerström Test for Cigarette Dependence; QSU = Questionnaire of Smoking Urges; BMI = body mass index; BES = binge eating scale; DEBQ = Dutch Eating Behavior Questionnaire; DASS-21 = Depression, Anxiety and Stress Scale; REGICOR = Registre Gironí del Cor.

very low (0-2), low (3-4), medium (5), high (6-7) and very high (8-10).

Cotinine Levels. Cotinine levels were biochemically measured through urine cotinine analysis using a BS-120 chemistry analyzer (Shenzhen Mindray Bio-Medical Electronics Co. Ltd., Shenzhen, P.R. China).

Smoking Craving. The brief Questionnaire of Smoking Urges (QSU) validated in Spanish (Cepeda-Benito & Reig-Ferrer, 2004) was used to assess the desire to smoke and the expectations of negative reinforcement or improvements through smoking. The scale consists of two subscales: intention or desire to smoke (e.g., 'If I were offered a cigarette, I would smoke it immediately'), and expectations of negative reinforcement or improvements through smoking (e.g., 'Smoking would make me less depressed'). Each subscale comprises five items, measured on a seven-point Likert-type scale ranging from 1 (*totally disagree*) to 7 (*totally agree*). Both subscales demonstrated adequate psychometric properties in the sample of our study, as evidenced by the satisfactory Cronbach's alpha values of .839 for the intention or desire to smoke subscale and .747 for the negative reinforcement subscale.

Body Weight

Body Mass Index. Participants' height was measured using a medical stadiometer (SECA Mod.213, 20–205 cm), and body weight was measured in light clothing and without shoes using a calibrated medical scale (CL.III 200 kg. SECA Mod. 877). Both variables were then used to calculate the BMI.

Post-Cessation Weight Gain Concerns. Participants rated their level of post-cessation weight gain concerns from 0 to 100, with 100 indicating extreme concerns (Perkins et al., 2001). The translation process for the question, which has not yet been validated in Spanish, followed a procedure similar to that used for the SWEET instrument.

Current Motivation for Weight Control. The S-Weight Questionnaire, validated in Spanish by Andrés et al. (2011), requires participants to select one of five items corresponding to a stage of change in motivation to lose weight (i.e., precontemplation, contemplation, preparation, action or maintenance) specifically by dieting or exercising. This variable was recoded in order to ascertain whether participants were making efforts to lose weight or not, as was done in the confirmatory factor analysis previously published (Farris et al., 2018). The first three items, which referred to precontemplation, contemplation and preparation for action stage, were considered as a single category of 'not dieting or exercising to lose weight'. Conversely, the remaining two items (i.e., referred to the action and maintenance stages) were categorized as 'dieting or exercising to lose weight'.

Eating Behaviors

Severity of Binge Eating Episodes. The Binge Eating Scale (BES) validated in Spanish (Escrivá-Martínez et al., 2019) assesses behavioral manifestations and feelings or cognitions associated with binge eating episodes. The scale comprises 16 items ranging from 0 to 3, with higher scores indicating more severe binge eating behavior. This instrument showed excellent reliability in the sample used for our study (Cronbach's $\alpha = .915$).

Eating Styles. The Spanish version of the Dutch Eating Behavior Questionnaire (DEBQ; Cebolla et al., 2014) comprises 33 items on a 5-point Likert scale ranging from 1 (*never*) to 5 (*very often*), and assesses emotional eating (i.e., in response to emotional arousal states) through 13 items, external eating (i.e., in response to environmental food cues) with 10 items, and restrained eating (i.e., intentions to restrict food intake) through 10 items. All three subscales demonstrated excellent psychometric properties in the sample used for our study (Cronbach's α ranged from .861 to .961).

Emotional Symptoms

Depression, Anxiety, and Stress Symptomatology. The Spanish version of the Depression, Anxiety and Stress Scale (Bados et al., 2005) was used to evaluate emotional symptomatology through 21 items, in which responders evaluated from 0 to 3 the severity or frequency in which they had experienced each of the symptoms during the previous week. The scale is composed of three subscales (i.e. anxiety, depression and stress), each with seven items. Higher scores indicate greater presence of symptoms, and the scale showed acceptable psychometric properties in the sample used for our study (Cronbach's α ranged from .753 to .860).

Physical Activity

Physical Activity Intensity. The validated short version of the Spanish REGICOR (Molina et al., 2017) classifies specific physical activities (i.e., walking at a normal pace, walking fast, walking in the countryside or mountains, climbing stairs, working in the yard or garden, and exercising indoors or outdoors) by energy expenditure based on work metabolic rates (METs), which had been established in a previous compendium of physical activity intensity levels. Total energy expenditure was calculated from the type of activity performed, frequency (number of times per month), duration (minutes per day), and the equivalent METs of the activities performed; and categorized as light, moderate, and vigorous physical activity intensity.

Procedure

The Spanish version of the SWEET was obtained through a three-step process following the international guidelines (International Test Commission, 2017; Muñiz et al., 2013). Firstly, the items were translated into Spanish by a native Spanish psychologist member of the research team who also

possesses an advanced command of the English language. Subsequently, a native English translator proficient in Spanish conducted the back-translation process. Finally, the research team and the translator held a discussion to address any discrepancies between the original and back-translated versions, with the aim of producing the final Spanish version shown in Table 2. The resulting items bear a strong resemblance to the originals, with no significant modifications being necessary.

Participants used an electronic platform to answer the battery of instruments, including the SWEET. Before completing the assessment, participants were informed about the study, assured of the confidentiality of their data and asked for their consent.

Data Analysis

A series of descriptive analyses were conducted to provide clearer context regarding the relevance of SWEET scores in this sample. To this end, three groups were created based on participants' percentile rank on the total SWEET score: a low group (below the 25th percentile), a moderate group (between the 25th and 75th percentiles), and a high group (above the 75th percentile). Once the groups were defined, means and standard deviations were reported for the quantitative variables age, cigarettes per day, years of regular smoking, urinary cotinine, weight, and BMI. In addition, percentages were reported according to sex and whether participants were currently dieting.

The assumptions of normality and homogeneity of variances were examined prior to conducting the analyses. A Confirmatory Factor Analysis (CFA) was conducted using the Robust Maximum Likelihood (MLR) estimator due to moderate deviations from normality (Savalei & Rosseel, 2022). Although the items were measured on five-point Likert scales and are technically ordinal, they were treated as continuous, as this approach has been shown to yield results comparable to categorical estimators when five or more response categories are used (Rhemtulla et al., 2012). A four-factor model was tested, with each item loading exclusively on its respective factor, as outlined by the original authors in their validation study (Adams et al., 2011). The fit of the model was tested using the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximate (RMSEA) and the Standardized Root Mean Square Residual (SRMSR). CFI and TLI values above 0.90 were considered to indicate a good fit and above 0.95 excellent, while a SRMR \leq 0.08 was necessary to consider an appropriate adjustment and a RMSEA \leq 0.05 to consider a close fit and less than .08 reasonable fit (Hu & Bentler, 1999; Browne & Cudeck, 1993). Cronbach's alpha coefficient were used to evaluate internal consistency, and values between .6 and .8 are considered acceptable (Hajjar, 2018).

To examine convergent validity, the following variables were analyzed for their correlation with the SWEET subscales: age (as younger individuals are more likely to smoke for weight control, see e.g., Fahey et al., 2021), cigarettes smoked per day, years of regular smoking, nicotine dependence (FTCD), urine cotinine levels, smoking craving (QSU), BMI, post-cessation weight gain concerns, severity of the binge eating episodes (BES), eating styles (i.e., emotional, external, and restrained eating subscales from the DEBQ), and emotional symptomatology (i.e., depression and anxiety subscales from the DASS-21). Regarding discriminant validity, the SWEET subscales were correlated with levels of physical activity (i.e., light, moderate, and vigorous activity, as assessed through the REGICOR). Finally, independent *t*-tests were conducted to examine the differences in all SWEET subscales by sex and current state of dieting or exercising to lose weight. Given that the sample sizes exceeded 30 participants per comparison group, approximate normality was assumed in accordance with the central limit theorem (Kwak & Park, 2019). Homogeneity of variances was assessed using Levene's test, and when this assumption was violated, Welch's *t*-test was applied. The effect size was calculated through the Cohen's *d* considering small values those between 0.1 and 0.3, intermediate between 0.3 and 0.5, and large those values over 0.5. The SPSS 24 statistics package (IBM Corp, 2016) was used to calculate descriptive statistics, Pearson correlations, and *t*-tests. The RStudio 2021.09.0 "Ghost Orchid" was used to conduct the CFA and calculate reliability coefficients.

Results

Descriptive Analysis

In Table 2, the different characteristics of the sample across low, moderate, and high levels of the total SWEET score are presented. Participants with higher SWEET scores tended to be younger and more likely to report currently being on a diet. In contrast, those in the low SWEET group tended to be older and reported a longer history of regular smoking. Regarding BMI, mean values were in the obese range across all three groups.

Evidence Based on Internal Structure

Table 3 depicts the results of the CFA. The CFI and SRMR values (.96 and .05 respectively) indicate a good model fit. Additionally, TLI and RMSEA values (.92 and .08 respectively) indicate a reasonable model fit. High factor loadings were observed in the four factors. In terms of the reliability of the factors, the subscale *Appetite Suppression* demonstrated an alpha coefficient of .855, *Prevent Overeating* exhibited an alpha coefficient of .876, and *Body Dissatisfaction* displayed an alpha of .852. All three

Table 2
Sample Characteristics by Percentile-based SWEET Scores (N = 123)

Variable	Low SWEET scores (n = 31)	Moderate SWEET scores (n = 59)	High SWEET scores (n = 33)
SWEET Total, M(SD)	11.80 (1.66)	19.10 (3.23)	31.10 (4.62)
Sex, n (%)			
Women	12 (9.8)	32 (26)	23 (18.7)
Men	19 (15.4)	27 (22)	10 (8.1)
Attempting to lose weight through diet or exercise, n (%)			
Yes	7 (5.7)	17 (13.8)	13 (10.6)
No	24 (19.5)	42 (34.1)	20 (16.3)
Age (years), M (SD)	58.50 (10.10)	50.90 (8.56)	48.70 (11.40)
Cigarettes per day, M (SD)	20.50 (7.49)	22.10 (10.40)	20.60 (6.48)
Years of regular smoking, M (SD)	36.00 (11.10)	29.80 (8.51)	27.00 (12.10)
Urine cotinine (ng/mL), M (SD)	2,225 (1,095)	2,342 (1,183)	2,272 (1,397)
Weight (kg), M (SD)	88.00 (16.20)	88.90 (13.30)	86.20 (13.50)
BMI (kg/m ²), M (SD)	31.10 (4.41)	31.80 (4.14)	32.20 (4.42)

Note. SWEET = Smoking-Related Weight and Eating Episodes Test; SWEET Total = Total Score of the SWEET Test. The low group comprised participants scoring at or below the 25th percentile, the moderate group included those scoring between the 25th and 75th percentiles, and the high group consisted of participants scoring above the 75th percentile on the total SWEET score.

Table 3
Confirmatory Factor Analysis of the Items of the SWEET, with items both in English and Spanish

Items	F. L. Appetite Suppression	F. L. Prevent Overeating	F. L. Body Dissatisfaction	F. L. Cope with Withdrawal
1. When I feel hungry, I have a cigarette to curb my appetite (Cuando tengo hambre fumo para reducir mi apetito).	.78			
2. When I crave unhealthy food, I have a cigarette to avoid eating (Cuando se me antoja comida no saludable fumo para evitar comerla).	.89			
3. When I feel like having a snack, I have a cigarette instead (Cuando me apetece un snack fumo en vez de comerlo).	.77			
4. If I don't smoke soon after a meal, I continue to eat more than I need (Si no fumo pronto después de comer, continuo comiendo más de lo que necesito).		.84		
5. Smoking after a meal helps me to avoid overeating (Fumar después de las comidas me ayuda a evitar comer en exceso).		.91		
6. When I am full, I smoke so that I won't eat more (Cuando estoy lleno/a, fumo para no comer más).		.79		
7. When I feel fat, I have a cigarette (Cuando me siento gordo/a, fumo).			.79	
8. I smoke when I am worried about gaining weight (Fumo cuando me preocupa ganar peso).			.94	
9. I crave tasty foods when I haven't smoked in a while (Siento ganas de comer comida sabrosa cuando no he fumado en un tiempo).				.64
10. I feel hungrier when I haven't smoked in a while (Me siento más hambriento/a cuando no he fumado en un tiempo).				.80
CFI		.96		
TLI		.92		
SRMSR		.05		
RMSEA		.08, 90% IC [.06, .13]		

Note. SWEET = Smoking-Related Weight and Eating Episodes Test; F.L. = Factor Loadings; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; SRMSR = Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation.

were optimal values. In the case of *Cope with Withdrawal*, an alpha coefficient of .680 was obtained, which could be considered acceptable.

Validity Evidence Based on Relationships with Other Variables

Table 4 reflects correlations between the SWEET subscales and several relevant variables, providing evidence of both convergent and discriminant validity.

Convergent Validity

A significant negative correlation was evidenced between age and the four SWEET subscales. Similarly, a negative association was found between years of regular smoking and all subscales. However, these latter associations were statistically significant only for the *Appetite Suppression* and

Prevent Overeating subscales. Regarding the phenomenon of smoking craving, assessed by the two QSU subscales (i.e., intention to smoke and expectations of negative reinforcement), significant positive correlations were identified with all subscales. Notably, the highest correlations were observed for the subscale *Cope with Withdrawal*. Furthermore, post-cessation weight gain concerns were significantly positively correlated with the four subscales, especially with *Body Dissatisfaction*. No significant correlations were found with the remaining smoking-related variables (i.e., cigarettes smoked per day, nicotine dependence or urine cotinine levels) or with the BMI.

Considering the variables related to eating behaviors, the severity of binge eating, as assessed by the BES, showed significant positive correlations with all SWEET subscales,

Table 4
Correlations Between SWEET Subscales and Other Variables as Evidence of Convergent and Discriminant Validity

	Appetite Suppression Subscale	Prevent Overeating Subscale	Body Dissatisfaction Subscale	Cope with Withdrawal Subscale
Appetite Suppression subscale	1			
Prevent Overeating subscale	.56	1		
Body Dissatisfaction subscale	.68	.47	1	
Cope with Withdrawal subscale	.68	.58	.54	1
Convergent validity				
Age	-.336***	-.305***	-.236**	-.226*
Cigarettes smoked per day	-.001	.043	.056	-.112
Years of regular smoking	-.273**	-.285**	-.172	-.134
Nicotine dependence (FTCD)	.055	.151	.151	.159
Urine cotinine levels (ng/ml)	.018	.004	-.091	-.063
Intention to smoke (QSU)	.195*	.344***	.189*	.353***
Expectations of negative reinforcement (QSU)	.294***	.299***	.303***	.325***
BMI	.148	.008	.111	.121
Post-cessation weight gain concerns (0-100)	.300***	.251**	.437***	.315***
Severity of binge eating (BES)	.412***	.445***	.571***	.404***
Emotional eating (DEBQ)	.473***	.468***	.556***	.466***
External eating (DEBQ)	.421***	.485***	.369***	.471***
Restrictive eating (DEBQ)	.318***	.105	.347***	.211*
Depression (DASS-21)	.130	.084	.463***	.267**
Anxiety (DASS-21)	.216*	.159	.456***	.292**
Stress (DASS-21)	.305***	.186*	.489***	.386***
Discriminant validity				
Light physical activity (REGICOR)	-.008	.035	-.104	.164
Moderate physical activity (REGICOR)	.128	-.030	-.040	.047
Vigorous physical activity (REGICOR)	-.016	.020	-.160	-.027

Note. FTCD = Fagerström Test for Cigarette Dependence; ng/ml = nanograms per milliliter; QSU = Questionnaire of Smoking Urges; BMI = body mass index; BES = binge eating scale; DEBQ = Dutch Eating Behavior Questionnaire; DASS-21 = Depression, Anxiety and Stress Scale; REGICOR = Registre Gironí del Cor.
* $p < .05$; ** $p < .01$; *** $p < .001$.

with the highest being *Body Dissatisfaction*. In terms of eating styles, as assessed by the DEBQ, the Emotional Eating subscale and the External Eating subscale showed significant positive correlations with all SWEET subscales. The highest correlations were found with *Body Dissatisfaction* and the *Prevent Overeating* subscales, respectively. The Restrictive Eating subscale showed significant positive correlations with *Appetite Suppression*, *Cope with Withdrawal*, and *Body Dissatisfaction*, with the latter having the highest correlation.

Finally, in terms of emotional symptoms, stress symptomatology correlated significantly with all subscales, depression symptomatology correlated significantly with *Body Dissatisfaction* and *Cope with Withdrawal*, and anxiety symptomatology correlated significantly with *Appetite Suppression*, *Body Dissatisfaction*, and *Cope with Withdrawal*. In all three cases, the highest correlation was with the *Body Dissatisfaction* subscale.

Discriminant Validity

The correlations between the SWEET factor scores and intensity of physical activity assessed by the REGICOR (including light, moderate and vigorous intensity subscales) were extremely low and non-significant in either case.

Known Groups Validity

The results of the analysis of the differences in SWEET subscales scores by sex and current state of dieting or exercising to lose weight are summarized in Table 4. Women evidenced significantly higher scores than men in the *Appetite Suppression* and *Body Dissatisfaction* subscales. These findings indicated that female participants used cigarettes to suppress their appetite more than male participants ($d = 0.45$) and to cope with body dissatisfaction ($d = 0.51$). No differences were found in the *Prevent Overeating* and *Cope with Withdrawal* subscales.

Finally, a comparison was conducted between participants who were currently attempting to lose weight through diet or exercise and participants who were not. The results revealed significant differences only in the *Body Dissatisfaction* subscale. That is, participants who were currently attempting to reduce their body weight used cigarettes more frequently to cope with body dissatisfaction than those who were not making such efforts ($d = 0.47$).

Discussion

This study aimed to validate the SWEET in Spanish adults with overweight or obesity who smoke. The findings indicated that the Spanish version of the SWEET presented adequate psychometric properties in terms of reliability and convergent and discriminant validity. Women displayed a greater tendency to smoke to suppress their appetite and to cope with body dissatisfaction in comparison with men. Individuals pursuing weight reduction exhibited a greater tendency to smoke as a coping mechanism for body dissatisfaction in contrast to those not engaged in similar efforts.

The findings indicate that the four-correlated-factor structure of the SWEET has a good fit and preserves the structure of the original questionnaire (Farris et al., 2018). Additionally, the alpha coefficients demonstrated adequate reliability across all subscales, with values ranging from .68 to .88. The coefficients were also similar to the original questionnaire, except for the *Cope with Withdrawal* subscale, which demonstrated a lower alpha value, although it remained within the acceptable range (Hajjar, 2018). The appropriate psychometric properties of this version of the SWEET demonstrate the adequacy of its utilization among individuals with overweight or obesity. This is particularly salient considering that the instruments that have been validated for assessing tobacco use as a weight control method employ a single subscale (Brandon & Baker, 1991; Copeland

Table 5
T-test for Differences in the Means of Each SWEET Subscale Between Sex and by Current Motivation for Weight Control

	Appetite Suppression	t	p	Prevent Overeating	t	p	Body Dissatisfaction	t	p	Cope with Withdrawal	t	p
Sex												
Women ($n = 67$)	7.16 (2.99)	2.50	.014	5.48 (2.78)	.20	.844	4.13 (2.27)	2.84*	.005	5.07 (2.04)	1.63	.107
Men ($n = 56$)	5.88 (2.67)			5.38 (2.99)			3.07 (1.89)			4.48 (1.98)		
Current motivation for weight control												
Dieting or exercising to lose weight ($n = 37$)	7.08 (3.23)	1.26	.209	5.32 (2.73)	-.27	.788	4.38 (2.45)	2.29*	.026	4.89 (1.82)	.31	.756
Not dieting or exercising to lose weight ($n = 86$)	6.36 (2.76)			5.48 (2.94)			3.34 (1.96)			4.77 (2.12)		

Note. * Welch's t-test was used, as the assumption of homogeneity of variances was not met.

et al., 1995; Pomerleau & Snedecor, 2008; Smith et al. 2010; Weekley et al., 1992), and only two have been validated in the Spanish language. The four-factor structure of the SWEET enables the assessment and identification of four related but distinct ways that people might use tobacco for weight control. This is clinically important, as it could help tailor smoking cessation treatments for individuals with overweight or obesity considering the different patterns of weight control behaviors linked to tobacco use (Adams et al., 2011).

With regard to convergent validity, the strong negative correlation between SWEET scores and age aligns with the negative relationship observed between SWEET scores and years of regular smoking, and is also in agreement with previous research (Burr et al., 2020). This finding also supports existing literature indicating that smoking for weight control is more common among young adults (Fahey et al., 2021). The findings, however, showed no significant correlation between the number of cigarettes smoked per day, urine cotinine levels, and nicotine dependence with the SWEET scores, which is unexpected in light of the extant literature (Adams et al., 2011; Burr et al., 2020; Farris et al., 2018). One possible explanation for this finding is the age difference between studies, with a mean age of 52 years in our sample compared to 20 or 44 years of age in previous research. Younger age has been associated with smoking for weight control in adults (Wee et al., 2001), so in our older sample, a larger proportion of participants may smoke heavily for reasons unrelated to weight control. Conversely, a robust relationship was identified between all SWEET subscales and smoking craving. This finding is noteworthy considering the well-established link between smoking cravings and relapse (Robinson et al., 2019). It underscores the importance of providing tailored support for individuals with overweight and obesity who use smoking for weight management, as they may require additional strategies to effectively manage cravings. Furthermore, despite previous evidence (Adams et al., 2011; Burr et al., 2020; Farris et al., 2018), no statistically significant correlation was identified between BMI and SWEET scores. Since the present study encompassed individuals with a BMI of 25 or higher, a distinction from the aforementioned studies, it might be that individuals within this BMI range are equally inclined to use tobacco for the purpose of weight control. The lack of significant finding could also be due to a restricted range of the BMI variable.

As demonstrated in prior research (Adams et al., 2011; Burr et al., 2020; Farris et al., 2018), SWEET scores were associated with post-cessation weight gain concerns as well as a range of maladaptive eating behaviors, including severity of binge eating, emotional eating, external eating, and restrictive eating. In addition, SWEET scores were related to heightened prevalence of emotional symptomatology (i.e., depression, anxiety, and stress), as reported previously (Burr et al., 2020; Farris et al., 2018). A notable finding was

the predominance of the highest correlation with the *Body Dissatisfaction* subscale with all the aforementioned variables, except for the external eating subscale from the DEBQ. Therefore, including strategies to improve body image in smoking cessation programs aimed at individuals with overweight or obesity could have a notable effect on other key factors related to concerns about body appearance, disordered eating, or emotional symptoms. Finally, evidence of discriminant validity was obtained in relation to physical activity levels, specifically low, moderate, and vigorous levels, as in line with previous literature, physical activity is not expected to be associated with the use of tobacco as a means of weight control (Farris et al., 2018).

The SWEET demonstrated sensitivity to variations among subgroups in our study, particularly regarding sex and current weight loss attempts. Female participants exhibited higher scores on the *Appetite Suppression* subscale in comparison to their male counterparts. This finding aligns with the results from Farris et al. (2018) conducted with adults who smoked daily. In contrast with Farris et al.'s findings, women in our study demonstrated higher scores than men on the *Body Dissatisfaction* subscale. This discrepancy may be attributed to the sample's BMI (individuals with overweight or obesity in our study vs. the absence of BMI inclusion criteria for the Farris et al. study). A substantial body of literature has pointed out the link between being female or having excessive body weight with both body dissatisfaction (Weinberger et al., 2016) and post-cessation weight gain concerns (Levine et al., 2013). According to our results, it is crucial to monitor changes in body dissatisfaction and body weight during smoking cessation treatment in this vulnerable population (i.e., women with excessive body weight) in order to prevent smoking relapse (Marqueta et al., 2016; Tuovinen et al., 2018). Finally, individuals currently attempting to lose weight showed higher scores on the *Body Dissatisfaction* subscale than those who were not, while Farris et al. (2018) found differences in all subscales. This finding suggests that there is a need to identify individuals attempting to lose weight prior to initiating smoking cessation interventions and to target body image concerns to achieve successful smoking cessation outcomes regardless of post-cessation weight gain.

Some limitations should be considered when interpreting the results of this study. Firstly, the sample size ($N = 123$) exceeds the minimum recommended criterion of at least 10 participants per item to conduct an instrument validation (Anthoine et al., 2014; Nunnally, 1978). However, it falls below the commonly desired threshold number of participants to perform a CFA (Wolf et al., 2013). This also prevented us from conducting an invariance analysis by sex, as performed in the original study validation (Farris et al., 2018). Additionally, it is important to note that the original structure of the questionnaire consisted of four subscales, two of which included only two items. It is generally recommended that each factor be represented by at least

three indicators, as a smaller number of items may affect the reliability and stability of the factor structure (Kline, 2023). Notwithstanding, it should be noted that, given the model's satisfactory factor loadings and fit indices, as well as its adequate internal consistency indices, the instrument can be regarded as a psychometrically sound tool for use in analogous populations. Importantly, the sample consists of a highly specific and hard-to-reach population: individuals who smoke, with overweight or obesity, and motivated to initiate a smoking cessation treatment. Recruiting participants who simultaneously meet these criteria poses substantial challenges, which justifies the sample size and enhances the relevance of the findings for this clinical subgroup. Secondly, the cross-sectional nature of the study prevented us from establishing causal relationships. Thirdly, the participants in this study were individuals seeking to initiate smoking cessation treatment, and the mean age of the participants was relatively high (over 50 years); therefore, the instrument may not be universally applicable to individuals with overweight or obesity who do not intend to quit smoking, or to younger individuals.

Despite its limitations, the current study provides evidence that the SWEET is a reliable and valid instrument for assessing four distinct eating- and weight-related motivations for smoking among Spanish individuals with overweight or obesity. The measure demonstrated high internal consistency and was significantly associated with relevant clinical constructs, including smoking craving, concerns about post-cessation weight gain, maladaptive eating patterns, and emotional symptoms. Additionally, variations in response were observed based on sex and current weight-loss efforts through diet or exercise. Notably, the *Body Dissatisfaction* subscale showed the strongest associations with clinical variables, indicating that smoking as a coping mechanism for body dissatisfaction may represent a key target for intervention in smoking cessation programs in individuals with overweight or obesity.

Declarations

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Conflicts of Interest

The authors have no conflict of interest to report.

Ethics Approval and Consent to Participate

The study protocol was approved by the Research Ethics Committee of the Principality of Asturias (n° 329/19). All participants provided informed consent.

Data Availability Statement

Data will be made available on request.

CRedit Authorship Contribution Statement

Andrea Krotter: Conceptualization, Data curation, Investigation, Validation, Writing – original draft. Covadonga González-Nuevo: Conceptualization, Formal analysis, Methodology, Software, Writing – original draft. Claire A. Spears: Writing – review and editing. Gloria Garcia-Fernandez: Conceptualization, Funding acquisition, Investigation, Resources, Methodology, Project administration, Supervision, Writing – review and editing.

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