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Eating Behavior and Body Composition in Chilean Young Adults

Lorena S. Pacheco, PhD, MPH, RDN[1,2], **Estela Blanco, MPH, MA**[3,4], **Raquel Burrows, MD**[5], **Paulina Correa-Burrows, PhD**[5], **Jose L. Santos, PhD**[6], **Sheila Gahagan, MD, MPH**[3]

[1]Department of Family Medicine and Public Health, University of California San Diego, 9500 Gilman Dr., MC 0725, La Jolla, CA, 92093-0725, United States of America

[2]School of Public Health, San Diego State University, Hardy Tower 119, 5500 Campanile Dr., San Diego, CA, 92182-4162, United States of America

[3]Division of Child Development and Community Health, Department of Pediatrics, University of California, 9500 Gilman Dr., MC 0927, La Jolla, CA, 92093-0927, United States of America

[4]University of Chile Doctoral Program in Public Health. Av. Independencia 939, Independencia, Región Metropolitana, Santiago, Chile

[5]Public Health Nutrition Unit, Institute of Nutrition and Food Technology (INTA), University of Chile, El Líbano 5524, Macul, Región Metropolitana, Santiago, Chile

[6]Department of Nutrition, Diabetes and Metabolism, School of Medicine, Pontificia Universidad Católica de Chile, Av. Libertador Bernardo O'Higgins 340, 8331150, Santiago, Chile

Abstract

Background: Notable weight gain is observed during young adulthood, compared to other adult age groups, yet the relation between eating behavior and body composition at this stage remains poorly understood.

Correspondence: Dr. Sheila Gahagan, Department of Pediatrics, University of California San Diego, 9500 Gilman Dr, MC 0927, La Jolla, CA 92093-0927; or sgahagan@ucsd.edu, telephone: 619-681-0662.

7. Contributions

L.S.P. conceived and designed the research, performed statistical analyses, analyzed and interpreted the data, and wrote the manuscript; E.B. collected data, and reviewed and revised the manuscript; R.B. collected data, contributed to data cleaning/management, and reviewed and revised the manuscript; P.C-B. collected data, contributed data cleaning/management, and reviewed the manuscript; J.L.S conceived and designed the research, contributed to statistical analyses, and reviewed and revised the manuscript; and S.G. conceived and designed the research, reviewed and revised the manuscript, and provided funding (PI of awarded grants).

8. Disclosure

The authors have no competing interests to declare. All authors have reviewed and approved the submitted version of this manuscript.

Ethical statement

This study was approved by the independent institutional review boards of the University of California, San Diego, the University of Michigan, and the University of Chile Institute of Nutrition and Food Technology (INTA). This statement is included in the manuscript. Approval documentation and further information regarding institutional review board decisions can be shared with the Editor upon request.

Objective: The aim of this cross-sectional study was to assess the association between eating behavior scores (cognitive restraint, uncontrolled eating, and emotional eating), and body composition in a sample of Chilean young adults.

Methods: Logistic and linear regression models assessed the independent associations between cognitive restraint, uncontrolled eating, and emotional eating, derived from the Three Factor Eating Questionnaire-R18, and body mass index (BMI), percent body fat by dual-energy X-ray absorptiometry, and central obesity, accounting for demographic covariates, stratified by sex, in a sample of 555 participants of the Santiago Longitudinal Study (mean age 22.6 years [SD 0.4]).

Results: Cognitive restraint was positively associated with obesity, defined by BMI, % body fat, and central obesity. Emotional eating was related to obesity, defined by % body fat and central obesity in men and women and to obesity, defined by BMI, in women. Cognitive restraint was related to BMI in men and % body fat in women. Uncontrolled eating was not associated with adiposity in men or women.

Conclusions: In Chilean young adults, cognitive restraint and emotional eating scores were associated with higher BMI, elevated percent body fat, and greater central obesity.

Keywords

eating behavior; body composition; obesity; young adults; public health

1. Introduction

Obesity is a risk factor for unfavorable health conditions including type 2 diabetes mellitus, cardiovascular disease (CVD), hypertension, and some cancers (Haslam & James, 2005; Lauby-Secretan et al., 2016; NHLBI Overweight and Obesity in Adults Expert Panel, 2013). Global obesity prevalence statistics demonstrate the continuous rise in obesity rates since the 1980s in men and women of every age group in developed and developing nations (Ng et al., 2014). Worldwide, 36.9% and 38.0% of adult men and women ≥20 years of age, have BMIs in the overweight or obese range with a body mass index (BMI) of 25 or greater (Ng et al., 2014).

In Chile over the last five decades, rapid demographic, epidemiological and nutritional shifts have impacted the population, with obesity reaching epidemic proportions (NCD Risk Factor Collaboration (NCD-RisC) et al., 2017). Based on the latest Chile National Health Survey, 35.8% of 20- to 29-year old men and women have BMIs in the overweight range and 22.5% have BMIs in the obese range (Ministerio de Salud Gobierno de Chile, 2017). In response, the Chilean government has implemented new national nutritional policies and food marketing restraints as public health efforts to help reduce obesity in the population (Corvalán, Reyes, Garmendia, & Uauy, 2013).

Young adulthood, typically defined as 18- to 25-years old, is of particular interest as the period of highest weight gain compared with other adult age groups (Tanamas et al, 2012; Truesdale et al, 2006). Studies have shown that individuals who were overweight in adolescence, were likely to gain weight during their early twenties, leading to obesity in middle adulthood (Lanoye, Brown, & LaRose, 2017; León-Muñoz et al., 2016; Mokdad et

al., 1999; Williamson, Kahn, Remington, & Anda, 1990). Furthermore, young adulthood is characterized by significant lifestyle changes including the pursuit of higher education, independence from parents, full-time occupation, marriage or cohabitation, as well as pregnancy and parenting, all of which may influence the development of obesity (Arnett, 2000; Laska, Pelletier, Larson, & Story, 2012; Williamson et al., 1990). The Coronary Artery Risk Development in Young Adults (CARDIA) longitudinal cohort study in the United States (U.S.), which focuses on the development and determinants of CVD in participants who were 18- to 30-years old at baseline (Burke et al., 1996), provides evidence that young adulthood is a critical period related to weight gain in some groups. At the 10-year follow-up, the greatest weight gain was observed among participants who entered the study in their early- to mid-twenties, compared to older sub-groups (Lewis et al., 2000). Moreover, findings from the 25-year follow-up showed that weight gain was most pronounced, overall, for individuals in their twenties, and began to attenuate for black men and women in their mid-thirties and for white men in their forties. No slowing in weight gain was found in women of either race (Dutton et al., 2016).

The etiology of obesity is multifactorial and eating behavior plays an important role. Eating behavior may be driven by individual characteristics such as: 1) cognitive restraint, control over food intake to influence body weight (Stunkard & Messick, 1985); 2) uncontrolled eating, over-eating while feeling a lack of control; and 3) emotional eating, management of negative emotions with food. (French, Epstein, Jeffery, Blundell, & Wardle, 2012; Karlsson, Persson, Sjöström, & Sullivan, 2000; Stunkard & Messick, 1985). Studies have reported that compared to individuals with normal BMI, those with obesity exhibit higher disinhibition scores and hunger (Boschi, Iorio, Margiotta, D'Orsi, & Falconi, 2001; Hays et al., 2002; Hays & Roberts, 2008; Lawson et al., 1995; Lindroos et al., 1997). Identifying eating behavior dimensions in emerging adults can inform effective evidence-based obesity prevention strategies and effective weight management programs for this understudied sub-group of the population (Laska et al., 2012; Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). This is even more important in a country, such as Chile, with alarming overweight and obesity rates in young adults. Therefore, the aim of this cross-sectional study was to examine the associations between three eating behavior dimensions: cognitive restraint, uncontrolled eating and emotional eating, related to body composition in a sample of Chilean young adults. Three measures of body composition were used, body mass index (BMI), central obesity and percent body fat. Given the existing literature, we hypothesized that higher scores for cognitive restraint, uncontrolled eating and emotional eating would each be associated with greater adiposity. Additionally, we hypothesized that women, in the cohort, would have higher levels of these three eating behavior dimensions compared to men (De Lauzon et al., 2004; Provencher, Drapeau, Tremblay, Després, & Lemieux, 2003; Vega et al., 2016). To our knowledge, this is the first study addressing eating behavior and body composition in a Chilean young adulthood population.

2. Methods

2.1 Study Design and Participants

We conducted a cross-sectional study of 555 Chilean young adults, who were part of a longitudinal study of biopsychosocial determinants of obesity and CVD risk in Santiago, Chile. Participants were recruited as infants, ages 4- to 6-months old, between 1991 and 1996, and enrolled in either a trial of iron supplementation to prevent iron-deficiency anemia, or a neuromaturation study that assessed neurodevelopment for infants who had iron-deficiency anemia. Additional details about the infancy studies are described elsewhere (Lozoff et al., 2003; Roncagliolo, Garrido, Walter, Peirano, & Lozoff, 1998). When participants were adolescents, they were invited to take part in a study of obesity and related cardiovascular risk factors. The present analysis includes the first 555 participants evaluated at the young adulthood follow-up, including only those with complete data for the desired exposure and outcome variable relationship, gathered from May 2015 to January 2018.

The sample was representative of the original cohort, with no statistically significant differences in sociodemographic characteristics between the original cohort and the selected sample in the following measures: birthweight (mean 3.5 kg vs 3.6 kg); breastfeeding for at least 6 months (61% vs 61%); socioeconomic status (SES), measured using the Graffar index (Mendez-Castellano & Mendez, 1986) (mean [SD] 27.7 [6.4] vs 26.9 [6.3]), and household environment, measured using the Home Observation for Measurement of the Environment [HOME] (R. H. Bradley, Corwyn, McAdoo, & Coll, 2001), (mean [SD] 30.1 [4.8] vs 30.1 [4.7]) (all $p < 0.05$).

All participants provided written informed consent and the study was approved by the institutional review boards of the University of California, San Diego, the University of Michigan, and the University of Chile Institute of Nutrition and Food Technology (INTA).

2.2 Anthropometric Data

Height (cm), weight (kg), and waist circumference (cm) were measured by a physician-investigator. Height and waist circumference were measured to the closest 0.1 cm by using a Holtain stadiometer (Holtain Ltd) (Lohman, Roche, & Martorell, 1998) and a non-elastic flexible SECA 201 tape measure (SECA GMBH & Co. Hamburg, Germany), respectively. Waist circumference was measured midway between the lower rib and the iliac crest on the midaxillary line. Weight was measured to the nearest 0.1 kg by using a SECA scale. Anthropometric measurements were taken twice, and an additional measurement was taken if the difference between the first two exceeded 0.3 kg for weight, 0.5 cm for height, or 1.0 cm for waist circumference. Percent of body fat was measured by using dual energy x-ray absorptiometry (DEXA) scan, Lunar DPX-LIQ model (Lunar Corp., Madison, WI, USA) and Lunar iDXA Encore 2001 software (Version 13.60.033 Copyright © 1998–2010).

Three continuous body composition measures were used to assess adiposity outcomes in this study: BMI (kg/m^2), central obesity measured by waist circumference (as an estimate of the amount of abdominal fat; cm), and percent body fat. Furthermore, we assessed obesity using three dichotomous criteria: BMI ≥30 kg/m^2; central obesity >90cm for men and >80cm for

women (NHLBI Cholesterol Expert Panel, 2013); and obesity based on percent body fat >24% for men and >37% for women (Jeukendrup & Gleeson, 2010).

2.3 Three-Factor Eating Questionnaire

The original Three-Factor Eating Questionnaire (TFEQ), developed by Stunkard and Messick (Stunkard & Messick, 1985), is a 51-item self-assessment questionnaire, divided into 3 subscales: a 21-item dietary restraint scale (TFEQ-R), a 16-item dietary disinhibition scale (TFEQ-D) and a 14-item hunger scale (TFEQ-H). Karlsson et al., proposed a revised version of the questionnaire with good internal consistency and convergent and discriminant reliability (Karlsson et al., 2000). The revised questionnaire, TFEQ-Revised 18 (TFEQ-R18), used in the current study, consists of 18 items on a 1- to 4-point response scale (definitely true/mostly true/mostly false/definitely false), and determines three distinct factors: cognitive restraint, uncontrolled eating, and emotional eating (Karlsson et al., 2000). Disinhibition and hunger scales included nine questions, which were grouped together as a single scale, labeled as “uncontrolled eating”. The cognitive restraint scale was shortened to six questions and a third dimension was added containing three items identified as emotional eating, involving emotions such as anxiety, solitude, discontent, and sadness. Higher scores in the respective dimensions depict greater cognitive restraint, uncontrolled eating and emotional eating behavior. The Spanish translation of the TFEQ-R18 assessed cognitive restraint, uncontrolled eating and emotional eating scales in Spanish study participants (Jáuregui-Lobera, García-Cruz, Carbonero-Carreño, Magallares, & Ruiz-Prieto, 2014). This instrument, adapted and validated for the Chilean population (Vega et al., 2016) was used in this study. The eating behavior dimension scores were mean scores, determined by summing the raw scores and dividing by the number of items in each specific dimension, three, six and nine for emotional eating, cognitive restraint, and uncontrolled eating, respectively, as conducted in a similar study (Vega et al., 2016)

The Cronbach’s α method was used to assess internal consistency. The Cronbach’s α value was 0.77 for cognitive restraint, 0.71 for emotional eating and 0.85 for uncontrolled eating. These values were above the cut-off point of 0.70 and considered satisfactory (Bland & Altman, 1997).

2.4 Demographic and lifestyle characteristics

Known confounders in the relationship between eating behavior and body composition include age, education, and sex (Wagenknecht et al., 2007). Age was treated as a continuous variable. Education was dichotomized to completion (or not) of *enseñanza media*, equivalent to high school in the U.S. This dichotomous educational variable relates to SES. The models were stratified by sex.

We asked participants about current smoking status (yes or no), consumption of alcohol, “yes” for consumed alcohol at least once in the last 30 days vs “no”. Exercise frequency was coded ≥ 2–3 times/week or < 2 times/week. These self-reported variables were used to describe the study population.

2.5 Statistical Analyses

SAS version 9.4 (SAS Institute) was used for all statistical analyses. To describe the study sample, continuous variables were expressed as means and SDs and categorical variables as frequencies. Unadjusted comparisons between men and women were calculated by using t-tests and χ^2 tests for continuous and categorical variables, respectively. Multivariable linear and logistic regression analyses were used to assess the association between each of the eating behavior dimensions and the three adiposity outcomes, BMI, central obesity and percent body fat, adjusting for known confounders. We used logistic and linear regression analyses to model the influence of eating behaviors on both continuous measures of adiposity and categorical measures of obesity. In addition to modelling the influence of eating behaviors on the risk for obesity, we aimed to understand how eating behaviors influenced adiposity in young adulthood. Models were stratified by sex, to account for distinct adiposity cut-points for men and women. The Hosmer-Lemeshow test was used to assess goodness of fit for the logistic regression models, with all models meeting a good fit assumption. Regression diagnostics examined linear regression assumptions including linearity, normality, homogeneity of variance, and independence, using residual vs predictor plot, Shapiro—Wilk test, Breusch—Pagan test, and Durbin—Watson statistic, respectively, for each of the body composition variables in their continuous form. All of the linear regression assumptions were met. No extreme deviations were observed for studentized and jackknife residuals, while observing small leverage and Cook's distance values. This indicates no evidence of influence or collinearity. Models show the point estimate for each independent eating behavior dimension and corresponding 95% confidence intervals. Multivariable linear regression models present standardized beta coefficients, to compare the strength of the effect of each individual independent variable to the dependent variable. Statistical tests were two-sided and significance was set at a p value of less than 0.05. We also considered post-hoc Bonferroni corrections to account for multiple testing. These were conducted at an alpha = 0.003 (alpha corrected for eighteen tests per type of analysis).

3. Results

Descriptive statistics of the young adult participants are provided in Table 1. Obesity prevalence was equivalent in men and women based on BMI and percent body fat. However, central obesity was more prevalent in women than men (39.3% vs 30.7%, $p = 0.035$). Mean eating behavior dimension scores were in the low to moderate range with higher scores in women compared to men for cognitive restraint ($p = 0.006$) and emotional eating ($p < 0.0001$). Median cognitive restraint and emotional eating scores were higher among men and women with obesity compared to those without obesity (determined by BMI, percent body fat or central obesity).

In multivariable linear regression models, cognitive restraint and emotional eating behaviors were significantly associated with higher BMI, percent body fat, and waist circumference, in both men and women (Table 2). Uncontrolled eating was not associated with any of the body composition measures.

Similarly, in all but one of the multivariable logistic regression models, cognitive restraint and emotional eating were significantly associated with adiposity outcomes in men and

women (Table 3). Participants with obesity had higher odds of cognitive restraint and emotional eating than those without obesity, regardless of the adiposity measures considered. Uncontrolled eating was not associated with any adiposity measures, based on BMI, percent body fat or waist circumference.

Upon adjusting for multiple testing using the Bonferroni corrections, the linear regression main results and conclusions did not change, with the exception of the emotional eating dimension and BMI and percent body fat in men, where the associations were no longer statistically significant (p value >0.003). In the case of logistic regression, the cognitive restraint main results did not change in men. However, only the association between cognitive restraint and percent body fat in women persisted after multiple testing adjustment. Emotional eating remained significantly associated with percent body fat in young adult women.

4. Discussion

We studied the relationships of eating behaviors to body composition in 555 Chilean young adults. The eating behavior dimensions included cognitive restraint, uncontrolled eating and emotional eating. Body composition was measured in three ways, BMI, percent body fat, and central obesity. Based on prior literature, we hypothesized that higher scores for each of the eating behavior dimensions would be associated with greater adiposity and that women would have higher scores on the eating behavior dimensions compared to men. We found that higher cognitive restraint and higher emotional eating were significantly related to BMI, percent body fat, and central obesity in both men and women, but uncontrolled eating was not. Furthermore, similar to findings from prior research, higher cognitive restraint and higher emotional eating scores were more prevalent in women compared to men (De Lauzon et al., 2004; Provencher, Drapeau, Tremblay, Després, & Lemieux, 2003; Vega et al., 2016). Scores for uncontrolled eating did not differ by sex.

Our findings are largely consistent with prior published work on the relationship of eating behavior to body composition in young adults. In a large study of eating behaviors, in almost 3000 Finnish young women, 17- to 20-years old, investigators found that higher levels of cognitive restraint and emotional eating (but not uncontrolled eating) were associated with higher BMI (both $p < 0.001$) (Anglé et al., 2009). Similarly, in a Swedish study of mothers and their 16- to 17-year-old adolescents, cognitive restraint was associated with higher BMI in both the mothers ($p < 0.001$) and their children ($p < 0.01$) (Elfhag & Linné, 2005). They also found that adolescent body mass was more highly related to cognitive restraint than to the other eating behavior measures. Eating behavior scores did not differ between the boys and the girls.

Findings from other studies differ from ours. Our finding of a relationship between emotional eating and obesity in both men and women differs from findings from a study of middle-aged Chilean men and women (mean age 39 years) (Vega *et al.*, 2016). An association was found between BMI and uncontrolled eating scores among middle-age Chilean women with obesity ($p = 0.002$) but not among men. This finding was, surprisingly, not replicated in our young adult sample. Equally unexpected, and in contrast to our

findings, Lesdéma et al., identified disinhibition — uncontrolled eating — as the strongest independent eating behavior associated with BMI in a young adult cohort in France (Lesdéma *et al,* 2012). This has also been reported in other cross-sectional studies using the original 51-item TFEQ (Kruger, De Bray, Beck, Conlon, & Stonehouse, 2016; Löffler et al., 2015). A possible explanation of why we did not observe this in our sample is that there is evidence that the relationship between uncontrolled eating and BMI may develop with age, at least in women. In a Swedish study, uncontrolled eating was not associated with BMI among adolescent girls, but was found among adult women ($p < 0.001$) (Elfhag & Linné, 2005). Another possible explanation could be associated with self-serving bias (G. W. Bradley, 1978; Miller & Ross, 1975), being manifested among individuals with obesity in our sample. Within attribution theory in cognitive psychology, self-serving bias leads individuals to attribute success to internal factors and attribute failure to external factors. This works in parallel with one's self-perception and associated behaviors and that of others, where situationally, individuals highlight their perceived behaviors as favorable, enhancing self-esteem (G. W. Bradley, 1978; Miller & Ross, 1975).

Our research has several strengths. Our findings that cognitive restraint and emotional eating were associated with higher BMI, elevated percent body fat, and greater central obesity are similar to previous findings in different contexts including in Finland and in Sweden. We included three adiposity measures: BMI, central obesity, and percent body fat, assessed by DXA. Measurement by DXA allowed more accurate estimation of body fat compared to the other two measures. The data are highly reliable as all anthropometry, adiposity measures and eating behavior measures were collected at an academic nutrition research institute by highly trained personnel following standardized procedures. Furthermore, our analytical approach allowed us to examine these relationships beyond the presence or absence of obesity and adiposity (logistic regression), but rather assessing them from the perspective of a continuum of risk with linear regression, without missing some of the nuanced relationships. We find these two approaches complementing each other can have both clinical and public health applications, highlighting potential areas of investigation and intervention regarding eating behavior and obesity, percent body fat and central obesity in young adults.

We also note several limitations. Our participants were recruited from low- to middle—income neighborhoods in Santiago, Chile. Therefore, generalizability of these findings may be limited to populations with comparable demographics. Due to the cross-sectional nature of the study, reverse causality should be considered. Further research using longitudinal data, including repeated exposure and outcome assessments, would help discern the direction of the associations. Thus, another limitation includes the lack of temporality and the ability to establish causal inference between eating behaviors and adiposity. Social desirability bias, over-reporting good behavior and/or under-reporting undesirable behavior, may have led study participants to answer the TFEQ-R18 questions based on perceived investigator expectations. We contemplate the qualitative nature of this instrument and how an individual's self-perception, alongside the neurobiological interplay of cognitive, emotional and metabolic regulations, could potentially affect participant responses during the assessment (Zheng & Berthoud, 2008).

This study adds to the existing literature on the relationship between eating behavior and obesity. We found two eating behaviors, cognitive restraint and higher emotional eating, were significantly related to concurrent measures of adiposity. As this was a cross-sectional study, it remains to be determined how eating behaviors are causally involved in the observed relationships. Establishment of temporal precedence would support the hypothesis that eating behaviors lead to obesity. Future research using a longitudinal design would allow for causal inference based on temporal precedence. If such eating behaviors predict the development of obesity, strategies to modify them may support obesity prevention and intervention strategies.

5. Conclusion

Overall, our findings highlight the relationship between eating behavior and adiposity in a sample of Chilean young adults. Cognitive restraint and emotional eating were associated with higher BMI, elevated percent body fat, and greater central obesity. Obesity prevention and intervention research in Chile and other countries with increasing rates of obesity could assess strategies that address eating behaviors associated with obesity. Future studies addressing the longitudinal associations between eating behavior and body composition are warranted.

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Table 1.

Santiago Longitudinal Study – Descriptive statistics, anthropometry and eating behavior dimensions at 22 years Chile (n=555).

Characteristics [a]	Men (n=280)	Women (n=275)	p-value
Demographic and Behavioral			
Age (years)	22.6 (0.4)	22.6 (0.4)	0.135
High school graduate	85.0%	89.5%	0.116
Socioeconomic status, Graffar [b] score	26.9 (6.3)	27.0 (6.3)	0.802
Current smoker	50.4%	45.1%	0.214
Consumed alcohol ≥ once in last 30 days	70.7%	58.6%	0.003
Exercise (2–3 times/week or more)	32.1%	13.8%	<0.001
Anthropometric			
Weight (kg) [c]	79.3 (16.1)	69.2 (16.5)	<0.001
Body mass index (kg/m^2) [d]	26.6 (5.2)	26.9 (6.1)	0.481
Obesity by body mass index [e]	23.2%	27.3%	0.271
Percent Body fat	30.4 (7.5)	41.9 (6.8)	<0.001
Obesity by percent body fat [f]	79.6%	76.4%	0.870
Waist circumference (cm)	85.5 (11.2)	79.4 (12.1)	<0.001
Central obesity [e]	30.7%	39.3%	0.035
Eating Behavior [g]			
Cognitive Restraint	1.9 (0.5)	2.0 (0.6)	0.006
Uncontrolled Eating	2.0 (0.6)	2.1 (0.6)	0.274
Emotional Eating	1.7 (0.6)	2.2 (0.8)	<0.001

[a] Mean (Standard Deviation) or n %.

[b] Graffar index is a social stratification tool used to assess socioeconomic status (range 13–78); the higher the Graffar index, the lower the socioeconomic status.

[c] kg - kilograms

[d] kg/m^2, weight in kilograms over height in meters squared; cm, centimeters

[e] Defined as body mass index ≥30 kg/m^2.

[f] Defined as percent body fat >24% in men and >37% in women Defined as waist circumference ≥90cm in men and ≥80cm in women.

[g] Measured with the Three-Factor Eating Questionnaire-Revised 18.

Table 2.

Body mass index, percent body fat and waist circumference related to measures of eating behavior: cognitive restraint; uncontrolled eating; and emotional eating, assessed using the Three Factor Eating Questionnaire Revised [a]

	Men (n=280)			Women (n=275)		
	Body mass index			Body mass index		
Eating behavior dimension	**B (95% CI)**	**Standardized B**	**P Value**	**B (95% CI)**	**Standardized B**	**P Value**
Cognitive Restraint	2.92 (1.78, 4.07)	0.29	<0.001	2.20 (1.03, 3.37)	0.22	<0.001
Uncontrolled eating	−0.33 (−1.43, 0.77)	−0.04	0.556	−0.16 (−1.32, 0.99)	−0.02	0.781
Emotional eating	1.22 (0.26, 2.17)	0.15	0.013	1.92 (0.99, 2.84)	0.24	<0.001
	Percent body fat			Percent body fat		
Eating behavior dimension	**B (95% CI)**	**Standardized B**	**P Value**	**B (95% CI)**	**Standardized B**	**P Value**
Cognitive Restraint	3.62 (1.92, 5.31)	0.25	<0.001	2.77 (1.47, 4.06)	0.25	<0.001
Uncontrolled eating	−0.57 (−2.18, 1.04)	−0.04	0.485	−0.39 (−1.68, 0.90)	−0.04	0.552
Emotional eating	1.68 (0.29, 3.08)	0.14	0.018	2.14 (1.11, 3.18)	0.24	<0.001
	Waist circumference			Waist circumference		
Eating behavior dimension	**B (95% CI)**	**Standardized B**	**P Value**	**B (95% CI)**	**Standardized B**	**P Value**
Cognitive Restraint	5.34 (2.84, 7.85)	0.25	<0.001	4.05 (1.70, 6.40)	0.20	<0.001
Uncontrolled eating	−0.08 (−2.46, 2.29)	−0.004	0.945	−0.03 (−2.34, 2.28)	−0.002	0.980
Emotional eating	3.10 (1.05, 5.15)	0.18	0.003	3.68 (1.83, 5.54)	0.23	<0.001

[a]Multivariable linear regression models adjusted for age and education, stratified by sex

CI: Confidence Interval

TFEQ-R18: Three Factor Eating Questionnaire

Table 3.

Multivariable logistic regression models[a] assessing obesity, measured by body mass index BMI, percent body fat and central obesity related to eating behavior dimensions based on the Three Factor Eating Questionnaire (TFEQ-R18), stratified by sex.

	Men (n=280)						Women (n=275)					
	Obesity by Body Mass Index[b]		Obesity by Percent Body Fat[c]		Central Obesity[d]		Obesity by Body Mass Index[b]		Obesity by Percent Body Fat[c]		Central Obesity[d]	
Dimension	**OR (95% CI)**	**P value**	**OR (95% CI)**	**P value**	**OR (95% CI)**	**P value**	**OR (95% CI)**	**P value**	**OR (95% CI)**	**P value**	**OR (95% CI)**	**P value**
Cognitive Restraint	2.95 (1.67, 5.22)	<0.001	3.41 (1.76, 6.61)	<0.001	2.62 (1.56, 4.42)	<0.001	1.61 (1.04, 2.50)	0.033	2.54 (1.50, 4.30)	<0.001	1.73 (1.15, 2.61)	0.009
Uncontrolled Eating	1.02 (0.62, 1.69)	0.943	0.80 (0.48, 1.34)	0.639	1.05 (0.66, 1.66)	0.844	0.93 (0.47, 1.14)	0.265	0.96 (0.62, 1.49)	0.853	1.06 (0.72, 1.56)	0.754
Emotional Eating	1.48 (0.97, 2.27)	0.070	1.73 (1.03, 2.89)	0.038	1.55 (1.04, 2.31)	0.030	1.44 (1.02, 2.04)	0.040	1.91 (1.26, 2.88)	0.002	1.60 (1.15, 2.22)	0.005

[a] Models adjusted for age and education, stratified by sex.

[b] Defined as body mass index ≥30 kg/m^2.

[c] Defined as percent body fat >24% in men and >37% in women. Source: Sport Nutrition, Second Edition, by Asker Jeukendrup, PhD, and Michael Gleeson, PhD.

[d] Defined as waist circumference ≥90 cm in men and ≥80 cm in women.

BMI: Body mass index

OR: Odds ratio

CI: Confidence Interval

TFEQ-R18: Three Factor Eating Questionnaire

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