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ORIGINAL RESEARCH

Eating Behaviors and Adiposity Indicators – Observations from the 2016/17 Examination of the Population Study of Women in Gothenburg

Kirsten Mehlig[1], Pawel Sliwa[1], Ann Blomstrand[1], Lena Farhan[1], Tore Hällström[2], Dominique Hange[1,3]

[1]School of Public Health and Community Medicine, Institute of Medicine, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden; [2]Neuropsychiatric Epidemiology Unit, Department of Psychiatry and Neurochemistry, Institute of Neuroscience and Physiology, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden; [3]Research, Education, Development & Innovation, Primary Health Care, Region Västra Götaland, Gothenburg, Sweden

Correspondence: Kirsten Mehlig, School of Public Health and Community Medicine, Institute of Medicine, University of Gothenburg, Box 453, SE-405 30, Gothenburg, Sweden, Tel +46 766 186844, Email kirsten.mehlig@gu.se

Purpose: To determine the cross-sectional association between eating behavior in terms of the three-factor eating questionnaire (TFEQ) and adiposity measures.

Methods: The TFEQ-R21 was administered to 573 women aged 38 and 50 who participated in the population study of women in Gothenburg 2016/17. Three domains, emotional eating (EE), uncontrolled eating (UE), and cognitive restraint (CR) were examined as outcomes as well as predictors of adiposity outcomes. Multiple linear and logistic regression models were adjusted for age, education, lifestyle factors, and dieting behavior.

Results: All TFEQ domains were positively associated with dieting. EE and UE were associated with higher consumption of sweets and CR with lower consumption of sweets. Wellbeing was negatively associated with EE and UE. In mutually adjusted models, EE and CR but not UE were positively associated with BMI, waist circumference (WC), waist-to-hip ratio, waist-to-height ratio, and skinfold. One standard deviation higher EE was associated with obesity, BMI $\geq$ 30 kg/m^2, OR = 1.62 (1.26, 2.10), and abdominal fatness, WC > 88 cm, OR = 1.57 (1.26, 1.95). Former and current dieting were positively associated with these outcomes, too, but UE and CR were not associated in mutually adjusted models.

Conclusion: This study shows that emotional eating behavior is associated with adiposity in a population of middle-aged women, over a large range of values for body fatness, and independent of dieting behavior. The results imply that treatment of obesity should include psychological support to restrict the risk for emotional eating in response to states of negative mood.

Keywords: three-factor eating questionnaire, eating behavior, dieting, obesity, adiposity, women, population-based study

Introduction

The prevalence of overweight and obesity worldwide continues to be high.[1] In Sweden, trends are still increasing[2–4] and so are the projected costs for society.[5] The prevalence of overweight and obesity is about 50%, with higher values for men than for women, but women have overtaken men with regard to severe obesity.[2–4] Poor dietary habits and lack of physical activity lead to a positive energy balance and accumulation of excess body fat.[6] Underlying reasons are societal and economic changes that are often beyond the control of a single individual, eg a growing availability of cheap energy-dense and nutrient-depleted foods, as well as industrialization and urbanization.[7,8] The impact of these changes on the individual may vary according to education, socioeconomic status, and genetic predisposition to obesity,[2,9,10] and may be mediated by mental health problems including depression, anxiety, eating disorders, low self-esteem, and social isolation.[11] The relationship between obesity and mental health is complex and often of bidirectional nature, and may

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differ by sex. A recent study showed that overweight and obesity correlated with lower quality of life in women but not men, compared to normal weight.[12]

Understanding food intake biology and weight management is crucial for effective obesity treatment and weight loss strategies. Dietary manipulation, like calorie restriction, is central to treatment, but long-term studies show modest results,[13,14] and non-adherence to interventions is common.[15–17] To strengthen adherence to lifestyle intervention programs and ascertain long-term maintenance of beneficial changes, it is increasingly recognized that the intervention should include aspects of behavioral treatment leading to a healthier attitude towards eating.[18–20] A small intervention study in Finnish adults with obesity showed that weight loss was larger the more the participants learned to maintain control over their food consumption.[21] A study of patients who underwent bariatric surgery showed that those with good control over food consumption had better weight maintenance and quality of life than those with poor control.[22] Both studies used short versions of the Three-Factor-Eating-Questionnaire (TFEQ-R18, TFEQ-R21) that measure three domains of eating behavior: emotional eating that describes overeating during periods of negative mood, uncontrolled eating that describes loss of control over food intake when hungry or exposed to external stimuli, and cognitive restraint that describes the conscious restriction of food intake to control body weight and shape.[23–25] The latter is one of the most fundamental and well-researched variables in studies of human eating behavior.[14] It refers to the tendency to constantly control food intake instead of following natural physiological cues such as hunger and satiety. This behavior must not be confounded with what is commonly known as dieting, when people restrict food intake to reach a negative energy balance and lose weight. Instead, restrained eaters limit their food consumption while keeping a constant energy balance.[26]

While most studies focused on the treatment of obesity, the relationship between eating behavior and weight status in the general adult population is less explored. The overall aim of this study was to examine whether eating behaviors assessed by the TFEQ-R21 are associated with different measures of adiposity in a population-based sample of 38- and 50-year-old women living in Gothenburg, Sweden. The rationale for choosing this segment of the population was the increasing trend of severe obesity among women[2–4] and the mental burden associated with it.[12] Also, a previous study of PSWG with women examined 1968–2000 showed that perceived stress was highest in the age interval 38–54,[27] which may also be the age range with high risk for the development of unhealthy eating behaviors. In a first step, we sought to determine correlates of eating behaviors, eg sociodemographic and lifestyle variables. Special attention was given to dieting behaviors that are common in contemporary female populations, and to the assessment of social desirability bias regarding self-reported eating behavior. In the main analysis, we aimed to determine the mutually adjusted associations between emotional, uncontrolled, and restricted eating behavior with different measures of body fatness and determine the impact of potential confounders including dieting. Affirmative findings may inform clinicians on how to improve obesity interventions by addressing the underlying eating behavior in addition to changes in diet and physical activity.

Subjects and Methods

Data Set

The population study of women in Gothenburg (PSWG) consists of population-based samples of women in specific age strata between 38 and 60 invited and examined every 12th year between 1968 and 2016. The age span was chosen to cover the age range around the menopausal transition, which is a major research aim of PSWG from the beginning.[28] Subsequent examinations added newly recruited participants aged 38 and 50 in order to allow for analyses of trends in risk factors over time, which is another research aim of PSWG.[29] The present study is based on the most recent examination that took place in 2016/17 and included 573 women aged 38 (n = 279) and 50 (n = 294), with participation rates given by 63% and 73%, respectively.[30] It is also the first examination including the TFEQ questionnaire to assess eating behavior.

Exposure

Three types of eating behaviors were self-assessed using a revised 21-item version of the Three-Factor Eating Questionnaire (TFEQ-R21); emotional eating (EE, 6 items) that describes overeating during periods of negative mood, uncontrolled eating (UE, 6 items) that describes loss of control over food intake when hungry or exposed to external stimuli, and cognitive restraint (CR, 9 items), that describes the conscious restriction of food intake to control body weight and shape. The TFEQ-R21 was constructed in a Swedish population[31] and shown to be valid in populations of varying ethnicity, age, and weight status.[24,32–34] The items were measured on a 4-point Likert scale and domain scores for EE, UE, and CR were calculated as mean scores of their respective items excluding observations with missing items. The scores were standardized to values between zero and 100, with higher values indicating more problematic behavior. Validated cut-offs for excessive eating behaviors are lacking, however, dichotomization at value 50 was proposed by Chacko et al[35] and we adopted this definition. For association analyses, the three TFEQ scores were standardized to zero mean and unit standard deviation (SD) to be able to compare the magnitude of their associations with the different health outcomes.

Anthropometric Variables

The physical examination included measurements of weight and height, waist and hip circumferences, and skinfolds at three different positions. For this study, the sum of skinfolds at the biceps, triceps, and subscapular skinfold was used. Body mass index was calculated as weight/height^2 (in units of kg/m^2) as well as the dimensionless quantities waist-to-hip ratio (WHR) and waist-to-height ratio (WHtR). BMI was further categorized into underweight (BMI < 18.5), overweight (BMI ≥ 25) and obesity (BMI ≥ 30). Markers involving waist circumference were dichotomized at cut points for increased metabolic risk, according to the American Heart Association and the WHO, waist circumference at 88 cm,[36] WHR at 0.85,[37] and WHtR at 0.5.[38] The sum of skinfolds was dichotomized at the highest quintile, given by 64 mm.

Potential Confounders

All regression models included age (50 vs 38 years) which is an important design variable and is known to be related to weight status. The self-reported questionnaire included a validated question about maximally attained education, dichotomized into university education vs lower education. The women's and their partners' socioeconomic status (SES) was derived from their occupation,[39] and low family SES was defined as maximum SES dichotomized into low vs medium/high. The validated question about general wellbeing was answered on a 7-step Likert scale,[40] and was used as a linear predictor, with higher values indicating better wellbeing. The question about marital status was dichotomized into "living with a partner" vs "living alone". Women were asked whether they had been on a weight-loss diet previously and whether they were currently dieting. Because all except one woman currently dieting had been on a diet previously, we defined three mutually exclusive categories: never, previous only, and current dieting irrespective of previous dieting. Consumption of sweets was measured in four categories: never, a few sweets/day, consumption several times/day, is very fond of sweets and consumes a lot almost every day; due to small numbers, the latter two categories were combined for this analysis. The self-reported frequency of habitual alcohol consumption from beer, wine and spirits was converted into total ethanol intake in grams/day using assumptions about portion size and ethanol content as described in.[41] Habitual coffee consumption was included as the number of cups/day irrespective of type of coffee or preparation method. Smoking status was defined as current use of any tobacco (cigarette, cigar, pipe, e-cigarette, and moist snuff) versus none. Habitual leisure-time physical activity (LTPA) was measured in four categories, including sedentary behavior, moderate activity $\geq$ four hours/week, regular training, and competitive sports. Eating behavior was assessed using a validated instrument, but it cannot be excluded that the women underreported behavior that is considered undesirable, such as emotional and uncontrolled eating.[42] For this reason, we also adjusted for a control variable derived from the Eysenck Personality Inventory assessing the tendency to give socially desirable answers, commonly known as the lie scale.[43,44]

Ethical Approval

Ethical approval was granted by the Regional Ethics Committee Gothenburg (258–16). The study complies with the Declaration of Helsinki and written informed consent was obtained from all participants.

Statistical Methods

Between group comparisons were performed using the Mann–Whitney *U*-test (continuous variables), χ^2-test (binary variables), and Cochran-Armitage test of trend (categorical variables). Pearson correlation coefficients were calculated for EE, UE, and CR. Multiple linear regression was used to examine the associations between TFEQ scores and sociodemographic and lifestyle variables as well as age, and the Eysenck lie scale. TFEQ scores per se were used as outcome variables because residuals were normally distributed despite some positive skewness of the distributions, 0.8 (EE), 0.7 (UE), and 0.1 (CR). Logistic regression with stepwise forward selection of variables was applied to identify predictors of excessive eating behaviors. Furthermore, we assessed the mutually adjusted associations between TFEQ scores and indicators of adiposity. All anthropometric variables were positively skewed and logarithmized values were used in linear regression models to ensure normally distributed residuals. As a result, the exponentiated value of the beta coefficient was given that describes the relative change in outcome per one-unit change in predictor according to (exp(beta) – 1) × 100%. Regression models were adjusted for age, university education, living with a partner, wellbeing, coffee consumption, ethanol consumption, current tobacco use, LTPA, and the Eysenck lie scale. University education was chosen over family SES because of fewer missing values. Because of the large conceptual overlap between dieting behavior as well as sweet consumption with eating behaviors, association results were reported for models with and without further adjustment for these variables. Dichotomized markers for adiposity were related to TFEQ scores via logistic regression. While all models included EE and CR, we applied stepwise forward selection of covariates to account for the restricted number of event outcomes. Model check included the assessment of correlations between beta-values of predicting variables, with variance inflation factors <2.0 for all models presented here. Model fit was assessed in terms of adjusted coefficient of determination (R_{adj}^2) for linear regression models and area under the ROC curve (AUROC) for logistic regression models. The statistical significance level was set at 0.05 (2-sided tests). Analyses were performed using SAS v.9.4 and MATLAB R2022a.

Results

Definition of the Analytic Sample

Primary exclusion criteria were missing answers to any item of the TFEQ (n = 27). After the exclusion of five women, who were pregnant at the time of the examination, the final sample size was given by 541 women.

Psychometric Properties of TFEQ-R21

The three domains of TFEQ-R21 showed very good internal validity, Cronbach's alpha = 0.93 (EE), 0.88 (UE) and 0.84 (CR). Pairwise correlations between eating scores were positive, with larger correlation between EE and UE, Pearson correlation coefficient r = 0.65, and somewhat smaller values for EE and CR, r = 0.22, and UE and CR, r = 0.18 ($p < 0.0001$ for all three estimates). Some domains reached the minimum value of zero (EE, UE, and CR) or the maximum of 100 points (EE), but the skewness of the distributions was small (<0.8). Defining excessive eating behaviors as values >50 points, we found that 87 women presented with excessive EE behavior (16%), 83 women with excessive UE behavior (15%), and 140 women with excessive CR eating behavior (26%), cf. Table 1.

Basic Characteristics of the Study Sample (Table 1)

About half of the women were 38 or 50 years old. Most of them had university education (68%) and only a few had economic difficulties (14%). More than two-thirds of the women had been dieting previously, and among those currently dieting, all except one had dieted previously. Eleven women were underweight (2%), while 201 had overweight with a BMI ≥ 25 (37%) and 73 women were obese (14%).

Correlates of Eating Behavior

Table 2 shows the results from multiple linear regression of TFEQ scores on potential confounders of their association with adiposity measures. Consumption of sweets was most strongly associated with all three factors, in a positive way for EE and UE, and negatively for CR. The associations showed a dose–response relationship, ie significant differences in beta values for low-intermediate and intermediate-high consumption of sweets. Dieting behavior was positively associated with UE, EE, and CR, in order of increasing effect size. Current dieting showed stronger associations with TFEQ scores than former dieting. Living with a partner and better wellbeing were associated with lower EE, the latter also with lower UE. Higher CR scores were associated with more physical activity and less smoking. Coffee consumption was positively associated with CR, but alcohol consumption was not associated with eating behavior. A higher propensity to give socially desirable answers was negatively associated with EE and UE, and positively with CR. The small number of cases of excessive eating behavior

Table 1 Basic Characteristics of Women Participating in the Population Study of Women in Gothenburg 2016–17

	Total N [a]	Mean (SD)	Range
TFEQ: Emotional eating	541	26.4 (25.1)	0–100
Uncontrolled eating	541	28.8 (19.9)	0–96.3
Cognitive restraint	541	37.1 (21.6)	0–94.4
		N (%)	
Excessive eating behavior: EE > 50	541	87 (16)	
UE > 50	541	83 (15)	
CR > 50	541	140 (26)	
		Mean (SD)	**Range**
Anthropometry: BMI (kg/m^2)	538	24.7 (4.6)	16.5–49.1
Waist circumference (cm)	540	83.0 (11.2)	60–136
WHR	538	0.81 (0.07)	0.60–1.05
Waist/height ratio	539	0.50 (0.07)	0.38–0.82
Sum of skinfolds (mm) [b]	530	51.0 (18.1)	17–118
Wellbeing [c]	540	3.7 (1.3)	0–6
Social desirability score (Eysenck) [d]	541	2.9 (1.8)	0–8
Ethanol (g/day)	540	5.4 (4.7)	0.0–21.6
Coffee (cups/day)	541	2.6 (2.0)	0–15
		N (%)	
Age strata: 38 years	541	279 (46)	
50 years		294 (54)	
University education	537	362 (67)	
Low family SES	514	74 (14)	
Living with a partner	541	427 (79)	
Sweets: never	538	110 (20)	
Few sweets/day		389 (72)	
Several times/day		39 (7)	
Dieting: never	541	162 (30)	
Former only		315 (58)	
Current		64 (12)	
LTPA: sedentary	541	46 (9)	
Moderate		197 (36)	
Regular training		250 (46)	
Competitive sports		48 (9)	
Current tobacco use	541	98 (18)	

Notes: [a]Total number of non-missing observations for each variable. [b]Individual range values (mm): biceps: 3.2–35.6, triceps: 6.8–42.5, subscapular skinfold: 5.8–60.0. [c]Seven categories, higher is better. [d] Nine categories, higher values indicate a larger propensity to give socially desirable answers.

limited the number of beta-values estimable in logistic regression, but stepwise variable selection confirmed the results for predictors most strongly associated with the continuous eating scores (Table S1). Sensitivity analyses showed that dieting behavior and CR did not share risk factors except for coffee consumption (Table S2). In contrast to women with higher level of CR, there were no differences in sweet consumption or LTPA among the different dieting categories. While former and especially current dieters reported lesser wellbeing, there was no association between wellbeing and CR (Table 2).

Table 2 Associations Between Sociodemographic and Lifestyle Variables as Well as the Eysenck Lie Scale with Individual TFEQ Scores (N = 506) [a]

	EE [b]	UE [b]	CR [b]
Age stratum 50 (ref=38)	−2.7 (−7.0, 1.6)	−3.3 (−6.9, 0.2)	2.5 (−1.1, 6.1)
University education (ref=less education)	0.0 (−4.6, 4.7)	−0.9 (−4.7, 2.9)	−1.7 (−5.6, 2.1)
Low family SES (ref=high)	−2.7 (−9.2, 3.8)	4.3 (−1.1, 9.7)	−1.1 (−6.6, 4.3)
Living with a partner (ref=no)	−6.8 (−11.8, −1.7)**	−3.5 (−7.7, 0.7)	−1.4 (−5.6, 2.8)
Wellbeing [c]	−3.5 (−5.2, −1.9)***	−1.6 (−2.9, −0.2)*	0.0 (−1.3, 1.4)
Dieting (ref=never)			
Former only	10.0 (5.5, 14.6)***	5.3 (1.5, 9.1)**	12.7 (8.9, 16.5)***
Current	22.9 (15.8, 30.0)***	10.2 (4.4, 16.1)***	30.3 (24.5, 36.2)***
Sweets: (ref=never)			
Few sweets/day	5.9 (0.7, 11.1)*	7.1 (2.9, 11.4)**	−5.7 (−10.0, −1.4)**
Several times/day	23.7 (14.8, 32.6)***	16.3 (8.9, 23.7)***	−13.8 (−21.2, −6.4)***
LTPA: (ref=sedentary)			
Moderate	−0.9 (−8.8, 7.0)	3.7 (−2.8, 10.3)	4.2 (−2.4, 10.8)
Regular training	1.5 (−6.5, 9.4)	2.1 (−4.4, 8.7)	7.6 (1.0, 14.1)*
Competitive sports	−1.9 (−12.1, 8.3)	0.9 (−7.5, 9.4)	8.8 (0.3, 17.3)*
Coffee (cups/day)	0.4 (−0.6, 1.5)	0.3 (−0.6, 1.2)	0.9 (0.1, 1.8)*
Ethanol (g/day)	−0.0 (−0.5, 0.4)	0.3 (−0.1, 0.6)	0.1 (−0.3, 0.5)
Current tobacco use (ref=no)	−4.6 (−10.1, 1.0)	−3.7 (−8.3, 0.8)	−5.1 (−9.7, −0.5)*
Eysenck lie scale	−1.6 (−2.7, −0.4)**	−1.3 (−2.3, −0.4)**	1.3 (0.3, 2.3)**
R_{adj}^2	0.19	0.11	0.23

Notes: *p <0.05, **p <0.01, ***p<0.001. [a]Linear regression of TFEQ scores on sociodemographic and lifestyle variables as well as the Eysenck lie scale (beta-values with 95% CI). [b]On a scale from 0 to 100. [c]Seven categories, higher is better.

Table 3 Cross-Sectional Associations Between TFEQ Scores and Anthropometric Measures[a]

	BMI	WC	WHR	WHtR	Skinfolds
Basic adjustment[b]					
N	532	534	532	533	525
R_{adj}^2	0.21	0.19	0.08	0.20	0.19
EE (SD)	4.2***	3.0***	1.0*	2.7***	5.0**
	(2.4, 6.1)	(1.7, 4.4)	(0.1, 1.9)	(1.3, 4.1)	(1.3, 8.9)
UE (SD)	−0.8	−0.7	−0.6	−0.9	−0.4
	(−2.5, 0.9)	(−2.0, 0.6)	(−1.5, 0.3)	(−2.2, 0.4)	(−3.9, 3.1)
CR (SD)	3.4***	2.0***	0.9*	2.5***	5.8***
	(2.0, 4.8)	(1.0, 3.1)	(0.2, 1.6)	(1.4, 3.6)	(2.9, 8.9)
Further adjusted for dieting and sweets consumption					
N	530	531	530	531	522
R_{adj}^2	0.28	0.23	0.08	0.24	0.21
EE (SD)	2.7**	2.2**	1.0*	1.8*	3.1
	(0.9, 4.5)	(0.8, 3.6)	(0.0, 1.9)	(0.4, 3.2)	(−0.7, 6.9)
UE (SD)	−0.7	−0.6	−0.6	−0.9	−0.3
	(−2.3, 1.0)	(−1.9, 0.7)	(−1.5, 0.3)	(−2.2, 0.5)	(−3.7, 3.3)
CR (SD)	1.8*	1.2*	0.8*	1.7**	4.1*
	(0.3, 3.4)	(0.1, 2.4)	(0.0, 1.6)	(0.5, 2.9)	(0.9, 7.5)

Notes: *p <0.05, **p <0.01, ***p<0.001. [a]Linear regression of logarithmized values for anthropometry on the three TFEQ scores and potential confounders. Results are given in terms of the relative change in % per SD of TFEQ-score, ie exp(beta) – 1) x 100%. [b]Age, education, living with a partner, wellbeing, coffee consumption, current tobacco use, ethanol intake, leisure time physical activity, Eysenck lie scale.

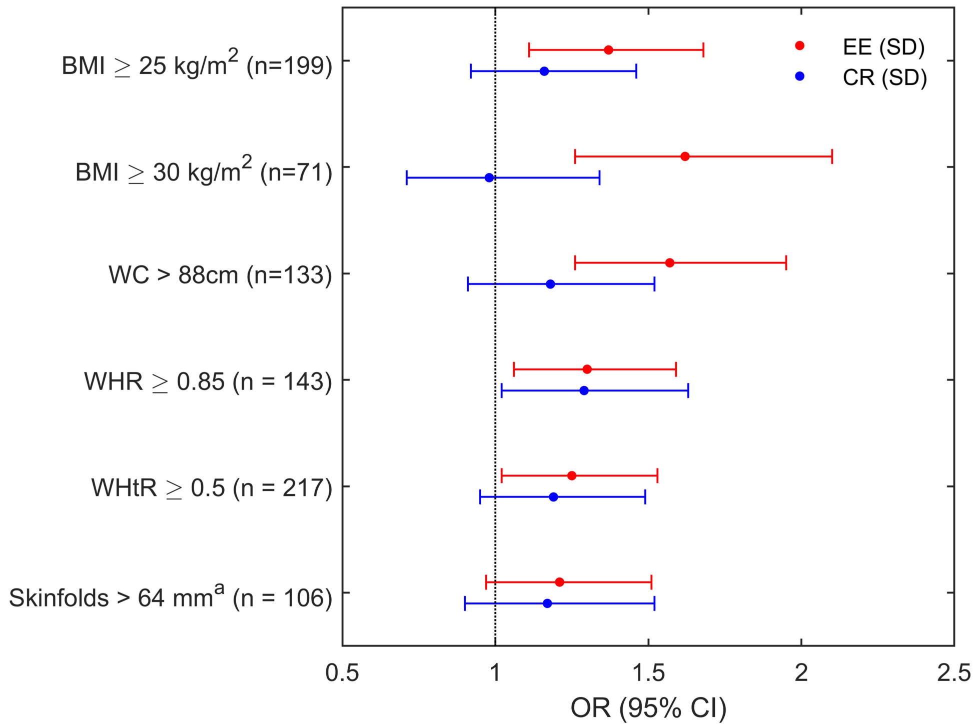

Figure 1 Associations between EE, CR and dichotomized adiposity markers, OR (95% CI). Stepwise variable selection from covariates listed in Table 2, forcing the variables for eating behavior into the regression model (Table S5). [a]Highest quintile vs lower values of the sum of skinfolds (biceps, triceps, and subscapular skinfold).

Associations with Anthropometric Markers

Table 3 shows the results for associations between TFEQ items and adiposity indicators adjusted for potential confounders as described in Table 2. Higher scores of EE and CR but not UE were associated with higher anthropometric values in mutually adjusted models. One SD higher EE was associated with 4.2% higher BMI, and 3.4% higher BMI for one SD higher CR. Further adjustment for dieting attenuated the associations between TFEQ scores and BMI to 2.7% per SD for emotional eating, and 1.8% per SD for cognitive restraint. Current and former dieting per se were associated with 17.4% and 8.9% higher BMI, respectively (Table S3). Comparing effect sizes, the strongest associations were observed for BMI and total skinfold, and the weakest for WHR. Interaction analyses showed that the associations between TFEQ domains and BMI were generally stronger among younger vs older women, among never-dieters compared to former or current dieters, and among women not currently smoking (compared to current smokers, Table S4). The interaction terms were not statistically significant except for age class, where associations with EE and UE were observed in younger women only (p-values for interaction = 0.04 and 0.02, respectively). The association pattern between EE and continuous anthropometric measures was confirmed with respect to dichotomized outcomes (Figure 1). One SD higher EE increased the risk for all markers of adiposity by 30–60%, except for skinfold. CR was not associated with dichotomized outcomes in regression models that also included dieting behavior, except for a weak positive association with WHR ≥ 0.85 (Table S5). Higher values for EE and CR were associated with lower odds for underweight but not significantly so (not shown). Associations between TFEQ and anthropometry were not confounded by the Eysenck lie scale that was not associated with any anthropometric measure (Tables S3 and S5).

Discussion

This population-based study of middle-aged women showed that emotional eating (EE) and cognitive restraint (CR) were positively associated with continuous measures of adiposity. EE rather than CR was associated with the dichotomized outcome measures obesity and abdominal fatness based on waist circumference. Uncontrolled eating was not associated with adiposity measures in models including EE and CR. The associations between eating behaviors and adiposity indicators were independent of lifestyle and social factors measured in this study. The associations were also independent of dieting behavior, which was common in this sample of women, and per se positively correlated with TFEQ domains and with adiposity indicators. Women with a higher propensity to give socially desirable answers in the Eysenck lie scale scored lower on EE and UE and higher on CR, but this bias did not affect the associations between TFEQ scores and objectively measured weight status.

A Finnish study of almost 3000 women aged 17–20 years reported positive associations between BMI and both EE and CR, but not UE.[45] Our study extends these results to other adiposity indicators, and to a population of middle-aged women. The positive association between EE and adiposity is plausible given that EE correlates with sweet consumption, which suggests a positive energy balance and risk for weight gain. Uncontrolled eating was not associated with adiposity in regression models adjusting for emotional eating, indicating that EE has a larger impact on adiposity than UE, at least in women. Previous studies showing associations between UE and BMI used older versions of TFEQ that did not explicitly assess emotional eating.[46] Based on our results we hypothesize that the association between UE and BMI might have been reduced if it had been adjusted for EE. Another Swedish population study showed that recent negative life events were associated with weight gain over 13 years suggesting that overeating may be a common way to cope with adversities.[47] The importance of EE relative to the other components of TFEQ is also demonstrated in the present study by the finding that only EE was consistently associated with dichotomized adiposity measures. The largest associations were observed for EE in relation to the more severe outcomes obesity and abdominal adiposity defined as WC > 88 cm.

The positive association between CR and obesity may be unexpected because conscious food restriction, as suggested by lesser sweet consumption, may be expected to correlate negatively with obesity. Indeed, a previous study among 3000 Czech adults found that BMI and waist circumference were negatively related to restraint, but positively to disinhibition (a factor from the original 51-item TFEQ that corresponds to uncontrolled eating in TFEQ-R21).[48] Lowe argues that the eating behavior exhibited by restrained eaters stems from frequent dieting and overeating in the past rather than from their current state of dietary or cognitive restraint.[49] In this sense, we could interpret the positive association between CR and adiposity as a sign of a vicious circle with dieting, overeating, and eating restraint alternating and reinforcing each other, which is supported by positive correlations observed between TFEQ scores, dieting behavior, and adiposity measures.

About 70% of the women had a history of dieting behavior. Both former and current dieting were positively associated with all adiposity measures, and the association with former dieting may show the futility of previous dieting attempts. Associations of dieting and higher values for EE and UE with lesser wellbeing suggest that weight dissatisfaction is a widespread mental health problem for women in these ages. The strong association between emotional eating and adiposity suggests that weight-loss interventions should include psychological support on how to cope with negative mood states, and how to avoid overeating in these situations. For example, cognitive behavioral therapy (CBT) targeting eating behavior could be an effective approach to treat obesity within primary care settings. The method utilizes a short-term cognitive group treatment with elements from CBT and psycho-education in a group therapy format.[18,20] Surgical or drug treatment may be a good solution for some patients, but even then psychological support is highly needed to avoid getting back to old eating habits and regaining weight.[50]

Because eating behaviors may be misreported by some individuals, we included a validated score for the propensity to give socially desirable answers. This so-called lie scale by Eysenck & Eysenck[43,44] was negatively associated with overeating (EE, UE) and positively with restrained eating (CR), indicating under- and over-reporting of eating habits deemed undesirable or desirable, respectively. However, inclusion of the lie scale in the regression models for anthropometric variables did not confound the associations with TFEQ scores, because the lie scale was not associated with these objectively measured outcome measures. This confirms the robustness of the association results despite manifest reporting bias for self-reported eating behavior.

Fat distribution is strongly linked to metabolic risk, with differential risk for various fat depots.[51] While BMI is a marker for overall body fat, waist circumference alone or in relation to hip circumference or height has been found to pose more health risks than fat elsewhere.[52] Skinfold is both a marker for the less risky subcutaneous fat but correlates with total body fat as well.[53] In the present study, eating behaviors are consistently associated with all five measures of adiposity. Larger effect sizes were obtained for BMI and skinfold compared to measures based on waist circumference, which may be partly due to lower measurement accuracy for waist and hip circumference. It shows that the most common measures of weight and height may be sufficient to monitor the risk of unhealthy eating behavior in women.

Strengths and Limitations

The examination of different adiposity measures in a contemporary population-based sample of middle-aged women is a strength of this study. Accounting for dieting behavior and social desirability bias is a further strength. The fact that data were collected eight years ago may be a limitation as living conditions may have changed since then. However, the prevalence of obesity is still increasing among Swedish women[3] while eating habits deteriorated[54] and socioeconomic imparities increased,[55] suggesting that our results and conclusions are still relevant. A related limitation is the restriction to cross-sectional data. Prospective data are needed to establish time order and causality among the different risk factors, as a basis for improvement of current lifestyle interventions for obesity.

Conclusions

In this study of middle-aged women, we showed that emotional eating and, to a lesser extent, cognitive restraint correlated positively with different adiposity indicators, while no associations were observed for uncontrolled eating, in mutually adjusted models. The consistency of associations with adiposity measures beyond BMI as well as their independence of dieting behavior and social desirability bias are important novel aspects of this study. The negative associations between the propensity to give socially desirable answers with overeating and the positive association with eating restraint are interesting on own account and support the validity of both the TFEQ and the Eysenck lie scale.

Data Sharing Statement

The data sets used and analysed during the current study are available from the corresponding author upon reasonable request.

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Disclosure

The authors report no conflicts of interest in this work.

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