Published in final edited form as:

Appetite. 2015 April ; 87: 365–370. doi:10.1016/j.appet.2015.01.008.

Eating tasty food to cope. Longitudinal association with BMI[☆]

M.M. Boggiano^{a,1,*}, L.E. Wenger^b, B. Turan^a, M.M. Tatum^a, P.R. Morgan^a, and M.D. Sylvester^a

^aDepartment of Psychology, The University of Alabama at Birmingham, Birmingham, USA

^bDepartment of Physics, The University of Alabama at Birmingham, Birmingham, USA

Abstract

The goals of this study were to determine if a change in certain motives to eat highly palatable food, as measured by the Palatable Eating Motives Scale (PEMS), could predict a change in body mass index (BMI) over time, to assess the temporal stability of these motive scores, and to test the reliability of previously reported associations between eating tasty foods to cope and BMI. BMI, demographics, and scores on the PEMS and the Binge Eating Scale were obtained from 192 college students. Test–retest analysis was performed on the PEMS motives in groups varying in three gap times between tests. Regression analyses determined what PEMS motives predicted a change in BMI over two years. The results replicated previous findings that eating palatable food for Coping motives (e.g., to forget about problems, reduce negative feelings) is associated with BMI. Test–retest correlations revealed that motive scores, while somewhat stable, can change over time. Importantly, among overweight participants, a change in Coping scores predicted a change in BMI over 2 years, such that a 1-point change in Coping predicted a 1.76 change in BMI (equivalent to a 10.5 lb. change in body weight) independent of age, sex, ethnicity, and initial binge-eating status (Cohen's f^2 effect size = 1.44). The large range in change of Coping scores suggests it is possible to decrease frequency of eating to cope by more than 1 scale point to achieve weight losses greater than 10 lbs. in young overweight adults, a group already at risk for rapid weight gain. Hence, treatments aimed specifically at reducing palatable food intake for coping reasons vs. for social, reward, or conformity reasons, should help achieve a healthier body weight and prevent obesity if this motive-type is identified prior to significant weight gain.

Keywords

Binge-eating; Emotions; Obesity; Motivation; Reward; Assessment

Introduction

Despite the continuing growing rate of obesity (Bauer, Briss, Goodman, & Bowman, 2014; Imes & Burke, 2014), prevention and treatment strategies are less than adequate (Blomain,

[☆]This study was supported by a Faculty Development Program Grant (to MMB). We thank Dr. Ed Cook for manning the Introduction to Psychology screening system which was used to recruit some of the participants.

*Corresponding author: boggiano@uab.edu (M.M. Boggiano).

¹Formerly MM Hagan.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Dirhan, Valentino, Kim, & Waldman, 2013; Douketis, Macie, Thabane, & Williamson, 2005). While bariatric surgery yields the most weight loss, reoperation and need of additional treatment is not uncommon (Brethauer et al., 2014). Also, current FDA-approved drugs result in only modest weight loss and have adverse side effects so they are often recommended as adjunct treatments to life-style changes (Hainer & Aldhoon-Hainerová, 2014; Nigro, Luon, & Baker, 2013). In an effort to improve obesity treatments, the Palatable Eating Motives Scale or PEMS (Burgess, Turan, Lokken, Morse, & Boggiano, 2014) was developed with the impetus that there is great heterogeneity among obese individuals for their motives behind eating highly palatable foods. The PEMS identifies four subscales or “motives” for eating tasty foods and drinks: Coping, Reward Enhancement, Social, and Conformity motives. The PEMS limits questions to the intake frequency of items such as sweets, salty snacks, fast foods, homemade fried foods, and non-alcoholic sugary drinks since these types of foods and drinks have a salient role in the development and maintenance of obesity. They are convenient, passively consumed for reasons other than metabolic need, and are typically high-fat, high-sugar, or highly salty and calorie-dense, all of which contribute to overweight (Astrup & Brand-Miller, 2012; Drewnowski, 1998; Hill & Peters, 1998; Thomas, Doshi, Crosby, & Lowe, 2011). The PEMS probes motivations for consuming highly palatable foods as a means of meeting a certain goal. This differs from eating behavior questionnaires that assess addictive-like traits (Gearhardt, Corbin, & Brownell, 2009), eating triggered by emotions, sensory, economic or other environmental cues (Arnow, Kenardy, & Agras, 1995; Steptoe, Pollard, & Wardle, 1995; Van Strien, Fritjers, Bergers, & Defares, 1986), or the degree to which one feels controlled by food (Lowe & Butryn, 2007).

Prior studies with the PEMS revealed that of the four motives, Coping is significantly associated with BMI in college students and a weight-loss seeking sample, such that a higher frequency to eat tasty foods for Coping motives correlates with higher BMI (Boggiano et al., 2014; Burgess et al., 2014). In both populations, these findings held while controlling for demographic variables, addictive-like eating as assessed with the Yale Food Addiction Scale (Gearhardt et al., 2009), and binge-eating status as assessed with the Binge Eating Scale (Gormally, Black, Daston, & Rardin, 1982). The Coping motive is composed of only 4-items that ask how often one eats highly palatable foods to forget about worries and problems, to cheer up when in a bad mood, and because it helps when feeling depressed or nervous. See Burgess et al., 2014, for the full PEMS scale. However, we do not know whether a change in Coping scores or in scores of any other PEMS motives could be used to predict a change in BMI over time. If so, treatments could be designed to specifically target one's primary motive either to prevent the development of obesity or to enhance weight loss in those already suffering the consequences of obesity.

Therefore, the goal of this study was to obtain longitudinal data from ethnically-diverse college students to determine if PEMS motives could predict changes in BMI over time. Young adults living away from home, as is true of many college students, and especially if African American, are at particular risk of rapid weight gain, with many expressing that weight gain is a major concern (Darden, 2014; Nikolaou, Hankey, & Lean, 2014). In conducting the longitudinal study we were also able to perform the first test–retest on the PEMS to evaluate the static or dynamic nature of the scale which is important if it is to be

used clinically. Additionally, and partly in response to the recent call to publish replications of psychological findings especially if they have high clinical impact potential (Drew, 2014; Yong, 2013), we also examined the reliability of our previously reported correlational link between Coping scores and BMI in two cross-sectional samples.

Materials and methods

Participants and participant groups

The participants were $N = 192$ male and female undergraduate students of various ethnic backgrounds and majors from the University of Alabama at Birmingham (UAB). These students were enrolled in Introduction to Psychology classes and were recruited from these classes through the SONA electronic system which screened students via questionnaires for research studies. The only exclusionary factors were pregnancy, breastfeeding, and an age younger than 18. Participants in the longitudinal study were students from these classes who gave written consent to be contacted for future studies. The mean age of the entire student sample was 20.5 years ($SD = 4.0$, range 18–44). Females constituted 64% and males 36% of the sample. The ethnic distribution was 53% White, 30% African American, and 17% other (which included 9% Asian and 8% either Hispanic, Middle Eastern, Native American or “Other”). For analytical purposes, the students were treated as three groups based on differences in the time gap between their first (t_1) and second (t_2) completion of questionnaires. The groups also differed in the manner in which their t_1 -BMI was obtained and the t_1 setting in which they completed the questionnaires. Group 1 ($N = 64$) had a two-year gap between tests, completed all t_1 questionnaires in the laboratory, and their t_1 -BMI was obtained in the laboratory. Group 2 ($N = 35$) had a one-year gap between tests, completed all t_1 questionnaires in a classroom setting, and their t_1 -BMI was obtained from paper/pen self-reported height and weight. Group 3 ($N = 93$) had a 1–2 month gap between tests, completed all t_1 surveys electronically through a screening questionnaire system available to Introduction to Psychology students, and their t_1 -BMI was obtained through electronic self-report of height and weight. For t_2 of the study, all 192 students completed electronic versions of the questionnaires in the laboratory and had their BMI obtained by height and weight measured in the laboratory.

Measures

The Palatable Eating Motives Scale (PEMS)—The PEMS is a 19-item Likert-like five-choice frequency response scale scored 1 for “Never/Almost Never” to 5 for “Always/Almost Always”. The instructions ask how often tasty foods or drinks are consumed “for the following reasons”, followed by the 19 reasons (items). The instructions provide examples of what is meant by “tasty foods” in categories that include various examples of sweets, salty snacks, fast food, fatty foods, and sugary drinks (Burgess et al., 2014). The PEMS factors into 4 motives: Coping, Reward Enhancement, Social, and Conformity motives. Coping motives include consuming these foods/drinks in an effort to deal with a negative state or situation (e.g., to forget about worries). Reward Enhancement motives relate to consuming these foods/drinks to enhance positive states or situations or for their inherently rewarding properties, e.g., “because it is fun”. Social motives pertain to eating these foods/drinks to be more sociable or enhance enjoyment of gatherings, e.g., “to enjoy a party”.

Conformity motives pertain to eating these foods/drinks because of pressures by others to do so, e.g., “to fit in”. Scores for each motive are calculated from the mean of the response values for items comprising each motive. Note that the first publication of the PEMS (Burgess et al., 2014) used the sum of response values rather than the mean but the mean is now the standard scoring method (Boggiano et al., 2014). A total PEMS score is obtained by summing the mean scores of each motive. In the present administration of the PEMS, individual motives had good internal reliability with Cronbach's α ranging from 0.72 to 0.89 at t1 and 0.76 to 0.92 at t2.

Binge Eating Scale (BES)

The BES is a 16-item scale that yields a total sum score ranging from 0 to 64 (Gormally et al., 1982). All participants completed the BES at t1. The BES is psychometrically sound as a pre-screen in adults for a possible diagnosis of eating disorders including bulimia nervosa and binge eating disorder (Celio, Wilfley, Crow, Mitchell, & Walsh, 2004; Dalton, Blundell, & Finlayson, 2013; Greeno, Marcus, & Wing, 1995).

Body Mass Index (BMI)

As described under Participants, weight and height were obtained by different means for the t1 part of the study, but all students had height and weight measured in the laboratory by a research assistant using a stadiometer and a digital scale for the t2 part of the study. Subjects were barefoot during the measurements and were not instructed to fast prior to coming to the lab. BMI was calculated with the formula: weight in kg/height in m².

Procedures

At t1, participants provided demographic information and completed the PEMS and the BES. BMIs were also obtained at this time as described for each of the groups in the Participants section above. For t2 part of the study, consenting students (the total $N=192$ described here) came into the laboratory, provided only their age for updated demographic information, were weighed and measured for a t2-BMI, and completed an electronic version of the PEMS among other surveys. This study was approved by the UAB Institutional Review Board for Human Use.

Statistical analyses

Cross-sectional analyses were used to test the reliability of previously reported associations between Coping scores and BMI using separate linear regressions with t1-BMI and with t2-BMI as dependent variables and the PEMS motives and demographics as predictors. Only Group 1 was included in the t1-BMI regression because they had in-lab vs. self-reported BMIs. In the t2-BMI regression, all students (Groups 1, 2, and 3 together) were included because all had in-lab measured BMIs at this time point. ANOVA and a Tukey post hoc test assessed differences in Coping scores between conventional BMI categories, and these analyses included all students at t2 because their BMIs were measured in the lab. Pearson's r was used to determine test-retest reliability of the PEMS motives for each of the three student groups separately since they varied in time between tests. Partial correlations tested associations among changes in PEMS motives scores (t2 score – t1 score) controlling for

demographics and initial t1-BMI only for Group 1 because they had the longest gap time between tests. Also using only Group 1, linear regression was used to determine if a change in PEMS motive scores as the independent variable predicted a change in BMI (t2-BMI – t1-BMI) as the dependent variable. The regression controlled for demographics, t1-BMI and BES scores obtained at t1. Cohen's f^2 determined the effect size of the regression. Only Group 1 was used in this regression as they had the longest period of time, 2 years, between tests and they had their heights and weights measured in the laboratory at both time t1 and t2.

Results

At t1 of the study which used all three groups of students, $N = 82$ (43%) of the students had a healthy BMI (17–24.9; mean 21.4, SD 2.2), $N = 57$ (30%) had an overweight BMI (25–29.9; mean 26.0, SD 2.4) and $N = 53$ (27%) had an obese BMI (30–60; mean 35.0, SD 6.1). The four students (2 self-reported and 2 taken in the lab) with a BMI < 18 at t1 had a BMI > 18 at t2. As a test of the reliability of self-reported BMI, we correlated self-reported with lab-measured BMIs of students in Group 3 who had the shortest (1–2 month) gap between tests. The correlation was $r = 0.98$, $p < 0.001$.

Replication of the association between coping and BMI

As shown in Table 1, only the PEMS motive, Coping, was significantly associated with BMI at t1 ($p = 0.01$) and at t2 ($p = 0.03$) controlling for sex, age, ethnicity, and the other PEMS motives. Data from t1 included only Group 1 ($N = 64$, all with in-lab BMIs). In the t2 regression which included all groups who all had in-lab BMIs, being older ($p = 0.03$) and African American ($p = 0.01$) were also independent predictors of BMI but their interactions with Coping were not significant. The mean Coping score at t1 was 1.94, SD = 1.0, and at t2 it was 1.95, SD = 1.0. As shown in Table 2, obese students had a significantly higher mean Coping score than healthy or overweight students ($p < 0.01$). While the mean Coping score for the Overweight group was unexpectedly lower than Coping scores of the Healthy group, this difference was not statistically significant.

PEMS test–retest reliability

As shown in Table 3, there was moderate stability of PEMS motive scores since the Pearson correlation coefficients were less than 0.7, indicating that they can also change over time. Coping scores were the most reliable in all 3 student Groups compared to the other PEMS motives but changed in magnitude with passage of time. Because motive scores can change over time, we calculated the difference in scores for each motive (e.g., t2 Coping scores – t1 Coping scores). This also allowed us to explore associations between changes in one motive to another motive over time, and to determine if changes in motives could predict a corresponding change in BMI over time.

Relationship between changes in PEMS motives over time

Table 4 depicts results that included only Group 1 ($N = 64$) because of their 2-year lag time between t1 and t2. As shown, partial correlations among change in the four motive scores resulted in a positive correlation between a change in Social scores and a change in

Conformity scores, and in a positive correlation between a change in Coping scores and a change in Reward Enhancement scores controlling for BMI and demographics. Changes in Social or Conformity scores were not correlated with changes in Coping or Reward Enhancement scores. These pairs of correlations were not solely an extension of a similar pattern of correlations between motive scores at t1 or at t2. For example, Coping scores at t1 correlated with Social, Reward Enhancement, and Conformity scores ($r = 0.30, 0.38, 0.31$, respectively; all $p < 0.05$), while Coping scores at t2 correlated only with Reward Enhancement and Conformity scores ($r = 0.46, 0.41$, respectively; all $p < 0.01$).

Ability of change in PEMS motive scores to predict a change in BMI over time

Linear regression analysis also using only Group 1 because of their 2-year lag time between t1 and t2 revealed that over two years, a change in Coping scores, and only in Coping scores, predicted a change in BMI and in a positive direction such that an increase in Coping scores predicted an increase in BMI ($\beta = 0.49, t = 4.07, p < 0.001, R^2 = 0.42$). The data from two participants were removed from the regression analysis as their residual change in BMI was greater than 2 standard deviations. However, even when the outliers were included, the change in Coping scores still predicted a significant change in BMI. Furthermore, ANOVA revealed a significant interaction between initial t1-BMI and a change in Coping scores ($p < 0.05$) when predicting a change in BMI. Therefore, separate regressions were conducted for Healthy BMI participants and Overweight/Obese participants. The latter were grouped together because of the low number comprising the overweight category. There were no significant predictors for the Healthy group, but a change in Coping scores predicted a change in BMI for the overweight/obese individuals (Table 5). The slope (unstandardized B) indicated that a 1.0 increase or decrease in the mean Coping score of these individuals would correspond to a 1.76 increase or decrease in BMI, respectively. The linear regression using change in body weight as the dependent variable yielded similar results as expected. The slope indicated a 10.5 ± 3.3 lb change for every 1.0 change in Coping scores. Figure 1 displays the unstandardized residuals when changes in BMI (y-axis) were regressed onto sex, ethnicity, age, BES scores, and the changes in other PEMS motive scores and residuals when changes in Coping scores (x-axis) were regressed onto sex, ethnicity, age, BES scores, and the changes in other PEMS motive scores for both Healthy ($N = 30$) and Overweight/Obese ($N = 32$) categories. These residuals represent change in BMI and change in Coping scores adjusting for these covariates. This visual representation clearly shows that a change in BMI is associated with a change in Coping scores only for the Overweight/Obese students and not the Healthy students.

Discussion

This study was the first to explore the Palatable Eating Motives Scale (PEMS) in a longitudinal design. In ethnically-diverse college students, a high-risk group for rapid weight gain (Darden, 2014; Nikolaou et al., 2014), a test-retest analysis of the PEMS indicated that though moderately stable, the frequency with which the students reported eating highly palatable foods for a particular motive also changed within a 2-year period. Another interesting finding was that changes in Coping scores correlated with changes in Reward Enhancement scores, while changes in Social scores correlated with changes in Conformity

scores over time. Both Coping and Reward Enhancement have the common characteristic of being internally-driven motives vs. Social and Conformity motives which are externally-driven motives. This internal/external conceptualization has been used in alcohol drinking research with greater alcohol use and problem drinking predicted by the internal motives (Kuntsche, Stewart, & Cooper, 2008). Likewise, Coping, an internal motive of the PEMS, was previously found to be associated with obesity risk (higher BMI's) in college students and an older weight-loss seeking population (Boggiano et al., 2014; Burgess et al., 2014). This association was replicated here in two additional groups of college students. Reward Enhancement, the other internal motive, was previously found to contribute to variance in binge-eating severity among college students, which can also exacerbate weight gain (Abraham, Massaro, Hoffmann, Yanovski, & Fox, 2014; Peterson, Latendresse, Bartholome, Warren, & Raymond, 2012).

In an adolescent population administered a child version of the PEMS, Reward Enhancement, not Coping motives, correlated most strongly with BMI (Boggiano, Wenger, Mrug, Burgess, & Morgan, 2015). This and the currently observed strong correlation between Coping and Reward Enhancement scores in adults raises the possibility that eating to enhance reward may precede eating to cope and the development of obesity. This possibility is supported by the link between reward sensitivity and obesity in children (Faith, Carnell, & Kral, 2013; Graziano, Calkins, & Keane, 2010; Rollins, Loken, Savage, & Birch, 2014). Alternatively, children and adolescents may simply not understand the concept of using food to cope or may not be aware that this is what they are doing until they are older, have acquired greater cognitive capacity, and are no longer as dependent on their parents to help them feel better or solve their problems. Longitudinal studies are needed to confirm if eating primarily for Reward Enhancement at an early age can cross over to eating primarily for Coping motives as adults. This would be consistent with the theory that initial high reward sensitivity promotes overeating of highly palatable foods, but brain reward signaling becomes blunted with sustained intake of these foods so that overeating tasty foods then becomes a means of self-medicating (Stice, Yokum, Burger, Epstein, & Small, 2011; Verbeken, Braet, Lammertyn, Goossens, & Moens, 2012). Eating for Coping motives certainly embodies eating to self-medicate. Hence, keeping in mind that the internal motives of Reward Enhancement and Coping are highly associated and change congruently with time may be important in understanding the development of eating to cope and may have greater health consequences than eating for external motives.

The PEMS Coping motive was not only found to be associated with BMI in this study, but also to predict a change in BMI. Specifically, decreased or increased frequency of eating highly palatable foods to cope predicted a corresponding decrease or increase in body weight, respectively, for the overweight/obese participants. Changes in Coping scores accounted for 59% of the variance in the BMI change over a 2-year period independent of age, sex, ethnicity, scores on the other PEMS motives, and initial binge-eating status. Cohen's f^2 was 1.44, which is considered a large effect size (Cohen, 1988). The regression predicted a 1.76 change in BMI (10.5 lb weight change) for every one point change in mean Coping scores. Given this association between eating to Cope and BMI, it should be possible to target the habit of using palatable food to cope in order to help one lose weight. A caveat inherent of associative findings however, is that the converse may be true: weight loss itself

may decrease frequency with which one eats for coping motives. There was also a large range in the change in Coping scores (−3.75 to 2.50). The large range in change of Coping scores suggests that it is possible to decrease frequency of eating for Coping motives by more than 1 point, as some participants did. The data would correspondingly predict this change to coincide with an even greater weight loss than 10-lbs. In those identified to have Coping as a primary motive, awareness of using food to cope and knowledge of the specific kinds of foods eaten to cope should enhance the efficacy of cognitive and/or behavioral treatments (Field, Camargo, & Ogino, 2013; Locke, Chah, Harrison, & Lustgarten, 1989).

Certain shortcomings of this study should be considered. For one, we do not know what factors contributed to the change in Coping scores which affected BMI over time. BMI could have been affected by changes in medications known to affect appetite and body weight, by the development of conditions comorbid with obesity, or by enrollment in a weight-loss program during the 2-year interval. This information was not obtained from the students but it should affect other motives for eating palatable food, not just Coping motives, unless they had a specific effect on eating for Coping motives. As previously mentioned, the correlational nature of this study cannot definitively rule out that it was a change in BMI itself that caused a change in Coping scores. However, the PEMS was developed as a tool that could be used to target specific motives in order to bring about healthier BMI. We first needed to determine if changes in motive-based eating were associated with BMI over time and this study was able to affirmatively answer this question. While the UAB student population is an urban one, longitudinal studies in community samples controlling for effects of socio-economic status are still needed to determine if our findings generalize beyond college samples.

In summary, the PEMS is useful in identifying the primary motive(s) behind eating highly palatable foods. More useful is the novel information learned in the present study that an increase or decrease in eating palatable foods for Coping motives, above and beyond eating palatable foods for Social, Reward Enhancement, or Conformity reasons, can predict future weight gain or loss, respectively. This new information should be encouraging to patients and clinicians because it provides a specific target for intervention compared to overgeneralized messages and attempts to simply 'eat less to lose weight'. Strategies designed to direct coping behavior away from food intake should improve cognitive, behavioral, or pharmacological approaches to prevent and treat obesity.

References

- Abraham TM, Massaro JM, Hoffmann U, Yanovski JA, Fox CS. Metabolic characterization of adults with binge eating in the general population. The Framingham heart study. *Obesity*. 2014; 22:2441–2449. [PubMed: 25136837]
- Arnoult B, Kenardy J, Agras WS. The Emotional Eating Scale. The development of a measure to assess coping with negative affect by eating. *International Journal of Eating Disorders*. 1995; 18:79–90. [PubMed: 7670446]
- Astrup A, Brand-Miller J. Diet composition and obesity. *Lancet*. 2012; 379:1100. [PubMed: 22444397]
- Bauer UE, Briss PA, Goodman RA, Bowman BA. Prevention of chronic disease in the 21st century. Elimination of the leading preventable causes of premature death and disability in the USA. *Lancet*. 2014; 384:45–52. [PubMed: 24996589]

- Blomain ES, Dirhan DA, Valentino MA, Kim GW, Waldman SA. Mechanisms of weight regain following weight loss. *ISRN Obesity*. 2013; 2013:210524. [PubMed: 24533218]
- Boggiano MM, Burgess EE, Turan B, Soleymani T, Daniel S, Vinson LD, et al. Motives for eating tasty foods associated with binge-eating. Results from a student and a weight loss seeking population. *Appetite*. 2014; 83:160–166. [PubMed: 25169880]
- Boggiano MM, Wenger LE, Mrug S, Burgess EE, Morgan PR. The Kids-Palatable Eating Motives Scale: Relation to BMI and binge eating traits. *Eating Behaviors*. 2015; 17:69–73. [PubMed: 25613823]
- Brethauer SA, Kothari S, Sudan R, Williams B, English WJ, Brengman M, et al. Systematic review on reoperative bariatric surgery. American Society for Metabolic and Bariatric Surgery Revision Task Force. *Surgery for Obesity and Related Disorders*. 2014; 10:952–972.
- Burgess EE, Turan B, Lokken KL, Morse A, Boggiano MM. Profiling motives behind hedonic eating. Preliminary validation of the Palatable Eating Motives Scale. *Appetite*. 2014; 72:66–72. [PubMed: 24076018]
- Celio AA, Wilfley DE, Crow SJ, Mitchell J, Walsh BT. A comparison of the binge eating scale, questionnaire for eating and weight patterns-revised, and eating disorder examination questionnaire with instructions with the eating disorder examination in the assessment of binge eating disorder and its symptoms. *International Journal of Eating Disorders*. 2004; 36:434–444. [PubMed: 15558644]
- Cohen, JE. Statistical power analysis for the behavioral sciences. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc; 1988.
- Dalton M, Blundell J, Finlayson GS. Examination of food reward and energy intake under laboratory and free-living conditions in a trait binge eating subtype of obesity. *Frontiers in Psychology*. 2013; 4:757. [PubMed: 24155732]
- Darden S. Weight changes in African American college students. A review of literature. *The ABNF Journal*. 2014; 25:10–12. [PubMed: 24660314]
- Douketis JD, Macie C, Thabane L, Williamson DF. Systematic review of long-term weight loss studies in obese adults. Clinical significance and applicability to clinical practice. *International Journal of Obesity*. 2005; 29:1153–1167. [PubMed: 15997250]
- Drew A. A year of reproducibility initiatives. The replication revolution forges ahead. *Observer*. 2014; 27 [Last accessed 20.01.15] <http://www.psychologicalscience.org/index.php/publications/observer/2014/july-august-14/a-year-of-reproducibility-initiatives-the-replication-revolution-forges-ahead.html>.
- Drewnowski A. Energy density, palatability, and satiety. Implications for weight control. *Nutrition Reviews*. 1998; 56:347–353. [PubMed: 9884582]
- Faith MS, Carnell S, Kral TV. Genetics of food intake self-regulation in childhood. Literature review and research opportunities. *Human Heredity*. 2013; 75:80–89. [PubMed: 24081223]
- Field AE, Camargo CAJ, Ogino S. The merits of subtyping obesity one size does not fit all. *JAMA: The Journal of the American Medical Association*. 2013; 310:281501.
- Gearhardt AN, Corbin WR, Brownell KD. Preliminary validation of the Yale Food Addiction Scale. *Appetite*. 2009; 52:430–436. [PubMed: 19121351]
- Gormally J, Black S, Daston S, Rardin D. The assessment of binge eating severity among obese persons. *Addictive Behaviors*. 1982; 7:47–55. [PubMed: 7080884]
- Graziano PA, Calkins SD, Keane SP. Toddler self-regulation skills predict risk for pediatric obesity. *International Journal of Obesity*. 2010; 34:633–641. [PubMed: 20065961]
- Greeno CG, Marcus MD, Wing RR. Diagnosis of binge eating disorder. Discrepancies between a questionnaire and clinical interview. *International Journal of Eating Disorders*. 1995; 17:153–160. [PubMed: 7757096]
- Hainer V, Aldhoon-Hainerová I. Tolerability and safety of the new anti-obesity medications. *Drug Safety*. 2014; 37:693–702. [PubMed: 25096956]
- Hill JO, Peters JC. Environmental contributions to the obesity epidemic. *Science*. 1998; 29:1371–1374. [PubMed: 9603719]
- Imes CC, Burke LE. The obesity epidemic. The United States as a cautionary tale for the rest of the world. *Current Epidemiology Reports*. 2014; 1:82–88. [PubMed: 24977112]

- Kuntsche E, Stewart SH, Cooper ML. How stable is the motive-alcohol use link? A cross-national validation of the Drinking Motives Questionnaire Revised among adolescents from Switzerland, Canada, and the United States. *Journal of Studies on Alcohol and Drugs*. 2008; 69:388–396. [PubMed: 18432381]
- Locke EA, Chah D, Harrison S, Lustgarten N. Separating the effects of goal specificity from goal level. *Organizational Behavior and Human Performance*. 1989; 43:270–287.
- Lowe MR, Butryn ML. Hedonic hunger. A new dimension of appetite? *Physiology and Behavior*. 2007; 91:432–439. [PubMed: 17531274]
- Nigro SC, Luon D, Baker WL. Lorcaserin. A novel serotonin 2C agonist for the treatment of obesity. *Current Medical Research Opinion*. 2013; 29:839–848. [PubMed: 23574263]
- Nikolaou CK, Hankey CR, Lean ME. Weight changes in young adults. A mixed methods study. *International Journal of Obesity*. 2014; 22:2277–2283.
- Peterson RE, Latendresse SJ, Bartholome LT, Warren CS, Raymond NC. Binge eating disorder mediates links between symptoms of depression, anxiety, and caloric intake in overweight and obese women. *Journal of Obesity*. 2012; 2012:407103. [PubMed: 22778917]
- Rollins BY, Loken E, Savage JS, Birch LL. Measurement of food reinforcement in preschool children. Associations with food intake, BMI, and reward sensitivity. *Appetite*. 2014; 72:21–27. [PubMed: 24090537]
- Seftoe A, Pollard TM, Wardle J. Development of a measure of the motives underlying the selection of food. The food choice questionnaire. *Appetite*. 1995; 25:17. [PubMed: 7495324]
- Stice E, Yokum S, Burger KS, Epstein LH, Small DM. Youth at risk for obesity show greater activation of striatal and somatosensory regions to food. *Journal of Neuroscience*. 2011; 31:4360–4366. [PubMed: 21430137]
- Thomas JG, Doshi S, Crosby RD, Lowe MR. Ecological momentary assessment of obesogenic eating behavior. Combining person-specific and environmental predictors. *Obesity*. 2011; 19:1574–1579. [PubMed: 21273995]
- Van Strien T, Fritjers JER, Bergers GPA, Defares PB. Dutch Eating Behaviour Questionnaire for assessment of restrained, emotional and external eating behaviour. *International Journal of Eating Disorders*. 1986; 20:295–315.
- Verbeken S, Braet C, Lammertyn J, Goossens L, Moens E. How is reward sensitivity related to bodyweight in children? *Appetite*. 2012; 58:478–483. [PubMed: 22138702]
- Yong, E. Psychologists strike a blow for reproducibility. *Nature News*. 2013. <http://www.nature.com/news/psychologists-strike-a-blow-for-reproducibility-1.14232>

Fig. 1.

Scatter plot showing the linear relationship of residualized BMI with Coping. Residuals were obtained while controlling for sex, ethnicity, age, Binge Eating Scale scores, and change in the other Palatable Eating Motives Scale (PEMS) motive scores for both Overweight/Obese (●) and Healthy (○) participants. The solid line represents a linear fit of the residuals for the Overweight/Obese participants ($p < 0.001$) while the dashed line represents a linear fit of the residuals for the Healthy participants (ns).

Table 1

Linear regressions of Palatable Eating Motives Scale (PEMS) subscale motives with BMI as the dependent variable during testing at t1 and testing at t2.^a

Dependent variable	BMI					
	Time 1(t1)			Time 2 (t2)		
	β	t	p	β	t	p
Independent variables						
Sex ^b	0.13	1.10	0.28	0.15	1.98	0.05
Age	0.19	1.54	0.13	0.15	2.13	0.04 [*]
Ethnicity ^c	0.23	1.64	0.11	0.19	2.54	0.01 [*]
PEMS motives						
Coping	0.38	2.63	0.01 [*]	0.18	2.19	0.03 [*]
Enhancement	0.05	0.35	0.73	0.09	1.11	0.27
Conformity	-0.06	-0.39	0.70	-0.01	-0.10	0.92
Social	0.03	0.18	0.86	0.11	1.21	0.23

^a t1 data from $N=64$; t2 data from $N=192$ students.

^b Sex was coded 0 for females and 1 for males.

^c Ethnicity was dummy-coded for African American, White, or Other. Only African American (coded 1) vs. White (coded 0) values are shown as it was the only significant ethnicity correlate found (African American ethnicity was an independent correlate of BMI at t2).

^{*} $p < 0.05$

Table 2

Mean Palatable Eating Motives Scale (PEMS) Coping scores of participants per conventional BMI categories at time t2 when all BMIs were measured in-lab.

BMI category	N	Coping score	SD	p
Healthy (17–24.9)	82	1.86	0.9	0.006 **
Overweight (25–29.9)	57	1.65	0.7	0.000 ***
Obese (30–60)	53	2.40	1.2	

**
Healthy vs. Obese scores

Overweight vs. Obese scores Healthy vs. Overweight scores were not significantly different.

Table 3

Pearson test–retest correlation coefficients for the Palatable Eating Motives Scale (PEMS) subscales in three participant groups varying in gap times between tests.

	Group 1	Group 2	Group 3
	(2 Year gap)	(1 Year gap)	(1–2 Month gap)
	<i>N</i> = 64	<i>N</i> = 35	<i>N</i> = 93
Total PEMS	0.61 **	0.75 **	0.68 **
PEMS Motives			
Coping	0.53 **	0.68 **	0.78 **
Enhancement	0.47 **	0.63 **	0.57 **
Social	0.52 **	0.65 **	0.47 **
Conformity	0.39 **	0.50 **	0.69 **

**
 $p < 0.01$ significance of the correlation between scores obtained at t1 and t2.

Table 4

Partial correlation coefficients between change in Palatable Eating Motives Scale (PEMS) subscales over a 2-year period.^{a,b}

	Coping	Enhancement	Social	Conformity
Coping	–	0.39 **	0.04	0.20
Enhancement	0.39 **	–	.09	0.14
Social	0.04	0.09	–	0.60 ***
Conformity	0.20	0.14	0.60 ***	–

^aCorrelations control for age, sex, ethnicity, and initial t1-BMI.

^bOnly students with a two-year gap between tests were analyzed (Group 1; $N = 64$).

 $p < 0.001$ and

**
 $p < 0.01$.

Table 5

Linear regression with change in Palatable Eating Motives Scale (PEMS) motive scores predicting change in BMI over two years for the overweight/obese participants.

Dependent variable:	BMI					
	Unstandardized coefficients			Standardized coefficients		
	B	Std error	β	t	p	
Independent variables ^a						
t1-Binge Eating Scale scores	0.03	0.07	0.06	0.37	0.71	
PEMS motive scores ^b						
Coping	1.76	0.49	0.61	3.61	0.002 ^{***}	
Enhancement	-0.37	0.57	-0.11	-0.64	0.53	
Social	-0.08	0.65	-0.02	-0.12	0.91	
Conformity	-0.60	1.02	-0.12	-0.59	0.56	
$R^2 = 0.59$						

^a Sex, ethnicity, and age were included in the model as independent variables and were not significant.

^b Change in PEMS motive scores were calculated by subtracting scores at t2 from scores at t1.

^{***} $p < 0.01$ denote significant predictors.