

Stress and Obesity: Basic, Translational and Clinical Perspectives

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ABSTRACTS

Presented during Poster Session A –
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6:30 pm – 8:00 pm
Golden Gate Room of the Hilton Union Square



CHRONIC STRESS IS ASSOCIATED WITH INCREASED VULNERABILITY TO DIET-RELATED VISCERAL ADIPOSITY AND METABOLIC RISK

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Background: In animals, chronic stress upregulates Neuropeptide Y (NPY) release from sympathetic nerve terminals into adipose tissue. When these animals are subsequently fed high sugar/fat foods (HSF), they develop metabolic syndrome and obesity at a significantly faster rate than their non-stressed counterparts. It is unknown whether chronic stress similarly augments the adverse metabolic effects of HSF consumption occurs among humans.

Objective: To test whether chronic stress exposure, or stress-induced elevations in NPY, in combination with HSF consumption, is associated with increased visceral adiposity and metabolic risk.

Methods: 29 post-menopausal dementia caregivers (CGs, a model for chronic stress), and 24 age-matched non-caregiving (NC) control women reported HSF consumption using the Food Frequency Questionnaire. Participants provided a fasting blood draw that was assayed for plasma NPY. To assess metabolic risk, a 3-hour Oral Glucose Tolerance Test was used to determine insulin sensitivity (IS) and waistline measurements at the narrowest point were taken.

Results: The interaction between CG status and HSF consumption significantly predicted greater waistline circumference ($p=.01$) and lower IS ($p=.03$). CGs had significantly higher plasma NPY than NCs ($p<.01$). To evaluate whether HSF was more strongly associated with visceral adiposity when NPY levels were high, independent of other differences between CGs and NCs, the interactive effect of NPY*HSF on waistline was calculated, controlling for CG status, and it was significant ($p=.04$).

Conclusions: Chronic stress among post-menopausal women is associated with vulnerability to diet-induced visceral adiposity and metabolic risk, and this may be mediated in part by peripheral NPY release.

STRESS REDUCTION, DEPRESSION, AND OBESITY AMONG WOMEN WITH A FAMILY HISTORY OF CANCER

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Background. Obesity is an important breast cancer risk and is important to consider for women with a family history of cancer (FH+). FH+ women have elevated rates of mental health conditions, which may influence obesity-related behaviors. Stress reduction interventions for FH+ women may influence obesity through changes in distress, diet, or physical activity.

Objective. We addressed a) changes in obesity across arms of a stress reduction intervention; b) changes in obesity in terms of mental health; and c) the mediating roles of distress, diet, and physical activity.

Method. Participants were 18-60 year old Seattle residents with a family history of breast cancer, a healthy immune system, and elevated levels of distress. Women completed a baseline questionnaire (T1), were randomized to either a 10-week CBSM intervention or a wait-list comparison group, and completed a questionnaire immediately afterward (T2). The following measures were analyzed: waist circumference (WC); body mass index (BMI); diet (FFB); physical activity (IPAQ); a previous depression diagnosis (self-report) and distress (IES, POMS, PSS). We conducted MANCOVAs and tested mediation (Preacher & Hayes, 2009).

Results. Intervention participants had greater WC reduction ($n = 47$; T1: $M = 83.57$; T2: $M = 81.31$) than comparison participants, $n = 50$; T1: $M = 86.53$; T2: $M = 87.78$; $F(1, 93) = 8.04$, $p = .006$. A history of depression ($n = 29$) was associated with less WC reduction compared to no history of depression at T1, $n = 68$; $F(1, 93) = 11.94$, $p = .001$. Women with a history of depression in the control group ($n = 10$) had the least WC reduction, $F(1,93) = 5.31$, $p = .02$. Distress, diet, and activity did not mediate these relationships.

Conclusions. Our preliminary findings suggest the value of stress reduction with regard to obesity among a high-risk population. Future research will clarify the mechanisms by which stress reduction techniques impact waist circumference.

STRESS AND ITS RELATIONSHIP WITH BINGE EATING BEHAVIOR

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Introduction: Binge eating (BE), consumption of an unusually large amount of food in a discrete period of time accompanied by a loss of control, has been identified as a common and important behavior strongly associated with obesity. There is evidence that stress is an antecedent of BE, yet few studies have assessed the contribution of different types of stress and adversity on BE. This study assessed total cumulative stress, including adverse life events, traumas and chronic stress and determined their contribution to BE behavior.

Method: Participants were 331 adults participating in a cross-sectional study examining stress, self-control and addiction (UL1-DE019586; PL1-DA024859). Participants completed a comprehensive assessment battery, including the Cumulative Adversity Interview (CAI) and Eating Disorder Examination-Questionnaire (EDE-Q). BMIs were calculated using measured heights and weights. Stress was assessed using z-scores for the total score and 4 CAI subscales (major life events, recent life events, traumatic events, and chronic stress). BE was assessed using the EDE-Q and dichotomized into no BE and 1 or more episodes of BE. Data were analyzed using binary logistic regression controlling for BMI. The sample was 54% male with a mean age of 28.7 ± 8.3 years, and mean BMI of 27.1 ± 5.2 kg/m². In the sample, 64% of participants were white, 24% black and 12% other.

Result: Twenty-seven percent of the sample engaged in at least 1 episode of BE in the past month. The final logistic regression analysis revealed that after controlling for BMI, chronic stress was the only type of stress that significantly explained BE (OR=1.4; $p=.03$). Total cumulative stress, major life events, recent life events, and traumatic events did not reach significance ($p>.05$).

Conclusion: While total cumulative stress, adverse life events and trauma were not strongly associated with BE, this study suggests that adults with greater chronic stress are more likely to binge eat. This supports a potential role for stress management in the prevention and treatment of BE behavior.

PSYCHOSOCIAL STRESS, ENERGY BALANCE, AND PHYSIOLOGIC HEALTH IN AN EMPLOYED POPULATION

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The direct relationship between psychosocial stress and physiologic health is well established. Modifiable behaviors, however, may mediate this relationship because they influence energy balance and physiologic status, such as body mass. We studied the extent to which the psychosocial stress—physiologic health relationship is mediated by proxy measures of energy intake (dietary intake) and energy expenditure (physical activity) in a sample of 2,224 25-59 year old Kaiser Permanente Georgia enrollees who were employed by large private or public organizations and responded to a 2005 survey. We computed an “index of physiologic health” (IPH), based on the “allostatic load” concept, from computerized records of patients treated in routine practice in 2006. IPH includes: BMI, blood pressure, serum lipids, and serum albumin. Scales of psychosocial stress, dietary intake, and leisure and work physical activity were measured from survey items. All scales were scored from 0 (worst state) to 100 (best state). In a mediation regression model, the path from psychosocial stress to IPH was positive (0.0432, $p=0.01$); and, the paths from psychosocial stress to dietary intake and physical activity were also positive (0.0735 and 0.1086, both $p<0.01$). For physical activity, but not dietary intake, the path to IPH was significant and positive (0.0783, $p<0.01$); and, the mediated effect of physical activity was significant and positive (0.0085, bootstrapped 95% CI: 0.0033-0.0181). Energy expenditure from leisure or work related physical activity mediated approximately 20% (95% CI: 8%-42%) of the psychosocial stress—physiologic health relationship in this sample of insured, employed adults. In conclusion, physical activity, which primarily affects energy expenditure, may be more important than dietary intake for modifying energy balance and, therefore, the psychosocial stress—physiologic health relationship.

EFFECTS OF CHILDHOOD DRIVE FOR THINNESS ON FOOD ADDICTION AND BMI IN ADULTHOOD: A PILOT STUDY

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Excessive concern with dieting in childhood may lead to disordered eating behaviors and weight gain in adulthood. Data came from a unique, follow-up pilot study of 80 original participants of the NHLBI Growth and Health Study (NGHS), a longitudinal study of White and Black girls enrolled at age 9-10 years in 1985 and followed for 10 years. Childhood drive for thinness was examined as the average score measured at ages 12, 14, 16, 18 and 19 years in the original NGHS study. Outcomes of BMI, drive for thinness and food addiction were assessed in women at age 32-33 years. We developed a conceptual model of the effects of childhood drive for thinness on food addiction and BMI in adulthood, controlling for race/ethnicity, baseline income and baseline BMI. We first tested the associations using ordinary least squares regression, and then used structural equation modeling to examine the direct and indirect effects on childhood drive for thinness on BMI in adulthood. Results showed that drive for thinness in childhood positively predicted adult food addiction behaviors (standardized $\beta=0.27$, 95% CI 0.04, 0.50). Furthermore, drive for thinness in childhood (standardized $\beta=0.22$, 95% CI 0.05, 0.38) and drive for thinness in adulthood (standardized $\beta=0.29$, 95% CI 0.03, 0.56) were significant, independent predictors of higher BMI in adulthood after adjustment for baseline characteristics. The total effect of childhood drive for thinness on BMI in adulthood was mostly comprised of a direct effect; a small indirect effect was mediated through adult drive for thinness and food addiction. The results did not differ in sensitivity analyses excluding women who were obese at baseline ($n=12$). Childhood drive for thinness may exert long-term effects on food addiction, drive for thinness and BMI in adulthood, and should be considered an important target of intervention.

Caregivers' Personal and Neighborhood Stressors Decrease Adolescents' Weight-Loss Session Attendance and Healthy Strategies

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Nearly ¼ of African American (AA) teens are obese. Many AA face high levels of personal (e.g., personal crises) and environmental (e.g., living in high-crime neighborhoods) stressors that may interfere with participating in weight loss interventions. The purpose of the current study was to examine associations between caregivers' (CG) perceptions of personal and neighborhood stressors, attendance in a motivational interviewing-based weight loss intervention, and teens' adoption of healthier nutrition and physical activity behavioral strategies following treatment. 108 AA teens with obesity ($M\text{ BMI}=37.9, SD=7.5$; $M\text{ age}=13.8, SD=1.3$; 65% girls) and a CG (87% biological mothers) were randomly assigned to home- or clinic-based weight loss intervention in which they met with a community health worker twice a week for 3 months. CGs completed measures of neighborhood characteristics (baseline) and personal stress (3mo follow-up) and teens rated how often they engaged in healthy nutrition and physical activity strategies (3mo follow-up). Bivariate analyses indicated that home (vs clinic) intervention ($r=.45$), fewer CG-rated crises at home ($r=-.23$), and lower CG perception of neighborhood crime rate ($r=-.26, p's<.05$) were associated with higher session attendance. Fewer crises ($r=-.32$) and more intervention sessions attended ($r=.41, p's<.01$) were associated with more teen healthy behavior strategies. In addition, path analysis ($X^2=8.18, p=.15$; CFI=.96; RMSEA=.08) indicated that higher perceptions of crime and home (vs clinic) sessions were indirectly associated with healthy behavior strategies, via session attendance ($p's<.05$). Although personal and neighborhood stressors were related to session attendance, only neighborhood stressors indirectly decreased teens' adoption of healthy eating and physical activity strategies. Thus, identifying ways to improve intervention attendance may be a key factor in helping teens acquire the skills necessary for sustained weight loss.

MOMENTARY VERSUS DURABLE STRESS EXPERIENCES AS PREDICTORS OF BMI AMONG ADULTS

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A growing literature supports a link between chronic psychosocial stress and obesity. Stress is often measured using retrospective survey instruments such as the Cohen Perceived Stress Scale (CPSS), which asks respondents to report stress experienced over the past month. Respondents must recall and summarize the frequency of stress over this period. Although the CPSS is reliable and valid, it is not known if these cognitive tasks overemphasize peaks or obscure fluctuations in stress, which may have implications for the stress-obesity link. These limitations may be mitigated by Ecological Momentary Assessment (EMA), an emerging method for capturing self-report data in real time. The current study compares EMA versus CPSS stress experiences as predictors of Body Mass Index (BMI) and waist circumference (WC).

Adults in the Project MOBILE (n=114) study were provided with a mobile phone, which randomly prompted them up to eight times per day across four days to respond to a series of questions about their current status, including a 1-item measure of perceived stress at the time of assessment. Participants also completed a 4-item subscale of the CPSS (CPSS4) using a traditional paper-and-pencil survey. We find that average EMA-stress is correlated with CPSS4, but not strongly ($r=0.36$, $p=0.0001$). In addition, standard deviation in EMA-stress and the maximum level of stress reported via EMA are correlated with CPSS4 ($r=0.26$, $p=0.006$; $r=0.25$, $p=0.008$ respectively). CPSS4 predicts BMI in multivariate models adjusting for age, sex, and race ($p=0.037$). The EMA stress mean, standard deviation, and maximum have no associations with BMI. Results using WC as an outcome were similar.

Results show that a survey-based measure of psychosocial stress does not capture the same information as an EMA-based measure of stress. People who recall more stress over the past month have a higher BMI, regardless of their momentary experience of stress. Differences in how individuals experience and report momentary stress warrant further investigation.

CULTURAL STRESS AND OBESITY IN HISPANIC ADULTS

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In Los Angeles, Hispanic adults have the highest rates of obesity (29.4%) in the county, above all racial and ethnic groups. The association between psychosocial stress and obesity is well documented; life stressors were correlated with a 16% increase in the risk for obesity in Hispanics. However, there are no studies on how cultural stressors, such as those related to immigration and intergenerational conflict, relate to obesity in Hispanics. The current study used the Hispanic Stress Inventory-2 (HSI2) to examine the relationship between cultural stressors and body mass index (BMI) in a sample of 330 U.S. born and immigrant Hispanic adults in Los Angeles, California. This study is part of an on-going NIMHD funded project to standardize the HSI2. The preliminary HSI2 consists of 242 dichotomous questions about life events. Self-reported weight and height were used to calculate BMI. The majority of the sample were female (61.4% compared to 38.6% male). Over half (55.6%) of the sample was born outside of the United States. The mean age was 41.7 (SD = 17.7) and average education level in years was 11.1 (SD = 3.61). Mean BMI was 26.9 (SD= 4.88) for men and 29.0 (SD = 7.20) for women, suggesting that most individuals in the sample were in the overweight or obese group. Cultural stress scores ranged from 0-187 (mean= 33.6, SD = 34.6). Pearson R correlation show a positive relationship between HSI2 total stress and BMI ($r = .13$, $p = .02$), with greater stress associated with higher BMIs. A closer examination of this relationship revealed that greater stress was associated with increased BMI for U.S. born Hispanics ($r = .19$, $p = .02$) but not immigrant Hispanics ($r = .07$, $p = .35$); this was despite findings showing immigrant Hispanics had higher mean stress scores ($t = -4.83$, $p < .001$) and BMI scores ($t = -2.45$, $p = .01$) than U.S. born Hispanics. Females had higher stress ($t = -1.75$, $p = .08$) and BMI ($t = -3.19$, $p = .002$) than did males. Preliminary results suggest differences in cultural stress and BMI by gender and nativity.

SELF-DISTRACTION AND AVOIDANCE MODERATE THE RELATIONSHIP BETWEEN BMI AND STIGMA IN BEHAVIORAL WEIGHT MANAGEMENT

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Obesity is a common, chronic medical condition that currently affects over 78 million adults in the United States and almost 500 million adults worldwide. Individuals with obesity face significant weight-related stigmatization and engage in a variety of coping strategies to alleviate the distress associated with stigmatizing experiences. Although prior research suggests that weight-related stigmatization is positively correlated with body weight, no prior study has examined the moderating influence of coping style. As part of a longitudinal study, individuals with overweight and obesity were recruited from a university-based behavioral weight management program. Ninety-five participants (76% female; 76% white; mean age 45.4 ± 11.5 ; mean BMI 47.4 ± 12.1 ; BMI range: 28.3 to 98.5) completed self-report questionnaires at the start of the weight management program and granted study personnel access to all weight management records. Self-report assessments included the Social Impact Scale (measuring stigma), Brief Approach/Avoidance Coping Questionnaire, and the Coping Orientation to Problems Experienced- Short Form. Hierarchical linear regression analyses were conducted to examine the moderating effect of coping on the relationship between BMI and perceived stigmatization. Results indicated that the maladaptive coping style of self-distraction moderated the influence of BMI on level of perceived stigma ($t = -2.42$, $p = .02$). Similarly, avoidance moderated the influence of BMI on perceived stigma ($t = -2.09$, $p = .04$). Individuals with higher BMI reported higher levels of perceived stigma regardless of coping style, but individuals with relatively lower BMI reported lower perceived stigmatization in the context of lower self-distraction and lower avoidance. These results underscore the importance of coping style for perceived stigmatization among patients with lower levels of adiposity (overweight, class I obesity, and class II obesity) and suggest that coping style may be important to address in behavioral weight management interventions.

DOES SKIPPING BREAKFAST INCREASE RISK FOR OVEREATING AND CENTRAL OBESITY BY ALTERING THE HYPOTHALAMIC-PITUITARY-ADRENAL AXIS?

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Breakfast skipping, an increasingly prevalent trend in the US, is associated with increased BMI, poor dietary habits, and impaired cognitive function. Few studies have attempted to unmask the mechanisms underlying these reported associations. Data from animal studies show that chronic breakfast skipping causes deleterious changes to diurnal patterns of circulating cortisol, a stress hormone that mediates several metabolic and behavioral pathways related to glucose metabolism and food intake. We hypothesized that chronic breakfast skippers will display a pattern of circulating cortisol that is marked by sustained elevations after the typical morning peak, and an exaggerated response to an afternoon snack buffet. Female breakfast “eaters” (n=26) (defined as a person who consumes a meal between 0400h and 1000h, ≥ 6 days a week) and breakfast “skippers” (n=12) (defined as a person who consumes zero calories between 0400h and 1000h, ≥ 6 days a week) were asked to participate in a 5 hour laboratory protocol that included a standard lunch meal and a snack buffet. Before the test day, participants were asked to follow their normal breakfast routine. In addition, saliva was collected at 10 time-points across the test day for the measurement of free circulating cortisol. Data were analyzed using an ANOVA with repeated measures design. Preliminary analysis revealed a “between subject” group effect ($p=0.003$) whereby circulating cortisol was higher for the breakfast “skipper” group both before, immediately after and 30 and 60 minutes post lunch ($p<0.01$). Circulating cortisol was also higher for the breakfast skippers immediately after the buffet and 30 minutes post buffet ($p<0.03$). Our results suggest that breakfast skippers display a hormonal pattern that may increase risk for overeating and central obesity. Supported by NIFA grant #2009-35215-05364 and USDA intramural funds Project #5306-51530-019-00D.

INTERACTIONS OF DRD4 UVNTR POLYMORPHISM WITH NEGATIVE STRESSORS ON ENERGY-BALANCE BEHAVIORS IN CHINESE ADOLESCENTS

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As China undergoes rapid economic development and sociocultural change, both obesity and stress among Chinese adolescents have become an increasing public health problem. Chronic stress due to stressful life events or daily hassles has been linked to the etiology of obesity through involvement of dopamine and serotonin for mood regulation leading to the disruption of energy balance. The gene coding for the dopamine receptor D4 (DRD4) contains a 16 amino acid (48-bp) repeat polymorphism that has been previously linked to energy balance behaviors and body mass index (BMI) with mixed findings across populations in the literature, and its potential interactive effects with environmental exposure of psychological stressors has not been investigated yet. In this analysis, we attempted to examine the population effects of experience of negative stressors from school, family, peers, violence and negative health situations, DRD4 uVNTR Polymorphism, and their interactions on various type of food consumptions (soda, fast food, and snack) and physical activity (vigorous exercise and TV watching) with data collected from 1,018 Chinese adolescents 11-15 years old living in Wuhan, China. In girls carrying DRD4 uVNTR wild type, experience of negative stressors were significantly associated with engagement in vigorous exercise (OR=6.55, p=0.0002), but were also related to having significantly greater odds of drinking soda (OR=1.93, p=0.008). Comparing to those with DRD4 wild type, carrying DRD4 variants significantly weakened the observed effects of negative stressors on vigorous exercise (OR for interaction=0.14, p=0.0004) and soda drinking (OR for interaction=0.44, p=0.03). No similar effect was observed among males. Our findings may convey the potential to suggest a new sight about the interactions between DRD4 and negative stressors on certain types of energy balance behaviors.