Childhood Abuse and Neglect as Risk Factors for Central Adiposity: A Test of Association and Mediation Pathways

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Childhood abuse and neglect are traumatic early-life stressors that may be risk factors for central adiposity. Our objective was to examine the association between childhood abuse/neglect and central adiposity and obesity in a sample of 311 women (106 Black, 205 White) from the Pittsburgh site of the Study of Women's Health Across the Nation (SWAN). SWAN included a baseline measurement of women in midlife (mean age = 45.7) and 8 follow-up visits during which waist circumference (WC) and body mass index (BMI) were measured. The Childhood Trauma Questionnaire, given at visit 8, retrospectively assessed 5 domains of abuse and neglect in childhood and adolescence: emotional, physical, and sexual abuse; emotional and physical neglect. ANCOVAs were used to determine whether a history of any abuse/neglect, or each type of abuse or neglect, was associated with WC, controlling for age. Results showed that women with a history of any abuse/neglect had significantly higher WC at visit 8 than women with no abuse history (M = 90.8, SE = 1.2; M = 96.1, SE = 1.5; $F(1, 308)=7.7$, $p = .01$). Of the specific types of abuse, only physical abuse was significantly related to WC at visit 8 (M = 91.7, SE = 1.0; M = 97.9, SE = 2.3; $F(1,308)=6.2$, $p = .01$)]. Analyses for the outcome of BMI showed similar results, with the addition of sexual abuse being important for obesity. Histories of any abuse/neglect, or specific types of abuse or neglect, were not associated with increased WC from baseline to visit 8 in the full sample. However, among women with BMI < 30, a history of any abuse/neglect, emotional abuse, physical abuse, sexual abuse, or physical neglect predicted

increased WC over time. Additional mediation analyses showed that Trait Anger scores mediated some relationships between abuse/neglect and WC. This study suggests that traumatic early-life stressors are associated with adulthood body fat distribution, especially among normal-weight and overweight women. Supported by NIH/DHHS AG012546 and MHO59689. The content of this abstract is solely the responsibility of the authors and does not necessarily represent the official views of the NIA, NIMH, or the NIH.

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1.0 INTRODUCTION

Central adiposity, defined as the deposition of body fat around the abdomen, has been shown to predict all-cause mortality and cardiovascular disease-related mortality (Lapidus, Bengtsson, Larsson, Pennert, Rybo, & Sjostrom, 1984; Prineas, Folsom, & Kaye, 1993). Additionally, central adiposity is associated with other risk factors for disease, such as type II diabetes, hypertension, and increased plasma triglycerides (Carey, Waiters, Colditz, Solomon, Willet, & Rosner, 1997; Cox, Whichelow, Ashwell, Prevost, & Lejeune, 1997; Evans, Hoffman, Kalkhoff, & Kissebah, 1984). Central adiposity's associations with morbidity and mortality are independent of overall body weight, thereby suggesting that localization of fat around the abdomen is particularly deleterious for one's health.

It is important to identify the factors that contribute to the development of central adiposity. Previous research has suggested that two factors play a role in increasing central adiposity: negative health behaviors and negative emotions. However, little is known about stressors that occur in childhood that also predict future central adiposity. Childhood abuse and neglect are devastating experiences that may have a lasting effect on health. Studies have linked childhood abuse and neglect to various negative health outcomes, such as ischemic heart disease, stroke, and obesity (Batten, Aslan, Maciejewski, & Mazure, 2004; Dong, Giles, Felitti, Dube, Williams, Chapman, et al., 2004; Lissau & Sorensen, 1994); but there is a dearth of literature

examining the relationship between childhood abuse and neglect on central adiposity. The first published study by Thomas et al. (2008) showed that retrospective reports of verbal abuse, humiliation, physical abuse, and physical neglect increased the odds of having central adiposity in adulthood.

The current paper begins by detailing the negative health consequences of central adiposity. Next, there is a review of the previously studied predictors of central adiposity: negative health behaviors and negative emotions. Childhood abuse and neglect are understudied risk factors for central adiposity, and the challenges associated with studying childhood abuse and neglect are discussed. The paper then describes the literature that connects childhood abuse and neglect to cardiovascular disease and obesity, suggesting that abuse and neglect play an important role in negative health outcomes. Finally, negative health behaviors and negative emotions are proposed to link childhood abuse and neglect to central adiposity. The primary purpose of the current study is to examine the relationship between childhood abuse and neglect and central adiposity in a sample of Black and White middle-aged women. Furthermore, the present study examines associations between childhood abuse and neglect with changes in central adiposity over time. Subsequent analyses test pathways in which negative health behaviors and negative emotions may mediate the relationship between abuse and neglect and central adiposity. In summary, the present study may bring attention to a traumatic childhood stressor and its potential for enduring influences on body fat distribution.

2.0 LITERATURE REVIEW

2.1 CENTRAL ADIPOSITY

Central adiposity is defined as the deposition of body fat around the abdomen. Central adiposity includes subcutaneous adipose tissue, found directly under the skin, and visceral adipose tissue, found between and around the internal organs. Visceral fat has been found to be more highly correlated with disease outcomes than subcutaneous fat (Melanson, McInnis, Rippe, Blackburn, & Wilson, 2001). Non-invasive measurements of central adiposity include waist circumference (WC) and waist-to-hip-ratio (WHR). Many studies report central adiposity findings using either WHR or WC, although studies that compare the two measures suggest that WC is a better marker of visceral fat (Taylor, Keil, Gold, Williams, & Goulding, 1998; Wajchenberg, 2000).

Several studies suggest that central adiposity is a better predictor of all-cause mortality than BMI (Lapidus, Bengtsson, Larsson, Pennert, Rybo, & Sjostrom, 1984; Folsom, Kay, Sellers, Hong, Cerhan, Potter, et al., 1993). Central adiposity has also been studied in regard to cause-specific mortality, notably cardiovascular disease. High WHR was a strong predictor of death from ischemic heart disease in men and women (Terry, Page, & Haskell, 1992) and coronary heart disease in women (Prineas, Folsom, & Kaye, 1993), even after adjusting for BMI and other coronary risk factors.

The relationship between central adiposity and mortality is in part mediated by the traditional risk factors for cardiovascular disease. Central adiposity is associated with type II diabetes (Carey, Waiters, Colditz, Solomon, Willet, & Rosner, 1997, Ohlson et al., 1985), hypertension (Cox, Whichelow, Ashwell, Prevost, & Lejeune, 1997; Janssen, Katzmarzyk, & Ross, 2002), and an unhealthy lipid profile (Evans, Hoffman, Kalkhoff, & Kissebah, 1984; Soler, Folsom, Kaye, & Prineas, 1989; Despres, Moorjani, Ferland, Tremblay, Lupien, Nadeau, et al., 1989). Many of these findings are independent of BMI, for both men and women across the adult lifespan. For a more detailed review of the literature describing central adiposity's associations with negative health outcomes, see Appendix A.

2.1.1 Health Behavior Correlates of Central Adiposity in Adults

It is important to understand the factors that influence the development of central adiposity so that these risk factors can be targeted for early intervention. Evidence from several epidemiological studies of large cohorts suggests that negative health behaviors, specifically smoking cigarettes, physical inactivity, and unhealthy dietary patterns, contribute to the development and maintenance of central adiposity in adults. For instance, cross-sectional findings demonstrate a positive association between smoking and WHR, adjusted for BMI, in men and women (Barrett-Connor & Khaw, 1989; Kaye, Folsom, Prineas, Potter, & Gapsture, 1990; Laws, Terry, & Barrett-Connor, 1990; Rosmond & Bjorntorp, 1999; Shimokata, Muller, & Andres, 1989; Wing, Matthews, Kuller, Meilahn, & Plantinga, 1991). These studies also consistently find a dose-response relation between the number of cigarettes smoked and WHR.

Physical inactivity has also been positively associated with increased WC and WHR in women (Pols, Peeters, Twisk, Kemper, & Grobbee, 1997; Wing et al., 1991; Rosmond & Bjorntorp, 1999) and men (Laws, Terry, & Barrett-Connor, 1990). Furthermore, decreases in physical activity were associated with increases in WHR in middle-aged women, even after adjustments for BMI (Wing et al., 1991).

Dietary patterns also have been connected to central adiposity. Newby and colleagues (2003) found that men and women with a healthy diet pattern (fruit, high-fiber cereal, reduced-fat dairy, and relatively smaller contributions from fast food, non-diet soda, and salty snacks) had the smallest WC at baseline, but there were no significant differences in baseline BMI. Another study showed that a dietary pattern high in fruits, vegetables, and dairy was inversely associated with WC in women (McNaughton, Mishra, Stephen, & Wadsworth, 2007). These studies suggest that individuals who consume diets low in fruits, vegetables, and fiber, and high in red meat and high-fat dairy are at increased risk for central adiposity. In summary, smoking, physical inactivity, and unhealthy dietary patterns are negative health behaviors that are risk factors for central adiposity.

2.1.2 Emotion Correlates of Central Adiposity in Adults

Health behaviors are not the only predictors of central adiposity; recent research suggests that psychosocial variables, specifically negative emotions, are associated with central adiposity independent of BMI. Several cross-sectional studies reported a positive association in adults between negative emotions, such as depression, anger, anxiety, and hostility, and WHR (Ahlberg, Ljung, Rosmond, McEwen, Holm, Åkesson, et al., 2002; Kaye, Folsom, Jacobs,

Hughes, & Flack, 1993; Miller, Freedland, Carney, Stetler, & Banks, 2003; Niaura, Banks, Ward, Stoney, Spiro, Aldwin, et al., 2000; Niaura, Todaro, Stroud, Spiro, Ward, & Weiss, 2002; Rosmond, Lapidus, Marin, & Bjorntorp, 1996). Moreover, in a longitudinal investigation of women, anger and hostility predicted an increase in central adiposity over time, measured by WC and visceral adipose tissue (Räikkönen et al., 1999a; Räikkönen, Matthews, Kuller, Reiber, & Bunker, 1999b).

2.1.3 Health Behavior and Emotion Correlates of Central Adiposity in Adolescents

Only a few studies have explored risk factors for central adiposity in adolescents. For instance, Yin and colleagues (2005) found a negative correlation between physical activity and WC in a sample of male and female youth, ages 12-24. Two studies examined negative emotions and central adiposity in adolescents. In a study of Black and White adolescents, trait anger and hostile affect predicted WHR approximately 3 years later, controlling for BMI and initial WHR (Midei & Matthews, in press). The second study reported that among 15-16 year-olds, higher expressive anger was cross-sectionally associated with greater central body fat in boys but not girls (Mueller, Meininger, Liehr, Chandler, & Chan, 1998). These studies suggest that negative health behaviors and negative emotions may be associated with or predict central adiposity as early as adolescence.

2.2 CHILD ABUSE AND NEGLECT

Although much of the literature examining risk factors for central adiposity has been done in adults, there are a few studies to suggest that among adolescents, negative health behaviors and emotions may affect central adiposity. Another stressor that occurs in childhood and adolescence with potentially devastating consequences is childhood abuse and neglect. The Federal Child Abuse Prevention and Treatment Act defines child abuse and neglect as any act or failure to act on the part of a parent or caretaker which results in serious physical or emotional harm, sexual abuse or exploitation, or death. Furthermore, child abuse or neglect includes any act or failure to act which presents an imminent risk of serious harm. In the child maltreatment literature, neglect is defined as acts of omission including failure to provide for basic biological needs, abandonment, or lack of supervision; abuse is defined as acts of commission by intentionally inflicted behaviors that can harm a child (Lutzker & Boyle, 2002).

Childhood abuse and neglect are prevalent in the United States. The Administration on Children and Families (2006) reported that 905,000 children were abused or neglected, as reported by Child Protective Services. Of those victims, 64.1% experienced neglect, 16.0% experienced physical abuse, 8.8% were sexually abused, and 6.6% were psychologically maltreated. Many children were victims to more than one type of abuse, which has been termed poly-victimization. Approximately 48% of the child victims were boys, and 52% of the victims were girls, suggesting no sex difference in the overall rates of childhood abuse or neglect. African-American children experienced the highest rates of abuse, and White children experienced the lowest rates of abuse. Children with low socioeconomic status (SES) were at risk for experiencing multiple forms of abuse and re-occurrence of abuse (Connell, Bergeron,

Katz, Saunders, & Tebes, 2007; Finkelhor, Ormrod, & Turner, 2007). Statistics that report prevalence rates of abuse do not explore the ways in which specific types of abuse vary by race or SES.

The Third National Incidence Study (Sedlack & Broadhurst, 2008) was designed to estimate the number of abused and neglected children by including cases reported to Child Protective Services, as well as those referred by community professionals. Data from 1993 showed that 2,815,600 children were abused or neglected. Emotional abuse was reported for 18.9% of children, 21.8% were physically abused, 10.7% were sexually abused, 20.8% were emotionally neglected, and 47.4% were physically neglected. There were no significant race differences in abuse/neglect incidence. Official United States statistics from the Administration on Children and Families, as well as the Third National Incidence Study, are potentially under-representative of the national prevalence of abuse and neglect, due to the fact that most abuse does not come to the attention of government authorities (Hopper, 2008).

Research in the area of childhood abuse and neglect has multiple methodological problems. Some challenges are inherent to the construct being studied. Recall of temporally distant and emotionally painful events has the potential for distortion, possibly because of repression, denial, or current mood at the time of recall (Briere, 1992). Previous attempts to capture childhood maltreatment have included chart review and structured interviews. Interviews can assess a wide range of childhood trauma but are time-consuming to administer. Consequently, many studies rely on questionnaires to determine a history of childhood abuse; however, published reports on these assessments have contained little or no data on their reliability and construct validity (Briere, 1992). Furthermore, abuse researchers have tended to overlook other forms of maltreatment that a child might experience, such as emotional or

physical neglect. A similar limitation is that many studies only analyze one type of abuse, despite the fact that physical abuse, emotional abuse, and sexual abuse frequently co-occur (Rosenberg, 1987). When studies compare "abused" versus "not abused" on a single abuse dimension, between-group differences may go undetected. Greater care in assessing a range of abusive experiences should produce results that better illuminate the effects of childhood victimization. In summary, research examining childhood abuse and neglect has been challenged by methodological constraints, and future research should consider these limitations when designing studies.

2.3 CHILDHOOD ABUSE AND NEGLECT AND CARDIOVASCULAR DISEASE

Childhood abuse and neglect have been examined as predictors of many health outcomes, but the current study will focus on outcomes related to cardiovascular disease, obesity, and central adiposity. Childhood abuse and neglect was linked to cardiovascular disease in the U.S. National Comorbidity Survey, a nationally represented sample containing over 5,000 adults (Batten, Aslan, Maciejewski, & Mazure, 2004). Results showed that women with a history of childhood sexual abuse, physical abuse, or general neglect, experienced before the age of 18, reported almost a 9-fold increase in cardiovascular disorders compared to women without a history of cardiovascular disease. Dong et al. (2004) examined data from the Adverse Childhood Experiences Study, which included 17,000 men and women, and found that when an individual experienced two forms of abuse, the likelihood of reporting ischemic heart disease increased by 20%. Childhood abuse or neglect may affect cardiovascular disease through activation of

inflammation pathways. Danese, Pariante, Caspi, Taylor, and Poulton (2007) used a prospective, longitudinal study to test the relationship between childhood maltreatment and high-sensitivity C-reactive protein. The authors found that children who experienced two or more forms of childhood maltreatment were 1.86 times more likely to have adult elevated high-sensitivity C-reactive protein (> 3 mg/L) compared to non-maltreated children.

In summary, these studies suggest that childhood abuse and neglect are risk factors for cardiovascular disease, or markers of cardiovascular disease. One notable limitation of these studies was the assessment of childhood abuse or neglect with one yes or no question, for example, ―You were physically abused as a child.‖ Studies report that questions relying on the word ―abuse,‖ rather than behaviorally specific experiences, are less effective in identifying individuals with a past history of abuse (Fricker, Smith, Davis, & Hanson, 2003; Thombs et al., 2006). Some survivors of what clinicians would clearly label abuse do not label their own experiences in that way (Hamby & Gray-Little, 2000) or some survivors desire to avoid the stigma associated with the term ―abuse‖ (Fricker, Smith, Davis, & Hanson, 2003).

2.4 CHILDHOOD ABUSE AND NEGLECT AND OBESITY

Research in the past 15 years has provided increasing evidence of an association between childhood abuse and neglect and adulthood obesity. In a prospective, population-based study examining 9-10 year old children, teacher and school nurses reported their impressions of the students‘ family structure, parental support and general hygiene (Lissau & Sorensen, 1994). Participants then had anthropometric measurements at the 10 year follow-up. After controlling

for age, sex, BMI in childhood, and measures of SES, children characterized as _dirty and neglected' had 10 times the risk of becoming obese adults compared to those with _average' childhood hygiene. Furthermore, parental neglect was more strongly associated with adulthood obesity than various measures of SES, such as parental education, occupation or neighborhood. This study's strength was its focus on an understudied childhood stressor, parental neglect. However, general hygiene was assumed to be a proxy for parental neglect and this methodology had not been tested for reliability and validity.

A retrospective cohort study examined 13,000 participants to assess the impact of childhood experiences on adult health behaviors and outcomes (Williamson, Thompson, Anda, Dietz, & Felitti, 2002). Questionnaires were used to measure four types of abuse: sexual, verbal, physical, and fear of physical abuse. All types of abuse were associated with increased weight in adulthood, even after adjusting for household dysfunction in childhood, smoking, alcohol, physical activity, education, employment status, and parity. Frequent verbal abuse and frequent physical abuse with injury were most strongly associated with increased risk of obesity in adulthood. Additional analyses showed that there was a dose-response relationship; obesity risk increased with poly-victimization and severity of abuse. The study by Williamson et al. was limited in that neglect was not assessed.

Another study examined the prevalence of childhood maltreatment in extremely obese men and women who were candidates for gastric bypass surgery (Grilo, Masheb, Brody, Toth, Burke-Martindale, & Rothschild, 2005). Childhood maltreatment was assessed using the Childhood Trauma Questionnaire (short version), which assessed emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect before the age of 18. Reports of childhood abuse or neglect were quite common in the treatment-seeking sample, with 69%

reporting at least one form of maltreatment. The rates of maltreatment reported by these extremely obese patients were roughly two to three times higher than those reported by a normative sample of adult women. Reported abuse or neglect was not associated with BMI, which may have been caused by a "restricted ceiling" (Grilo et al., 2005). This investigation used a validated and reliable questionnaire to assess childhood maltreatment. A history of abuse or neglect appeared to be prevalent among the treatment-seeking morbidly obese population, although conclusions should not be generalized to other treatment-seeking populations.

Noll and colleagues (2007) conducted a longitudinal, prospective study on the link between sexual abuse in childhood or adolescence and young adulthood obesity. Eighty-four female subjects were referred by child protective services for having experienced substantiated familial sexual abuse and were compared to a demographically similar group of non-abused peers. Abused female subjects were 2.85 times more likely to be obese by young adulthood (ages 20-27). Growth-trajectory analyses suggested that abused subjects increased BMI at a significantly steeper rate from childhood through young adulthood than did comparison female subjects after controlling for demographic variables and parity. A strength of this study was its prospective nature and a measure of obesity in young adulthood. The study was limited by only recruiting victims of sexual abuse, thereby excluding other forms of abuse and childhood neglect. Additionally, for children to be referred by child protective services for this study, they needed to have a non-abusing caregiver present, which may only represent a sub-sample of abuse victims (i.e., those who had reported and whose caregiver was available or supportive).

2.5 CHILDHOOD ABUSE AND NEGLECT AND CENTRAL ADIPOSITY

Although a multitude of studies have shown that childhood abuse and neglect are risk factors for obesity, this work has recently been extended to connect childhood abuse and neglect to central adiposity, measured by WC. Thomas, Hypponen, and Power (2008) analyzed longitudinal data from approximately 9,000 British men and women. Data analysis examined childhood abuse and neglect as predictors of WC, as well as BMI. Retrospective questions regarding childhood abuse and neglect showed that verbal abuse and physical abuse were positively associated with WC, as well as BMI. Additionally, reports of humiliation (similar to emotional abuse) and physical neglect were associated with high WC, but not BMI. Adjustment for childhood risk factors (childhood SES, birth weight, and cognitive ability) and adulthood risk factors (adulthood SES, smoking, alcohol consumption, diet, physical activity, and television viewing) reduced the significance of some associations, but physical abuse continued to predict WC. Although this study supported an association between childhood abuse and neglect and central adiposity, future work would benefit from adjusting central adiposity outcomes for overall obesity and using a standardized questionnaire to assess various types of abuse and neglect.

2.6 POTENTIAL PATHWAYS BETWEEN CHILDHOOD ABUSE/NEGLECT AND CENTRAL ADIPOSITY

Negative health behaviors and negative emotions may be two mechanisms connecting childhood abuse and central adiposity. As previously mentioned in this paper, health behaviors and emotions have been shown to correlate with central adiposity. The following review of the literature presents reports of associations between retrospective reports of childhood abuse/neglect and negative health behaviors and negative emotions in adulthood.

2.6.1 Negative health behaviors

Evidence suggests that a history of childhood abuse and neglect is associated with increased odds of developing negative health behaviors. Felitti et al. (1998) reported that when adults had a history of three or more adverse childhood experiences, they were 2.0 times more likely to be a smoker compared to adults with no adverse childhood experiences. Using the same data, Anda et al. (1999) found that adults who were verbally, physically, or sexually abused had a significantly increased odds ratio for initiating smoking at an earlier age and for being a current smoker, compared to the adults without a history of each specific abuse. Physical inactivity has also been correlated with childhood abuse/neglect. Male and female adults who had a history of three or more adverse childhood experiences were 1.4 times more likely to be physically inactive, defined as no participation in recreational physical activity in the past month (Felitti et al., 1998). Regarding dietary patterns, no studies have examined relationships between eating patterns and childhood abuse/neglect. In summary, there is some evidence to suggest that

childhood abuse and neglect may lead to increased negative health behaviors, with smoking cigarettes receiving the strongest support. This area of research is limited in that childhood neglect is understudied and the multiple forms of childhood abuse and neglect are rarely separated to differentiate connections between specific forms of abuse and negative health behaviors.

2.6.2 Negative emotions

Men and women who report abuse and neglect occurring in childhood have an increased risk of experiencing chronic negative emotions in adulthood. Depression has been the most widely studied negative emotion. Childhood abuse and neglect have been linked to depression symptoms and disorder in clinical populations (McCauley, Kern, Kolodner, Dill, Schroeder, DeChant, et al., 1997) and community samples (Kendler, Bulik, Silberg, Hettema, Myers, & Prescott, 2000; Weiss, Longhurst, & Mazure, 1999). Although the literature tends to focus on sexual abuse, several studies found a link between physical abuse and depression (Duncan, Saunders, Kilpatrick, Hanson, & Resnick, 1996; Mullen, Martin, Anderson, Romans, & Herbison, 1996) and between neglect and depression (Hill, Pickles, Burnside, Byatt, Rollinson, Davis, et al., 2001).

Most studies report associations between childhood abuse and neglect and adulthood depression, but two studies in particular tested for depression in young adulthood or adolescence. Widom and colleagues (2007) used a prospective, longitudinal design to study abused and neglected children as they progressed into young adulthood. Compared to controls, abused or neglected children, with the exception of those sexually abused, were more likely to have a

current or lifetime diagnoses of major depressive disorder in young adulthood (mean age was 28.7) and show earlier onset for major depressive disorder. The second study reported findings on adolescents. Brown and colleagues (1999) found that adolescents with a history of maltreatment were 3 times more likely to become depressed in adolescence, and those who experienced sexual abuse in particular were more vulnerable to depression.

Although research is limited, evidence hints at a relationship between child abuse/neglect and childhood aggression, anger, and hostility. Reidy (1977) found that abused children exhibited significantly more aggression than neglected and normal children in a free play environment. Additionally, being emotionally and physically abused in childhood was associated with overt and covert hostility and expressed and suppressed anger in college-aged men and women (Hoglund & Nicholas, 1995).

2.7 SUMMARY OF THE CURRENT LITERATURE

Central adiposity predicts mortality and morbidity and is an important risk factor for cardiovascular disease. Previous research shows that negative health behaviors, particularly smoking cigarettes, physical inactivity, and unhealthy dietary patterns play a role in the development and maintenance of central adiposity, independent of overall obesity. In addition to negative health behaviors, negative emotions such as depression, anxiety, anger, and cynicism have been associated with central adiposity. Childhood abuse and neglect are traumatic early-life stressors that may be risk factors for central adiposity. A history of childhood abuse and neglect has been previously associated with cardiovascular disease and obesity. Furthermore, a

recent study found a positive relationship between specific types of abuse and neglect and central adiposity. Two pathways may lead childhood abuse and neglect to predict central adiposity. The first pathway connects childhood abuse and neglect to negative health behaviors, and the negative health behaviors then put the individual at greater risk for central deposition of body fat. The second pathway links childhood abuse and neglect to psychological distress, particularly negative emotion, which then leads to central adiposity. Considering the prevalence of childhood abuse and neglect and its association with cardiovascular disease and obesity, it is important for research to understand abuse and neglect in the context of central adiposity. Furthermore, identifying the pathways that connect childhood abuse and neglect to central adiposity will add to the literature examining mechanisms between early-life stressors and negative health outcomes. A connection between childhood abuse and neglect and central adiposity would suggest the value of early prevention and intervention, identify susceptible subgroups, as well as improve understanding of the pathogenesis of central adiposity.

3.0 STATEMENT OF PURPOSE

The objective of this study was to examine the association between childhood abuse and neglect and central adiposity in a sample of Black and White women, who were part of the Study of Women's Health Across the Nation (SWAN). SWAN included a baseline measurement of women and 9 follow-up visits during which BMI and WC were assessed. We examined the association of retrospective reports of childhood abuse and neglect (assessed at visit 8) and adulthood central adiposity (assessed at visit 8), to understand associations between a history of any abuse and neglect and concurrently reported central adiposity. Furthermore, we tested the association between reports of childhood abuse and neglect and changes in central adiposity between baseline and visit 8. Another objective of this study was to investigate the predictive value of various types of abuse and neglect for concurrent and longitudinal central adiposity. Finally, the current study also explored whether poly-victimization was related to central adiposity.

To fully understand the relationship between abuse and neglect and central adiposity, primary analyses first tested the direct relationship with abuse as the independent variable and central adiposity as the outcome variable. Due to the findings in the literature that connect abuse and neglect to obesity, mentioned earlier in this paper, additional analyses tested the relationship between abuse and BMI. Follow-up analyses adjusted for BMI to understand the relationship

between abuse and central adiposity, independent of obesity. Furthermore, in order to disentangle the strong, positive correlation between BMI and WC in the present study's sample ($r = .91$, $p < .001$), associations between abuse and neglect and central adiposity were examined at various levels of BMI. Accordingly, participants were stratified into 2 groups: those with a BMI < 30 (normal weight and overweight individuals), and those with a BMI ≥ 30 (obese individuals), and associations between abuse and WC were tested in each group. Finally, the current study examined whether negative health behaviors and negative emotions mediated significant relationships between abuse/neglect and central adiposity and obesity.

4.0 HYPOTHESES

The hypotheses listed here highlight the primary hypotheses predicting the relationship between abuse/neglect and central adiposity.

H1a. Women who report a history of any abuse/neglect prior to 18 years of age will have higher central adiposity, measured at visit 8, adjusted for concurrent age.

H1b. Women with histories of emotional abuse, physical abuse, sexual abuse or physical neglect will have higher central adiposity at visit 8 than women with histories of emotional neglect, adjusted for concurrent age.

H1c. There will be a dose-response relationship such that women who reported more than one type of abuse (poly-victimization) will have greater central adiposity at visit 8 than women who reported only one type of abuse, adjusted for concurrent age.

Childhood abuse and neglect will also be examined for their association with changes in central adiposity, from baseline to visit 8. Similar to the above hypotheses, the influence of specific types of abuse/neglect and poly-victimization will be explored for associations with longitudinal central adiposity.

H2a. Women who report a history of any abuse/neglect prior to 18 years of age will have greater increases in central adiposity between baseline and visit 8, adjusted for time between WC measurements.

H2b. Women with histories of emotional abuse, physical abuse, sexual abuse or physical neglect will have greater increases in central adiposity from baseline to visit 8, compared to women with histories of emotional neglect, adjusted for time between WC measurements.

H2c. There will be a dose-response relationship, such that women who reported more than one type of abuse (poly-victimization) will have greater increases in central adiposity from baseline to visit 8, than women reporting only one type of abuse, adjusted for time between WC measurements.

Negative health behaviors have been associated with central adiposity and childhood abuse/neglect in separate bodies of literature, with a particular focus on smoking, physical inactivity, and unhealthy dietary patterns. Negative emotions have also been linked to central adiposity and childhood abuse/neglect, specifically depressive symptoms, anger, anxiety, and cynicism. The present study will evaluate whether negative health behaviors and negative emotions mediate any significant associations between childhood abuse/neglect and central adiposity. Negative health behaviors and negative emotions will first be examined for their association with childhood abuse/neglect and central adiposity, and then significant variables will be tested for mediation. Mediating variables will only be considered if they were assessed before or during visit 8.

H3a. Smoking cigarettes, physical inactivity, and an unhealthy dietary pattern measured at visits closest to visit 8 will be positively associated with a history of any childhood abuse/neglect and central adiposity measured at visit 8. The negative health behaviors will mediate the relationship between childhood abuse/neglect and central adiposity measured at visit 8, adjusted for concurrent age.

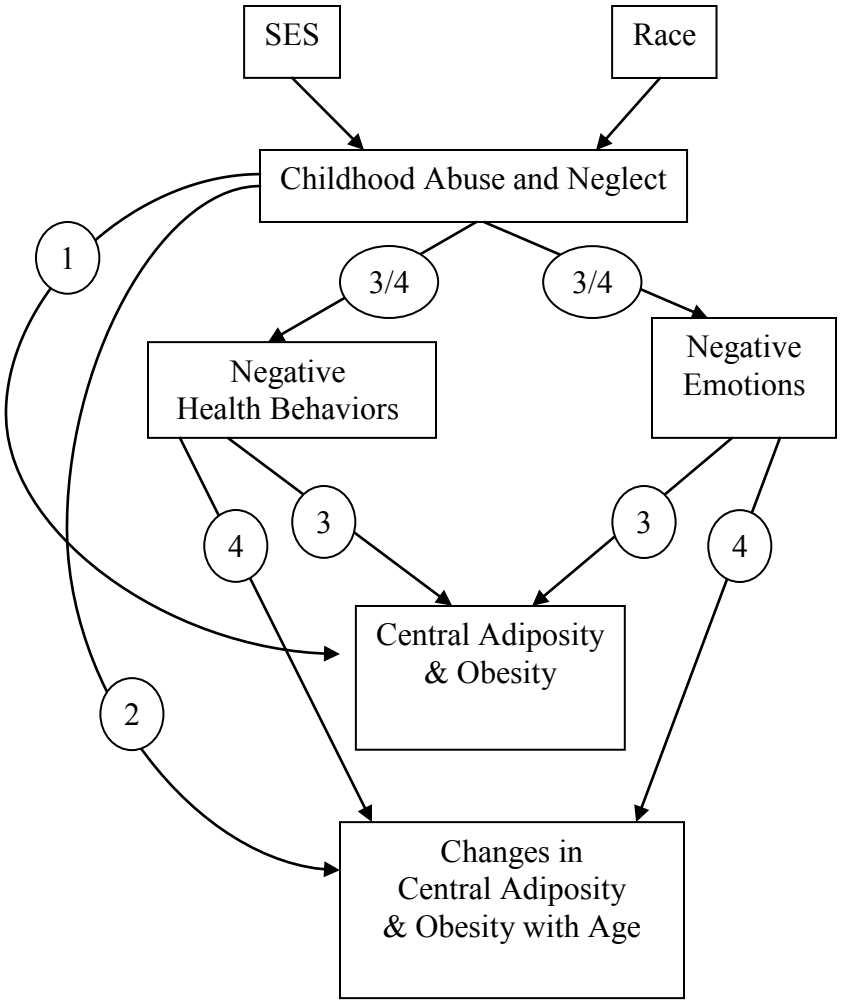
H3b. Depressive symptoms, Trait Anger, Trait Anxiety, and Cynicism measured at visits closest to visit 8 will be positively associated with childhood abuse/neglect and central adiposity measured at visit 8. The negative emotions will mediate the relationship between childhood abuse/neglect and central adiposity measured at visit 8, adjusted for concurrent age.

Negative health behaviors and negative emotions will also be tested as mediators between abuse/neglect and changes in central adiposity.

H4a. Smoking, physical inactivity, and an unhealthy dietary pattern, measured at visits closest to baseline, will mediate the relationship between childhood abuse/neglect and changes in central adiposity from baseline to visit 8, adjusted for time between WC measurements.

H4b. Depressive symptoms, Trait Anger, Trait Anxiety and Cynicism, measured closest to baseline, will mediate the relationship between childhood abuse/neglect and changes in central adiposity measured from baseline to visit 8, adjusted for time between WC measurements.

Figure 1 portrays the model indicating the suggested hypotheses and directions. For example, the number 1 in the model offers a general pictorial representation of hypotheses 1a through 1c.



Note: Numbers indicate hypotheses. SES = socioeconomic status

Figure 1. Model of the Pathways Connecting Childhood Abuse/Neglect to Central Adiposity and Obesity

5.0 METHOD

5.1 PARTICIPANTS

The present study was conducted using data from participants in the Study of Women's Health Across the Nation (SWAN), a multi-site, community-based, cohort investigation of midlife women. The sample included participants that enrolled in the Mental Health Study at the Pittsburgh SWAN site, which was designed to collect detailed mental health measures at baseline and over 9 years of follow-up visits. Participants were eligible for inclusion if they were 42 to 52 years old, premenopausal or early perimenopausal, not using hormone therapy or oral contraceptives, had not undergone a hysterectomy or bilateral oophorectomy, and not pregnant or breast-feeding. All instruments and study protocol were approved by the University of Pittsburgh Institutional Review Board, and written informed consent was obtained from all participants.

Of the 463 Pittsburgh SWAN participants eligible for the Mental Health Study, 96% enrolled (n = 443). The Mental Health Study retention rate was approximately 82% through visit 9 (n = 365). Twenty-three participants did not complete the Childhood Trauma Questionnaire (CTQ) at visit 8, leaving 342 participants that were retained in the study and completed the measure of childhood abuse and neglect. To be included in the present study, women needed to have responded to the CTQ and have anthropometric indices at visit 8, or within one year of visit

8. The final sample used in this study included 311 women (106 Black, 205 White). See Figure 2 for a flow chart of participant retention.

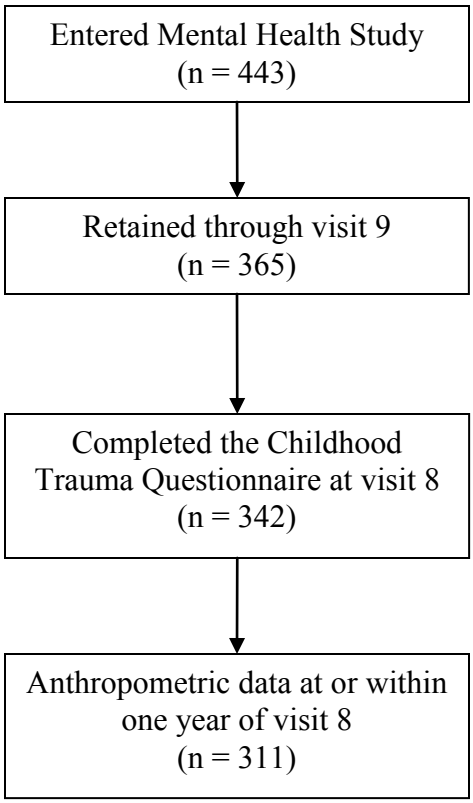


Figure 2. Flow Chart Showing the Selection of Participants

5.2 PROCEDURE

SWAN and Mental Health Study baseline assessments were conducted in 1996 and 1997. Core SWAN data from baseline through study visit 9 and Mental Health Study data from baseline through study visit 9 were available for analysis for the present study. SWAN

participants completed self-administered questionnaires, interview-administered questionnaires, and a physical examination at the SWAN baseline and annually thereafter. See Table 1 for an overview of the timing of assessments examined in the current study.

Table 1. Timing of Assessments at Baseline and 9 Follow-up Visits

	Baseline	1	2	3	4	5	6	7	8	9
WC	x	x	x	x	x	x	x	x	x	x
BMI	x	x	x	x	x	x	x	x	x	x
CTQ									x	
Smoking	x	x	x	x	x	x	x	x	x	x
Physical Activity	x			x		x	x			
Alcohol Intake	x	x	x	x	x	x	x	x	x	x
Dietary Patterns	x					x				
Depression Symptoms	x	x	x	x	x	x	x	x	x	x
Trait Anxiety					x			x		
Trait Anger								x		
Cynicism	x									
Race	x									
Adulthood SES	x									

Childhood SES								x		
Menopausal Status	x	x	x	x	x	x	x	x	x	x

Note. WC = Waist circumference; BMI = Body mass index; CTQ = Childhood Trauma Questionnaire; SES = Socioeconomic status.

5.3 MEASURES

5.3.1 Anthropometric Indices

Standardized protocols were used to measure weight, height, and waist circumference. WC was measured in centimeters at the level of the natural waist, defined as the narrowest part of the torso as seen from the anterior aspect. In cases where a waist narrowing was difficult to identify, the measurement was taken at the smallest horizontal circumference in the area between the ribs and the iliac crest. Weight was measured without shoes, and in light indoor clothing, using a portable digital scale or a balance beam scale, depending on location of the visit. Portable scales were calibrated weekly and stationary clinic scales were calibrated monthly. Height was measured without shoes using either a metric folding wooden ruler, measuring tape, or a fixed stadiometer, depending on location of the visit. BMI was calculated as weight (kg)/height (m2). Both WC and BMI were measured during the baseline and 9 annual SWAN examinations. There was a high correlation between visit 8 WC and BMI ($r = .91$, $p < .001$). Concurrent analyses used WC or BMI from visit 8; however, if visit 8 data was missing, then a measurement from visit 7 was used first, or else data from visit 9. Additionally, longitudinal WC and BMI were computed as the change score, or the difference, between baseline and visit 8.

5.3.2 Childhood Abuse and Neglect

Childhood abuse and neglect were assessed using the 28-item short form of the Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1998), a self-report instrument that assesses emotional abuse (5 items), physical abuse (5 items), sexual abuse (5 items), emotional neglect (5 items), and physical neglect (5 items). Subjects rated statements about childhood experiences on five-point Likert-type scales (―never true" to ―very often true"). Most items were phrased in objective and behavioral terms (e.g., ―When I was growing up, someone touched me in a sexual way or made me touch them"), whereas some items required subjective evaluation (e.g., ―When I was growing up, I believe I was sexually abused"). Abuse/neglect items were summed to yield scores on five subscales (emotional abuse, physical abuse, emotional neglect, physical neglect, and sexual abuse) with scores ranging from 5 to 25. Clinical cut-off points have been validated and have sensitivity and specificity at 0.85 or higher relative to clinical interview (therapists' ratings of childhood maltreatment) (Bernstein & Fink, 1998; Berstein, Stein, Newcomb, Walker, Pogge, Ahluvalia, et al., 2003; Walker, Gelfand, Katon, Koss, Von Korff, Bernstein et al., 1999). Scores for each scale that were at or above these thresholds were classified as positive for abuse or neglect: emotional abuse = 10, physical abuse = 8, sexual abuse = 8, emotional neglect = 15, and physical neglect = 8. If scoring at or above the clinical threshold on any one subscale, individuals were classified as having been exposed to any abuse or neglect. If scoring below all clinical cut-off points, an individual was classified as not exposed to abuse or neglect. To measure poly-victimization, types of abuse or neglect experienced within the five domains were summed for each participant; therefore, poly-victimization represents a range from 0 to 5. To reduce skew in the distribution, poly-

victimization was categorized into three groups: women reporting no abuse, women reporting one type of abuse, and women reporting two or more types of abuse.

The CTQ has strong test-retest reliability and convergent validity with clinical interview and therapist ratings (Bernstein, Fink, Handelsman, Foote, Lovejoy, Wenzel et al., 1994; Bernstein et al., 2003). See Appendix B for a detailed report on validity and reliability findings. Responses from SWAN participants showed that the CTQ had strong internal consistency, Cronbach's $\alpha = 0.74\text{-}0.95$ for the subscales in this investigation.

5.3.3 Negative Health Behaviors

5.3.3.1 Cigarette Smoking

Cigarette smoking was assessed by response to the item, "Since your last study visit, have you smoked cigarettes regularly (at least one cigarette a day)?" A positive or negative response to this item indicated current smoking status. Individuals answering "no" to the current smoking status question were the referent group. Smoking status was measured at baseline and at every follow-up visit.

5.3.3.2 Physical Inactivity

Physical activity questions were adapted from the Kaiser Physical Activity Survey, which was originally adapted from the Baecke physical activity questionnaire (Sternfeld, Ainsworth, & Quesenberry, 1999; Baecke, Burema, & Frijters, 1982), and assessed physical activity in three domains: 1) household and care giving, 2) sports and exercise, and 3) work activities. The time frame for the activity assessment was the past year. Physical activity was a summary score of

hours spent in leisure activity per week, which does not include work activity. The scale was reverse coded so that high scores indicated greater physical inactivity (less physical activity). The Physical Activity Survey was given at baseline, visit 3, visit 5, and visit 6.

5.3.3.3 Unhealthy Dietary Patterns

Unhealthy dietary patterns were measured using the Food Frequency Questionnaire (Block et al., 1986). The core food list included 103 items covering 90% of population nutrient intake of each nutrient. Participants reported their frequency of consumption of a given serving of each food item during the previous year on a daily (e.g. bread), weekly (e.g. rice, meat), or monthly (e.g. fish) basis. An unhealthy dietary pattern was operationalized by a combination of the following variables: servings of fruits and vegetables per day, grams of saturated fat per day, and grams of dietary fiber per day. Servings of fruits and vegetables and grams of dietary fiber were reverse coded so that a high score on the composite variable indicated an unhealthy dietary pattern. A summary score was created by standardizing the scores based on sample distribution and averaging. Thus, high scores on the unhealthy dietary pattern variable indicated high grams of saturated fat, low servings of fruits and vegetables, and low grams of dietary fiber. Participants responded to the Food Frequency Questionnaire at the baseline assessment and at visit 5.

5.3.4 Negative Emotions

5.3.4.1 Depressive Symptoms

Depressive symptoms were assessed by the Center for Epidemiological Studies Depression scale (CES-D) (Radloff, 1977). This is a 20-item scale measuring depressive symptoms with four-level responses indicating frequency of experiencing each symptom in the past week. Scores ranged from 0 to 60 and the continuous scale was used in the current study. The CES-D has well-established reliability (Cronbach's alpha=.85) and has been shown to correlate well with other depressive symptom questionnaires and with interview assessments of severity of depression (Fechner-Bates, Coyne, & Schwenk, 1994). The CES-D was given at baseline and all follow-up visits.

5.3.4.2 Trait Anger

Participants completed the Trait Anger scale of the State-Trait Personality Inventory (Spielberger, Jacobs, Russell, & Crane, 1983). The Spielberger Trait Anger scale contains 10 statements concerning the frequency with which the emotion of anger is experienced. Example items reflecting Trait Anger are, "I am quick-tempered" and "I feel infuriated when I do a job and get a poor evaluation." Each statement was rated on a four-point scale ranging from almost never to almost always felt. Trait Anger was assessed at visit 7.

5.3.4.3 Trait Anxiety

Anxiety was measured by the Trait Anxiety scale of the State-Trait Personality Inventory (Spielberger, Gorsuch, & Lushene, 1970). Participants were asked to respond to 10

items on the basis of how they generally feel. Example Trait Anxiety items are "I feel nervous and restless" and "I am a steady person." Items were scored on a four-point scale ranging from 1 (not at all like me) to 4 (a lot like me). High scores reflected high levels of anxiety. The State-Trait Anxiety Inventory has high internal consistency (.86-.95) and good test-retest reliability (.64-.86) (Spielberger et al, 1970). Trait Anxiety was measured at baseline and at visit 4.

5.3.4.4 Cynicism

Cynicism was assessed using 13 true/false items derived from the Cook-Medley Hostility Scale (Barefoot, Dodge, Peterson, Dahlstrom, & Williams, 1989; Cook & Medley, 1954), which measures cynical attitudes and hostile feelings and behaviors. Scores could range from 0 to 13; higher scores indicated greater cynicism. This scale has been shown to predict visceral adipose tissue in healthy postmenopausal women (Räikkönen et al, 1999b). Cynicism was measured at baseline.

5.3.5 Potential Covariates

Concurrent analyses adjusted for age at the time of WC measurement. Longitudinal analyses controlled for the time between the longitudinal assessments in order to adjust for WC measurements taken at visits other than visit 8. Race and childhood SES were explored for their correlations with childhood abuse and neglect, due to statistics reporting that abuse and neglect are more common among African-American women and those of low SES status (Administration on Children and Families, 2006; Finkelhor et al., 2007; Connell et al., 2007).

The following covariates were considered for inclusion in analyses: race, adulthood SES, childhood SES, and menopausal status. Race/ethnicity was self-identified as Caucasian or African American during the baseline SWAN interview. Adulthood SES was a measure of the highest grade completed by the participant, assessed at baseline. Childhood SES, indicated by level of education achieved by each parent, was measured at visit 7 and included: less than high school, high school degree or GED, technical or vocational school, some college, college degree, and postgraduate. Menopause status was determined from self-reported bleeding patterns over the year preceding each visit and was organized into the following categories: surgical menopause, postmenopause, late perimenopause, early perimenopause, premenopause, pregnancy, and hormone replacement therapy when pre or perimenopausal.

5.4 ANALYTIC PLAN

T-tests examined for differences between participants who completed the CTQ and those who did not, thereby being excluded from further analyses. Covariates were chosen based on significant associations with childhood abuse/neglect and WC, and associations were examined using t-tests, chi-square analyses, and correlations.

Hypotheses 1a and 1b were tested using Analysis of Covariance (ANCOVA, 2 groups, yes/no any abuse or yes/no abuse type) with the outcome variable of WC at visit 8, or within one year of visit 8. Hypothesis 1c was examined with an ANCOVA (3 groups; no abuse, one type of abuse, two or more types of abuse) to test for a significant relationship and an overall linear trend between poly-victimization and concurrent WC.

Hypotheses 2a and 2b were examined using ANCOVAs (2 groups, yes/no any abuse or yes/no abuse type) with the change score for WC as the outcome variable. Hypothesis 2c was examined with an ANCOVA (3 groups; no abuse, one type of abuse, two or more types of abuse) to test for a significant and an overall linear trend between poly-victimization and changes in WC.

In order to determine mediators, point-biserial correlations examined the association among childhood abuse/neglect, negative health behaviors, negative emotions, and WC. A negative health behavior or negative emotion was considered for mediation if it was significantly correlated to both an abuse variable and WC ($p < .10$). If most or all negative health behaviors were significantly related to the predictor and outcome variables, then a composite score was devised by standardizing each component and averaging, in order to devise a negative health behaviors construct. If only one or two negative health behaviors were significantly related to the predictor and outcome variables, then the significant behaviors were tested individually as mediators. Negative emotions were also considered as a summary score if applicable.

Only relationships that were significant from hypotheses 1a through 1c were tested for mediators. To understand if negative health behaviors or negative emotions mediated the relationship between childhood abuse/neglect and central adiposity, the Sobel test (Sobel, 1982) was used, which determined the size and significance of the indirect effect. The indirect effect was defined as the product of the following two paths: the childhood abuse/neglect to negative health behaviors path and the negative health behaviors to concurrent central adiposity path. An alternative indirect path was represented by childhood abuse/neglect leading to negative emotions, and negative emotions leading to concurrent central adiposity. A significance test of the indirect effect addresses mediation more directly than a series of separate significant tests not

involving the indirect effect, as in the Baron and Kenny method (Baron & Kenny, 1986). Furthermore, the Baron and Kenny method suffers from low statistical power (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). The Sobel test directly addresses the primary question—whether or not the total effect of childhood abuse/neglect on central adiposity was significantly reduced upon the addition of negative health behaviors (or negative emotions) in the model. After the indirect effect was computed, it was divided by the standard error to yield a critical ratio. This critical ratio was then compared to traditional critical values from the standard normal distribution appropriate for a given alpha level (Preacher & Hayes, 2004). Mediation pathways for hypotheses 4a and 4b followed the same analytic plan as for 3a and 3b, but with the outcome variable of changes in WC.

For mediation analyses, contrast codes were used to describe the categorical variable of poly-victimization. In the first group, results compared the means of women reporting two or more types of abuse to women reporting one type of abuse. The second group compared the mean of women reporting two or more types of abuse to the mean in the combined group of women reporting one type of abuse and women reporting no abuse.

Primary analyses tested the direct relationship with abuse as the independent variable and WC (concurrent or longitudinal) as the outcome variable. Additional results were reported for analyses that adjusted for BMI, analyses with BMI as the outcome variable, and analyses predicting WC at varying levels of BMI: those with a BMI < 30 (normal weight and overweight individuals), and those with a BMI ≥ 30 (obese individuals).

6.0 RESULTS

6.1 PARTICIPANT CHARACTERISTICS

Thirty-six percent (n=112) of the sample reported experiencing some form of childhood abuse or neglect. Table 2 shows the number of participants reporting each type of abuse/neglect, as well as a breakdown of types of abuse and neglect by race. Analyses showed that Blacks experienced significantly more physical abuse than did Whites ($\chi^2 = 15.49$, $p < .001$); however, there was not a significant difference for a history of any childhood abuse/neglect, poly-victimization, or other types of abuse/neglect between Whites and Blacks (ps > .22).

Comparisons of baseline characteristics between the 342 participants that completed the CTQ questionnaire and the 101 non-participants showed no differences in race, WC, BMI, age, Trait Anxiety, Trait Anger, and adulthood SES. At baseline, the non-participants had significantly higher depressive symptoms, $t(441) = 2.29$, $p = .02$, higher cynicism, $t(429) = 2.01$, $p = .05$, and were later in the menopausal transition, $t(441) = -2.48$, $p = .01$, than participants who completed the CTQ.

To identify covariates, t-tests or chi-square tests were conducted to examine group differences between those that reported abuse and those reporting no abuse (see Table 3). Only WC and BMI were significantly different between groups, such that women reporting any abuse/neglect had higher WC and BMI at baseline and visit 8, compared to women reporting no

abuse/neglect. Table 4 shows correlations between suggested covariates and anthropometric indices. WC and BMI at visit 8 were higher for Blacks and for women with fathers with lower education. Women who were premenopausal at baseline, as opposed to perimenopausal, had greater increases in WC and BMI over time. Due to significant findings, race and menopausal status were considered as covariates and their influences are noted in the subsequent analyses. Table 5 shows group differences between Whites and Blacks for most study variables. Blacks experienced significantly more depressive symptoms and Cynicism at baseline. Additionally, Blacks were more physically inactive, ate more grams of saturated fat per day than Whites, were more likely to be smokers, and had higher concurrent WC and BMI than Whites.

Table 2. Descriptive Statistics for Types of Abuse in the Full Sample (N = 311)

	N (%) of Total Sample	N (%) of Blacks	N (%) of Whites
Yes to any childhood abuse/neglect	112 (36.0%)	43 (40.6%)	69 (33.7%)
Emotional abuse	61 (19.6%)	18 (17.0%)	43 (21.0%)
Physical abuse [a]	52 (16.7%)	30 (28.3%)	22 (10.7%)
Sexual abuse	44 (14.1%)	18 (17.0%)	26 (12.7%)
Emotional neglect	20 (6.4%)	5 (4.7%)	15 (7.3%)
Physical neglect	43 (14.8%)	16 (15.1%)	27 (13.2%)
Poly-victimization (2 or more abuse types)	56 (18.0%)	23 (21.7%)	33 (16.1%)

[a] Blacks reported more physical abuse than Whites ($\chi^2 = 15.49$, $p < .001$).

Table 3. Sample Characteristics

	Abuse or Neglect		
	Any	None	Significance
N	112	199	
Age at baseline – mean (*SD*)	45.7 (2.5)	45.7 (2.5)	$t(309) = -.19$, $p = .88$
% Black (n)	38.4 (43)	31.7 (63)	$\chi^2 = 1.45$, $p = .23$
Highest grade completed by participant – mean (*SD*)	15.4 (2.2)	14.9 (2.2)	$t(309) = -1.59$, $p = .11$
Parental Education			
% Mothers with Some College or Greater (n)	23.9 (26)	20.7 (40)	$\chi^2 = 8.54$, $p = .13$
% Fathers with Some College or Greater (n)	37.1 (39)	29.4 (57)	$\chi^2 = 4.99$, $p = .42$
Menopause Status at baseline			$\chi^2 = .80$, $p = .37$
% Premenopause (n)	53.6 (60)	58.8 (117)	
Menopause Status at visit 8			$\chi^2 = 1.34$, $p = .93$
% Postmenopause (n)	59.8 (67)	56.3 (112)	
WC (cm) - mean (*SD*)			
Baseline	90.3 (15.6)	86.0 (14.7)	$t(308) = -2.41$, $p = .02$
Visit 8	96.1 (15.7)	90.8 (16.6)	$t(309) = -2.8$, $p < .01$
BMI - mean (*SD*)			

Baseline	29.8 (6.7)	28.0 (6.0)	$t(309) = -2.50$, $p = .01$
Visit 8	31.4 (6.0)	29.1 (6.4)	$t(309) = -3.0$, $p < .01$

Note. SD = standard deviation; WC = waist circumference; BMI = body mass index.

Table 4. Pearson or Point-biserial Correlations between Covariates and Anthropometric Indices

	WC at visit 8	BMI at visit 8	Changes in WC from baseline to visit 8	Changes in BMI from baseline to visit 8
Age at baseline	.05	.06	.01	-.04
Race	.24***	.29***	-.02	.01
Adulthood SES	-.04	-.01	.02	.06
Maternal education	.01	-.003	.05	.05
Paternal education	-.10*	-.09	.03	.01
Menopause status at baseline	-.02	-.02	.09*	.16***
Menopause status at visit 8	.06	.09	-.01	.01

Note: WC = waist circumference; BMI = body mass index; SES = socioeconomic status.
* $p \leq .10$ (2-tailed).
** $p \leq .05$ (2-tailed).
*** $p \leq .01$ (2-tailed).

Table 5. Sample Characteristics by Race (N = 311)

	Race		
	White	Black	Significance
N	205	106	
Age at baseline – mean (*SD*)	45.8 (2.6)	45.4 (2.3)	$t(309) = 1.52$, $p = .13$
Highest grade completed by participant – mean (*SD*)	15.2 (2.2)	14.9 (2.3)	$t(309) = 1.32$, $p = .19$
Parental Education			
% Mothers with Some College or Greater (n)	29.9 (60)	31.7 (32)	$\chi^2 = 1.50$, $p = .91$
% Fathers with Some College or Greater (n)	43.8 (88)	33.7 (33)	$\chi^2 = 8.73$, $p = .12$
Menopause Status at baseline			$\chi^2 = .29$, $p = .59$
% Premenopause (n)	57.9 (117)	54.7 (58)	
WC (cm) - mean (*SD*)			
Baseline	84.7 (14.4)	93.2 (14.9)	$t(308) = -4.84$, $p < .01$
Concurrent (visit 8)	89.9 (15.6)	98.2 (16.8)	$t(309) = -4.35$, $p < .01$
Longitudinal (change between baseline to visit 8)	5.2 (7.5)	4.9 (8.6)	$t(308) = .29$, $p = .77$
BMI - mean (*SD*)			
Baseline	27.3 (5.7)	31.1 (6.7)	$t(309) = -5.21$, $p < .01$

Concurrent (visit 8)	28.6 (5.8)	32.5 (6.6)	$t(309) = -5.29$, $p < .01$
Longitudinal (change between baseline to visit 8)	1.3 (2.6)	1.3 (3.1)	$t(309) = -.25$, $p = .81$
CESD at baseline – mean (*SD*)	9.1 (7.7)	11.8 (9.7)	$t(309) = -2.70$, $p < .01$
Trait Anger at visit 7 – mean (*SD*)	14.1 (3.7)	14.2 (3.9)	$t(295) = -.17$, $p = .87$
Trait Anxiety at visit 4 – mean (*SD*)	15.8 (4.8)	16.1 (4.5)	$t(296) = -.38$, $p = .71$
Cynicism at baseline – mean (*SD*)	3.1 (2.6)	4.6 (2.9)	$t(302) = -2.31$, $p = .02$
% Current Smoker at baseline (n)	13.2 (27)	22.1 (23)	$\chi^2 = 4.07$, $p = .04$
Physical Inactivity at baseline – mean (*SD*)	4.8 (1.6)	5.6 (1.5)	$t(307) = -3.99$, $p < .01$
Daily dietary grams of saturated fat at baseline– mean (*SD*)	21.8 (10.9)	25.3 (13.0)	$t(309) = -2.51$, $p = .01$
Daily servings of fruits and vegetables at baseline – mean (*SD*)	3.1 (1.7)	3.0 (2.1)	$t(309) = .57$, $p = .57$
Daily dietary grams of fiber at baseline – mean (*SD*)	12.1 (5.1)	12.3 (7.6)	$t(309) = -.29$, $p = .77$

Note. SD = Standard deviation. WC = Waist circumference; BMI = Body mass index; CESD = Center for Epidemiological Studies Depression scale.

6.2 ABUSE/NEGLECT AND CONCURRENT ANTHROPOMETRIC INDICES

6.2.1 Hypothesis 1a

Table 6 shows that women who reported any abuse/neglect in childhood had higher WC at visit 8. Women who reported any abuse/neglect in childhood had higher BMI as well (Table 7). When analyses for WC were adjusted for concurrent BMI, there were no significant associations between any abuse/neglect and WC. Among women with BMI < 30 (n = 172), however, women who reported any abuse/neglect had higher WC; among women with BMI ≥ 30 (n = 139), no significant relationship was observed. After adjustments for race and menopausal status at visit 8, any abuse/neglect remained associated with WC, BMI, and WC when BMI < 30.

6.2.2 Hypothesis 1b

Participants who reported physical abuse had significantly higher WC measurements than those reporting no physical abuse (Table 6). Controlling for race and menopause status at visit 8 reduced the association to a trend ($F(1,306) = 2.84$, $p = .09$), but there was not a significant interaction between race and physical abuse ($\beta = -.01$, $p = .89$). Other types of abuse or neglect were not significantly associated with WC at visit 8. The association between physical abuse and concurrent WC became non-significant when adjusting for BMI. Table 7 shows relationships between types of abuse/neglect and BMI; specifically, women who reported physical abuse or sexual abuse had higher BMI than woman reporting no physical abuse or

sexual abuse. After adjustments for race and menopausal status at visit 8, physical abuse and sexual abuse remained associated with BMI. ANCOVAs showed that women with BMI < 30, who had experienced emotional abuse or sexual abuse, had significantly higher WC than woman who reported no history of emotional abuse or sexual abuse. No significant effects were found in participants with BMI ≥ 30. Adjustments for race and menopausal status did not affect associations between emotional abuse and sexual abuse and WC in the low BMI group.

6.2.3 Hypothesis 1c

ANCOVA results showed a significant relationship between poly-victimization and concurrent WC. There was a significant relationship and a significant linear trend ($F(1, 308) = 4.55$, $p = .03$) and quadratic trend ($F(1, 308) = 4.15$, $p = .04$) between the number of types of abuse reported and WC for each group (see Table 6 for group means). Specifically, women that reported no abuse had the lowest WC, those reporting one type of abuse had the highest WC, and women reporting two or more types of abuse had WC measurements between the other two groups. When analyses for WC adjusted for BMI at visit 8, poly-victimization was not associated with WC. There was a significant relationship and linear trend ($F(1, 308) = 6.25$, $p = .01$), as well as a marginal quadratic trend in ($F(1, 308) = 3.23$, $p = .07$) between poly-victimization and mean BMI for each group, see Table 7. Table 7 also shows results from ANCOVAs for WC stratified by BMI groups, which showed that the relationship between poly-victimization and WC was significant when BMI < 30, and there was a linear trend ($F(1, 169) = 6.59$, $p = .01$). Poly-victimization and concurrent WC was not significant in the obese individuals (BMI ≥ 30). Controlling for race and menopause status at visit 8 did not reduce

significant relationships for concurrent WC and BMI. However, these adjustments did reduce the relationship between poly-victimization and WC in the lower BMI group to a marginal association ($F(2, 166) = 2.90$, $p = .06$).

Table 6. Estimated Marginal Means (Standard Errors) and F Values from ANCOVAs Examining Abuse/Neglect Status and Concurrent WC

	Concurrent WC, adjusted for age		Concurrent WC, adjusted for age and BMI	
	Mean (*SE*)	Sig.	Mean (*SE*)	Sig.
No Abuse/Neglect	90.8 (1.2)	$F = 7.70$, $p = .01$	92.7 (.5)	$F = .004$, $p = .95$
Yes Abuse/ Neglect	96.1 (1.5)		92.7 (.7)	
No Abuse/ Neglect	90.8 (1.2)		92.7 (.5)	
1 type of Abuse/Neglect	97.6 (2.2)	$F = 4.30$, $p = .01$	93.4 (.9)	$F = .51$, $p = .60$
2 or more types Abuse/Neg	94.7 (2.2)		92.1 (.9)	
No Emotional Abuse	92.0 (1.0)	$F = 2.30$, $p = .13$	92.6 (.4)	$F = .50$, $p = .48$
Yes Emotional Abuse	95.6 (2.1)		93.3 (.9)	
No Physical Abuse	91.7 (1.0)	$F = 6.21$, $p = .01$	93.0 (.4)	$F = 2.16$, $p = .14$
Yes Physical Abuse	97.9 (2.3)		91.4 (1.0)	
No Sexual Abuse	92.0 (1.0)	$F = 3.48$, $p = .06$	92.9 (.4)	$F = .97$, $p = .33$

Yes Sexual Abuse	97.0 (2.5)		91.8 (1.0)	
No Emotional Neglect	92.6 (1.0)		92.5 (.4)	
		$F = .22$, $p = .64$		$F = 2.97$, $p = .09$
Yes Emotional Neglect	94.4 (3.7)		95.2 (1.5)	
No Physical Neglect	92.6 (1.0)		92.7 (.4)	
		$F = .11$, $p = .74$		$F = .11$, $p = .74$
Yes Physical Neglect	93.5 (2.5)		93.0 (1.0)	

Note: BMI = body mass index; WC = waist circumference.

Table 7. Estimated Marginal Means (Standard Errors) and F Values from ANCOVAs Examining Abuse/Neglect Status and Concurrent BMI, or Abuse/Neglect Status and Concurrent WC Stratified by BMI

	Concurrent BMI, adjusted for age		Concurrent WC, adjusted for age			
			BMI < 30		BMI ≥ 30	
	Mean (*SE*)	Sig.	Mean (*SE*)	Sig.	Mean (*SE*)	Sig.
No Abuse/Neglect	29.1 (.4)	$F = 9.16, p < .01$	80.8 (.9)	$F = 7.07, p = .01$	105.8 (1.5)	$F = 0, p = .99$
Yes Abuse/ Neglect	31.4 (.6)		85.0 (1.3)		105.8 (1.8)	
No Abuse/ Neglect	29.1 (.4)		80.8 (.9)		105.8 (1.5)	
1 type of Abuse/Neglect	31.7 (.8)	$F = 4.74, p = .01$	84.7 (1.8)	$F = 3.55, p = .03$	109.9 (2.5)	$F = 2.54, p = .08$
2 or more types Abuse/Neg	31.0 (.8)		85.4 (1.9)		102.0 (2.4)	
No Emotional Abuse	29.7 (.4)	$F = 1.81, p = .18$	81.4 (.8)	$F = 4.38, p = .04$	106.1 (1.3)	$F = .29, p = .63$
Yes Emotional Abuse	30.9 (.8)		85.5 (1.8)		104.8 (2.4)	
No Physical Abuse	29.4 (.4)	$F = 11.72, p < .01$	81.9 (.8)	$F = .54, p = .47$	106.0 (1.3)	$F = .10, p = .76$
Yes Physical Abuse	32.6 (.9)		83.7 (2.3)		105.2 (2.4)	

No Sexual Abuse	29.6 (.4)		81.5 (.8)	$F = 5.90$, $p = .02$	106.1 (1.3)	
		$F = 6.27$, $p = .01$				$F = .35$, $p = .56$
Yes Sexual Abuse	32.2 (1.0)		87.1 (2.2)		104.4 (2.7)	
No Emotional Neglect	29.9 (.4)		81.8 (.7)		106.2 (1.2)	
		$F = .07$, $p = .80$		$F = 2.68$, $p = .10$		$F = .81$, $p = .37$
Yes Emotional Neglect	29.6 (1.4)		86.9 (3.0)		102.2 (4.3)	
No Physical Neglect	29.9 (.4)		81.7 (.8)		106.6 (1.2)	
		$F = .05$, $p = .83$		$F = 2.38$, $p = .12$		$F = 2.64$, $p = .11$
Yes Physical Neglect	30.1 (1.0)		85.1 (2.1)		101.5 (2.9)	

Note: BMI = body mass index; WC = waist circumference.

6.3 ABUSE/NEGLECT AND LONGITUDINAL ANTHROPOMETRIC INDICES

6.3.1 Hypothesis 2a

Results suggested that women with any childhood abuse/neglect did not have significantly greater increases in WC than women with no history of abuse/neglect (Table 8). Furthermore, any abuse/neglect was not significantly associated with longitudinal BMI (Table 9). Table 9 shows that women with baseline BMI < 30 (n = 202) and any childhood abuse/neglect had significantly greater increases in WC over time. The association was non-significant for women with baseline BMI ≥ 30 (n = 109). After adjustments for race and menopausal status at baseline, any abuse/neglect remained associated with longitudinal WC, when BMI < 30.

6.3.2 Hypothesis 2b

Table 8 displays ANCOVA results showing that there were no significant associations between specific types of abuse or neglect and longitudinal WC or longitudinal BMI. With regard to separating groups on BMI, ANCOVAs showed that women with baseline BMI < 30 had significant relationship between types of abuse and longitudinal WC (Table 9). Women who reported any of the specific types of abuse and neglect, with the exception of emotional neglect, had greater increases in WC over time. After adjustments for race and baseline menopausal status, specific types of abuse (emotional abuse, sexual abuse, physical abuse, physical neglect)

remained significant with WC when BMI < 30. There were also significant relationships in the BMI ≥ 30 group; specifically, obese women who reported sexual abuse had greater declines in WC than women reporting no history of sexual abuse. Relationships in women with BMI ≥ 30 remained significant after controlling for race and menopausal status at baseline.

6.3.3 Hypothesis 2c

Results showed a non-significant association between poly-victimization and longitudinal WC (Table 8). ANCOVAs also showed that poly-victimization was not significantly associated with greater increases in BMI (Table 9). Among women with BMI < 30, however, results suggested that there was a significant and a linear relationship ($F(1, 198) = 16.43$, $p < .001$) between poly-victimization and longitudinal WC. Thus, normal-weight and overweight women reporting two or more types of abuse had greater increases in WC over time than women who reported a history of one type of abuse and women who reported no abuse, see Table 9. Poly-victimization and longitudinal WC was significant when BMI ≥ 30, but in the opposite direction. Controlling for race and menopause status at baseline did not reduce associations for either BMI group.

Table 8. Estimated Marginal Means (Standard Errors) and F Values from ANCOVAs Examining Abuse/Neglect Status and WC Change Scores (Baseline to Visit 8)

	Δ WC, adjusted for time between measurements		Δ WC, adjusted for time between measurements and Δ BMI	
	Mean (*SE*)	Sig.	Mean (*SE*)	Sig.
No Abuse/Neglect	4.66 (.56)		5.00 (.35)	
		$F = 1.42, p = .24$		$F = .11, p = .74$
Yes Abuse/ Neglect	5.78 (.75)		5.19 (.47)	
No Abuse/ Neglect	4.66 (.56)		5.00 (.35)	
1 type of Abuse/Neglect	6.12 (1.06)	$F = .81, p = .45$	5.51 (.662)	$F = .29, p = .75$
2 or more types Abuse/Neg	5.44 (1.06)		4.87 (.66)	
No Emotional Abuse	4.65 (.50)		4.88 (.31)	
		$F = 3.53, p = .06$		$F = 1.68, p = .20$
Yes Emotional Abuse	6.78 (1.01)		5.81 (.64)	
No Physical Abuse	5.16 (.49)		5.23 (.31)	
		$F = .20, p = .66$		$F = 1.77, p = .19$
Yes Physical Abuse	4.63 (1.10)		4.24 (.68)	
No Sexual Abuse	5.16 (.49)	$F = .23, p = .64$	5.05 (.30)	$F = .03, p = .89$

Yes Sexual Abuse	4.54 (1.20)		5.19 (.75)	
No Emotional Neglect	4.85 (.46)	$F = 3.07$, $p = .08$	4.97 (.29)	$F = 1.31$, $p = .25$
Yes Emotional Neglect	8.04 (1.76)		6.28 (1.11)	
No Physical Neglect	4.92 (.48)	$F = .65$, $p = .42$	5.04 (.30)	$F = .05$, $p = .82$
Yes Physical Neglect	5.97 (1.21)		5.23 (.76)	

Note: BMI = body mass index; WC = waist circumference.

Table 9. Estimated Marginal Means (Standard Errors) and F Values from ANCOVAs Examining Abuse/Neglect Status and BMI Change Score (Baseline to Visit 8), or Abuse/Neglect Status and WC Change Score, Stratified by BMI

	Δ BMI, adjusted for time between measurements		Δ WC, adjusted for time between measurements			
			Baseline BMI < 30		Baseline BMI ≥ 30	
	Mean (SE)	Sig.	Mean (SE)	Sig.	Mean (SE)	Sig.
No Abuse/Neglect	1.14 (.20)	*F*=1.48, *p*=.22	4.43 (.60)	*F*=13.80, *p*<.00	5.16 (1.14)	*F*=2.75, *p*=.10
Yes Abuse/ Neglect	1.55 (.27)		8.34 (.87)		2. 26 (1.31)	
No Abuse/ Neglect	1.14 (.20)		4.43 (.60)		5.19 (1.11)	
1 type oF Abuse/Neglect	1.56 (.38)	*F*=.74, *p*=.48	6.75 (1.25)	*F*=8.52, *p*<.00	5.29 (1.74)	*F*=4.75, *p*=.01
2 or more types Abuse/Neg	1.52 (.38)		9.78 (1.19)		-1.27 (1.88)	
No Emotional Abuse	1.18 (.18)	*F*=1.79, *p*=.18	4.73 (.55)	*F*=15.78, *p*<.00	4.48 (.96)	*F*=1.70, *p*=.20
Yes Emotional Abuse	1.73 (.36)		9.68 (1.12)		1.66 (1.93)	
No Physical Abuse	1.26 (.18)	*F*=.22, *p*=.64	5.31 (.54)	*F*=4.37, *p*=.04	4.79 (.99)	*F*=2.99, *p*=.09

Yes Physical Abuse	1.46 (.39)		8.54 (1.45)		1.37 (1.70)	
No Sexual Abuse	1.34 (.17)		5.14 (.53)		5.18 (.91)	
		F=.60, p=.44		F=9.11, p<.01		F=10.41, p<.01
Yes Sexual Abuse	.99 (.43)		9.80 (1.45)		-1.73 (1.93)	
No Emotional Neglect	1.23 (.17)		5.42 (.52)	F=3.59, p=.06	3.83 (.89)	
		F=1.72, p=.19				F=.13, p=.72
Yes Emotional Neglect	2.09 (.63)		9.18 (1.91)		5.21 (3.69)	
No Physical Neglect	1.24 (.17)		5.25 (.54)		4.33 (.92)	
		F=.69, p=.41		F=4.69, p=.03		F=1.65, p=.20
Yes Physical Neglect	1.62 (.43)		8.35 (1.32)		1.03 (2.40)	

Note: BMI = body mass index; WC = waist circumference.

6.4 MEDIATORS BETWEEN ABUSE AND ANTHROPOMETRIC INDICES AT VISIT 8

6.4.1 Hypothesis 3a – Negative Health Behaviors

Table 10 shows point-biserial or Pearson correlation coefficients between negative health behaviors, abuse, and concurrent WC. Physical inactivity was the only health behavior positively associated with abuse variables and WC, and was only examined as a mediator in the significant relationship between any abuse/neglect and WC. However, the Sobel test of mediation suggested that physical inactivity did not significantly mediate the relationship between a history of any abuse/neglect and concurrent WC ($z = 1.68$, $p = .09$).

Table 10 shows point-biserial or Pearson correlation coefficients between the negative health behaviors and abuse and BMI. Physical inactivity was positively associated with any abuse/neglect, sexual abuse, and BMI. However, the Sobel test of mediation suggested that physical inactivity did not significantly mediate the relationship between a history of any abuse/neglect and concurrent BMI ($z = 1.68$, $p = .09$), nor between sexual abuse and concurrent BMI ($z = 1.56$, $p = .12$).

Additional secondary analyses tested whether unhealthy behaviors were associated with abuse variables and WC, in individuals with lower BMI (BMI < 30). Although Pearson correlation coefficients showed that physical inactivity was positively associated with concurrent

WC when BMI < 30 (r = .20, p = .01), physical inactivity was not associated with any abuse variables in the lower BMI group (ps > .25). Therefore, mediation analyses were not conducted.

6.4.2 Hypothesis 3b – Negative Emotions

Depressive symptoms at visit 8 and Trait Anger at visit 7 were positively skewed so these variables were log transformed. Table 11 shows point-biserial or Pearson correlation coefficients between the negative emotions, abuse variables, and concurrent WC. Trait Anger, Trait Anxiety, and Cynicism were related to most abuse and neglect variables, as well as concurrent WC. Therefore, a composite negative emotion construct that included Trait Anger, Trait Anxiety, and Cynicism was tested in mediation analyses. Based on Sobel tests for mediation, composite negative emotion was identified as a mediator between a history of any abuse/neglect and WC (z = 2.42, p = .02) and physical abuse and WC (z = 2.41, p = .02). Exploratory analyses suggested that Trait Anger was driving the significant findings for the composite negative emotion construct. It was the only emotion with significant Sobel tests between any abuse/neglect and WC (z = 2.16, p = .03) and physical abuse and WC (z = 2.17, p = .03).

Point-biserial and Pearson correlations (Table 11) showed that Trait Anger, Trait Anxiety, and Cynicism were related to most abuse/neglect variables and BMI. Therefore, a composite negative emotion construct that included Trait Anger, Trait Anxiety, and Cynicism was tested in mediation analyses. Sobel tests determined that composite negative emotion was a mediator between a history of any abuse/neglect and BMI (z = 2.50, p = .01), physical abuse and BMI (z = 2.44, p = .01), and sexual abuse and BMI (z = 2.35, p = .02). Additional exploratory

analyses suggested that Trait Anger was the negative emotion driving the significance behind the composite negative emotion construct. It was the only emotion with significant Sobel tests between any abuse/neglect and BMI ($z = 2.32$, $p = .02$), physical abuse and BMI ($z = 2.27$, $p = .02$), and sexual abuse and BMI ($z = 2.15$, $p = .03$).

Only Trait Anger and Trait Anxiety were significantly associated with WC in women with BMI < 30 (Table 11). These two negative emotions were run in separate mediation analyses for the models that significantly predicted WC, when BMI < 30 (any abuse/neglect, emotional abuse, sexual abuse, poly-victimization). Sobel tests of mediation were not significant, suggesting that neither Trait Anger nor Trait Anxiety mediated the relationship between abuse variables and WC, when BMI < 30 (ps ≥ .17).

Table 10. Correlations between Negative Health Behaviors, Abuse/Neglect, and Anthropometric Indices

	Cigarette Smoking at visit 8	Physical Inactivity at visit 6	Unhealthy Dietary Pattern at visit 5
Yes/No Any Abuse	-.014	.105*	-.062
Poly-victimization	.031	.085	-.045
Emotional Abuse	-.011	.002	-.043
Physical Abuse	.017	.070	-.044
Sexual Abuse	.017	.097*	-.006
Emotional Neglect	.022	.078	-.046
Physical Neglect	.078	.003	-.001
WC – concurrent	.038	.281***	.067
BMI – concurrent	-.005	.281***	.059
WC – concurrent, concur. BMI < 30	.077	.198 ***	.046
Δ WC	.040	.067	.038
Δ BMI	.059	.046	.017

Note: WC = waist circumference; BMI = body mass index.
* $p \leq .10$ (2-tailed).
** $p \leq .05$ (2-tailed).
*** $p \leq .01$ (2-tailed).

Table 11. Correlations between Negative Emotions, Abuse/Neglect, and Anthropometric Indices

	Depressive Symptoms at visit 8	Trait Anger at visit 7	Trait Anxiety at visit 7	Cynicism at baseline
Yes/No Any Abuse	.170***	.209***	.120**	.116**
Poly-victimization	.220***	.262***	.143**	.164***
Emotional Abuse	.160***	.258***	.121**	.108*
Physical Abuse	.226***	.212***	.136**	.116**
Sexual Abuse	.122**	.170***	.165***	.064
Emotional Neglect	.151***	.064	.075	.006
Physical Neglect	.095*	.195***	.055	.137**
WC – concurrent	.087	.178***	.132**	.145**
BMI – concurrent	.084	.199***	.096*	.182***
WC – concurrent, concur. BMI < 30	.083	.156**	.133*	.086
Δ WC	.053	.050	.021	.093
Δ BMI	.073	.076	.055	.077

Note. WC = waist circumference; BMI = body mass index.
* $p \leq .10$ (2-tailed).
** $p \leq .05$ (2-tailed).
*** $p \leq .01$ (2-tailed).

6.5 MEDIATORS BETWEEN ABUSE AND CHANGES IN ANTHROPOMETRIC INDICES

6.5.1 Hypothesis 4a – Negative Health Behaviors

Results examining the relationship between abuse/neglect and longitudinal WC or longitudinal BMI showed non-significant relationships. However, when women were stratified by baseline BMI, then several significant relationships were found between abuse/neglect and changes in WC when BMI < 30; therefore, mediation analyses focused on the outcome of longitudinal WC, for women with BMI < 30. Point-biserial or Pearson correlation coefficients showed that only an unhealthy dietary pattern was associated with longitudinal WC (r = -.147, p = .04), and only sexual abuse was associated with an unhealthy dietary pattern (r = -.142, p = .05). Sobel tests for mediation suggested that an unhealthy dietary pattern was not a mediator between sexual abuse and longitudinal WC, for women with BMI < 30 (z = 1.31, p = .19).

6.5.2 Hypothesis 4b – Negative Emotions

Point-biserial or Pearson correlation (Table 12) coefficients showed that Trait Anger and Cynicism were related to several abuse and neglect variables, as well as with changes in WC, for women with baseline BMI < 30. Trait Anger and Cynicism were run separately in mediation analyses predicting longitudinal WC, when BMI < 30. Sobel tests of mediation were not significant for most analyses (ps ≥ .09).

Table 12. Correlations between Baseline Negative Emotions, Abuse/Neglect, and Anthropometric Indices when Baseline BMI < 30

	Depressive Symptoms at baseline	Trait Anger at visit 7	Trait Anxiety at visit 4	Cynicism at baseline
Yes/No Any Abuse	.048	.199**	.188**	.080
Poly-victimization	.135*	.250***	.227***	.135*
Emotional Abuse	.034	.260***	.180**	.070
Physical Abuse	.069	.143**	.216***	.058
Sexual Abuse	.186***	.169**	.221***	.140**
Emotional Neglect	.032	.059	.086	-.029
Physical Neglect	.093	.195***	.136*	.146**
Δ WC	.103	.170**	.025	.240***

Note: BMI = body mass index; WC = waist circumference.
* $p \leq .10$ (2-tailed).
** $p \leq .05$ (2-tailed).
*** $p \leq .01$ (2-tailed).

7.0 DISCUSSION

The present study examined a retrospective assessment of childhood abuse and neglect in Black and White women. One aim of this study was to test for an association between a history of childhood abuse and neglect and adulthood central adiposity and obesity. Furthermore, the present study examined a relationship between childhood abuse and neglect and changes in central adiposity and obesity over time. Finally, when significant associations were found, then negative health behaviors and negative emotions were tested as potential mediators between childhood abuse/neglect and body fat. This study had the unique capability to explore several relationships between abuse/neglect and body fat, specifically, a history of any abuse or neglect, specific subtypes of abuse or neglect, and poly-victimization.

7.1 ASSOCIATIONS OF CHILDHOOD ABUSE/NEGLECT AND CENTRAL ADIPOSITY AND OBESITY

It was found that women with a history of any childhood abuse or neglect had higher central adiposity and obesity in adulthood. Furthermore, women who reported physical abuse had higher central adiposity. The physical abuse result is consistent with the only study that examined relationships between abuse/neglect and central adiposity (Thomas, Hypponen, &

Power, 2008), but the present study found this relationship using a standardized, validated questionnaire and in an ethnically diverse sample. Physical abuse may be a more severe childhood stressor than other forms of abuse or neglect. The experience of physical abuse may initiate enduring behavioral, emotional, and physiological changes in a child, which subsequently influence central adiposity. It is possible that other types of abuse and neglect affect body fat distribution earlier in life, such as adolescence or young adulthood, but those relationships diminished before the time of assessment in the present study.

Women with a history of physical abuse or sexual abuse had higher obesity. These findings are in line with the literature connecting childhood abuse/neglect and obesity (Williamson, Thompson, Anda, Dietz, & Felitti, 2002, Thomas, Hypponen, & Power, 2008). Physical abuse and sexual abuse may be severe forms of childhood stressors that are more likely to influence habits related to eating and physical activity. Obesity may serve an adaptive function for women who were sexually abused, in particular, because weight may discourage unwanted sexual attention.

Poly-victimization results indicated that women only needed to experience one type of abuse to see an impact on adulthood central adiposity and obesity; experiencing two or more types of abuse did not confer greater risk. Although Williamson et al. (2002) found a positive association between poly-victimization and obesity, the high prevalence of abuse in their sample (66%) may reflect lenient abuse criteria and the inclusion of "fear of physical abuse" as an abuse category. The non-significant findings for poly-victimization in our sample may be due to the fact that few types of abuse predicted central adiposity and obesity, therefore making the culmination of several adversities not significantly more harmful than just one adversity, like physical abuse.

We found that significant relationships between any abuse/neglect existed for the normal-weight and overweight women (BMI < 30), but not for obese women (BMI ≥ 30). Normal-weight and overweight women with a history of emotional abuse or sexual abuse had higher central adiposity in adulthood, and poly-victimization was also related to central adiposity. These findings are similar to those reported by Grilo et al. (2005), in which reported abuse was not associated with BMI in a group of female bariatric patients, even though the prevalence of abuse was much higher in the surgery population than in a normative sample. It may be possible that there is a ceiling effect for the influence of a psychosocial risk factor, such as abuse and neglect, on body fat distribution. Perhaps the effects of psychosocial factors on central adiposity in obese women are masked by other overriding factors, such as diet, physical activity, and smoking.

7.2 ASSOCIATION OF CHILDHOOD ABUSE/NEGLECT AND CHANGES IN CENTRAL ADIPOSITY AND OBESITY

Childhood abuse and neglect was not associated with changes in central adiposity or obesity in the full sample. However, among women with baseline BMI < 30, a history of any abuse or neglect was related to greater increases in WC across eight years. This is the first study to report on the relationship between childhood abuse/neglect and changes in central adiposity. Abuse and neglect, as a psychosocial stressor, may be more salient for normal-weight and overweight women because obese women may experience a ceiling effect for the influence of childhood abuse and neglect on central adiposity, as mentioned earlier.

Normal-weight and overweight women who experienced emotional abuse, physical abuse, sexual abuse, or physical neglect, but not emotional neglect, had greater increases in WC compared to women with no history of each specific type of abuse or neglect. Items describing emotional neglect on the CTQ reflected an absence of feeling loved, supported, and appreciated by family members. Although parental warmth and acceptance may be important in the development of healthy adults, results from this study suggest that it does not affect changes in central adiposity in midlife.

Additionally, normal-weight and overweight women reporting poly-victimization, or two or more types of abuse, had greater increases in WC over time compared to women reporting one type of abuse or no abuse. One reason that poly-victimization may be important for this subsample is because most specific types of abuse were related to changes in central adiposity; thus, experiencing two or more types of abuse would be associated with greater increases in central adiposity.

There were some unexpected results for obese women; poly-victimization and sexual abuse were associated with decreases in WC over time. These findings are opposite of what was expected and cannot be readily explained by the data or theory.

7.3 NEGATIVE HEALTH BEHAVIORS AS MECHANISMS

Although the data suggests non-significant mediating effects for negative health behaviors, we cannot disqualify the potential importance of negative health behaviors. Future research should take care to adequately measure and test these potential pathways for mediation.

Physical Inactivity was associated with childhood abuse/neglect and central adiposity and obesity, and these findings are consistent with the literature that connects abuse/neglect to physical inactivity (Felitti et al., 1998) and physical inactivity to greater central adiposity and obesity (Pols, Peeters, Twisk, Kemper, & Grobbee, 1997; Wing et al., 1991). However, the inclusion of Physical Inactivity into the model did not significantly reduce the effect between childhood abuse/neglect and central adiposity and obesity. Smoking cigarettes may not have been a mediator in the present study because of the low frequency of current smokers in the sample. Additionally, unhealthy dietary patterns may not have adequately captured what participants ate that would contribute to body fat, due to the fact that it was not correlated to WC or BMI. When relationships were examined in normal-weight and overweight women, negative health behaviors were not significant pathways between abuse/neglect and cross-sectional central adiposity, suggesting the importance of other, perhaps physiological, mechanisms to explain the relationship.

This was the first study to examine negative health behaviors as mediators between childhood abuse/neglect and changes in central adiposity. Negative health behaviors were not mechanisms linking childhood abuse/neglect to changes in central adiposity for normal-weight or overweight women. Although an unhealthy dietary pattern was associated with increases in WC for these women, it did not mediate the relationship, suggesting other mechanisms to be important between abuse/neglect and central adiposity for normal-weight and over-weight women.

7.4 NEGATIVE EMOTIONS AS MECHANISMS

This is the first study to test whether negative emotions mediated the relationship between childhood abuse/neglect and central adiposity or overall obesity. Trait Anger was a significant mediator in all relevant relationships between childhood abuse/neglect and central adiposity and obesity. Trait Anger, specifically, may promote dysregulation of physiological processes because the experience of anger may be associated with hyper-arousal; Cynicism and Trait Anxiety may not elicit the same level of arousal. Furthermore, anger has been shown to be a particularly detrimental emotion that influences the development of central adiposity more than depression, anxiety, and cynicism both in adults (Räikkönen, Matthews, & Kuller, 1999a) and in adolescents (Midei & Matthews, in press, 2008). When examining normal-weight and overweight women, negative emotions did not mediate the relationships between reports of abuse/neglect and concurrent central adiposity nor changes in central adiposity. It appears that a history of abuse/neglect may influence central adiposity (concurrent or longitudinal) via alternative pathways in normal-weight and overweight.

7.5 POTENTIAL PHYSIOLOGICAL MECHANISMS

Even though Physical Inactivity and Trait Anger mediated some relationships between abuse and central adiposity and obesity, the total effect between abuse/neglect and body fat measures continued to be significant. Additionally, negative health behaviors and negative emotions did not mediate between childhood abuse/neglect and longitudinal central adiposity in

normal-weight and overweight women. It is possible that a physiological mechanism may be linking abuse/neglect history to body fat distribution. Childhood abuse and neglect may affect body fat distribution via neuroendocrine function, specifically, the activity of the hypothalamic-pituitary-adrenocortical (HPA) axis. The secretion of cortisol by the HPA axis plays an important role in the deposition and metabolism of fat. It has been suggested that cortisol directly influences visceral adipose tissue because it has greater blood flow and up to four times the amount of glucocorticoid receptors compared to peripheral fat, making visceral fat particularly sensitive to circulating cortisol (Pedersen, Jonler, & Richelsen, 1994). Victims of childhood abuse and neglect may experience dysregulated HPA axis activity because they perceive the abuse as a chronic stressor, either because of repeated abuse or rumination about the abuse. Inordinately high cortisol secretion has been documented in samples of sexually and physically abused children and adolescents (De Bellis, Chrousos, Dorn, Burke, Helmers, Kling, et al., 1994; Hart, Gunnar, & Cicchetti, 1996, Heim, Newport, Heit, Graham, Wilcox, Bonsall, et al., 2000). We did not include neuroendocrine measures in the present study so we cannot evaluate these mechanisms.

7.6 ALTERNATIVE EXPLANATIONS

It may be possible that a third factor explains the relationship between childhood abuse/neglect and central adiposity and obesity. Thomas et al. (2008) found that childhood SES accounted for some of their relationships between abuse/neglect and obesity. However, in our sample we found that childhood SES, measured by mother‘s and father‘s education level, was

not significantly correlated to abuse history (Table 3). There may also be a genetic, or genetic by environment, link for our results. Parental anger has been associated with forms of childhood abuse, such as physical abuse (Rodriguez & Green, 1997), and personality and emotion characteristics, such as Trait Anger, have been found to be partially heritable (Cates, Houston, Vavak, Crawford, & Uttley, 1993; Sluyter, Keijser, Boomsma, van den Oord, & Snieder, 2000). It is possible that the same women who are more likely to be abused are also more likely to respond to adversity with the specific emotion of anger, which then makes these individuals more susceptible to central adiposity and obesity.

7.7 LIMITATIONS AND STRENGTHS

There are several limitations to the current study. Although a history of childhood abuse/neglect was associated with central adiposity and overall obesity in midlife, the causal nature of these associations cannot be established. Additionally, multiple visits allow for a longitudinal perspective; however, abused women had higher WC at baseline, therefore we cannot clearly establish that negative emotions or negative health behaviors truly preceded the onset of central adiposity and obesity. A retrospective measure of childhood abuse and neglect may be a limitation in this study, because recall of temporally distant and emotionally painful events has the potential for distortion, possibly because of repression, denial, or current mood at time of recall (Briere, 1992). However, studies that use legal records to classify children as abused may misclassify cases that never reach the criminal justice system as ~~"n~~ot abused", thus biasing results toward the null (Widom, Weiler, & Cottler, 1999). Children identified by the

legal system as being abused not only receive intervention, but in most situations the abuse usually stops, suggesting that identified children may not be representative of all abused children (Kendall-Tackett & Becker-Blease, 2004). Parental or caretaker reports would also be unsuitable alternatives, given the social and legal implications of self-identification as a child abuser.

The strengths of the present study include its diverse sample and the longitudinal design. Although Black women had higher central adiposity and overall obesity, controlling for race did not explain the relationship between childhood abuse and neglect and body fat. The longitudinal design aids researchers in understanding the progression of health risks and factors that may precede their development. Additionally, a standardized questionnaire with strong reliability and validity data was used to assess several types of childhood abuse, as well as childhood neglect.

The present study captures women as they age through the menopausal transition. Body fat distribution has been associated with the menopausal transition, such that body fat localizes around the abdomen and is related to changes in levels of estradiol and the free testosterone index during peri- and post-menopause (Guthrie, Dennerstein, Taffe, Lehert, & Burger, 2004; Guthrie et al., 2003). However, we controlled for menopausal status so the results are not due to differential report of child abuse by menopausal status. The present study suggests that a history of childhood abuse or neglect may significantly influence body fat distribution for women during a time that is considered a critical period for changes in central adiposity.

7.8 FUTURE RESEARCH

Results suggest an important role of childhood abuse and neglect in central adiposity and obesity, measured concurrently and longitudinally, and identifies specific pathways (anger and physical inactivity) through which these relationships may develop. Figure 3 shows an adapted model that has been adjusted to account for the present study's findings. Future research would benefit from following participants beginning at age 18 with a retrospective assessment of childhood abuse and neglect. It is important to understand the relative timing for the onset of negative health behaviors, negative emotions, body fat, and physiologic measures. Additionally, assessing participants before the onset of morbid obesity may help to explain the discrepant findings between normal-weight/overweight women and obese women in our study. Finally, physiological mechanisms, such as cortisol and hormones, need to be the focus of future studies to understand how childhood abuse and neglect can influence body fat distribution, beyond negative health behaviors and negative emotions.

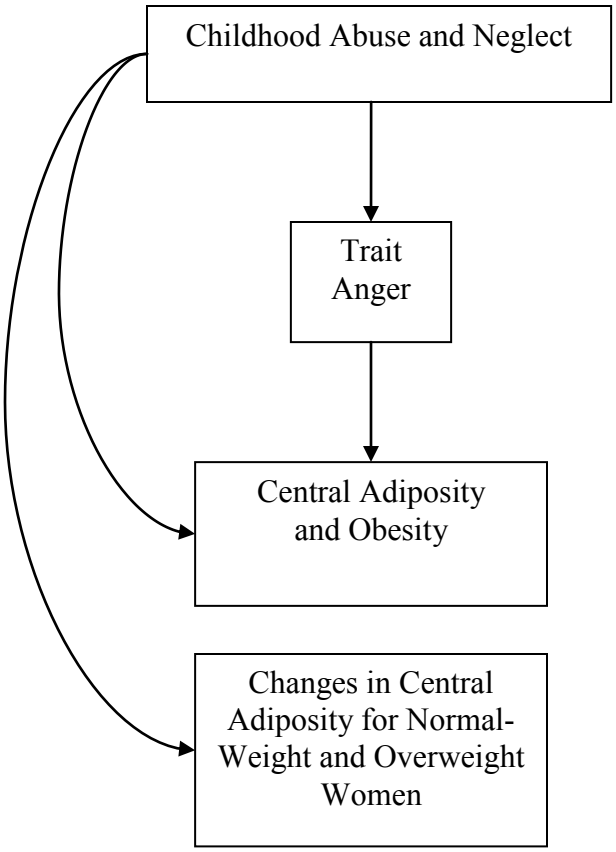


Figure 3. Revised model of pathways connecting childhood abuse/neglect to central adiposity and obesity.

7.9 SUMMARY

Findings from the present study have important implications. Using a reliable and valid questionnaire, childhood abuse and neglect were shown to be associated with central adiposity, as well as obesity, in Black and White women. This study is the first to suggest that childhood abuse and neglect are associated with changes in central adiposity, and that these findings appear to be particularly relevant for normal-weight and overweight women. Trait Anger was shown to mediate some relationships between childhood abuse/neglect and central adiposity and obesity, suggesting that negative emotions play a role in the link between traumatic early-life stressors and adulthood anthropometric indices.

APPENDIX A

ASSOCIATIONS BETWEEN CENTRAL ADIPOSITY AND MORTALITY AND MORBIDITY

Central adiposity is defined as the deposition of body fat around the abdomen. Central adiposity contains subcutaneous adipose tissue, found directly under the skin, and visceral adipose tissue, found between and around the internal organs. Visceral fat has been found to be more highly correlated with disease outcomes than subcutaneous fat (Melanson, McInnis, Rippe, Blackburn, & Wilson, 2001). Non-invasive measurements of central adiposity include waist circumference (WC) and waist-to-hip-ratio (WHR). Many studies report central adiposity findings using either WHR or WC, although studies that compare the two measures suggest that WC is a better marker of visceral fat (Taylor, Keil, Gold, Williams, & Goulding, 1998; Wajchenberg, 2000). Furthermore, Räikkönen and colleagues (1999a) reported that the simple, non-invasive WC measurement accounted for as much as 64% of the variance in visceral adipose tissue in healthy women, independent of BMI.

Several studies suggest that central adiposity more strongly predicts all-cause mortality, compared to BMI. For example, WHR was associated with death from all causes in women over a 12-year period, even after controlling for age, BMI, and traditional risk factors (Lapidus,

Bengtsson, Larsson, Pennert, Rybo, & Sjostrom, 1984). Another study analyzing a sample of over 40,000 older women found that WHR was positively associated with mortality over a 5-year period. Models that adjusted for age, BMI, smoking, education level, marital status, estrogen use, and alcohol use, showed that a 0.15 increase in WHR was associated with a 60% greater relative risk of death (Folsom, Kay, Sellers, Hong, Cerhan, Potter, et al., 1993). Central adiposity has also been studied in regard to cause-specific mortality, notably cardiovascular disease. High WHR was a strong predictor of death from ischemic heart disease in men (Terry, Page, & Haskell, 1992) and coronary heart disease in women (Prineas, Folsom, & Kaye, 1993), even after adjusting for BMI and other coronary risk factors. In addition, WHR predicted premature death from stroke in a sample of over 80,000 men, but BMI was not significantly related to stroke (Terry et al., 1992).

The relationship between central adiposity and mortality is in part mediated by the traditional risk factors for cardiovascular disease, such as type II diabetes, hypertension, and an unhealthy lipid profile. Data from the Nurses' Health Study showed that increases in WC was associated with significantly higher risk for type II diabetes, compared to WHR and BMI (Carey, Waiters, Colditz, Solomon, Willet, & Rosner, 1997). Even after adjusting for BMI, age, family history, smoking, exercise, and dietary factors, the authors found that the women in the top 10^{th} percentile of WC and WHR had increased risk for type II diabetes compared to those in the lower 10^{th} percentile. Men show similar patterns; Ohlson and colleagues (1985) found that WHR in men was a predictor of type II diabetes, independent of the effects of BMI.

Furthermore, central adiposity is associated with other aspects of dysregulated insulin and glucose, such as hyperinsulinemia, insulin resistance, and impaired glucose tolerance (see review by Despres, Moorjani, Lupien, Temblay, Nadeau, & Bouchard, 1990). In addition to being

linked with type II diabetes and its precursors, central adiposity is associated with hypertension. WC was a better predictor of hypertension than BMI, in men and women (Cox, Whichelow, Ashwell, Prevost, & Lejeune, 1997), and data from the Third National Health and Nutrition Examination Survey showed that high WC identified individuals with hypertension even within the normal-weight BMI category (Janssen, Katzmarzyk, & Ross, 2002). Finally, central adiposity is associated with an unhealthy lipid profile. For example, WHR was positively associated with high plasma triglycerides, independent of BMI, both in a sample of healthy premenopausal women (Evans, Hoffman, Kalkhoff, & Kissebah, 1984) and men and women that were normal weight and obese (Krotkiewski, Björntorp, Sjöström, & Smith, 1983). In addition to triglycerides, low HDL cholesterol or unhealthy HDL/LDL ratios have been linked in men and women with central adiposity measured by WHR (Soler, Folsom, Kaye, & Prineas, 1989) and visceral adiposity measured by computed tomography (Despres, Moorjani, Ferland, Tremblay, Lupien, Nadeau, et al., 1989).

Central adiposity early in the lifespan is concurrently associated with other health risk factors. Freedman and colleagues (1999) analyzed 3,000 children and adolescents aged 5-17 from the Bogalusa Heart Study. WC and WHR were associated with high plasma triglycerides, high LDL cholesterol, high plasma insulin, and low HDL cholesterol, even after adjusting for weight, height, and age. The authors indicate that WC showed the most consistent and generally strongest associations with adverse risk factors. The majority of findings were not significant for 5-9 year olds, implying that outcomes associated with central adiposity may develop around or after puberty. In another study of normal-weight children and adolescents aged 9-17, abdominally localized fat distribution, measured by fat mass assessed by dual-energy x-ray

absorptiometry, was associated with high triglycerides, low HDL cholesterol, systolic blood pressure, and left ventricular mass (Daniels, Morrison, Sprecher, Khoury, & Kimball, 1999).

Central adiposity in childhood predicts central adiposity and cardiovascular risk factors in adulthood. WC in male and female adolescents (mean age 15) was tracked over an average of 11 years and was found to be strongly correlated with WC in adulthood (Eisenmann, Welk, Wickel, & Blair, 2004). Using the same sample, the authors also found that adolescent WC was significantly related to adulthood blood pressure. Furthermore, increases in WC over time were related to decreases in physical fitness and HDL cholesterol (Eisenmann, Wickel, Welk, & Blair, 2005). In summary, children and adolescents with central adiposity have increased health risks in childhood, increased health risks in adulthood, and are more likely to have central adiposity in adulthood. Central adiposity in adolescence sets up a trajectory of health risk across the life span.

APPENDIX B

PSYCHOMETRIC QUALITIES OF THE CHILDHOOD TRAUMA QUESTIONNAIRE

The Childhood Trauma Questionnaire (CTQ) is a standardized and well validated questionnaire that takes a short time to complete. Bernstein et al. (2003) reported strong internal consistency within both clinical and normative community samples, mean Cronbach's $\alpha = .87$ for emotional abuse, $\alpha = .84$ for physical abuse, $\alpha = .94$ for sexual abuse, $\alpha = .88$ for emotional neglect, $\alpha = .68$ for physical neglect. Responses from SWAN participants showed that the CTQ continued to show strong internal consistency, Cronbach's $\alpha = 0.74\text{-}0.95$ for the subscales. Test-retest reliabilities have been reported for the CTQ subscales over a 2 to 6 month time period: $r = .82$ for emotional abuse, $r = .82$ for physical abuse, $r = .81$ for sexual abuse, $r = .83$ for emotional neglect, $r = .80$ for physical neglect, and $r = .88$ for the full scale (Bernstein et al., 1994).

Confirmatory factor analyses indicated measurement invariance of the five-factor structure utilized in the CTQ across four samples: adolescent psychiatric inpatients, two adult substance abuser populations, and a normative community sample (Bernstein et al., 2003). Thus, individuals in the four groups, which differed widely in terms of age, sex, ethnicity, SES, psychopathology, and life experiences, responded to the scale's items in a reasonably equivalent manner, indicating that the items held essentially the same meaning across diverse populations.

Criterion-related validity of the CTQ has also been examined by Bernstein et al. (2003). Specifically, therapist ratings of childhood maltreatment were examined within an adolescent psychiatric inpatient sample. Therapist ratings were positively associated with participant scores on the CTQ scales (r = .48 for emotional abuse, r = .59 for physical abuse, r = .75 for sexual abuse, r = .36 for emotional neglect, and r = .50 for physical neglect, all $p \leq .001$) and showed convergent and discriminant validity. In addition, convergent and discriminant validity was indicated in a sample of adult substance users; subscales were more highly correlated to analogous questions during a clinical interview than non-analogous questions (Fink, Bernstein, Handelsman, Foote, & Lovejoy, 1995). In summary, the CTQ is a superior measure of childhood abuse/neglect because it has been tested and shown to have strong reliability and validity across a wide range of populations.

BIBLIOGRAPHY

Administration for Children and Families, US Department of Health and Human Services: Child Maltreatment 2006. (2006). Retrieved April 4, 2008, from http://www.acf.hhs.gov/programs/cb/pubs/cm06/chapter3.htm#child

Ahlberg, A., Ljung, T., Rosmond, R., McEwen, B., Holm, G., Åkesson, H. O., et al. (2002). Depression and anxiety symptoms in relation to anthropometry and metabolism in men. *Psychiatry Research, 112*, 101-110.

Anda, R. F., Croft, J. B., Felitti, V. J., Nordenberg, D., Giles, W. H., Williamson, D. F., et al. (1999). Adverse childhood experiences and smoking during adolescence and adulthood. *JAMA, 282*, 1652-1658.

Baecke, J. A., Burema, J., & Frijters, J. E. (1982). A short questionnaire for the measurement of habitual physical activity in epidemiological studies. *American Journal of Clinical Nutrition, 36*, 936-942.

Barefoot, J., Dodge, K., Peterson, B., Dahlstrom, W., & Williams, R. (1989). The Cook-Medley Hostility Scale: Item content and ability to predict survival. *Psychosomatic Medicine*, 51, 46-57.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Barrett-Connor, E., & Khaw, K. T. (1989). Cigarette smoking and increased central adiposity. *Annals of Internal Medicine, 111*, 783-787.

Batten, S. V., Aslan, M., Maciejewski, P. K., & Mazure, C. M. (2004). Childhood maltreatment as a risk factor for adult cardiovascular disease and depression. *Journal of Clinical Psychiatry, 65*, 249-254.

Bernstein, D. P., & Fink, L. (1998). *Childhood Trauma Questionnaire*. San Antonio, TX: Psychological Corp.

Bernstein, D. P., Fink, L., Handelsman, L., Foote, J., Lovejoy, M., Wenzel, K., et al. (1994). Initial reliability and validity of a new retrospective measure of child abuse and neglect. *American Journal of Psychiatry, 151*, 1132-1136.

Berstein, D. P., Stein, J. A., Newcomb, M. D., Walker, E., Pogge, D., Ahluvalia, T., et al. (2003). Development and validation of a brief screening version of the Childhood Trauma Questionnaire. *Child Abuse & Neglect, 27*, 169-190.

Block, G., Hartman, A. M., Dresser, C. M., Carroll, M. D., Gannon, J., & Gardner, L. (1986). A data-based approach to diet questionnaire design and testing. *American Journal of Epidemiology, 124*, 453-469.

Briere, J. (1992). Methodological issues in the study of sexual abuse effects. *Journal of Consulting and Clinical Psychology, 60*, 196-203.

Brown, J., Cohen, P., Johnson, J., & Smailes, E. (1999). Child abuse and neglect: specificity of effects on adolescent and young adult depression and suicidality. *Journal of the American Academy of Child and Adolescent Psychiatry, 38*, 1490-1496.

Carey, V. J., Walters, E. E., Colditz, G. A., Solomon, C. G., Willett, W. C., Rosner, B. A., et al. (1997). Body fat distribution and risk of non-insulin-dependent diabetes mellitus in women. The Nurses' Health Study. *American Journal of Epidemiology, 145*, 14-19.

Cates, D. S., Houston, B. K., Vavak, C. R., Crawford, M. H., & Uttley, M. (1993). Heritability of hostility-related emotions, attitudes, and behaviors. *Journal of Behavioral Medicine,* 16, 237-256.

Connell, C. M., Bergeron, N., Katz, K. H., Saunders, L., & Tebes, J. D. (2007). Re-referral to child protective services: the influence of child, family, and case characteristics on risk status. *Child Abuse & Neglect, 31*, 573-588.

Cook, W. W., & Medley, D. M. (1954). Proposed hostility and pharisaic-virtue scales for the MMPI. *Journal of Applied Psychology*, 414–418.

Cox, B. D., Whichelow, M. J., Ashwell, M., Prevost, A. T., & Lejeune, S. R. E. (1997). Association of anthropometric indices with elevated blood pressure in British adults. *International Journal of Obesity, 21*, 674-680.

Danese, A., Pariante, C. M., Caspi, A., Taylor, A., & Poulton, R. (2007). Childhood maltreatment predicts adult inflammation in a life-course study. *Proceedings of the National Academy of Sciences of the United States of America, 104*, 1319-1324.

Daniels, S. R., Morrison, J. A., Sprecher, D. L., Khoury, P., & Kimball, T. (1999). Association of body fat distribution and cardiovascular risk factors in children and adolescents. *Circulation, 99*, 541-545.

De Bellis, M. D., Chrousos, G. P., Dorn, L. D., Burke, L., Helmers, K., Kling, M. A., et al. (1994). Hypothalamic-pituitary-adrenal axis dysregulation in sexually abused girls. *Journal of Clinical Endocrinology & Metabolism, 78*, 249-255.

Despres, J., Moorjani, S., Lupien, P., Tremblay, A., Nadeau, A., & Bouchard, C. (1990). Regional distributio of body fat, plasma lipoproteins, and cardiovascular disease. *Arteriosclerosis, 10*, 497-511.

Despres, J. P., Moorjani, S., Ferland, M., Tremblay, A., Lupien, P. J., Nadeau, A., et al. (1989). Adipose tissue distribution and plasma lipoprotein levels in obese women. Importance of intra-abdominal fat. *Arteriosclerosis, 9*, 203-210.

Dong, M., Giles, W. H., Felitti, V. J., Dube, S. R., Williams, J. E., Chapman, D. P., et al. (2004). Insights into causal pathways for ischemic heart disease: adverse childhood experiences study. *Circulation, 110*, 1761-1766.

Duncan, R. D., Saunders, B. E., Kilpatrick, D. G., Hanson, R. F., & Resnick, H. S. (1996). Childhood physical assault as a risk factor for PTSD, depression, and substance abuse: findings from a national survey. *American Journal of Orthopsychiatry, 66*, 437-448.

Eisenmann, J. C., Welk, G. J., Wickel, E. E., & Blair, S. N. (2004). Stability of variables associated with the metabolic syndrome from adolescence to adulthood: the Aerobics Center Longitudinal Study. *American Journal of Human Biology, 16*, 690-696.

Eisenmann, J. C., Wickel, E. E., Welk, G. J., & Blair, S. N. (2005). Relationship between adolescent fitness and fatness and cardiovascular disease risk factors in adulthood: the Aerobics Center Longitudinal Study (ACLS). *American Heart Journal, 149*, 46-53.

Evans, D. J., Hoffman, R. G., Kalkhoff, R. K., & Kissebah, A. H. (1984). Relationship of body fat topography to insulin sensitivity and metabolic profiles in premenopausal women. *Metabolism, 33*, 68-75.

Fechner-Bates, S., Coyne, J. C., & Schwenk, T. L. (1994). The relationship of self-reported distress to depressive disorders and other psychopathology. *Journal of Consulting and Clinical Psychology, 62*, 550-559.

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., et al. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine, 14*, 245-258.

Fink, L., Bernstein, D. P., Handelsman, L., Foote, J., & Lovejoy, M. (1995). Initial reliability and validity of the Childhood Trauma Interview: A new multidimensional measure of childhood interpersonal trauma. *American Journal of Psychiatry*, *152,* 1329–1335.

Finkelhor, D., Ormrod, R. K., & Turner, H. A. (2007). Poly-victimization: A neglected component in child victimization. *Child Abuse & Neglect, 31*, 7–26.

Folsom, A. R., Kay, S. A., Sellers, T. A., Hong, C. P., Cerhan, J. R., Potter, J. D., et al. (1993). Body fat distribution and 5-year risk of death in older women. *JAMA, 269*, 483-487.

Freedman, D. S., Serdula, M. K., Srinivasan, S. R., & Berenson, G. S. (1999). Relation of circumferences and skinfold thicknesses to lipid and insulin concentrations in children and adolescents: The Bogalusa Heart Study. *American Journal of Clinical Nutrition, 69*, 308-317.

Fricker, A. E., Smith, D. W., Davis, J. L., & Hanson, R. F. (2003). Effects of context and question type on endorsement of childhood sexual abuse. *Journal of Traumatic Stress,* 16, 265-268.

Grilo, C. M., Masheb, R. M., Brody, M., Toth, C., Burke-Martindale, C. H., & Rothschild, B. S. (2005). Childhood maltreatment in extremely obese male and female bariatric surgery candidates. *Obesity Research, 13*, 123-130.

Guthrie, J. R., Dennerstein, L., Taffe, J. R., Ebeling, P. R., Randolph, J. F., Burger, H. G., et al. (2003). Central abdominal fat and endogenous hormones during the menopausal transition. *Fertility and Sterility,* 79, 1335-1340.

Guthrie, J. R., Dennerstein, L., Taffe, J. R., Lehert, P., & Burger, H. G. (2004). The menopausal transition: a 9-year prospective population-based study. The Melbourne Women's Midlife Health Project. *Climacteric,* 7, 375-389.

Hamby, S. L. & Gray-Little, B. (2000). Labeling partner violence: when do victims differentiate among acts? *Violence and Victims,* 15, 173-186.

Hart, J., Gunnar, M. R., & D., C. (1996). Altered neuroendocrine activity in maltreated children related to symptoms of depression. *Development and Psychopathology, 8*, 201-214.

Heim, C., Newport, D. J., Heit, S., Graham, Y. P., Wilcox, M., Bonsall, R., et al. (2000). Pituitary adrenal and autonomic responses to stress in women after sexual and physical abuse in childhood. *JAMA, 284*, 592-597.

Hill, J., Pickles, A., Burnside, E., Byatt, M., Rollinson, L., Davis, R., et al. (2001). Child sexual abuse, poor parental care and adult depression: evidence for different mechanisms. *British Journal of Psychiatry, 179*, 104-109.

Hoglund, C. L., & Nicholas, K. B. (1995). Shame, guilt, and anger in college students exposed to abusive family environments. *Journal of Family Violence, 10*, 141-157.

Hopper, J. (2008). *Child abuse: Statistics, research, and resources*. Retrieved November 1, 2008, from http://www.jimhopper.com/abstats/#s-intro.

Janssen, I., Katzmarzyk, P. T., & Ross, R. (2002). Body mass index, waist circumference, and health risk: evidence in support of current National Institutes of Health guidelines. *Archives of Internal Medicine, 762*, 2074-2079.

Kaye, S. A., Folsom, A. R., Jacobs, D. R. J., Hughes, G. H., & Flack, J. M. (1993). Psychosocial correlates of body fat distribution in black and white young adults. *International Journal of Obesity & Related Metabolic Disorders, 17*, 271-277.

Kaye, S. A., Folsom, A. R., Prineas, R. J., Potter, J. D., & Gapstur, S. M. (1990). The association of body fat distribution with lifestyle and reproductive factors in a population study of postmenopausal women. *International Journal of Obesity, 14*, 583-591.

Kendall-Tackett, K. & Becker-Blease, K. (2004). The importance of retrospective findings in child maltreatment research. *Child Abuse and Neglect*, 28, 723–727

Kendler, K. S., Bulik, C. M., Silberg, J., Hettema, J. M., Myers, J., & Prescott, C. A. (2007). Childhood sexual abuse and adult psychiatric and substance use disorders in women: an epidemiological and cotwin control analysis. *Archives of General Psychiatry, 57*, 953-959.

Krotkiewski, M., Björntorp, P., Sjöström, L., & Smith, U. (1983). Impact of obesity on metabolism in men and women. Importance of regional adipose tissue distribution. *Jounral of Clinical Investigations, 72*, 1150-1162.

Lapidus, L., Bengtsson, C., Larsson, B., Pennert, K., Rybo, E., & Sjostrom, L. (1984). Distribution of adipose tissue and risk of cardiovascular disease and death: a 12-year follow-up of participants in the population study of women in Gothenburgh, Sweden. *British Journal of Medicine, 289*, 1257-1261.

Laws, A., Terry, R. B., & Barrett-Connor, E. (1990). Behavioral covariates of waist-to-hip ratio in Rancho Bernardo. *American Journal of Public Health, 80*, 1358-1362.

Lissau, I., & Sorensen, T. I. (1994). Parental neglect during childhood and increased risk of obesity in young adulthood. *Lancet, 343*, 324-327.

Lutzker, J. R., & Boyle, C. L. (2002). Preventing physical and sexual abuse. In D. Glenwick & L. Jason (Eds.), *Innovative strategies for preventing psychological problems*. New York: Springer.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methdos, 7*, 83-104.

McCauley, J., Kern, D. E., Kolodner, K., Dill, L., Schroeder, A. F., DeChant, H. K., et al. (1997). Clinical characteristics of women with a history of childhood abuse: unhealed wounds. *JAMA, 277*, 1362-1368.

McEwen, B. S. (2000). Allostasis and allostatic load: implications for neuropsychopharmacology. *Neuropsychopharmacology, 22*, 108-124.

McNaughton, S. A., Mishra, G. D., Stephen, A. M., & Wadsworth, M. E. (2007). Dietary patterns throughout adult life are associated with body mass index, waist circumference, blood pressure, and red cell folate. *Journal of Nutrition, 137*, 99-105.

Melanson, K. J., McInnis, K. J., Rippe, J. M., Blackburn, G., & Wilson, P. F. (2001). Obesity and cardiovascular disease risk: research update. *Cardiology in Review, 9*, 202-207.

Midei, A. J., & Matthews, K. A. (in press). Social relationships and negative emotional traits are associated with central adiposity and arterial stiffness in healthy adolescents. *Health Psychology.*

Miller, G. E., Freedland, K. E., Carney, R. M., Stetler, C. A., & Banks, W. A. (2003). Pathways linking depression, adiposity, and inflammatory markers in healthy young adults. *Brain, Behavior, and Immunity, 17*, 276-285.

Mueller, W. H., Meininger, J. C., Liehr, P., Chandler, P. S., & Chan, W. (1998). Adolescent blood pressure, anger expression and hostility: possible links with body fat. *Annals of Human Biology, 25*, 295-307.

Mullen, P. E., Martin, J. L., Anderson, J. C., Romans, S. E., & Herbison, G. P. (1996). The long-term impact of the physical, emotional, and sexual abuse of children: a community study. *Child Abuse & Neglect, 20*, 7-21.

Newby, P. K., Muller, D., Hallfrisch, J., Qiao, N., Andres, R., & Tucker, K. L. (2003). Dietary patterns and changes in body mass index and waist circumference in adults. *American Journal of Clinical Nutrition, 77*, 1417-1425.

Niaura, R., Banks, S. M., Ward, K. D., Stoney, C. M., Spiro, A., Aldwin, C. M., et al. (2000). Hostility and the metabolic syndrome in older males: The Normative Aging Study. *Psychosomatic Medicine, 62*, 7-16.

Niaura, R., Todaro, J. F., Stroud, L., Spiro, A., Ward, K. D., & Weiss, S. (2002). Hostility, the metabolic syndrome, and incident coronary heart disease. *Health Psychology, 21*, 588-593.

Noll, J. G., Zeller, M. H., Trickett, P. K., & Putnam, F. W. (2007). Obesity risk for female victims of childhood sexual abuse: a prospective study. *Pediatrics, 120*, e61-67.

Ohlson, L. O., Larsson, B., Svardsudd, K., Welin, L., Eriksson, H., Wilhelmsen, L., et al. (1985). The influence of body fat distribution on the incidence of diabetes mellitus. 13.5 years of follow-up of the participants in the study of men born in 1913. *Diabetes, 34*, 1055-1058.

Pedersen, S., Jonler, M., & Richelsen, B. (1994). Characterization of regional and gender differences in glucocorticoid receptors and lipoprotein lipase activity in human adipose tissue. *Journal of Clinical Endocrinology and Metabolism, 78*, 1354-1359.

Pols, M. A., Peeters, P. H., Twisk, J. W., Kemper, H. C., & Grobbee, D. E. (1997). Physical activity and cardiovascular disease risk profile in women. *American Journal of Epidemiology, 146*, 322-328.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers, 36*, 717-731.

Prineas, R. I., Folsom, A. R., & Kaye, S. A. (1993). Central adiposity and increased risk of coronary artery disease mortality in older women. *Annals of Epidemiology, 3*, 35-41.

Radloff, L. S. (1977). The CES-D scale: a self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385-401.

Räikkönen, K., Matthews, K. A., & Kuller, L. H. (1999a). Anthropometric and psychosocial determinants of visceral obesity in healthy postmenopausal women. *International Journal of Obesity, 23*, 775-782.

Räikkönen, K., Matthews, K. A., Kuller, L. H., Reiber, C., & Bunker, C. H. (1999b). Anger, hostility, and visceral adipose tissue in healthy postmenopausal women. *Metabolism, 48*, 1146-1151.

Reidy, J. (1977). The aggressive characteristics of abused and neglected children. *Journal of Clinical Psychology, 33*, 1140-1145.

Rodriguez, C. M. & Green, A. J. (1997). Parenting stress and anger expression as predictors of child abuse potential. *Child Abuse & Neglect,* 21, 367-377.

Rosenberg, M. S. (1987). New directions for research on the psychological maltreatment of children. *American Psychologist, 42*, 166-171.

Rosmond, R., & Bjorntorp, P. (1999). Psychosocial and socio-economic factors in women and their relationship to obesity and regional body fat distribution. *International Journal of Obesity, 23*, 138-145.

Rosmond, R., Lapidus, L., Marin, P., & Bjorntorp, P. (1996). Mental distress, obesity and body fat distribution in middle-aged men. *Obesity Research, 4*, 245-252.

Sedlack, A. J. & Broadhurst, D. D. (2008). *Executive Summary of the Third National Incidence Study of Child Abuse and Neglect.* Retrieved November 1, 2008, from http://www.childwelfare.gov/pubs/statsinfo/nis3.cfm#national.

Shimokata, H., Muller, D. C., & Andres, R. (1989). Studies in the distribution of body fat. III. Effects of cigarette smoking. *JAMA, 261*, 1169-1173.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhart (Ed.), *Sociological Methodology 1982* (pp. 290-312). San Francisco: Jossey-Bass.

Soler, J. T., Folsom, A. R., Kaye, S. A., & Prlneas, R. J. (1989). Associations of abdominal obesity, fasting insulin, sex hormone binding globulin, and estrone with lipids and lipoproteins in postmenopausal women. *Atherosclerosis, 79*, 21-27.

Spielberger, C., Gorsuch, R., & Lushene, R. (1970). *STAI Manual for the State-Trait Anxiety Inventory*. Palo Alto: Consulting Psychologists Press.

Spielberger, C. D., Jacobs, G., Russell, S., & Crane, R. S. (1983). Assessment of anger: The State-Trait Anger Scale. In J. N. Butcher & C. D. Spielberger (Eds.), *Advances in personality assessment* (Vol. 2, pp. 159-187). Hillsdale, NJ: Lawrence Erlbaum.

Sternfeld, B., Ainsworth, B. A., & Quesenberry, C. P. J. (1999). Physical activity patterns in a diverse population of women. *Preventative Medicine, 28*, 313-323.

Sluyter, F., Keijser, J. N., Boomsma, D. I., van den Oord, E. J., & Snieder, H. (2000). Genetics of testosterone and the aggression-hostility-anger (AHA) syndrome: a study of middle-aged male twins. *Twin Research,* 3, 266-276.

Taylor, R. W., Keil, D., Gold, E. J., Williams, S. M., & Goulding, A. (1998). Body mass index, waist girth, and waist-to-hip ratio as indexes of total and regional adiposity in women: evaluation using receiver operating characteristic curves. *American Journal of Clinical Nutrition, 67*, 44-49.

Terry, R. B., Page, W. F., & Haskell, W. L. (1992). Waist hip ratio, body mass index, and premature mortality in U.S. army veterans during a 23-year follow-up study. *International Journal of Obesity, 16*, 417-422.

Thomas, C., Hypponen, E., & Power, C. (2008). Obesity and Type 2 Diabetes Risk in Midadult Life: The Role of Childhood Adversity. *Pediatrics, 121*, e1240-1249.

Thombs, B. D., Bernstein, D. P., Ziegelstein, R. C., Scher, C. D., Forde, D. R., Walker, E. A. et al. (2006). An evaluation of screening questions for childhood abuse in 2 community samples: Implications for clinical practice. *Archives of Internal Medicine,* 166, 2020-2026.

Wajchenberg, B. L. (2000). Subcutaneous and visceral adipose tissue: their relation to the metabolic syndrome. *Endocrine Reviews, 21*, 697-738.

Walker, E. A., Gelfand, A., Katon, W. J., Koss, M. P., Von Korff, M., Bernstein, D., et al. (1999). Adult health status of women with histories of childhood abuse and neglect. *American Journal of Medicine, 107*, 332-339.

Weiss, E. L., Longhurst, J. G., & Mazure, C. M. (1999). Childhood sexual abuse as a risk factor for depression in women: psychosocial and neurobiological correlates. *American Journal of Psychiatry, 156*, 816-828.

Widom, C. S., DuMont, K., & Czaja, S. J. (2007). A prospective investigation of major depressive disorder and comorbidity in abused and neglected children grown up. *Archives of General Psychiatry, 64*, 49-56.

Widom, C. S., Weiler, B. L., & Cottler, L. B. (1999). Childhood victimization and drug abuse: a comparison of prospective and retrospective findings. *Journal of Consulting and Clinical Psychology*, 67, 867-880.

Williamson, D. F., Thompson, T. J., Anda, R. F., Dietz, W. H., & Felitti, V. (2002). Body weight and obesity in adults and self-reported abuse in childhood. *International Journal of Obesity and Related Metabolic Disorders, 26*, 1075-1082.

Wing, R. R., Matthews, K. A., Kuller, L. H., Meilahn, E. N., & Plantinga, P. (1991). Waist to hip ratio in middle-aged women. Associations with behavioral and psychosocial factors and

with changes in cardiovascular risk factors. *Arteriosclerosis & Thrombosis, 11*, 1250-1257.

Yin, Z., Davis, C. L., Moore, J. B., & Treiber, F. A. (2005). Physical activity buffers the effects of chronic stress on adiposity in youth. *Annals of Behavioral Medicine*, 29-36.