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The Roles of Posttraumatic Stress Disorder and Major Depressive Disorder in Childhood Traumatic Stress and Weight Problems among Women

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Abstract

In this study, symptoms of posttraumatic stress disorder (PTSD) and major depressive disorder (MDD) were modeled as intervening variables in the relationship between childhood traumatic stress and weight outcomes in civilian women in the United States. Of the 148 participants, 72 had current PTSD, 64 had current MDD, and 32 had neither disorder. In separate single indirect effect models, there were significant indirect effects of both PTSD and depressive symptoms on body mass index and waist-hip ratio. When models included both PTSD and depressive symptoms, an indirect effect of PTSD symptoms was evident in the relationship between childhood traumatic stress and waist-hip ratio. PTSD may play a particularly important role in the development of central adiposity.

Although a large body of evidence indicates obesity is associated with negative health consequences, obesity rates in the United States continue to be elevated. Recent data from the National Health and Nutrition Examination Survey estimate the age-adjusted obesity prevalence in the United States to be 32% in men and 36% in women (Flegal, 2002). In addition to the medical problems associated with obesity, significant morbidity is associated with central adiposity (Hollmann, 1997). Previous research has suggested that the influence of waist circumference on insulin resistance is independent of body mass index (BMI; Racette, 2006) and that waist-hip ratio plays an important role in the development of hypertension (Obesity in Asia Collaboration, 2008).

Recent research has identified childhood traumatic stress as a potential risk factor for obesity in adulthood (Fuemmeler, Dedert, McClernon, & Beckham, 2009). Elevated rates of obesity in patients reporting a history of childhood abuse were first reported in case-control hospital-based studies (Felitti, 1991, 1993). In an analysis of data from 11,115 adults in the California Women's Health Survey, reports of a history of child abuse were related to increased risk of obesity in adulthood. This effect remained significant after controlling for demographic/socioeconomic and behavioral health variables (Alvarez, Pavao, Baumrind, & Kimerling, 2007). Using a population attributable fraction, these authors estimated that nearly 5% of obesity in the U.S. population may be attributed to childhood abuse. Data from the Adverse Childhood Experiences Cohort, a large sample of middle-aged adult HMO enrollees, also suggested an approximately two-fold increased risk of obesity among those reporting at least four incidents of childhood abuse (Anda et al., 2006). While these studies collectively suggest an association of childhood trauma with obesity, none of these studies

have conducted assessments of PTSD. Consequently, it is unclear whether an increased risk of obesity is due to trauma exposure, PTSD, depression, or a combination of these factors.

Based on elevations in a number of physical health outcomes in those who have suffered trauma, Schnurr and Jankowski (1999) proposed a model that depicts both PTSD and psychological alterations such as depression as partial mediators of trauma and health outcomes. This model was slightly modified in a recent review of health outcomes in PTSD (Dedert, Calhoun, Watkins, Sherwood, & Beckham, 2010) to include the role of health behavior in the formation of pre-clinical disease markers, such as obesity and central adiposity, which subsequently progress to physical illness.

The role of PTSD in obesity risk is supported by several studies observing increased rates of obesity in PTSD (David, Woodward, Esquenazi, & Mellman, 2004; Dobie et al., 2004; Perkonig, Owashi, Stein, Kirschbaum, & Wittchen, 2009; Trief, Ouimette, Wade, Shanahan, & Weinstock, 2006; Vieweg et al., 2007). However, most of this research has been conducted in male veterans. Similarly, a substantial literature has linked depression with increased rates of obesity (Atlantis & Baker, 2008; Carpenter, Hasin, Allison, & Faith, 2000; Markowitz, Friedman, & Arent, 2008; Simon et al., 2006). Longitudinal research suggests the relationship is bidirectional, with both depression and obesity increasing risk of the other problem (Luppino et al., 2010). To gain a more complete understanding of the association between PTSD, depression, and weight problems, it is important to consider the potentially distinct roles of traumatic stress and psychiatric symptoms.

The existing evidence suggests the possibility that relationships between childhood traumatic stress and adult weight problems are due in part to the development of symptoms of psychiatric disorders, specifically PTSD and depression. The degree to which psychiatric symptoms play a role in the relationship between childhood trauma and weight problems has implications for intervention. A direct relationship between childhood trauma and weight problems in the absence of a significant role of intervening psychiatric symptoms suggests a primarily behavioral health approach to reducing risk of weight problems in those suffering from childhood trauma. In contrast, a predominant role of psychiatric symptoms argues for more focus on a mental health approach with possible implications for weight management.

The current study was designed to extend previous literature on the association between obesity and PTSD to a female sample. In a further extension of previous work, a measure of waist-hip ratio was included as a dependent measure. Specifically, the study examined cross-sectional associations of self-reported childhood traumatic stress, symptoms of depression and PTSD, and weight outcomes in a sample of women in which PTSD and Major Depressive Disorder (MDD) were highly represented. The relationships among these variables were further evaluated with models testing whether symptoms of depression and PTSD might serve as intervening variables in the relationship between childhood traumatic stress and weight outcomes.

Method

Participants and Procedure

This study employed a secondary analysis of data from an investigation of psychiatric disorders and physical health outcomes in women (Beckham, Flood, Dennis, & Calhoun, 2009). A total of 193 women were screened for this study from 2001–2005. Participants were screened to fill three groups: current PTSD, current MDD, and a comparison group with neither disorder. Participants were recruited via advertising for a study on trauma and health posted at two local hospitals and a more general flyer to recruit participants for a non-PTSD comparison group. After study procedures were fully explained, all women provided

informed consent. The study was fully approved by both the University and VA institutional review boards.

The Clinician Administered PTSD Scale was used to determine PTSD diagnostic status (CAPS; Blake et al., 1995), and the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1997) was used to diagnose other possible Axis I disorders. Both of these structured interviews have demonstrated excellent reliability and validity in clinical settings (Weathers, Keane, & Davidson, 2001).

From the 193 participants screened for the study, 11 participants were excluded because they met diagnostic criteria for current alcohol or other substance dependence/abuse or psychotic disorders, including schizophrenia and bipolar with active manic symptoms. Two participants were excluded during the screening process due to medication usage (amitriptyline and methadone). Further, 32 participants were recruited for the comparison group but excluded from this analysis because they met criteria for lifetime (but not current) PTSD or lifetime MDD. This resulted in a final *N* of 148 for this analysis. Eight diagnostic raters were utilized, and interrater reliability for diagnoses based on videotapes of patient interviews was good (Fleiss $K = .94$). Study participants were compensated a total of \$150 for two sessions of questionnaires and diagnostic assessment.

Measures

The Traumatic Life Events Questionnaire (TLEQ; Kubany et al., 2000) is a 22-item questionnaire designed to assess exposure and response to traumatic events. Respondents were asked how many times they have experienced each of 21 different traumatic events (DSM-IV Criterion A1 for PTSD), as well as an additional item providing an opportunity to report any other potentially traumatic events. Those endorsing a particular event were also asked whether it met DSM-IV Criterion A2 for PTSD (i.e. experience of intense fear, helplessness, or horror), as well as several other follow-up questions such as when the event first occurred. Initial studies have demonstrated content validity and reliability of this measure (Kubany, et al., 2000). The TLEQ included three questions asking about unwanted sexual contact before age 18 and two items asking about severe physical punishment or witnessing family violence while growing up. Participants endorsing Criterion A2 for a given childhood trauma (physical or sexual) were coded as having suffered that trauma, allowing coding of dichotomous variables for childhood sexual and physical traumatic events.

The Davidson Trauma Scale is a 17-item self-rating clinical/research scale that assesses frequency and severity of each DSM-IV symptom of PTSD. Items were rated on a five-point scale. The scale has demonstrated high test-retest and split-half reliability, excellent internal consistency, concurrent validity, and discriminant validity (Davidson et al., 1997). An overall PTSD symptom score was calculated by adding the sum of all 17 frequency items and the sum of all 17 intensity items.

The Beck Depression Inventory-II (BDI-II) is a frequently used scale for measuring depressive severity (Beck, Steer, & Brown, 1996). A sum of all 21 items was used in primary analyses.

Physical Health Measure

Study personnel measured each participant's height and weight for calculation of BMI, as well as measurements of hip and waist circumference to assess central adiposity. Participants with a BMI score of 30 or more were sorted into the "obese" category.

Data Analysis

Pearson correlation coefficients were calculated to establish the presence, magnitude, and direction of bivariate associations between study variables before investigating relationships in multivariate models. To further investigate the relationship of childhood trauma with weight outcomes, simple indirect effect analyses examined PTSD symptoms and depressive symptoms as intervening variables in the relationship between childhood traumatic stress and weight outcomes. Modeling analyses utilized a nonparametric resampling procedure called bootstrapping (with $n = 5,000$ bootstrap resamples) to estimate the model's indirect effects (for discussion, see Preacher & Hayes, 2004; Shrout & Bolger, 2002). Bootstrapping generates an empirical approximation of the sampling distribution of a statistic by sampling, with replacement, from the original data set and calculating effects from the resulting data set. This approach yields direct effects of the predictor on the outcome variable as well as indirect effects, which are the magnitudes of the association of the predictor with the outcome that is transmitted by the intervening variable. The bootstrapping approach offers several advantages to more conventional modeling analyses. First, the resampling procedure circumvents problems often presented by non-normal distributions of the products of coefficients for indirect effects (Efron & Tibshirani, 1993). Parametric procedures that test indirect effects, such as the Sobel test, assume a normal sampling distribution of the product of coefficients yielded by multiplying the relationship between the predictor and the intervening variable by the relationship between the intervening variable and the outcome. Because the product of these coefficients is often not normally distributed, especially in samples that are not large (Bollen & Stine, 1990), this assumption is potentially problematic and could limit statistical power (Preacher & Hayes, 2004). As a result, bootstrapping offers more statistical power than traditional, parametric approaches (Preacher & Hayes, 2004) without inflating type I error (MacKinnon, Lockwood, & Williams, 2004).

Bootstrapping procedures also provide the opportunity to test multiple intervening variables in the same model. In this study, PTSD symptoms and depressive symptoms were modeled as intervening variables in the same model to provide insight into the relative potential roles of these psychiatric symptoms in weight outcomes. Because the indirect effect is a product of the association between the predictor and the intervening variable multiplied by the association between the intervening variable and the outcome, if a 95% confidence interval for the indirect effect does not include zero, the effect is statistically significant at the $p < .05$ level. While the absence of a total direct effect between the predictor and outcome has precluded examination of indirect effects, recent commentary has supported this practice (Hayes, in press; Shrout & Bolger, 2002). This is due in part to the multiple pathways by which a predictor might influence an outcome variable, perhaps in opposing directions. Recent publications on bootstrapping methods do not advocate the use of standardized coefficients, so the indirect effect itself is typically used as the measure of effect size. Estimates of indirect effects are scaled in terms of the unit of metric of predictor and outcome variables. Consequently, the indirect effect is the amount of the effect of the predictor on the outcome that is attributable to a particular indirect effect.

Results

Participants reported a mean age of 39.9 ($SD = 12.9$), 55% of the sample was comprised of non-Caucasian participants, and 41% were married. The sample was primarily community-based, as 16% of participants were veterans. Mean education level was 15 years ($SD = 2.9$). Childhood sexual abuse (CSA) was reported by 67 (45%) participants, while childhood exposure to physical abuse (CPA) was reported by 68 (46%) participants. Descriptive data on psychiatric morbidity and symptom severity, as well as weight variables, are presented in Table 1.

Bivariate correlations between study variables are presented in Table 2. While BMI was positively correlated with both CSA and CPA, there was no statistically significant bivariate correlation between waist-hip ratio and either childhood traumatic event variable. Obesity was related to increased risk in both participants with CSA ($\chi^2 = 14.00, p < .05, OR = 3.6$) and those with CPA ($\chi^2 = 15.29, p < .05, OR = 3.8$). BMI was correlated with symptoms of both PTSD and depression. Waist-hip ratio was also correlated with symptoms of both PTSD and depression.

Models first explored the indirect effects of PTSD symptoms and depressive symptoms as individual intervening variables in separate models. Results of all indirect effect models are presented in Tables 3 and 4. In models with BMI as the outcome, its association with CSA had a significant indirect effect only through PTSD symptoms. The simple indirect effect of 0.98 for the effect of CPA on BMI through PTSD means that a 0.98 increase in BMI is attributable to PTSD symptoms, as specified in the model. The influence of CPA on BMI exhibited indirect effects in separate models of both PTSD symptoms and depressive symptoms. In models with waist-hip ratio as the outcome, CSA had significant indirect effects through both PTSD symptoms and depressive symptoms. Similarly, CPA had significant indirect effects through both PTSD symptoms and depressive symptoms.

Next, models that simultaneously tested indirect effects of both PTSD symptoms and depressive symptoms in the association between childhood traumatic stress and weight outcomes were executed. This model is depicted in Figure 1. Consistent with models showing significant indirect effects of both PTSD symptoms and depressive symptoms in the relationship between CSA and BMI, there was a significant overall indirect effect. Neither PTSD symptoms nor depressive symptoms, however, produced significant indirect effects that were uniquely significant. Similarly, in analyses with the presence of CPA predicting BMI, neither PTSD symptoms nor depressive symptoms exhibited significant indirect effects, though the combined indirect effect of PTSD symptoms and depressive symptoms was statistically significant.

In analyses with CSA predicting waist-hip ratio, there was a significant combined indirect effect. There was also a significant indirect effect through PTSD symptoms, while no indirect effect was evident with depressive symptoms. Similarly, when CPA was used as the predictor of waist-hip ratio, there was a significant combined indirect effect, as well as a significant indirect effect through PTSD symptom, but not depressive symptoms.

Due to the high correlation between symptom measures, we conducted additional multiple intervening variable analyses with modified symptom measures that removed DTS items previously identified as comprising a dysphoric factor (items 7, 8, 9, 10, 11, 12, 13, and 14) (Baschnagel, O'Connor, Colder, & Hawk, 2005), and BDI-II items assessing constructs that had conceptual overlap with PTSD, including anhedonia, sleep disturbance, irritability, and concentration (items 4, 12, 16, 17, and 19 of the BDI-II). Results were similar to those observed with the original measures, with neither PTSD nor depressive symptoms remaining significant when used in the same model predicting BMI. In addition, only PTSD symptoms were significantly predictive of waist-hip ratio.

To test the influence of PTSD on the relationship between childhood trauma and weight problems, we examined a multiple indirect effects model including both PTSD alone and PTSD with comorbid MDD. When both diagnostic groups were included in the same model, only the presence of comorbid PTSD/MDD was associated with a significant indirect effect on both BMI (indirect effect = 0.009, 95% CI: 0.002–0.022, $p < .05$) and waist-hip ratio (indirect effect = 0.009, 95% CI: 0.001–0.021, $p < .05$).

Discussion

Results from this study were consistent with previous research noting positive bivariate relationships among childhood traumatic stress, symptoms of PTSD and depression, and adulthood BMI and obesity prevalence. Our results are consistent with those of previous researchers noting obesity problems associated with veterans with PTSD (David, et al., 2004; Dobie, et al., 2004; Perkonig, et al., 2009; Trief, et al., 2006; Vieweg, et al., 2007), but this has not always been found in studies with civilian samples. In addition, this study provided preliminary evidence that the association between weight outcomes and PTSD found in men may generalize to a civilian female sample. Future research could investigate potential gender differences in the association between trauma and weight problems, a possibility that could not be analyzed in our all-female dataset. To our knowledge, this is the first study to document elevated waist-hip ratios in PTSD. While many previous studies that have examined the association between PTSD and obesity have failed to account for depression, the results in the current study are supplemented by inclusion of data on depression.

Our results are partially consistent with an epidemiologic study finding increased obesity rates in PTSD, particularly in women (Perkonig, et al., 2009). Though this study did not find an association between obesity and MDD, Perkonig and colleagues examined data from a younger sample of participants in Germany. Because the previous findings noted a prospective relationship between only PTSD and obesity, it is possible that obesity often precedes the development of MDD. Findings from the current study also conflict with a previous study of veterans that found no elevation in waist-hip ratio in PTSD (Heppner et al., 2009). This could be attributed to sample characteristics, as the previous study was comprised primarily by males and exclusively by veterans.

The current study extends previous findings on weight problems and trauma by testing a model of psychiatric symptoms as intervening variables. Results provide little evidence of direct effects of childhood traumatic stress on weight problems. Only the models on the relationship between CPA and BMI resulted in a significant direct effect of trauma on weight outcomes. In contrast, single intervening variable models supported indirect effects of psychiatric symptoms in the association of childhood traumatic stress and weight problems. The limited direct effects of traumatic stress on weight problems provided further support for a substantial influence of psychiatric symptoms on the development of weight problems.

Symptoms of both PTSD and depression were consistently significant in single indirect effect models. Effects were less consistent in models when both depression and PTSD symptoms were included in multiple intervening variable models, although the combined indirect effect of PTSD and depressive symptoms was significant in all models. This pattern could be due to the overlap between symptoms of PTSD and depression ($r = .69$ in this sample), preventing either from accounting for unique variance in models with BMI as the outcome. It is possible that neither PTSD nor depressive symptoms predominate in the development of elevated BMI. While the combined indirect effect of PTSD and depressive symptoms was significant in all models with waist-hip ratio as the outcome, only PTSD symptoms had a significant indirect effect when both PTSD and depressive symptoms were included in the same model. The potential unique effect of PTSD in central adiposity merits further research.

While the predominance of indirect effects of PTSD symptoms over depressive symptoms was only observed in models with waist-hip ratio as the outcome, examination of diagnostic categories revealed that the presence of both PTSD and MDD was associated with a

significant indirect effect on both BMI and waist-hip ratio, even when examined in the same model as PTSD only. Overall, results from this study suggest that both PTSD and depressive symptoms are associated with indirect effects of childhood trauma on weight problems. Future research may indicate that it is the combination of PTSD and MDD, rather than one particular disorder, that indicates increased risk of developing weight problems.

In addition to the psychiatric variables examined in this study, other variables likely contribute to the association between childhood trauma and weight outcomes. Several studies support a role of altered stress response systems, including the hypothalamic-pituitary-adrenal axis (Syed & Weaver, 2005). In addition, preliminary evidence of elevated rates of binge-eating disorder in those with childhood sexual abuse (Grilo & Masheb, 2001; Striegel-Moore, Dohm, Pike, Wilfley, & Fairburn, 2002) suggests binge eating as a potential mechanism linking trauma and obesity (Gustafson & Sarwer, 2004; Holzer, Uppala, Wonderlich, Crosby, & Simonich, 2008). However, the temporal relationship between binge eating and obesity in those who have suffered childhood trauma has not been established. It is also possible that genetic differences contribute to the link between psychiatric disorders and weight problems (Fuemmeler et al., 2009).

Several limitations to this study suggest caution in interpreting the observed results. Most notably, the cross-sectional design prevented any inference that PTSD or depression temporally preceded weight problems. Future studies could utilize longitudinal research to establish a timeline for the onset of traumatic stress PTSD, MDD, behavioral health problems, and weight problems. Relative to previous epidemiologic studies, this study was small and will require replication, especially of novel findings such as the indirect effects of PTSD symptoms in the association between childhood traumatic stress and weight problems. Future research would benefit from more detailed measures of dietary and exercise habits, as well as assessments of the physiological indicators of the stress response and metabolic health.

There are several important clinical implications of research on indirect effects of PTSD and depression in the relationship between childhood traumatic stress and weight problems. Results suggest that children who suffer sexual or physical abuse could benefit from intervention to prevent obesity. In addition, a role of both PTSD and MDD in the development of weight problems suggests that screening and early treatment of psychiatric disorders could, in addition to improving mental health, provide benefits in terms of weight problems and physical health in adulthood. Physical activity and behavioral activation interventions could also produce benefits for the physical health of young people with psychiatric disorders such as PTSD and MDD, and provides an especially promising intervention target given recent evidence that exercise (Diaz & Motta, 2008) and behavioral activation (Jakupcak et al., 2006) can reduce PTSD symptoms.

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Figure 1.

Multiple Indirect Effects Model for the Relationship between Childhood Trauma and Weight Outcomes. PTSD symptoms and depressive symptoms are modeled as intervening variables that could potentially transmit indirect effects between childhood trauma and weight outcomes. In this model, C' represents the direct effect of childhood trauma on weight outcomes, the a_1b_1 pathway represents the indirect effect of childhood trauma on weight outcomes via PTSD symptoms, and the a_2b_2 pathway represents the indirect effect of childhood trauma on weight outcomes via depressive symptoms. PTSD = posttraumatic stress disorder.

Table 1

Means and Frequencies for Psychiatric and Weight Descriptive Statistics.

	CSA exposure (<i>n</i> = 67)		CPA exposure (<i>n</i> = 68)		Total sample (<i>n</i> = 148)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Body mass index	32.8	9.2	33.8	10.4	30.9	8.9
Waist-hip ratio	0.81	0.08	0.82	0.08	0.81	0.08
PTSD symptoms (DTS total)	52.5	34.9	53.7	31.0	34.6	36.6
Depressive symptoms (BDI total)	16.6	9.6	17.5	9.9	11.5	10.5
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
PTSD	44	66	46	68	72	49
MDD	33	49	38	56	64	43
Current comorbid PTSD/MDD	26	39	27	40	40	27
Current PTSD w/o MDD	18	27	19	28	32	22
Current MDD w/o PTSD	7	10	11	16	24	16
Obese (BMI ≥ 30)	43	64	44	65	43	29
Overweight (BMI ≥ 25)	52	78	53	78	50	34

Note. PTSD = Posttraumatic Stress Disorder. MDD = Major Depressive Disorder. CSA = Childhood Sexual Abuse. CPA = Childhood exposure to Physical Abuse. DTS = Davidsonson Trauma Scale. BDI = Beck Depression Inventory-II.

Table 2
Correlations Among Childhood Trauma, Psychiatric Symptoms, and Weight Outcomes (n = 148).

	CPA	PTSD symptoms	Depressive symptoms	Body mass index (BMI)	Waist-hip ratio
Childhood sexual assault (CSA)	.28*	.25*	.18*	.20*	.10
Childhood physical assault (CPA)	—	.28*	.26*	.30*	.15
PTSD symptoms		—	.69*	.26*	.38*
Depressive symptoms			—	.28*	.31*
Body mass index (BMI)				—	.40*

Note. Correlations between a dichotomous variable and a continuous variable were calculated with point-biserial correlations. Correlations between two dichotomous variables were calculated with phi correlations. PTSD = posttraumatic stress disorder.

* $p < .05$.

Table 3

Simple and Multiple Indirect Effects of Childhood Traumatic Stress on BMI Through PTSD Symptoms and Depressive Symptoms (n = 148; 5000 Bootstrap Samples).

	Direct effect	Standard error	Indirect effect	Standard error	Indirect effect 95% CI
Predictor: childhood sexual assault					
Simple indirect effects					
PTSD symptoms	2.52	1.47	0.98**	0.49	0.12–2.95
Depressive symptoms	2.70	1.42	0.83	0.49	–0.05–2.67
Multiple indirect effects					
PTSD symptoms			0.39	0.52	–0.52–1.59
Depressive symptoms			0.62	0.50	–0.01–2.04
Total	2.50	1.46	1.01*	0.54	0.18–2.33
Contrast: PTSD vs. depression			–0.24	0.88	–2.33–1.21
Predictor: childhood physical assault					
Simple indirect effects					
PTSD symptoms	4.32**	1.45	0.96**	0.50	0.08–2.86
Depressive symptoms	4.26**	1.42	1.03**	0.49	0.08–2.87
Multiple indirect effects					
PTSD symptoms			0.38	0.62	–0.68–1.94
Depressive symptoms			0.79	0.61	–0.21–2.31
Total	4.11**	1.45	1.17*	0.55	0.32–2.60
Contrast: PTSD vs. depression			–0.42	1.10	–2.65–1.79

Confidence intervals are corrected for median bias and skew (Efron & Tibshirani, 1993). Statistically significant effects are inferred when the confidence intervals do not include zero. The heading “Direct Effect” refers to the magnitude of the relationship between childhood trauma and BMI in a given model. The heading “Indirect Effect” refers to the magnitude of the effect on BMI that is attributed to the corresponding intervening variable for that row. To correct for family-wise alpha, simple indirect effects used a 99% CI. Models with multiple indirect effects used a 95% CI.

* $p < .05$.

** $p < .01$.

Table 4

Simple and Multiple Indirect Effects of Childhood Traumatic Stress on Waist-Hip Ratio through PTSD Symptoms and Depressive Symptoms (n = 148; 5000 Bootstrap Samples).

	Direct effect	Standard error	Indirect effect	Standard error	Indirect effect 95% CI
Predictor: childhood sexual assault					
Simple indirect effects					
PTSD symptoms	0.001	0.012	0.015**	0.005	0.004–0.033
Depressive symptoms	0.007	0.012	0.009	0.004	–0.001–0.023
Multiple indirect effects					
PTSD symptoms			0.012*	0.006	0.003–0.028
Depressive symptoms			0.003	0.004	–0.002–0.013
Total	0.001	0.012	0.015*	0.006	0.005–0.028
Contrast: PTSD vs. depression			0.009	0.008	–0.005–0.028
Predictor: childhood physical assault					
Simple indirect effects					
PTSD symptoms	0.008	0.013	0.016**	0.005	0.005–0.034
Depressive symptoms	0.012	0.013	0.011**	0.005	0.002–0.027
Multiple indirect effects					
PTSD symptoms			0.013*	0.006	0.003–0.027
Depressive symptoms			0.004	0.005	–0.004–0.016
Total	0.007	0.013	0.017*	0.006	0.007–0.030
Contrast: PTSD vs. depression			0.009	0.009	–0.008–0.029

Confidence intervals are corrected for median bias and skew (Efron & Tibshirani, 1993). Statistically significant effects are inferred when the confidence intervals do not include zero. The heading “Direct Effect” refers to the magnitude of the relationship between childhood trauma and waist-hip ratio in a given model. The heading “Indirect Effect” refers to the magnitude of the effect on waist-hip ratio that is attributed to the corresponding intervening variable for that row. To correct for family-wise alpha, simple indirect effects used a 99% CI. Models with multiple indirect effects used a 95% CI.

* p < .05 level.

** p < .01.