

# Differences in the association between childhood trauma and BMI in black and white South African women

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## Abstract

**Objective:** Childhood trauma has previously been associated with adult obesity. The aim of this study was to determine if ethnicity altered the relationship between childhood trauma and obesity in South African women. **Methods:** Forty-four normal-weight (BMI < 25 kg/m<sup>2</sup>) and obese (BMI > 30 kg/m<sup>2</sup>), black and white premenopausal women completed the Childhood Trauma Questionnaire (CTQ), which retrospectively assessed emotional and physical neglect, and emotional, physical and sexual abuse in childhood. **Results:** Body composition did not differ by ethnicity in the normal-weight and obese groups. However, independent of BMI group, there were significant differences in socioeconomic status (SES) between black and white women (P < 0.01). Total CTQ score, as well as the sub-scales, physical and emotional neglect, and physical and sexual abuse were higher in black than white women (all P < 0.05), but these scores did not differ between BMI groups. Apart from the sexual abuse score, the differences in physical and emotional neglect and physical abuse scores were no longer significant after adjusting for ethnic differences in age and SES. For sexual abuse, there was a significant interaction between ethnicity and BMI group (P = 0.04), with scores in normal weight women being higher in black than white women, but scores in obese women not differing by ethnicity. **Conclusion:** Ethnicity alters the association between childhood sexual abuse and BMI status. Larger studies are required to verify this finding, including measures of body image and body size satisfaction that may explain these findings.

**Keywords:** Childhood trauma questionnaire; Body fat; Body image; Sexual abuse; Ethnicity, Socioeconomic status

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## Introduction

The prevalence of obesity (body mass index [BMI] > 30 kg/m<sup>2</sup>) in women in South Africa is high, with black women being more commonly affected than white women (31.8% vs. 22.7%).<sup>1</sup> Although many studies have examined traditional risk factors for obesity in South African women,

including genetics, diet, physical activity<sup>2</sup>, very few studies have examined childhood psychosocial circumstances and their effect on obesity risk.

Childhood psychological trauma has been associated with poor mental health, as well as poor physical health.<sup>3</sup> For example, Batten et al<sup>4</sup> indicated that reported history of childhood abuse or neglect was associated with an increased risk of lifetime depressive disorders in both men and women. Further, in women only, reported history of childhood abuse or neglect was also associated with a 9-fold increase in cardiovascular disorders. Obesity, a major risk factor for cardiovascular diseases, has also been associated with childhood abuse.<sup>5-10</sup> In a retrospective

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cohort study including 13 177 participants aged 19-92 years, Williamson et al.<sup>5</sup> found that the fraction of adult obesity cases that were attributable to childhood abuse were 8% for a BMI  $\geq 30$  kg/m<sup>2</sup> and 17% for BMI  $\geq 40$  kg/m<sup>2</sup>. Further, the risk of obesity increased with the number and severity of each type of abuse, i.e. neglect, sexual, emotional and physical abuse.<sup>5</sup>

Many factors/moderators may impact the relationship between childhood abuse and obesity risk, including age, gender, socioeconomic status, as well as ethnicity.<sup>7</sup> Notably, Medei and Matthews<sup>7</sup>, in their systematic review incorporating studies from mainly high-income countries, reported that the relationship between childhood abuse and obesity is more consistent in females than males, and that more black women reported histories of physical abuse than other races. Further, they reported that lower socioeconomic status is associated with increased risk of both childhood abuse and obesity.

The prevalence of child neglect and trauma is high in South Africa. In a nationally representative sample of South Africans (South African Stress and Health Study), Williams et al.<sup>11</sup> found that the prevalence of childhood abuse was as high as 11.6%, with the black population most affected. To our knowledge, no research has been undertaken examining the effects of childhood trauma on obesity risk in South Africa. South Africa provides a unique laboratory to explore the pathogenesis of different phenotypes, by examining whether different population groups, which have been exposed to quite different environments, show variance in such phenotypes. Accordingly, the aim of the study was to examine ethnic differences in the association between childhood trauma and obesity in black and white South African women matched for body fatness.

## Methods

### Subjects

The study included 44 urbanized premenopausal South African women, comprising eight normal-weight (BMI <25 kg/m<sup>2</sup>) black, 12 normal-weight white and 9 obese (BMI >30 kg/m<sup>2</sup>) black and 15 obese white South African women. The terms black and white are not meant to reify racial categories, but rather to reflect ongoing disparities that reflect different histories. Subjects were recruited by advertisement in local newspapers and from local church groups, community centers and universities. Inclusion criteria were: (i) age 18-45 years, (ii) no known diseases or taking medication for any metabolic disorders, and (iii) not currently pregnant, lactating or postmenopausal.

### Ethics

The study was approved by the Research Ethics Committee of the Faculty of Health Sciences of the University of Cape Town. Prior to participating in the study, participants gave written informed consent.

### Measurements

Socioeconomic status (SES) was assessed on the basis of asset index, housing density, education and employment, as previously described.<sup>12</sup> Asset index was based on 14 items reflecting individual and household wealth. Education was categorized by grades passed. Housing

density was defined as the number of persons per room living in the household. Subjects were categorized as unemployed, students, informally employed or formally employed. Based on a rank sum of these scores, a SES score was devised which showed good internal reliability (Standardized Cronbach's  $\alpha=0.829$ ).

Weight, height, and waist (level of umbilicus) circumferences were taken. Body fatness was measured using dual-energy-X-ray absorptiometry (DXA, Discovery-W, Software version 4.40, Hologic Inc., Bedford, MA). Body composition of subjects that exceeded the scanning region was calculated using the arm-replaced method.<sup>13</sup>

Self-reported exposure to childhood trauma was measured using the short form of the Childhood Trauma Questionnaire (CTQ).<sup>14</sup> The 28-item version of CTQ comprises the following subscales: physical and emotional neglect, and physical, emotional and sexual abuse. Each subscale score ranges from 5 to 25, with higher scores indicative of greater abuse. A total abuse score (ranging from 25 to 125) was calculated by summing the values obtained on the five subscales.

### Data analysis

The data was analyzed using STATISTICA Version 10 (Statsoft Inc., Tulsa, OK). Demographics and body composition of the normal-weight and obese, black and white women are presented as mean  $\pm$  standard error and were compared using a two-way analysis of variance (ANOVA) with Fisher LSD post-hoc analysis, adjusting for age. CTQ data of the normal-weight and obese, black and white women are presented as raw values (Figure 1), as well as adjusted (for age and SES) mean  $\pm$  standard error (Table 1). Differences in CTQ scores between ethnic and BMI groups were compared using a two-way ANOVA with Fisher LSD post-hoc analysis, with and without covarying for age and SES.

### Results

The characteristics of the participants are presented in Table I. Obese white women were older than their normal-weight counterparts, and consequently all subsequent analyses were adjusted for age. Irrespective of BMI group, black women had a significantly lower total SES score, based on lower levels of education, higher unemployment, a lower asset index and a higher housing density.

Black women were shorter than white women, but both the normal-weight and obese black and white women were well matched for BMI and body fat %. By design, obese women were heavier and had higher BMI and body fat % than normal-weight women.

The raw (unadjusted) scores for the CTQ and the CTQ subscales are presented in Figure 1. The total CTQ score, as well as all the scores for the subscales, apart from emotional abuse, were higher in black than white women ( $P<0.05$  for ethnicity), but did not differ by BMI group ( $P>0.05$  for BMI group). Specifically, total CTQ and physical abuse scores were higher in normal-weight black than normal-weight and obese white women, whereas emotional neglect was higher in obese black than normal-weight and obese white women. Physical neglect was

**Table I: Characteristics of the participants according to ethnicity and BMI**

	Normal-weight black (n=8)	Normal-weight white (n=12)	Obese black (n=9)	Obese white (n=15)
<b>Demographics</b>				
Age (yrs)	24±1	25±3 <sup>B</sup>	27±1	31±2 <sup>B</sup>
Tertiary education (%)	22.2 <sup>C</sup>	100 <sup>C</sup>	0 <sup>D</sup>	78.6 <sup>D</sup>
Unemployment (%)	77.8 <sup>C</sup>	0 <sup>C</sup>	62.5 <sup>D</sup>	13.3 <sup>D</sup>
Housing density (people/room)	2.2±0.6 <sup>C</sup>	0.4±0.1 <sup>C</sup>	2.0±0.3 <sup>D</sup>	0.4±0.2 <sup>D</sup>
Asset Index (%)	39.7±9.0 <sup>C</sup>	82.1±5.04 <sup>C</sup>	27.7±4.8 <sup>D</sup>	86.2±2.7 <sup>D</sup>
Total SES score	11.9±1.7 <sup>C</sup>	22.3±0.8 <sup>C</sup>	10.6±1.2 <sup>D</sup>	23.0±0.5 <sup>D</sup>
<b>Body composition</b>				
Height (cm)	157±3 <sup>C</sup>	169±2 <sup>C</sup>	157±3 <sup>D</sup>	167±2 <sup>D</sup>
Weight (kg)	56.9±2.4 <sup>A</sup>	64.9±1.3 <sup>B</sup>	95.1±3.4 <sup>A</sup>	106.6±6.6 <sup>B</sup>
BMI (kg/m <sup>2</sup> )	22.9±0.6 <sup>A</sup>	22.7±0.4 <sup>B</sup>	38.6±0.9 <sup>A</sup>	37.8±1.7 <sup>B</sup>
Body fat (%)	31.9±2.2 <sup>A</sup>	30.5±2.0 <sup>B</sup>	47.2±1.0 <sup>A</sup>	45.2±1.0 <sup>B</sup>
<b>Childhood trauma questionnaire (CTQ) scores adjusted for age and SES</b>				
Total CTQ score *	38.8±7.9	43.1±6.3	33.2±9.0	45.9±6.0
Physical neglect	8.6±1.6	7.7±1.2	8.4±1.8	7.1±1.2
Emotional neglect *	7.0±2.1	10.9±1.7	8.7±2.4	11.5±1.6
Physical abuse	9.0±1.9	7.7±1.5	6.2±2.1	7.2±1.4
Emotional abuse *	5.6±2.1	11.0±1.7	4.2±2.4	11.7±1.6
Sexual abuse	8.6±1.9 <sup>C</sup>	5.9±1.5 <sup>C</sup>	5.7±2.1	8.4±1.4

Values are mean ± standard error. Demographic and body composition variables adjusted for age. Childhood trauma questionnaire (CTQ) scores adjusted for age and total socioeconomic status (SES) score. <sup>A</sup>P<0.05 and <sup>B</sup>P<0.01 for normal-weight black vs. obese black; <sup>C</sup>P<0.05 and <sup>D</sup>P<0.01 for normal-weight white vs. obese white; <sup>E</sup>P<0.05 and <sup>F</sup>P<0.01 for normal-weight black vs. normal-weight white; <sup>G</sup>P<0.05 and <sup>H</sup>P<0.01 for obese black vs. obese white. \* represents a significant effect of SES score.

higher in all black than white women, and physical abuse was higher in normal-weight black than normal-weight white women. However, apart from the sexual abuse score, the differences in these scores were no longer significant after adjusting for ethnic differences in age and SES (Table I). For sexual abuse, there was a significant interaction between ethnicity and BMI group ( $P=0.04$ ), with scores in normal weight women being higher in black than white women, but scores in obese women not differing by ethnicity.

## Discussion

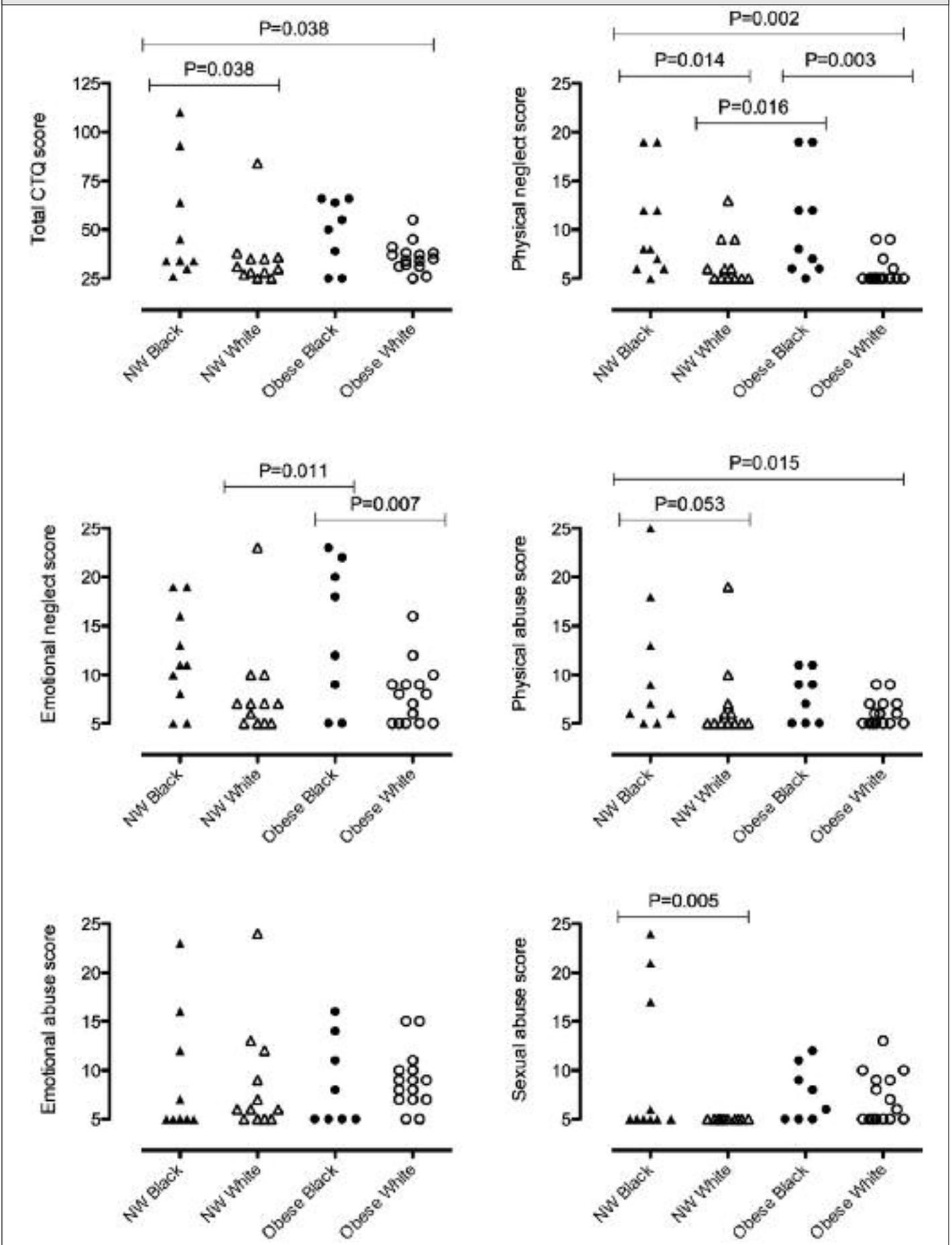
The main finding of this study was that ethnicity altered the association between childhood sexual abuse and BMI status such that in normal-weight women, sexual abuse was higher in black than white women, whereas in obese women, sexual abuse score did not differ by ethnicity. In contrast, no associations between the other subscales of childhood trauma, including physical and emotional neglect/abuse and BMI status were found. Rather, we found that childhood trauma was higher in black than white women (Figure 1), but this difference was largely driven by differences in socioeconomic status rather than ethnicity per se (Table I).

Many studies have shown an association between childhood abuse and obesity<sup>5-10</sup>, but few have examined specific subtypes of abuse or examined the interaction with ethnicity. In support of our findings, Midei et al.<sup>8</sup> in a sample of 311 black and white women in the USA, assessed childhood abuse using the CTQ, and showed that obesity was related to physical and sexual

abuse, as opposed to neglect and emotional abuse. However, the interaction with ethnicity was not reported.

In our study we showed that ethnicity altered the relationship between childhood sexual abuse and BMI status, which may possibly be explained by ethnic differences in body image and perceptions regarding body size. We have recently shown that white women associate beauty, respect and happiness with a smaller body size than their black counterparts.<sup>15</sup> Studies in largely white populations have suggested that eating is regulated as a 'protective function'.<sup>9</sup> These studies imply that white women who are sexually abused may become obese, in order to be viewed as less attractive and therefore are protected against future sexual advances/abuses.<sup>9</sup> In contrast to white women, black women in South Africa regard a larger BMI as attractive, showing greater wealth, dignity and respect, while being lean is regarded as being less beautiful, and associated with having HIV.<sup>16,17</sup> Extending the theory that eating is regulated as a 'protective function'<sup>9</sup>, our data suggest that being lean may protect black women against sexual advances/abusers. We therefore hypothesize that after early adversity there is emotional dysregulation, resulting in altered eating responses (e.g. altered eating patterns after exposure to stressors). In particular environments (e.g. those which emphasize that a low BMI is attractive), this may express itself as relative weight gain, while in other environments (e.g. those which emphasize that a high BMI is attractive), this may express itself as relative weight loss. It must be noted that there is a shift in black middle socio-economic classes that weight loss and a

Figure 1: Comparison of self-reported exposure to childhood trauma between normal-weight (NW) and obese, black and white women, measured using the Childhood Trauma Questionnaire (CTQ) and its sub-scales<sup>14</sup>



smaller body size is considered attractive, and that this sample is largely drawn from a disadvantaged community. This still leaves the question of whether the results are mediated by ethnicity or whether the effects of ethnicity are mediated by socioeconomic status.

Irrespective of body size, childhood trauma scores were higher in black than white women, supporting previous studies from South Africa<sup>11</sup> and the USA.<sup>8</sup> However, when adjusting for ethnic differences in socioeconomic status, we found that these differences were no longer significant. An association between interpersonal violence and socioeconomic status has been previously established<sup>7</sup> and possibly explains the higher childhood trauma in black women who were of a significantly lower socioeconomic status than the white women.

The strength of the study is the use of DXA as a precise measure of body fatness, compared to BMI estimates used in other studies<sup>7</sup>, and the use of the CTQ, which has been shown to have good test-retest reliability, measurement invariance across diverse populations and good criterion-related validity against clinical interview and therapist ratings.<sup>14,18,19</sup> Limitations of the study include the small sample size and the retrospective design, from which we cannot infer causality. The present study also relied on a self-report measure of abuse, which may result in either over- or under reporting. A study that includes a measure of collateral history to support the experience of trauma/abuse would have more predictive power. A more representative sample including larger numbers, as well as older adults and men would provide more information on these relationships. Further, information on resilience and recovery would be informative, as well as inclusion of additional measures to address the mechanisms underlying the relationship, are important for future research.

### Conclusion

In this small study we showed that ethnicity alters the association between childhood sexual abuse and BMI status. In our setting, ethnic population is partly a proxy for differences in views about body weight and beauty. If replicated in more extensive studies, this finding may provide a very useful model for exploring the pathogenesis of obesity in general, and the way in which early adversity interacts with societal views of weight gain in particular.

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