

Letter to the Editor

**Sex- and Type-specific Relationship of Childhood Maltreatment with General Obesity and Abdominal Adiposity in Chinese College Students***

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Childhood maltreatment (CM) is a serious problem for children's future development. The prevalence of childhood maltreatment (CM) among college students in China was 64.7 percent, with the highest prevalence observed for emotional neglect (60.0%) and the lowest for sexual abuse (15.7%)^[1]. A growing body of evidence suggests that CM related to multiple physical and mental health outcomes, such as depression and anxiety, especially in obesity^[2].

Obesity among adults is one of the major health concerns. WHO estimates that more than 1.3 billion adults worldwide are overweight, and a further 600 million are obese^[3]. Body mass index (BMI) measures general obesity (ie, abnormal or excessive fat accumulation), abdominal obesity is fat accumulation under the skin of the abdomen or in the internal organs of the abdomen^[4]. Measures of abdominal obesity are better predictors of cardiovascular disease and all-cause mortality than is general obesity^[4].

Although numerous previous studies have established a positive correlation between CM and adult obesity, several key questions remain that warrant further exploration. First, whether the effects of the five types of childhood abuse on obesity in adulthood uniform or heterogeneous? Evidence suggests that all five types of CM are positively associated with BMI in adulthood, but others believed there was no significant association between physical neglect or abuse, sexual abuse and adult obesity (BMI), among the various types of child

abuse^[5]. Second, whether the associations between subtypes of child maltreatment and obesity indexes differ across sexes? Previous studies have shown that childhood physical abuse in girls was not associated with obesity in adulthood, but recent studies have shown the specificity of physical and sexual abuse appeared to be stronger among females^[6]. In addition, the social context and cultural background of China differ from those of Western countries, which might impact the relationship between CM and obesity. For example, unlike in Western countries, Chinese parents prefer physically punitive education, which increases the risk of childhood somatic abuse and may affect obesity indicators in adulthood. Third, is there an interaction effect between recent adverse life events and CM on obesity indexes? Previous research indicates a connection between childhood maltreatment and obesity, suggesting that more recent adversities may exert a different influence on health than remote ones, including factors like depressive symptoms, anxiety, and pain^[5]. Stressful events occurring in the past six months had a more pronounced impact on neuroticism levels compared to distant events, with neuroticism levels serving as crucial predictors of both mental and physical health issues. There was a close link between early and recent adversity experiences, showing an interaction at the level of recent adverse events which heightened the risk of mental health problems. Nonetheless, limited research has delved into the repercussions of recent adverse life events on obesity.

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In summary, exposure to CM might be associated with obesity in early adulthood. There is a variation in the prevalence of obesity and childhood abuse across different countries, and the relationship between types of CM and obesity indicators has not been validated among individuals in early adulthood in China. To address this gap, our study employed a linear regression model to explore the associations among CM, obesity, and recent adverse life events.

We recruited college students *via* flyers and posters between October and November 2023. There were 337 college students from Anhui Medical University (Hefei, Anhui, China) in this study. All enumerators were uniformly trained before the survey. We provided a self-administered questionnaire on adolescent mental health behaviors, which collected information regarding general demographic characteristics ([Supplementary Table S1](#), available in www.besjournal.com). The study protocol was approved by the ethics committee of Anhui Medical University (No. 20210355), and informed consent was obtained from all participants. Moreover, the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) was used to report observational data ([Supplementary Table S2](#), available in www.besjournal.com).

The inclusion criterion was as follows: freshmen of the School of Public Health, Anhui Medical University, China (aged ≥ 18 years). Exclusion criteria included severe liver/kidney disease, physical disability, serious injury or infection, use of psychotropic drugs, and incomplete questionnaire data. Individuals with incomplete information on CM ($n = 12$) and those with missing body composition measurements ($n = 20$) were excluded from this study. Finally, 305 participants (aged ≥ 18 years) were included in this study ([Supplementary Figure S1](#), available in www.besjournal.com).

The Chinese version of the Childhood Trauma Questionnaire-Short Form (CTQ-SF) was used to assess CM^[7]. The CTQ-SF evaluates five dimensions, encompassing emotional abuse, physical abuse, sexual abuse, emotional neglect and physical neglect. Participants rated their responses to each question on a 5-point Likert scale, yielding total scores on the five dimensions ranging from 25 to 125. Higher scores indicate that participants have experienced severe child maltreatment (Cronbach $\alpha = 0.86$).

Two research assistants guided participants through the questionnaire. Height and weight were measured using appropriate devices, with

participants asked to remove their shoes before measurement. Height readings were expressed in centimeters and weight in kilograms. The result is averaged twice. Waist circumference (WC) was measured by the researchers at the fullest part of the buttocks. Participants were instructed to stand upright with legs together and arms naturally hanging down, and a tape measure was placed horizontally from the pubic symphysis to the most convex point of the gluteus maximus muscle.

Trained researchers carefully measured participants' body composition using the InBody S10 (InBody Corp., Seoul, Korea), a medical grade body composition analyzer, that utilizes advanced technology, including an 8-point tactile electrode system, direct segmented measurement, and multifrequency analysis. Data on abdominal obesity indexes, including fat mass (FM), body fat percentage (PBF), WC, abdominal visceral fat area (VFA), waist-hip ratio (WHR), and general obesity index such as body mass index (BMI) were recorded by the monitor, which is seamlessly integrated with telemedicine software for efficient storage in each participant's electronic health record.

The Chinese version of the Adolescent Self-Rating Life Events Checklist (ASLEC) comprises 27 negative life events specifically tailored to evaluate recent mental experiences in adolescents^[8]. The ASLEC scale encompasses 6 factors, including interpersonal relationships, academic pressure, punishment, loss, health adaptation, and other factors. Each item is rated on a six-point Likert scale, ranging from 0 to 5. By summing up all experienced events, the total number of negative life events encountered by the respondent can be calculated, with a higher total score indicating elevated stress levels (Cronbach $\alpha = 0.93$).

Drawing from prior research^[9], we incorporated the following covariates into our analysis: age, gender (male, female), family type (nuclear family, single-parent family or extended family), family economic status (< 5,000 yuan, 5,000–10,000 yuan, or > 10,000 yuan), parental educational attainment (primary school and below, junior high school, or senior high school), smoking habits (≥ 1 smoking episodes in the last 30 days, yes or no), and drinking habits (≥ 1 incidents of alcohol consumption in the last 30 days, yes or no).

The data is depicted as mean \pm SD or median (interquartile range). For discrete variables, absolute frequency, percentage, and 95% confidence intervals (CIs) were computed. Variances in different parameters between two groups were assessed

using the unpaired *t*-test, while the Fisher exact test was employed to compare frequencies between the two groups. To test for a potential association between CM and adiposity indicators, linear regression models were used to obtain β coefficients and 95% *CI*s for changes in adiposity indicators. Sex-stratified linear regression analyses were conducted to assess the correlation between CM and indicators of obesity in early adulthood after adjusting for covariates. To assess the effect of recent adverse life events on this relationship, linear regression analyses were performed to assess the correlation between CM, recent adverse life events, and indicators of obesity in adulthood after adjusting for covariates and to calculate the β -value. All analyses were performed with SPSS (version 27.0; IBM Corp). A two-sided *P* value of ≤ 0.05 was considered statistically significant.

This study assessed the association between five

dimensions of CM and obesity indicators through multiple comparisons. To reduce the risk of a type I error, a 99% *CI*s was used for the effect size of each dimension analyzed. After adjusting for covariates, emotional abuse demonstrated a stronger association with obesity indicators (VFA, BMI, PBF, FM, WC, and hipline). Physical abuse and emotional neglect were associated with two obesity indicators each (physical abuse: FM and hipline; emotional neglect: BMI and hipline). Sexual abuse showed an association only with hipline, however, no significant associations were found between somatic neglect and obesity indicators. **Table 1** provides further details. It is well established that individuals who have experienced CM often adopt unhealthy lifestyle behaviors, such as detrimental exercise patterns and poor dietary habits, which can substantially contribute to obesity.

In addition, we performed sex-stratified linear

Table 1. Association of different types of child maltreatment with obesity indicators

Variables	EA		PA		SA		EN		PN	
	β (<i>CI</i> s)	<i>P</i>	β (<i>CI</i> s)	<i>P</i>	β (<i>CI</i> s)	<i>P</i>	β (<i>CI</i> s)	<i>P</i>	β (<i>CI</i> s)	<i>P</i>
99% <i>CI</i> s; <i>P</i> ≤ 0.01										
VFA	29.090 (5.335, 52.845)	0.002	15.223 (-11.793, 42.239)	0.145	19.989 (-11.518, 51.495)	0.101	18.835 (-7.760, 45.430)	0.067	7.688 (-18.361, 33.736)	0.445
BMI	4.255 (1.687, 6.824)	< 0.001	2.917 (-0.022, 5.857)	0.011	2.884 (-0.559, 6.327)	0.031	3.253 (0.362, 6.144)	0.004	2.176 (-0.664, 5.016)	0.048
PBF	6.208 (1.516, 10.900)	< 0.001	2.666 (-2.690, 8.022)	0.198	3.729 (-2.516, 9.973)	0.123	3.933 (-1.331, 9.198)	0.054	1.964 (-3.193, 7.120)	0.324
FM	7.273 (2.368, 12.177)	< 0.001	4.470 (-1.131, 10.071)	0.039	5.295 (-1.242, 11.832)	0.037	5.201 (-0.308, 10.709)	0.015	3.063 (-2.343, 8.468)	0.143
WC	8.623 (1.891, 15.355)	0.001	5.407 (-2.246, 13.059)	0.068	6.249 (-2.685, 15.183)	0.071	5.926 (-1.613, 13.465)	0.042	2.840 (-4.548, 10.229)	0.320
Hipline	6.763 (1.796, 11.729)	< 0.001	6.802 (1.206, 12.397)	0.002	6.530 (-0.039, 13.099)	0.010	6.090 (0.553, 11.627)	0.005	4.510 (-0.920, 9.939)	0.032
WHR	0.025 (-0.020, 0.070)	0.146	-0.011 (-0.062, 0.039)	0.567	-0.002 (-0.061, 0.058)	0.947	0.004 (-0.046, 0.053)	0.852	-0.016 (-0.065, 0.033)	0.394
95% <i>CI</i> s; <i>P</i> ≤ 0.05										
VFA	29.090 (11.059, 47.121)	0.002	15.223 (-5.283, 35.729)	0.145	19.989 (-3.926, 43.903)	0.101	18.835 (-1.351, 39.021)	0.067	7.688 (-12.084, 27.460)	0.445
BMI	4.255 (2.306, 6.205)	< 0.001	2.917 (0.686, 5.149)	0.011	2.884 (0.271, 5.498)	0.031	3.253 (1.059, 5.447)	0.004	2.176 (0.021, 4.332)	0.048
PBF	6.208 (2.646, 9.769)	< 0.001	2.666 (-1.399, 6.731)	0.198	3.729 (-1.011, 8.468)	0.123	3.933 (-0.063, 7.929)	0.054	1.964 (-1.950, 5.878)	0.324
FM	7.273 (3.550, 10.995)	< 0.001	4.470 (0.219, 8.721)	0.039	5.295 (0.333, 10.257)	0.037	5.201 (1.019, 9.382)	0.015	3.063 (-1.040, 7.166)	0.143
WC	8.623 (3.513, 13.733)	0.001	5.407 (-0.402, 11.215)	0.068	6.249 (-0.532, 13.031)	0.071	5.926 (0.204, 11.649)	0.042	2.840 (-2.768, 8.449)	0.320
Hipline	6.763 (2.993, 10.532)	< 0.001	6.802 (2.554, 11.049)	0.002	6.530 (1.544, 11.516)	0.010	6.090 (1.887, 10.293)	0.005	4.510 (0.389, 8.631)	0.032
WHR	0.025 (-0.009, 0.059)	0.146	-0.011 (-0.050, 0.027)	0.567	-0.002 (-0.046, 0.043)	0.947	0.004 (-0.034, 0.041)	0.852	-0.016 (-0.053, 0.021)	0.394

Note. EA, Emotional abuse; PA, Physical abuse; SA, Sexual abuse; EN, Emotional neglect; PN, Physical neglect; VFA, visceral fat area; BMI, body mass index; PBF, percentage of body fat; FM, fat mass; WHR, waist hip ratio; WC, waist circumference. Models were adjusted for age, sex, drinking, smoking, father education, mother education, family type, family economic and recent adolescent self-rating life events.

regression models to explore the relationships between different types of CM and obesity indicators. The results indicated that none of the five types of CM were associated with obesity indicators in females. However, in males, emotional abuse showed a stronger association with obesity indicators (VFA, BMI, PBF, FM, WC, and hipline). Moreover, both physical abuse and emotional neglect exhibited significant associations (see Figure 1, Supplementary Figure S2, Supplementary Table S3, and Supplementary Table S4, available in www.besjournal.com). One plausible explanation for these findings is that males are more prone to experiencing the adverse effects of childhood abuse. Furthermore, in China, higher education is associated with an increased risk of overall obesity and abdominal obesity in males, whereas this risk is lower among females. Therefore, maltreated male college students may experience more psychological and behavioral problems, such as poor sleep and reduced physical activity, which contribute to obesity in early adulthood. However, a recent study in Germany reported contrasting findings^[6]. This difference may be explained by the fact that the German study focused on a middle-aged population, whereas our study focused on university students in China. The impact of CM on the onset of obesity in adolescents may manifest over 2–5 years^[10], or possibly even longer. Given that this study was conducted within

the Chinese cultural context, the cultural and social context unique to China may influence the extrapolation of the results to other countries.

The results further indicated that recent adverse life events were significantly associated with hipline ($\beta = -0.079$; 99% CIs: -0.153 to -0.006) and WHR ($\beta = 0.001$; 99% CIs: 0.000 to 0.001). In addition, we explored whether there was an interaction between recent adversarial life events and childhood abuse on obesity metrics. The results of the multiplicative interaction effects showed that physical abuse and neglect, sexual abuse, and emotional neglect interacted with recent adverse life events on the hip circumference. However, the results regarding joint effects did not show statistical significance. This finding revealed that participants who experienced childhood abuse and also recently encountered moderate levels of adverse life events tended to exhibit higher levels of BMI. One plausible explanation is that children who experienced childhood abuse may be more susceptible to adversities in adulthood. Furthermore, persistent stress may affect the brain's response to food, thus predisposing individuals to poor eating habits, which, if prolonged, could increase the risk of obesity. Therefore, it is crucial to address the impact of recent adverse life events on abdominal obesity in early adulthood. Further details can be found in Table 2, Supplementary Table S5 (available in

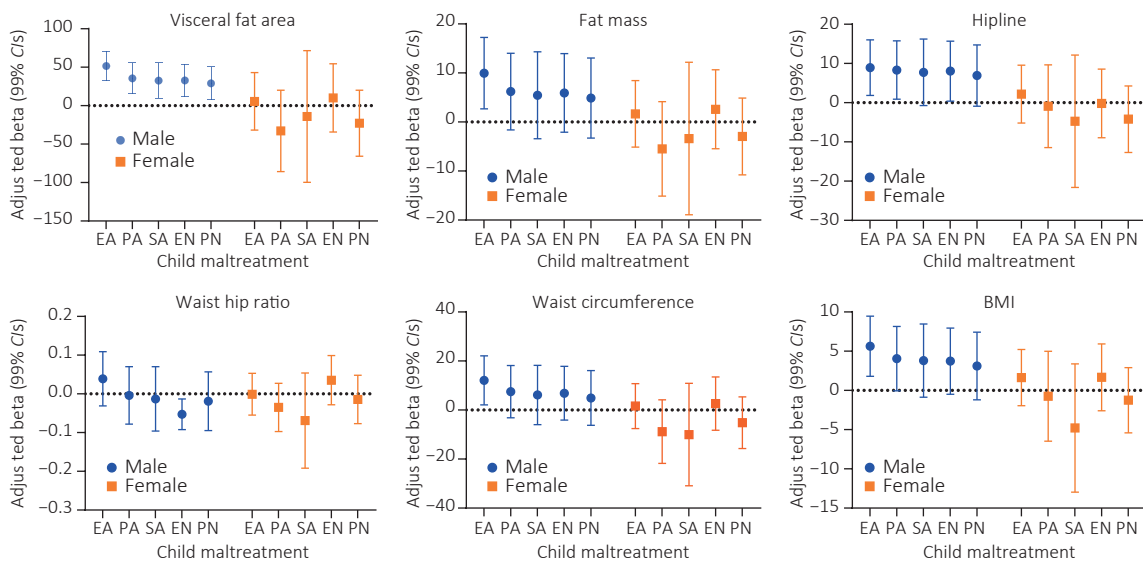


Figure 1. Relationship between child maltreatment and obesity indicators by sex. EA, Emotional abuse; PA, Physical abuse; SA, Sexual abuse; EN, Emotional neglect; PN, Physical neglect; Models were adjusted for age, sex, drinking, smoking, father education, mother education, family type, family economic and recent adolescent self-rating life events. (A two-sided P value of ≤ 0.01 was considered statistically significant).

www.besjournal.com), and [Supplementary Table S6](#) (available in www.besjournal.com).

Childhood maltreatment affects obesity indicators in adulthood, the effects of this adverse experience are long-lasting, and intervention strategies to prevent obesity should consider addressing adverse forms of maltreatment in childhood. In addition, it is recommended that relevant authorities conduct routine screening for CM in order to reduce the risk of CM on obesity.

This study has several limitations. First, data on early childhood maltreatment were gathered through a retrospective self-report questionnaire, potentially introducing recall bias. Second, the participants were exclusively recruited from a single college in China, restricting the broader applicability of our results to young adults from varied demographic backgrounds. Third, the indicators of obesity in this study were somewhat limited, and future studies could include objectively measured indicators that more accurately reflect obesity. Fourth, this study did not consider the influence of several potential confounders (such as physical activity and dietary patterns) on the outcomes. Fifth, the obesity detection rate in this study was low and the sample size was small, which could impact the reliability of the findings. Therefore, our results remain preliminary, and future studies in China should aim to include a larger sample size to further validate our findings.

In summary, four subtypes of CM (except for physical neglect) are associated with obesity indicators in early adulthood, especially in emotional abuse. The associations between exposure to CM and obesity-related traits in early adulthood are predominantly observed in males. Furthermore,

recent adverse life events were significantly associated with obesity. Overall, this study highlights the importance of addressing both distant (CM) and recent adverse life events to alleviate obesity in early adulthood.

Author Contributions Yingying Tong: Conceptualization, methodology, formal analysis, and data curation. Writing - original draft, and visualization. Min Li: Methodology, data curation, and writing - review & editing. Ting Tang and Han Ding: Methodology, writing - review & editing, and data curation. Ying Zhu: Investigation, and data curation. Yujie Su: Investigation, methodology, and data curation. Xueying Zhang: Investigation, methodology, and data curation. Puyu Su: Conceptualization, investigation, resources, supervision, project administration, and funding acquisition. Wei Chen and Gengfu Wang: Conceptualization, investigation, resources, supervision, project administration, and funding acquisition.

Competing Interest The authors declare that they have no conflict of interest.

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Table 2. Association between recent adverse life events and cardiovascular indicators

Variables	β (99% CIs)	P	β (95% CIs)	P
VFA	0.011 (-0.341, 0.362)	0.938	0.011 (-0.257, 0.278)	0.938
BMI	-0.023 (-0.062, 0.015)	0.113	-0.023 (-0.052, 0.006)	0.113
PBF	-0.015 (-0.084, 0.055)	0.586	-0.015 (-0.067, 0.038)	0.586
FM	-0.020 (-0.093, 0.053)	0.481	-0.020 (-0.075, 0.035)	0.481
WC	0.007 (-0.093, 0.107)	0.854	0.007 (-0.069, 0.083)	0.854
Hipline	-0.079 (-0.153, -0.006)	0.006	-0.079 (-0.135, -0.024)	0.006
WHR	0.001 (0.000, 0.001)	0.002	0.001 (0.000, 0.001)	0.002

Note. VFA, visceral fat area; BMI, body mass index; PBF, percentage of body fat; FM, fat mass; WHR, waist hip ratio; WC, waist circumference. Models were adjusted for age, sex, drinking, smoking, father education, mother education, family type, family economic, emotional abuse; physical abuse; sexual abuse; emotional neglect and physical neglect.

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Supplementary Table S1. Description of the sample characteristics

Variables	Total (n = 305)	Males (n = 152)	Females (n = 153)
Age, Mean (SD)	18.94 (0.71)	18.90 (0.75)	18.98 (0.67)
Only child			
Yes	89 (29.2)	47 (30.9)	42 (27.5)
No	216 (70.8)	105 (69.1)	111 (72.5)
Residential area			
Rural	196 (64.3)	96 (63.2)	100 (65.4)
Urban	109 (35.7)	56 (36.8)	96 (63.2)
Family type			
Nuclear family	203 (66.6)	108 (71.1)	95 (62.1)
Single-parent family	23 (7.5)	11 (7.2)	12 (7.8)
Extended family	79 (25.9)	33 (21.7)	46 (30.1)
Family economic			
Less than 5000	80 (26.2)	31 (20.4)	49 (32.0)
5000–10,000	124 (40.7)	61 (40.1)	63 (41.2)
More than 10,000	101 (33.1)	60 (39.5)	34 (26.8)
Mother's education level			
Primary and below	96 (31.5)	52 (34.2)	44 (28.8)
Junior middle	126 (41.3)	61 (40.1)	65 (42.5)
Senior middle	83 (27.2)	39 (25.7)	44 (28.8)
Father's education level			
Primary and below	58 (19.0)	28 (18.4)	30 (19.6)
Junior middle	122 (40.0)	61 (40.1)	61 (39.9)
Senior middle	125 (41.0)	63 (41.4)	62 (40.5)
Smoke			
Yes	8 (5.3)	8 (2.6)	0 (0)
No	297 (97.4)	144 (94.7)	153 (100)
Drink			
Yes	97 (31.8)	73 (48.0)	24 (15.7)
No	208 (68.2)	79 (52.0)	129 (84.3)
EA score, Mean (SD)	5.87 (2.30)	6.05 (2.93)	5.70 (1.42)
PA score, Mean (SD)	5.51 (2.24)	5.79 (3.01)	5.25 (0.92)
SA score, Mean (SD)	5.34 (1.95)	5.57 (2.70)	5.12 (0.50)
EN score, Mean (SD)	5.55 (2.26)	5.72 (2.77)	5.38 (1.57)
PN score, Mean (SD)	5.60 (2.13)	5.71 (2.76)	5.48 (1.22)
VFA, Mean (SD)	68.89 (35.35)	63.23 (39.52)	74.51 (29.73)
BMI, Mean (SD)	22.49 (3.92)	23.36 (4.59)	21.63 (2.87)
PBF, Mean (SD)	25.36 (8.24)	20.77 (7.88)	29.93 (5.67)
FM, Mean (SD)	16.50 (7.28)	15.66 (8.74)	17.33 (5.37)
WC, Mean (SD)	80.17 (10.29)	82.98 (12.04)	77.37 (7.21)
Hipline, Mean (SD)	93.36 (7.48)	94.02 (8.71)	92.70 (5.96)
WHR, Mean (SD)	0.86 (0.070)	0.88 (0.08)	0.83 (0.04)
ASLEC, Mean (SD)	41.61 (17.69)	45.42 (21.04)	37.83 (12.53)

Note. EA, Emotional abuse; PA, Physical abuse; SA, Sexual abuse; EN, Emotional neglect; PN, Physical neglect; VFA, visceral fat area; BMI, body mass index; PBF, percentage of body fat; FM, fat mass; WHR, Waist hip ratio; WC, waist circumference. ASLEC, Adolescent Self-Rating Life Events Checklist.

Supplementary Table S2. STROBE Statement-checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	None.
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	State specific objectives, including any prespecified hypotheses	2
Methods			
Study design	4	Present key elements of study design early in the paper	3-4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3-4
		(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (b) <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	3-4
Participants	6	<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	None.
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed	
		<i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3-4
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3-4
Bias	9	Describe any efforts to address potential sources of bias	Not reported
Study size	10	Explain how the study size was arrived at	3
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	3-4
		(a) Describe all statistical methods, including those used to control for confounding	4
		(b) Describe any methods used to examine subgroups and interactions	4
		(c) Explain how missing data were addressed	4
Statistical methods	12	(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed	4
		<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	
		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	Not reported
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	4, Table S1
		(b) Give reasons for non-participation at each stage	3, Figure S1
		(c) Consider use of a flow diagram	Figure S1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	4-5
		(b) Indicate number of participants with missing data for each variable of interest	Figure S1
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	None,

Continued

	Item No.	Recommendation	Page No.
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	4-5
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 2
		(b) Report category boundaries when continuous variables were categorized	None.
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not reported
Discussion			
Key results	18	Summarise key results with reference to study objectives	4-5
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	4-5
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	4-5
Generalisability	21	Discuss the generalisability (external validity) of the study results	4-5
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	1

Note. *Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Supplementary Table S3. Relationship between child maltreatment and obesity indicators by sex (A two-sided *P* value of ≤ 0.01 was considered statistically significant)

Variables	EA		PA		SA		EN		PN	
	β (99% CIs)	<i>P</i>	β (99% CIs)	<i>P</i>	β (99% CIs)	<i>P</i>	β (99% CIs)	<i>P</i>	β (99% CIs)	<i>P</i>
VFA										
Males	40.557 (7.538, 73.576)	0.002	23.830 (-11.462, 59.123)	0.080	19.357 (-20.681, 59.395)	0.209	20.694 (-15.537, 56.925)	0.138	16.676 (-20.189, 53.540)	0.239
Females	5.609 (-31.811, 43.029)	0.696	-32.859 (-85.825, 20.106)	0.107	-14.013 (-99.683, 71.656)	0.670	10.106 (-34.261, 54.430)	0.552	-22.778 (-65.702, 20.146)	0.168
BMI										
Males	5.631 (1.799, 9.462)	< 0.001	4.056 (-0.049, 8.161)	0.011	3.796 (-0.871, 8.463)	0.035	3.738 (-0.483, 7.958)	0.022	3.115 (-1.194, 7.424)	0.061
Females	1.634 (-1.950, 5.219)	0.236	-2.218 (-7.342, 2.905)	0.260	-4.791 (-12.971, 3.389)	0.128	1.672 (-2.584, 5.927)	0.307	-1.249 (-5.400, 2.903)	0.433
PBF										
Males	8.557 (1.873, 15.240)	0.001	4.780 (-2.387, 11.948)	0.084	4.014 (-4.113, 12.141)	0.199	4.038 (-3.323, 11.399)	0.154	3.351 (-4.135, 10.837)	0.244
Females	1.200 (-5.977, 8.378)	0.663	-7.109 (-17.244, 3.025)	0.069	-2.132 (-18.571, 14.308)	0.735	2.813 (-5.678, 11.304)	0.388	-2.446 (-10.721, 5.829)	0.441
FM										
Males	9.960 (2.677, 17.244)	< 0.001	6.213 (-1.605, 14.030)	0.040	5.454 (-3.421, 14.329)	0.111	5.928 (-2.088, 13.944)	0.055	4.873 (-3.297, 13.043)	0.121
Females	1.660 (-5.132, 8.451)	0.524	-5.480 (-15.117, 4.157)	0.140	-3.371 (-18.926, 12.184)	0.572	2.594 (-5.447, 10.635)	0.401	-2.946 (-10.771, 4.880)	0.327
WC										
Males	12.098 (2.078, 22.119)	0.002	7.491 (-3.197, 18.179)	0.069	6.137 (-5.993, 18.266)	0.188	6.843 (-4.122, 17.808)	0.105	4.932 (-6.245, 16.110)	0.251
Females	1.612 (-7.568, 10.792)	0.647	-8.823 (-21.794, 4.148)	0.078	-10.001 (-30.915, 10.913)	0.214	2.639 (-8.235, 13.513)	0.527	-5.185 (-15.728, 5.358)	0.201
Hipline										
Males	8.942 (1.855, 16.029)	0.001	8.326 (0.882, 15.770)	0.004	7.746 (-0.738, 16.229)	0.018	8.046 (0.403, 15.690)	0.007	6.928 (-0.887, 14.743)	0.022
Females	2.187 (-5.187, 9.560)	0.440	-0.902 (-11.456, 9.653)	0.824	-4.734 (-21.621, 12.153)	0.465	-0.177 (-8.937, 8.583)	0.958	-4.205 (-12.685, 4.275)	0.197
WHR										
Males	0.039 (-0.031, 0.109)	0.144	-0.004 (-0.078, 0.070)	0.887	-0.013 (-0.096, 0.070)	0.690	-0.008 (-0.083, -0.067)	0.780	-0.019 (-0.095, 0.057)	0.522
Females	-0.001 (-0.055, 0.053)	0.961	-0.084 (-0.056, 0.035)	0.004	-0.069 (-0.192, 0.054)	0.146	0.035 (-0.028, 0.099)	0.150	-0.014 (-0.077, 0.048)	0.554

Note. EA, Emotional abuse; PA, Physical abuse; SA, Sexual abuse; EN, Emotional neglect; PN, Physical neglect; VFA, visceral fat area; BMI, body mass index; PBF, percentage of body fat; FM, fat mass; WHR, Waist hip ratio; WC, waist circumference. Models were adjusted for age, drinking, smoking, father education, mother education, family type, family economic and recent adolescent self-rating life events. A two-sided *P* value of ≤ 0.01 was considered statistically significant.

Supplementary Table S4. Relationship between child maltreatment and obesity indicators by sex (A two-sided *P* value of ≤ 0.05 was considered statistically significant)

Variables	EA		PA		SA		EN		PN	
	β (95% CIs)	<i>P</i>	β (95% CIs)	<i>P</i>	β (95% CIs)	<i>P</i>	β (95% CIs)	<i>P</i>	β (95% CIs)	<i>P</i>
VFA										
Males	40.557 (15.565, 65.550)	0.002	23.830 (-2.883, 50.544)	0.080	19.357 (-10.948, 49.663)	0.209	20.694 (-6.729, 48.117)	0.138	16.676 (-11.228, 44.579)	0.239
Females	5.609 (-22.715, 33.933)	0.696	-32.859 (-72.950, 7.231)	0.107	-14.013 (-78.857, 50.831)	0.670	10.106 (-23.443, 43.656)	0.552	-22.778 (-55.268, 9.712)	0.168
BMI										
Males	5.631 (2.730, 8.531)	< 0.001	4.056 (0.949, 7.164)	0.011	3.796 (0.263, 7.328)	0.035	3.738 (0.543, 6.932)	0.022	3.115 (-0.146, 6.376)	0.061
Females	1.634 (-1.079, 3.584)	0.236	-2.218 (-6.096, 1.659)	0.260	-4.791 (-10.983, 1.401)	0.128	1.672 (-1.594, 4.892)	0.307	-1.249 (-4.391, 1.894)	0.433
PBF										
Males	8.557 (3.498, 13.616)	0.001	4.780 (-0.645, 10.206)	0.084	4.014 (-2.138, 10.166)	0.199	4.038 (-1.534, 9.610)	0.154	3.351 (-2.315, 9.017)	0.244
Females	1.200 (-4.233, 6.634)	0.663	-7.109 (-14.780, 0.561)	0.069	-2.132 (-14.575, 10.311)	0.735	2.813 (-3.614, 9.240)	0.388	-2.446 (-8.710, 3.818)	0.441
FM										
Males	9.960 (4.447, 15.474)	< 0.001	6.213 (0.296, 12.130)	0.040	5.454 (-1.264, 12.172)	0.111	5.928 (-0.139, 11.996)	0.055	4.873 (-1.311, 11.057)	0.121
Females	1.660 (-3.481, 6.800)	0.524	-5.480 (-12.774, 1.814)	0.140	-3.371 (-15.145, 8.403)	0.572	2.594 (-3.493, 8.681)	0.401	-2.946 (-8.869, 2.977)	0.327
WC										
Males	12.098 (4.513, 19.683)	0.002	7.491 (-0.599, 15.581)	0.069	6.137 (-3.044, 15.318)	0.188	6.843 (-1.456, 15.142)	0.105	4.932 (-3.528, 13.393)	0.251
Females	1.612 (-5.337, 8.560)	0.647	-8.823 (-18.641, 0.995)	0.078	-10.001 (-25.831, 5.829)	0.214	2.639 (-5.591, 10.870)	0.527	-5.185 (-13.165, 2.795)	0.201
Hipline										
Males	8.942 (3.577, 14.306)	0.001	8.326 (2.691, 13.961)	0.004	7.746 (1.324, 14.167)	0.018	8.046 (2.261, 13.832)	0.007	6.928 (1.013, 12.843)	0.022
Females	2.187 (-3.395, 7.768)	0.440	-0.902 (-8.891, 7.087)	0.824	-4.734 (-17.516, 8.048)	0.465	-0.177 (-6.808, 6.454)	0.958	-4.205 (-10.624, 2.214)	0.197
WHR										
Males	0.039 (-0.014, 0.092)	0.144	-0.004 (-0.060, 0.052)	0.887	-0.013 (-0.075, 0.050)	0.690	-0.008 (-0.065, 0.049)	0.780	-0.019 (-0.076, 0.039)	0.522
Females	-0.001 (-0.042, 0.040)	0.961	-0.084 (-0.141, -0.027)	0.004	-0.069 (-0.162, 0.024)	0.146	0.035 (-0.013, 0.084)	0.150	-0.014 (-0.062, 0.033)	0.554

Note. EA, Emotional abuse; PA, Physical abuse; SA, Sexual abuse; EN, Emotional neglect; PN, Physical neglect; VFA, visceral fat area; BMI, body mass index; PBF, percentage of body fat; FM, fat mass; WHR, Waist hip ratio; WC, waist circumference. Models were adjusted for age, drinking, smoking, father education, mother education, family type, family economic and recent adolescent self-rating life events. A two-sided *P* value of ≤ 0.05 was considered statistically significant.

Supplementary Table S5. Association between childhood adverse life events and recent adverse life events interacting with obesity indicators

Variables	EA*ASLEC		PA*ASLEC		SA*ASLEC		EN*ASLEC		PN*ASLEC	
	β (CIs)	P	β (CIs)	P	β (CIs)	P	β (CIs)	P	β (CIs)	P
99% CIs; $P_{interaction} \leq 0.01$										
VFA	-0.372 (-1.320, 0.577)	0.311	-0.525 (-1.375, 0.325)	0.110	-0.580 (-1.414, 0.253)	0.072	-0.797 (-1.720, 0.126)	0.026	-0.582 (-1.481, 0.317)	0.094
BMI	-0.027 (-0.130, 0.076)	0.493	-0.050 (-0.142, 0.043)	0.164	-0.053 (-0.144, 0.038)	0.131	-0.060 (-0.161, 0.041)	0.124	-0.035 (-0.133, 0.063)	0.351
PBF	-0.045 (-0.233, 0.142)	0.533	-0.096 (-0.264, 0.072)	0.138	-0.125 (-0.289, 0.040)	0.050	-0.145 (-0.328, 0.037)	0.040	-0.113 (-0.291, 0.064)	0.099
FM	-0.066 (-0.262, 0.130)	0.385	-0.104 (-0.280, 0.071)	0.125	-0.119 (-0.291, 0.053)	0.075	-0.154 (-0.345, 0.036)	0.037	-0.112 (-0.298, 0.073)	0.118
WC	-0.147 (-0.416, 0.123)	0.160	-0.174 (-0.416, 0.067)	0.062	-0.176 (-0.413, 0.061)	0.055	-0.247 (-0.510, 0.015)	0.015	-0.208 (-0.464, 0.047)	0.035
Hipline	-0.041 (-0.240, 0.158)	0.594	0.003 (-0.176, 0.182)	0.966	0.001 (-0.175, 0.177)	0.993	-0.059 (-0.254, 0.136)	0.433	0.008 (-0.181, 0.198)	0.910
WHR	-0.001 (-0.003, 0.001)	0.102	-0.002 (-0.003, 0.000)	0.003	-0.002 (-0.003, 0.000)	0.002	-0.002 (-0.004, 0.000)	0.003	-0.002 (-0.004, -0.001)	0.001
95% CIs; $P_{interaction} \leq 0.05$										
VFA	-0.372 (-1.092, 0.348)	0.311	-0.525 (-1.170, 0.120)	0.110	-0.580 (-1.213, 0.052)	0.072	-0.797 (-1.497, -0.096)	0.026	-0.582 (-1.265, 0.100)	0.094
BMI	-0.027 (-0.106, 0.051)	0.493	-0.050 (-0.120, 0.020)	0.164	-0.053 (-0.122, 0.016)	0.131	-0.060 (-0.136, 0.016)	0.124	-0.035 (-0.110, 0.039)	0.351
PBF	-0.045 (-0.188, 0.097)	0.533	-0.096 (-0.224, 0.031)	0.138	-0.125 (-0.250, 0.000)	0.050	-0.145 (-0.284, -0.007)	0.040	-0.113 (-0.248, 0.022)	0.099
FM	-0.066 (-0.215, 0.083)	0.385	-0.104 (-0.238, 0.029)	0.125	-0.119 (-0.249, 0.012)	0.075	-0.154 (-0.299, -0.010)	0.037	-0.112 (-0.253, 0.029)	0.118
WC	-0.147 (-0.351, 0.058)	0.160	-0.174 (-0.358, 0.009)	0.062	-0.176 (-0.356, 0.004)	0.055	-0.247 (-0.446, -0.048)	0.015	-0.208 (-0.402, -0.014)	0.035
Hipline	-0.041 (-0.192, 0.110)	0.594	0.003 (-0.133, 0.139)	0.966	0.001 (-0.133, 0.134)	0.993	-0.059 (-0.207, 0.089)	0.433	0.008 (-0.136, 0.152)	0.910
WHR	-0.001 (-0.002, 0.000)	0.102	-0.002 (-0.003, -0.001)	0.003	-0.002 (-0.003, -0.001)	0.002	-0.002 (-0.003, -0.001)	0.003	-0.002 (-0.004, -0.001)	0.001

Note. EA, Emotional abuse; PA, Physical abuse; SA, Sexual abuse; EN, Emotional neglect; PN, Physical neglect; VFA, visceral fat are; BMI, body mass index; PBF, percentage of body fat; FM, fat mass; WHR, Waist hip ratio; WC, waist circumference; ASLEC, Adolescent Self-Rating Life Events Checklist. Models were adjusted for age, sex, drinking, smoking, father education, mother education, family type, family economic, emotional abuse; physical abuse; sexual abuse; emotional neglect; physical neglect and recent adverse life events.

Supplementary Table S6. Association of different types of child maltreatment with obesity indicators

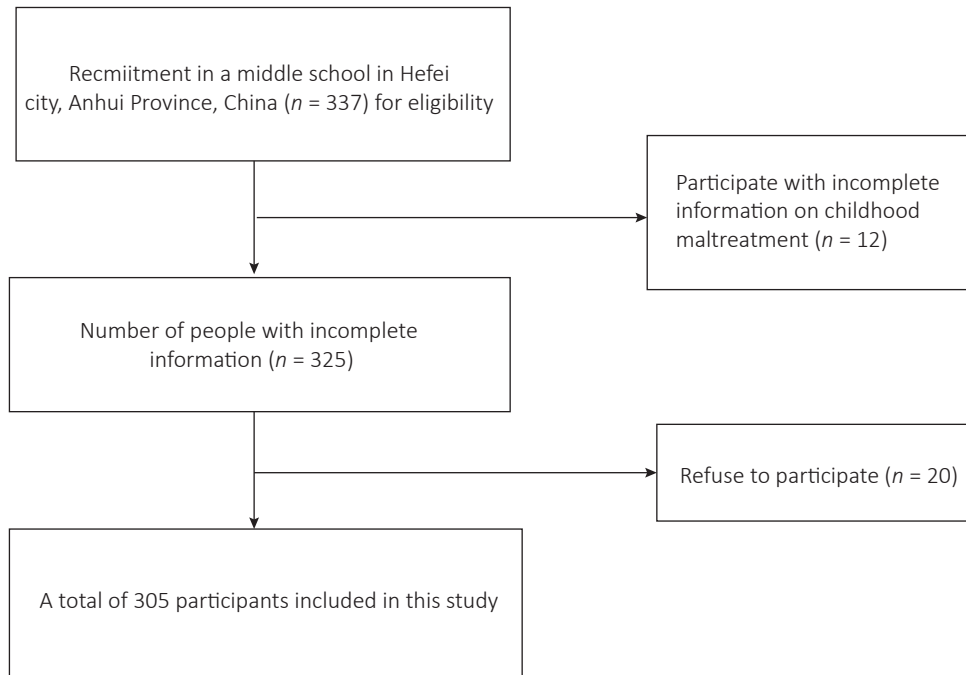
Variables	VFA	BMI	PBF	FM	WC	Hipline	WHR
	$\beta_{interaction}$ (CIs)	$\beta_{interaction}$ (CIs)	$\beta_{interaction}$ (CIs)	$\beta_{interaction}$ (CIs)	$\beta_{interaction}$ (CIs)	$\beta_{interaction}$ (CIs)	$\beta_{interaction}$ (CIs)
β, 99% CIs							
None CM, Low ASLEC	-	-	-	-	-	-	-
None CM, Medium ASLEC	0.537 (-14.694, 15.769)	0.201 (-1.458, 1.860)	-0.508 (-3.524, 2.508)	0.025 (-3.116, 3.167)	0.244 (-4.108, 4.596)	0.200 (-2.991, 3.391)	0.000 (-0.029, 0.029)
None CM, High ASLEC	-1.935 (-22.540, 18.670)	0.228 (-2.016, 2.472)	-0.268 (-4.348, 3.812)	-0.359 (-4.610, 3.891)	-1.183 (-7.070, 4.704)	-2.200 (-6.517, 2.117)	0.006 (-0.034, 0.045)
CM, Low ASLEC	-5.819 (-41.791, 30.153)	-0.695 (-4.613, 3.223)	-0.435 (-7.558, 6.688)	-0.752 (-8.172, 6.667)	-0.964 (-11.241, 9.314)	-0.285 (-7.822, 7.252)	-0.007 (-0.076, 0.062)
CM, Medium ASLEC	-26.793 (-56.290, 2.703)	-3.245 (-6.458, -0.032)	-5.796 (-11.637, 0.044)	-6.024 (-12.108, 0.060)	-7.028 (-15.455, 1.399)	-5.484 (-11.664, 0.697)	-0.023 (-0.080, 0.033)
CM, High ASLEC	-32.518 (-68.275, 3.239)	-1.722 (-5.616, 2.173)	-5.173 (-12.253, 1.907)	-6.564 (-13.939, 0.811)	-8.821 (-19.036, 1.395)	-7.701 (-15.193, -0.209)	-0.021 (-0.089, 0.048)
β, 95% CIs							
None CM, Low ASLEC	-	-	-	-	-	-	-
None CM, Medium ASLEC	0.537 (-11.022, 12.097)	0.201 (-1.058, 1.460)	-0.508 (-2.797, 1.781)	0.025 (-2.359, 2.410)	0.244 (-3.059, 3.547)	0.200 (-2.222, 2.622)	0.000 (-0.022, 0.022)
None CM, High ASLEC	-1.935 (-17.573, 13.704)	0.228 (-1.475, 1.931)	-0.268 (-3.365, 2.828)	-0.359 (-3.585, 2.866)	-1.183 (-5.651, 3.285)	-2.200 (-5.476, 1.077)	0.006 (-0.024, 0.036)
CM, Low ASLEC	-5.819 (-33.121, 21.483)	-0.695 (-3.668, 2.279)	-0.435 (-5.841, 4.971)	-0.752 (-6.384, 4.879)	-0.964 (-8.764, 6.837)	-0.285 (-6.005, 5.435)	-0.007 (-0.059, 0.045)
CM, Medium ASLEC	-26.793 (-49.180, -4.406)	-3.245 (-5.683, -0.807)	-5.796 (-10.229, -1.363)	-6.024 (-10.641, -1.406)	-7.028 (-13.424, -0.632)	-5.484 (-10.174, -0.793)	-0.023 (-0.066, 0.020)
CM, High ASLEC	-32.518 (-59.656, -5.380)	-1.722 (-4.678, 1.234)	-5.173 (-10.547, 0.200)	-6.564 (-12.162, -0.966)	-8.821 (-16.574, -1.067)	-7.701 (-13.387, -2.015)	-0.021 (-0.073, 0.031)

Note. EA, Emotional abuse; PA, Physical abuse; SA, Sexual abuse; EN, Emotional neglect; PN, Physical neglect; VFA, visceral fat area; BMI, body mass index; PBF, percentage of body fat; FM, fat mass; WHR, waist hip ratio; WC, waist circumference. Models were adjusted for age, sex, drinking, smoking, father education, mother education, family type, family economic and recent adolescent self-rating life events.

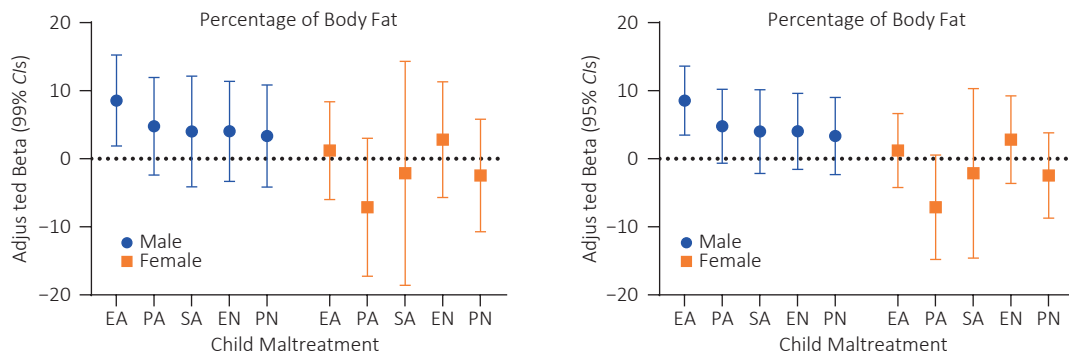
Supplementary Table S7. Association of different types of child maltreatment with obesity indicators by type of obesity

CM	EA		PA		SA		EN		PN	
	β (99% CIs)	P	β (99% CIs)	P	β (99% CIs)	P	β (99% CIs)	P	β (99% CIs)	P
VFA										
Normal	3.686 (-18.630, 26.002)	0.668	-7.805 (-34.715, 19.105)	0.452	-14.910 (-49.771, 19.951)	0.268	-0.502 (-25.757, 24.753)	0.959	-14.082 (-38.392, 10.228)	0.134
Obese/ overweight	-12.225 (-68.104, 43.665)	0.558	-12.252 (-75.811, 51.307)	0.605	-9.806 (-88.179, 68.567)	0.737	-10.994 (-86.954, 64.965)	0.698	1.982 (-62.264, 67.228)	0.935
BMI										
Normal	1.126 (-0.907, 3.159)	0.152	0.162 (-2.303, 2.627)	0.865	-2.213 (-5.388, 0.961)	0.071	0.850 (-1.456, 3.156)	0.339	-0.590 (-2.823, 1.643)	0.493
Obese/ overweight	-0.061 (-6.184, 6.062)	0.979	-3.724 (-10.503, 3.054)	0.145	-2.791 (-11.273, 5.692)	0.379	-1.954 (-10.216, 6.309)	0.527	-0.787 (-7.899, 6.325)	0.767
PBF										
Normal	2.135 (-3.313, 7.583)	0.310	-1.619 (-8.203, 4.966)	0.524	-2.265 (-10.807, 6.276)	0.491	0.994 (-5.181, 7.169)	0.676	-2.021 (-7.987, 3.944)	0.380
Obese/ overweight	1.322 (-8.190, 10.835)	0.709	0.459 (-10.368, 11.286)	0.909	1.751 (-11.555, 15.058)	0.724	1.988 (-10.907, 14.883)	0.679	3.759 (-7.207, 14.725)	0.360
FM										
Normal	1.796 (-2.657, 6.248)	0.296	-0.802 (-6.188, 4.583)	0.699	-2.460 (-9.436, 4.516)	0.360	0.823 (-4.225, 5.870)	0.672	-2.129 (-7.000, 2.742)	0.257
Obese/ overweight	-1.921 (-14.258, 10.416)	0.676	-2.451 (-16.462, 11.560)	0.639	-2.850 (-20.099, 14.399)	0.658	-1.662 (-18.414, 15.090)	0.790	2.144 (-12.203, 16.492)	0.689
WC										
Normal	1.807 (-4.312, 7.926)	0.444	-0.211 (-7.606, 7.184)	0.941	-2.250 (-11.837, 7.336)	0.543	0.755 (-6.175, 7.685)	0.777	-3.260 (-9.942, 3.422)	0.206
Obese/ overweight	-2.946 (-17.968, 12.077)	0.599	-4.719 (-21.732, 12.294)	0.458	-3.612 (-24.638, 17.415)	0.645	-3.141 (-23.540, 17.258)	0.680	2.189 (-15.314, 19.692)	0.737
Hipline										
Normal	1.418 (-3.618, 6.455)	0.465	3.414 (-2.643, 9.471)	0.145	0.564 (-7.332, 8.459)	0.853	1.737 (-3.960, 7.433)	0.429	0.285 (-5.234, 5.803)	0.894
Obese/ overweight	-2.636 (-14.421, 9.150)	0.549	-0.839 (-14.286, 12.608)	0.867	-5.571 (-21.959, 10.816)	0.364	-2.116 (-18.144, 13.9112)	0.723	1.314 (-12.439, 15.067)	0.798
WHR										
Normal	0.007 (-0.048, 0.061)	0.750	-0.035 (-0.101, 0.030)	0.162	-0.033 (-0.118, 0.052)	0.311	-0.006 (-0.067, 0.056)	0.813	-0.037 (-0.096, 0.022)	0.102
Obese/ overweight	-0.005 (-0.096, 0.087)	0.890	-0.040 (-0.143, 0.063)	0.300	0.015 (-0.113, 0.143)	0.757	-0.012 (-0.136, 0.112)	0.798	0.010 (-0.096, 0.117)	0.793

Note. EA, Emotional abuse; PA, Physical abuse; SA, Sexual abuse; EN, Emotional neglect; PN, Physical neglect; VFA, visceral fat area; BMI, body mass index; PBF, percentage of body fat; FM, fat mass; WHR, waist hip ratio; WC, waist circumference. ASLEC, Adolescent Self-Rating Life Events Checklist. Models were adjusted for age, sex, drinking, smoking, father education, mother education, family type, family economic and recent adolescent self-rating life events.



Supplementary Figure S1. The study follow chart.



Supplementary Figure S2. Relationship between child maltreatment and obesity indicators by sex; EA, Emotional abuse. PA, Physical abuse; SA, Sexual abuse; EN, Emotional neglect; PN, Physical neglect; Models were adjusted for age, sex, drinking, smoking, father education, mother education, family type, family economic and recent adolescent self-rating life events.