Personality traits and childhood trauma as correlates of metabolic risk factors

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Progress in Neuro-Psychopharmacology & Biological Psychiatry 2012, 36: 85-91

ABSTRACT

Introduction
Personality and childhood trauma may affect cardiovascular disease (CVD) risk. However, evidence for an association with metabolic risk factors for CVD is limited and ambiguous. Moreover, despite their interrelatedness, personality and childhood trauma were not yet studied simultaneously. Therefore, we aimed to explore whether personality and childhood trauma are correlates of metabolic risk factors.

Methods
Among 2755 participants of the Netherlands Study of Depression and Anxiety (NESDA), we investigated through linear regression models whether Big Five personality traits (i.e., extraversion, openness, agreeableness, neuroticism and conscientiousness) and childhood trauma type (i.e., emotional neglect, and psychological, physical and sexual abuse) were correlates of metabolic risk factors (i.e., lipids, waist circumference (WC), glucose and blood pressure). Basic covariates (i.e., age, sex and income level), lifestyle, severity of depressive symptoms and years of education were taken into account.

Results
Openness was the most robust favorable correlate, and sexual abuse was an unfavorable correlate of lipids and WC, and of overall metabolic risk ($\beta = .035$; $p = .04$ and $\beta = -.070$; $p < .001$, respectively).

Conclusions
People with a low openness trait and those who experienced childhood sexual abuse are at higher risk of dyslipidemia and abdominal obesity.

8.1 INTRODUCTION

Cardiovascular disease (CVD) is a major and growing global health problem.[98] Therefore, it is important to identify persons at increased risk of CVD. Lower levels of conscientiousness[76, 269-271] and openness,[77] and higher levels of neuroticism[269] have been related to CVD and general morbidity and mortality. Furthermore, emotional neglect, and sexual or physical abuse during infancy increase risk of CVD in adult women.[272]

Personality and childhood trauma may affect risk of CVD through changes in metabolic risk factors for CVD that include dyslipidemia, abdominal obesity, hyperglycemia and hypertension. As these factors collectively predict over half of CVD cases,[16,17] they are important targets in CVD prevention and treatment.[18] Therefore, it is valuable to know which personality and childhood trauma characteristics are their strongest correlates.

Personality may influence metabolic risk factors[97] through engagement in healthier lifestyles.[78] This might for instance be via the search for external stimulation and social events, vulnerability for depressive symptoms,[79] and amount of self-discipline.[80,81] Trauma may increase risk of CVD through a related lower socio-economic status and unhealthy lifestyles, a higher prevalence of psychopathology due to a fragile character structure,[82-84] or by adverse (early) programming of the biological stress system,[120,273,274] for instance accompanying posttraumatic stress disorder.[275,276]

Several studies on the association of personality traits or childhood trauma with metabolic risk factors have been reported. Openness[277] and conscientiousness[277,278] have been favorably associated with lipid values and abdominal obesity. However, extraversion,[279-283] neuroticism[279-284] and agreeableness[283,284] were ambiguously related to lipids, obesity and blood pressure. Neglect,[85-87] as well as emotional,[85] physical[88] and sexual abuse[87,89,90] during childhood were related to (abdominal) obesity in adulthood.

Personality and trauma are bi-directionally related. Twin studies showed that over 20 percent of the variance in (traumatic) life events is due to genetic influences[91] that are largely mediated by personality.[92] Personality shapes ones personal environment and thus protects for or facilitates the experience of certain (traumatic) events.[92] Also, personality affects the appraisal of traumatic events.[93] The other way around, trauma affects ones perceptions and beliefs. As perceptions and beliefs are building blocks of personality structure, trauma may facilitate unfavorable personality development.[94]

No previous studies jointly investigated both personality characteristics and childhood trauma in relation to metabolic risk factors. The current study is based on a large cohort of subjects with extensive assessment of personality and childhood trauma. We aim to explore whether Big Five personality traits and childhood trauma are independent

correlates of metabolic risk factors for CVD within the Netherlands Study of Depression and Anxiety (NESDA).

8.2 METHODS

Subjects

Subjects participated in the baseline assessment of the Netherlands Study of Depression and Anxiety (NESDA), a cohort study including 2981 persons aged 18 to 65 years. NESDA subjects were recruited from community, primary care and specialized mental health care, and selected to represent a range of depressive and anxiety symptoms with subjects having no depressive or anxiety disorder ('controls'), having had disorders in the past, or having a current depressive or anxiety disorder. All subjects completed the baseline assessment, which comprised a face-to-face interview, written questionnaires and biological measurements. A detailed description of the study design can be found elsewhere.[95] For the current study, only cross-sectional baseline data were available. The study protocol was approved by the Ethical Review Board of each participating centre, and all subjects signed informed consent.

Earlier, we found that persons using tricyclic antidepressants (TCAs) have a different metabolic risk profile than other NESDA subjects.[150] We did not find any associations between the use of other antidepressants and metabolic risk factors. The distinctive profile in TCA users is likely induced by TCA side effects, as it was not explained by more severe depressive symptoms in TCA users. Because of their distinct metabolic risk factor profile, TCA users were excluded from the analyses. Of the remaining 2901 subjects, subjects with missing values on personality traits, childhood trauma or metabolic risk factors (see below) were excluded, resulting in the current sample of 2755 subjects. Included subjects (n=2755) did not differ significantly from excluded subjects (n=226) with regard to age (mean 41.9 versus 42.1, p = .80), sex (both 33.6% male, p = 1.00), or CVD prevalence (6.0% versus 4.9%, p = .48).

Personality traits

The Big Five personality traits *extraversion, openness, agreeableness, neuroticism* and *conscientiousness* were measured with the Dutch version[285] of the NEO-Five Factor Inventory (NEO-FFI).[286] The NEO-FFI was sent to participants by mail, and completed before the start of the interview. The NEO-FFI consists of 60 five-point Likert-scaled items, with answer categories from 0 ("strongly disagree") to 4 ("strongly agree**"**). Each of the personality traits is addressed by 12 items. Cronbach's alphas were .84 for extraversion, .69 for openness, .71 for agreeableness, .90 for neuroticism, and .75 for conscientiousness in the current sample. Those values are considered acceptable.[287]

Childhood trauma

Frequency of *emotional neglect, psychological abuse, physical abuse* and *sexual abuse* was assessed retrospectively by the Childhood Trauma Interview that was previously used in the Netherlands Mental health Survey and Incidence Study (NEMESIS).[13,82] Subjects were asked the following questions concerning their first 16 years of life: 1) "Were you emotionally neglected, meaning nobody ever listened to you at home, your problems and experiences were ignored, and you felt that there was no attention or support from your parents?", 2) "Were you psychologically abused, meaning being yelled at, falsely punished, subordinated to your siblings, or being blackmailed?", 3) "Were you being abused physically, meaning being hit, kicked, beaten up or other types of physical abuse?", and 4) "Were you sexually abused, meaning being touched or having to touch someone in a sexual way against your will?". Scores for each question were categorized into never (score 0), once / sometimes (score 1) or regular / (very) often (score 2).

Metabolic risk factors

High-density lipoprotein (HDL) cholesterol, triglycerides, waist circumference (WC), glucose, diastolic (DBP) and systolic (SBP) blood pressure, and an overall metabolic risk factor score were included as metabolic risk factors. Blood samples were taken after a mean of 11:14 h overnight fasting period (SD=1:50 h). HDL cholesterol and triglycerides were determined according to routine laboratory methods. To account for use of lipid-lowering medication, HDL cholesterol and triglyceride values were adjusted according to published changes, as has been done before.[25] Medication use within the past month was registered by observation of drug containers brought in, and ATC coded.[111] 0.10 mmol/L was subtracted from HDL cholesterol and 0.67 mmol/L was added to triglycerides for persons using fibrates.[167,168] HDL cholesterol was lowered by 0.15 mmol/L, and 0.19 mmol/L was added to triglycerides for persons using nicotid acid. WC was measured with a measuring tape at the central point between the lowest front rib and the highest front point of the pelvis, upon light clothing. Glucose levels were determined by routine laboratory methods. For persons using anti-diabetic medication with a glucose level below 7.0 mmol/L [126 mg/dL] a value of 7.0 mmol/L [126 mg/dL] was used in the analyses, as was done before.[25] DBP and SBP were both averaged over two measurements during supine rest on the right arm by the OMRON M4 IntelliSense (HEM-752A, Omron Healthcare, Inc., Bannockburn, Illinois, US). For persons using antihypertensive medication, 5 mmHg was added to DBP, and 10 mmHg to SBP, as described previously.[25] These values represent the average decline in blood pressure in antihypertensive medication trials.[169,170] In order to normalize residuals, HDL cholesterol, triglyceride, WC, glucose, DBP and SBP levels were naturally log-transformed. As a measure of severity of metabolic abnormalities, a continuous overall metabolic risk score was computed by

mediating z-scores (i.e., standardized scores) of a HDL cholesterol and triglycerides index (i.e., (-zHDL cholesterol + zTriglycerides) / 2), WC, glucose, and a blood pressure index (i.e., (zDBP + zSBP) / 2).

Covariates

Sociodemographic variables included *age*, *sex* and *income level*. Prevalent medicated *CVD* (i.e., stroke, myocardial infarction, angina pectoris or coronary heart disease) was assessed by standardized questionnaires and observation of drug containers brought to the interview. Personality and childhood trauma affect lifestyle,[80,81] and thereby metabolic risk factors.[78,97] Therefore, lifestyle factors were taken into account; number of *tobacco* (i.e., cigarettes, cigars or pipe) and *alcohol consumptions* a day were assessed through standardized questionnaires; *physical activity* was assessed using the International Physical Activity Questionnaire,[112] and expressed in units of 1000 metabolic equivalent of task (MET)-minutes in the past week. MET minutes reflect the ratio of the associated metabolic rate for specific activities divided by the resting metabolic rate, multiplied by minutes performed activity. Since depression is associated with personality,[79] childhood trauma[82] and metabolic risk factors,[117,150] *depression severity* - as assessed by the 30-item Inventory of Depressive Symptoms self-report (IDS-SR)[133] ranging from 0 to 84 - was taken into account as an additional covariate. *Years of education* were also included as an additional covariate.

Statistical analyses

Sample characteristics were summarized using means and standard deviations for normally distributed quantitative variables, medians and inter-quartile ranges for non-normally distributed quantitative variables, and percentages for categorical variables. Correlations between metabolic risk factors (except for the overall metabolic risk score) were calculated by Pearson's correlation coefficient. Separate associations of every personality trait, and each type of childhood trauma with individual continuous metabolic risk factors and with the overall metabolic risk score were assessed by linear regression analyses. Analyses were adjusted for age, sex, income and CVD, and for smoking, alcohol use and physical activity. To determine the relative importance of personality traits and childhood trauma, for all metabolic risk factors regression analyses were carried out, adjusted for age, sex, income, CVD, smoking, alcohol use and physical activity. Personality traits and childhood trauma types with $p<.10$ in the preceding separate analyses were entered simultaneously into the regression model. Adjusted R^2 was calculated to indicate the amount of variance in metabolic risk factors that was explained by the regression model. To explore the impact of depressive symptoms on the associations of personality and childhood trauma with metabolic risk factors, the latter models were additionally adjusted for depression severity. As openness is suggested to be related to intelligence,[288] it was additionally investigated

whether years of education accounted for multivariate associations of openness with metabolic risk factors. And since personality traits could affect metabolic risk factors especially in those who experienced childhood trauma, their interaction was tested by entering personality trait x childhood trauma interaction terms in fully adjusted models. In order to more thoroughly evaluate the influence of CVD, all 166 subjects with CVD (see Covariates) were excluded in sensitivity analyses. All statistical analyses were undertaken with SPSS 17.0 (IBM Company, Chicago, Illinois, USA).

8.3 RESULTS

Sample characteristics are presented in Table 1. The mean age of the sample was 41.9 years (SD = 13.1) and 33.6% was male. 6.0% of the sample had prevalent CVD. Emotional neglect was more frequently experienced regular or (very) often (20.4%) than once or sometimes (17.6%). Psychological, physical and sexual abuse were more frequently experienced once or sometimes (13.4, 9.9 and 9.3% respectively) than regular or (very) often (10.8, 2.8 and 1.3% respectively).

Correlations between metabolic risk factors ranged from -.09 (between HDL cholesterol and DBP) through .78 (between DBP and SBP). Table 2 shows the separate associations of personality traits and childhood trauma with continuous metabolic risk factors. Since associations did not differ importantly between the model that was adjusted for age, sex, income and CVD, and the model that was additionally adjusted for smoking, alcohol use and physical activity, solely the crude and the fully adjusted models are reported. In the fully adjusted model, extraversion was associated with a higher SBP. Openness was associated with higher HDL cholesterol levels, and with lower triglycerides, WC, SBP and overall metabolic risk. Agreeableness was associated with lower triglyceride levels, WC and overall metabolic risk. Neuroticism was associated with a higher DBP. Conscientiousness was associated with none of the metabolic risk factors. Regarding childhood traumas, emotional neglect was associated with lower SBP. Psychological and physical abuse both were related to lower levels of HDL cholesterol and to a higher WC and overall metabolic risk. Sexual abuse was associated with lower levels of HDL cholesterol, and with higher WC and overall metabolic risk. The amplification of associations of sexual abuse with HDL cholesterol, WC and overall metabolic risk, and of emotional neglect with SBP after adjustment, was determined by childhood traumas being more prevalent among women. Figure 1 illustrates that HDL cholesterol levels increase, and triglycerides and WC decline with a higher score on openness. It also exemplifies that HDL cholesterol diminishes and WC increase with a higher frequency of childhood sexual abuse.

In Table 3, the multivariate association model is presented. Personality traits and childhood trauma types with $p<.10$ in separate linear regression analyses (see adjusted model in Table 2) were entered

Table 1. Sample characteristics in 2755 subjects

Characteristics		
Age	41.9	(13.1)
Sex (% men)	33.6	
Income (per month, in Euros)	2100.0	(1300.0-2900.0)
CVD (%)	6.0	
Tobacco consumptions (n per day)	0.0	(0.0-8.6)
Alcohol consumptions (n per day)	0.4	(0.02-1.3)
Physical activity (1000 MET-minutes last week)	3.0	(1.4-4.9)
Depression severity (IDS-SR score)	19.0	(9.0-31.0)
Metabolic risk factors		
HDL cholesterol (mmol/L)[a]	1.6	(1.3-1.9)
Triglycerides (mmol/L)[b]	1.1	(0.8-1.5)
Lipid-lowering medication use (%)	6.9	
Waist circumference (cm)	87.0	(79.0-97.0)
Glucose (mmol/L)[c]	5.0	(4.7-5.5)
Antidiabetic medication use (%)	3.2	
Diastolic blood pressure (mmHg)	80.0	(73.5-88.5)
Systolic blood pressure (mmHg)	132.0	(121.5-147.5)
Antihypertensive medication use (%)	14.4	
Personality traits		
Extraversion	25.0	(7.3)
Openness	26.2	(6.0)
Agreeableness	31.8	(5.3)
Neuroticism	24.1	(9.4)
Conscientiousness	30.2	(6.1)
Childhood trauma		
Emotional neglect (%)		
Once / sometimes	17.6	
Regular / (very) often	20.4	
Psychological abuse (%)		
Once / sometimes	13.4	
Regular / (very) often	10.8	
Physical abuse (%)		
Once / sometimes	9.9	
Regular / (very) often	2.8	
Sexual abuse (%)		
Once / sometimes	9.3	
Regular / (very) often	1.3	

Means (standard deviations) and medians (inter-quartile ranges) are given respectively for normally and non-normally distributed quantitative variables.
Percentages are given for categorical variables.
[a] To convert to mg/dL, multiply by 39; [b] To convert to mg/dL, multiply by 89;
[c] To convert to mg/dL, multiply by 18
Abbreviations: CVD, cardiovascular disease; HDL, high-density lipoprotein; IDS-SR, Inventory of Depressive Symptoms self-report; MET, metabolic equivalent of task.

Table 2. Separate crude associations of personality traits and childhood trauma with metabolic risk factors in 2755 subjects

	HDL cholesterol		Triglycerides		WC		Glucose		DBP		SBP		Overall metabolic risk	
	β[a]	*p*	β[a]	*p*	β[a]	*p*	β[a]	*p*	β[a]	*p*	β[a]	*p*	β[a]	*p*
Crude														
Personality traits														
Extraversion	**.050**	.01	**-.061**	.001	**-.066**	.001	**-.070**	<.001	**-.077**	<.001	**-.037**	.05	**-.087**	<.001
Openness	**.098**	<.001	**-.074**	<.001	**-.131**	<.001	**-.043**	.02	**-.065**	.001	**-.079**	<.001	**-.119**	<.001
Agreeableness	**.136**	<.001	**-.099**	<.001	**-.115**	<.001	**-.062**	.001	-.031	.11	**-.045**	.02	**-.135**	<.001
Neuroticism	-.008	.67	-.004	.82	**-.043**	.03	**-.053**	.01	-.025	.18	**-.100**	<.001	**-.042**	.03
Conscientiousness	.049	.01	-.028	.15	.001	.96	.019	.31	.011	.56	**.052**	.01	-.008	.66
Childhood trauma														
Emotional neglect	.029	.12	.014	.46	**.042**	.03	**.066**	.001	**.049**	.01	-.011	.57	**.045**	.02
Psychological abuse	-.032	.09	**.041**	.03	**.083**	<.001	**.062**	.001	**.046**	.02	.012	.51	**.082**	<.001
Physical abuse	**-.040**	.04	**.043**	.02	**.071**	<.001	**.038**	.05	.021	.28	.006	.73	**.069**	<.001
Sexual abuse	-.006	.75	.008	.66	.022	.24	.004	.85	.022	.25	**-.041**	.03	.015	.43

[a] β coefficients indicate the standardised beta by linear regression analysis. Statistically significant (p<.05) associations are marked bold.
[b] Adjusted for age, sex, income, CVD, tobacco use, alcohol use and physical activity.
Abbreviations: CVD, cardiovascular disease; DBP, diastolic blood pressure; HDL, high-density lipoprotein; SBP, systolic blood pressure; WC, waist circumference.

Table 3. Multivariate association model of personality traits and childhood trauma in relation to metabolic risk factors in 2755 subjects

	HDL cholesterol		Triglycerides		WC		Glucose		DBP		SBP		Overall metabolic risk	
	β[a]	*p*	β[a]	*p*	β[a]	p	β[a]	p	β[a]	p	β[a]	p	β[a]	P
Personality traits														
Extraversion											.030	.08		
Openness	**.071**	<.001	**-.036**	.04	**-.092**	<.001			-.031	.07	**-.040**	.01	**-.070**	<.001
Agreeableness	.018	.32	**-.041**	.03	-.023	.20							-.031	.06
Neuroticism					.002	.93			**.040**	.02				
Conscientiousness														
Childhood trauma														
Emotional neglect			-.034	.06							**-.038**	.03		
Psychological abuse	-.018	.37			**.042**	.03	.031	.07					.033	.08
Physical abuse	-.012	.56			.025	.21							.019	.31
Sexual abuse	**-.043**	.02			**.041**	.02							**.035**	.04
Adjusted R^2	.22		.16		.29		.21		.21		.29		.34	

[a] β coefficients indicate the standardised beta by enter method linear regression analysis. Solely personality traits and childhood trauma types with $p<.10$ in separate analyses (see Table 2) were included. Statistically significant ($p<.05$) associations are marked bold.
Analyses were adjusted for age, sex, income, CVD, tobacco use, alcohol use and physical activity.
Abbreviations: CVD, cardiovascular disease; DBP, diastolic blood pressure; HDL, high-density lipoprotein; SBP, systolic blood pressure; WC, waist circumference.
Adjusted R^2 indicates the variance in metabolic risk factors that is explained by the regression model.

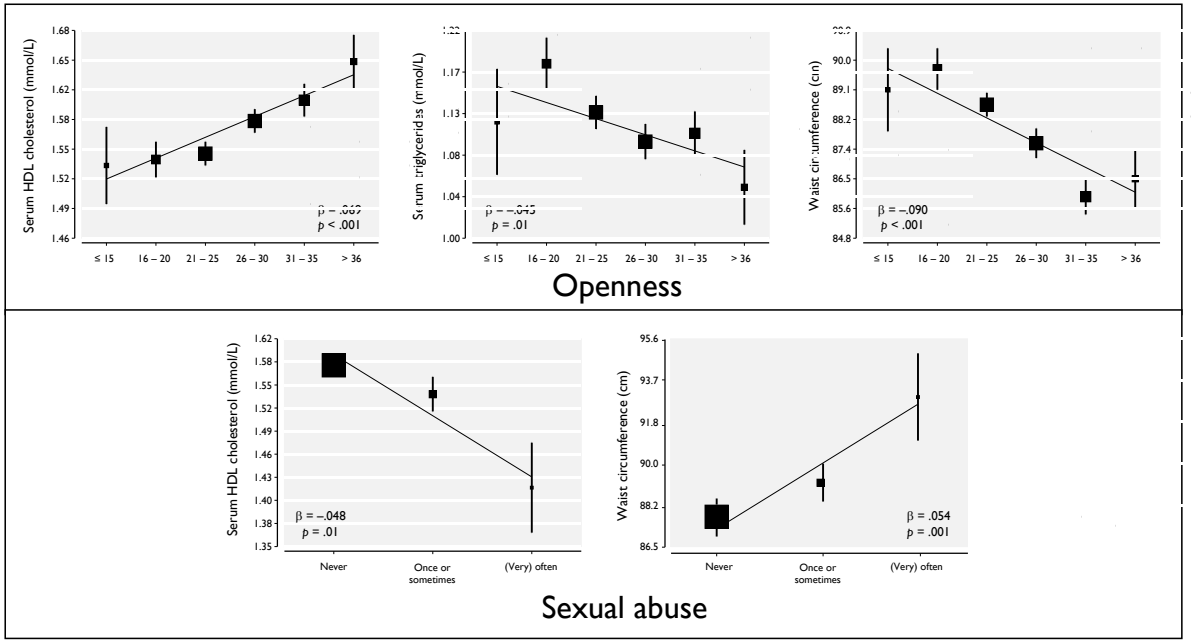

Figure 1.
The mean levels on logarithmic scales (with error bars representing standard errors) for HDL cholesterol, triglycerides and waist circumference according to categories of openness and for HDL cholesterol and waist circumference according to categories of childhood sexual abuse. The dotted lines indicate regression lines. The size of each square is proportional to the number of subjects. β coefficients and their *p* values indicate standardized betas by linear regression analyses. Means and betas were adjusted for age, sex, income, CVD, tobacco use, alcohol use and physical activity

simultaneously. The model was adjusted for age, sex, income, CVD, smoking, alcohol use and physical activity. Models were additionally adjusted for depression severity (data not shown). Openness was significantly associated with higher HDL cholesterol levels, and with lower triglycerides, WC, SBP and overall metabolic risk. Additional adjustment for depression severity did not reduce these associations considerably (i.e., by less than 10%). Agreeableness was associated with lower triglyceride levels, which was significantly determined by depression severity (β -.041 to -.025, i.e., 39.0% decrease). Neuroticism was associated with a higher DBP, which was significantly determined by depression severity (β .040 to -.016, i.e., 140.0% decrease). Emotional neglect was associated with a lower SBP. Psychological abuse related to a higher WC. Additional adjustment for depression severity considerably reduced this latter association (β .042 to .033, i.e., 21.4% decrease) to statistically non-significant. Physical abuse was not related to any of the metabolic risk factors any more. Sexual abuse remained associated with lower HDL cholesterol, and with higher WC and overall metabolic risk values. Additional adjustment for depression severity considerably reduced the associations of sexual abuse with WC (β .041 to .036 [p = .04], i.e., 12.2% decrease) and overall metabolic risk (β .035 to .031 [p = .06], i.e., 11.4% decrease). Adjusted R^2s ranged from .01 to .06 in crude models, and from .16 to .34 in adjusted models. Years of education significantly influenced associations of openness with HDL cholesterol (β .071 to .042 [p = .02], i.e., 40.9% decrease), triglycerides (β -.036 to -.007 [p = .72], i.e., 80.6% decrease), WC (β -.092 to -.052 [p = .003], i.e., 43.5% decrease), SBP (β -.040 to -.007 [p = .71], i.e., 82.5% decrease) and overall metabolic risk (β -.070 to -.032 [p = .06], i.e., 54.3% decrease). Interactions between personality traits and childhood trauma types in their associations with metabolic risk factors were all non-significant (all p >.05). Sensitivity analyses in which all 166 subjects with CVD or all 485 subjects on lipid-lowering, antidiabetic or antihypertensive medication were excluded yielded largely similar results (data not shown).

8.4 DISCUSSION

In this large study, we most robustly found higher levels of openness to protect people from, and childhood sexual abuse to make people vulnerable to adverse levels of the metabolic CVD risk factors dyslipidemia and abdominal obesity. Our findings were largely independent of the lifestyle factors smoking, alcohol use and physical activity, and of each other. To date, several studies have addressed these relationships,[25,85,279-282,284,289-294] with ambiguous results. More essentially, the current focus on personality as well as on childhood trauma is of great importance as theoretical evidence suggests a bidirectional influence between personality and trauma. Our findings might help identifying persons at increased risk of CVD in the future.

First, we will discuss the most important favorable correlate of metabolic risk factors: openness. More openness was associated with favorable HDL cholesterol, triglyceride and SBP levels, and with a lower WC. One former study also found facets of openness to be related to a lower WC.[277] Other studies did not report specific associations of openness with metabolic risk factors.[282,284] However, our findings are in line with the fact that persons with a high trait of openness have a better physical (including cardiovascular) health.[78] This may be mediated by a higher average intelligence level.[295] Indeed, years of education - as a proxy of intelligence - explained a substantial part of the associations of openness with HDL cholesterol, triglycerides, SBP and WC. The associations with HDL cholesterol and WC remained statistically significant and were therefore not sufficiently explained by education. Other influential factors may be increased interest in adopting physical activities, and more openness to public health recommendations. Although the relationship of openness with lipids and WC was of limited strength, it may explain part of the association between high openness and a lower overall mortality risk.[76]

The most important unfavorable correlate of metabolic risk factors was childhood sexual abuse. People with a history of sexual abuse were prone to abdominal obesity and lower HDL cholesterol levels. People experiencing such childhood trauma might be more prone to an adverse metabolic profile through a lower socioeconomic status[296] and accompanying unhealthy lifestyle habits. However, adjustment for socioeconomic status and lifestyle did not substantially alter associations. Alternatively, traumatic events during childhood might cause epigenetically modified activation of multiple genes involved in abdominal obesity and HDL cholesterol phenotyping. Animal studies have revealed that environmental adversities early in development profoundly affect epigenetic DNA methylation and histone deacetylation processes.[297] An example of epigenetic modification by childhood trauma may be silencing of glucocorticoid receptor gene expression[298] and a corresponding chronic adaptation of the stress system.[273,299] The accompanying higher levels of circulating cortisol[274] could contribute to metabolic alterations like abdominal obesity and lower HDL cholesterol levels.[25,120] However, probably only the accumulated epigenetic modification of multiple genes by childhood sexual abuse could adversely affect obesity and HDL cholesterol levels. Other gene regions that may be involved are those that are part of other pathways for stress regulation like inflammation[300] and autonomic nervous system functioning. Increased depressive symptoms among people who experienced childhood trauma[82,84] might also account for an adverse metabolic profile. Childhood trauma may adversely affect the set points of several endocrine systems and thereby cause among others a persistent elevation of prolactin[301] or thyroid dysregulation.[302] This might subsequently reduce serotonergic neurotransmission[301,303] and thereby cause depressive symptoms. Depression severity, however, did only explain part of the association in the current study. An obesity

tendency among sexually abused people was already found in some – although not all[88] – studies,[87,89,90] and might reduce HDL cholesterol levels.[51] Suggested sequelae of sexual abuse that might lead to adverse metabolic risk factor values are posttraumatic stress disorder,[276] eating disorders,[304] disrupted reproductive hormone regulation and increased feelings of anger.[87] Obesity might also serve as a defense posture that blocks unwanted sexual interest.[305]

Other personality traits and childhood traumas were also related to adverse metabolic risk, although less prominently. Agreeableness was associated with higher levels of triglycerides, neuroticism and emotional neglect were related to a higher blood pressure, and psychological abuse to abdominal obesity. Most of these associations were however significantly determined by an increased amount of depressive symptoms associated with these personality and trauma characteristics in our study,[84,306] which is also well-known from the literature.[307] It is noteworthy that conscientiousness was not associated with metabolic risk factors at all. In another large adult sample, conscientiousness was associated with favorable lipid[278] and abdominal obesity[277] levels. However, within this former study only certain facets of conscientiousness were related to less abdominal obesity. Also, conscientiousness is related to increased physical activity.[308] But physical activity was not taken into account in this former study. This might have attenuated the former associations of conscientiousness with lipid values,[278] as physical activity partly explained these associations in the current study. Theoretically, personality and childhood trauma seem to be bi-directionally connected. However in the current study, associations of metabolic risk factors with personality were not modified by childhood trauma, and vice versa associations of metabolic risk factors with childhood trauma were not modified by personality.

Our analyses have several limitations. First, the cross-sectional design does not allow us to make causal inferences on whether personality and trauma precede metabolic risk factors or vice versa. Second, although the experience of childhood trauma is rather stable, it has been retrospectively reported. This may have introduced recall bias. Third, the exploration of several hypotheses has increased the risk of false positive findings (i.e., type 1 error). Strengths of our study are the large sample size and the extensive assessment of personality, childhood trauma and metabolic risk factors. Another strength is the joint investigation of personality and childhood trauma as correlates of metabolic risk factors.

In conclusion, we found that persons with a low openness trait as well as persons who experienced childhood sexual abuse are at higher risk of adverse metabolic risk factor profiles, especially dyslipidemia and abdominal obesity. Future research is required to verify these results. These could eventually guide the development of CVD prevention and intervention guidelines.