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Abnormal serum lipid profile in Brazilian police officers with post-traumatic stress disorder

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Abstract

Background—To measure the serum lipid composition of a sample of Brazilian police officers with and without PTSD regularly exposed to potentially traumatic situations.

Methods—A cross-sectional survey was conducted with 118 active duty male police officers. Serum concentrations for total cholesterol, LDL-C, HDL-C, and triglycerides were enzymatically determined. Body mass index (BMI) was obtained for each participant.

Results—Officers with PTSD exhibited significantly higher serum total cholesterol, LDL-C and triglycerides levels than those without PTSD. Total cholesterol and triglycerides, but not LDL-C, remained associated with PTSD diagnosis after controlling for confounding influences (i.e. socio-demographics, BMI, and tobacco, alcohol and medication use).

Limitations—The sample size was small. A nutritional interview was employed instead of established scales to assess alimentary habits, tobacco or alcohol consumption. A self-report screening tool was used to assess the prevalence of PTSD.

Conclusions—The association between PTSD and abnormal serum lipid profile and a tendency to exhibit higher BMI suggests that individuals with PTSD may be at increased risk for developing metabolic syndrome, a condition that by itself could account for many of the most serious PTSD-related physical health problems.

Keywords

Post-traumatic stress disorder; cholesterol; low-density lipoprotein; high-density lipoprotein; triglycerides

Introduction

Recently, a small number of studies described abnormal serum lipids concentrations in male war veterans with PTSD. Kagan et al (Kagan et al., 1999) found that, compared with controls, 73 hospitalized Vietnam War Veterans with PTSD had significantly higher levels of serum cholesterol, low-density lipoprotein (LDL-C), and triglycerides and lower levels of high-density lipoproteins (HDL-C). Karlovic and colleagues (Karlovic et al.,

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2004b;Karlovic et al., 2004a) reported that Bosnian inpatients with combat-related PTSD [either with (n=37) or without comorbid major depression (n=43)] had higher levels of cholesterol, LDL-C, and triglycerides and lower levels of HDL-C than inpatients with major depressive disorder (n=38) or normal controls (n=39). Similar findings were reported by the same group in a comparison between outpatients with (n=53) and without combat-related PTSD (n=49). However, in the only study that measured lipid levels in trauma-exposed civilians, Tochigi and his associates (Tochigi et al., 2002) did not find a significant relationship between PTSD and serum cholesterol in a small sample of victims (n=34, 8 of them with PTSD) of the Tokyo subway sarin poisoning.

The goal of the present study was, therefore, to determine the generalizability of the findings of PTSD-related lipid abnormalities in combat veterans by measuring serum lipids in a sample of Brazilian police officers with and without PTSD, an understudied population that is regularly exposed to critical incident stressors.

Method

Study population

This cross-sectional survey was part of an institutional nutritional and psychological assessment program carried out from January to December, 2004 with 157 active duty male police officers of an elite unit of the Police Force of the State of Goiás, Brazil. This unit, which is deployed only in critical situations, is particularly well trained: its physical fitness program includes 40-minutes running sessions at least twice a week.

All volunteers were male, since female officers were not being recruited for this unit at the time of the study. Only officers on vacation or on leave (including those on sick leave) were not assessed. There were no refusals to participate in the study and all subjects provided written informed consent. The study was approved by the Internal Review Board of the Institute of Psychiatry of the Federal University of Rio de Janeiro.

Ultimately, thirty nine (25%) participants were excluded from the study - 2 respondents who failed to fill out the questionnaires and 37 volunteers whose serum lipid concentrations were not collected for various reasons. There were no significant differences with regard to age, education, marital status, body mass index (BMI), and alcohol and tobacco consumption between those included in the study and those excluded.

Measures

We used a Portuguese version of the *PTSD Checklist - Civilian Version* (PCL-C) (Berger et al., 2004) to screen for Post-Traumatic Stress Disorder (PTSD). Subjects indicate to what degree they have been distressed by these symptoms during the last month, rating them from “not at all’ to “very much’ (1-5). The PCL is a validated screening tool for PTSD (Blanchard et al., 1996).

Full and partial PTSD groups were determined according to the DSM-IV criteria: for “full PTSD” we considered scores equal or higher than three (“somewhat”) on at least one symptom of reexperiencing (cluster B), on at least three avoidance and numbing symptoms (cluster C), and at least two hyperarousal symptoms (cluster D). Similar to previous research in police officers, the presence of at least two out of three symptom clusters was considered as “partial PTSD” (3).

On the first day of assessment, a nutritionist interviewed the volunteers about their dietary habits, tobacco and alcohol consumption before any nutritional orientation was given. They were also asked to collect blood samples after a night of fasting. Venipuncture was conducted in a sitting position with a tourniquet between 7:00 am and 10:00 am, after an overnight fast of 12 hours. While no participants were in use of statins, three of them were taking beta-blockers for hypertension.

Statistical Analysis

Distributions of the socio-demographic and medical variables were estimated for those with full, partial, and no PTSD. Statistical significance was tested for differences between full PTSD versus no PTSD and partial PTSD versus no PTSD. Chi-square and Fisher exact tests were used for categorical variables and t-Student and Kruskal-Wallis tests were carried out for the continuous ones. Differences were considered statistically significant when $p \leq .05$.

Multivariate linear models were fitted in order to investigate the association between PTSD and lipid variables, controlling for age, BMI, educational level, and self-reported tobacco, alcohol, and beta-blocker use. The covariates associated with a greater than 10% change in the regression coefficients of the variables predicting lipid levels were considered confounders and maintained in the final model.

Results

The prevalence of post-traumatic stress symptoms in our sample, its sociodemographic characteristics, and the distribution of the variables related to the medical conditions in the three subgroups (full PTSD, partial PTSD and no PTSD) are shown in Table 1. The groups did not differ significantly in terms of age, education, and alcohol and tobacco use. A trend toward a statistically higher BMI among individuals with PTSD was observed. The PTSD positive group also used more beta-blockers than the PTSD negative group.

Table 1 also presents mean serum total cholesterol, LDL-C, HDL-C and triglycerides levels in the groups of officers with full, partial and no PTSD. As shown, officers with full PTSD exhibited significantly higher serum total cholesterol, LDL-C and triglycerides levels than those without PTSD. Since the statistical comparison between the partial PTSD and the PTSD negative group did not yield significant values for any of the variables, we presented in Table 1 only the tests of significance for contrasts between the full and the no PTSD groups.

In order to further investigate the role of potential confounders in the association between PTSD and lipid variables, multivariate linear regression models were conducted. For these regression analyses, PTSD diagnostic status (full PTSD vs. no PTSD) was significantly associated with total cholesterol (β=25.06; p=0.05) and triglycerides levels (β=82.18; p=0.001) even after controlling for age, BMI and tobacco use. Although the adjusted regression coefficient for PTSD diagnostic status for LDL-C was 16.4, it was no longer significant (p=0.13) after controlling for covariates. HDL-C did not show a statistically significant association with PTSD in both unadjusted (β=-3.77, p=0.23) and adjusted analysis (β=-2.06, p=0.51).

Discussion

Our main finding was that the PTSD positive group showed significantly higher total cholesterol, LDL-C, and triglyceride concentrations than the PTSD negative group. After controlling for age, educational level, BMI, tobacco and alcohol use and beta-blocker, PTSD remained significantly associated with lipid levels, with the exception of LDL-C levels. These results were comparable to those reported in American and Bosnian patients with combat-related PTSD, suggesting elevated lipid profiles are found in PTSD in different traumatic contexts. However, the only study that assessed a civilian sample did not find

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higher lipid serum levels in subjects with PTSD. One possible explanation for this inconsistency is that the psychological and physiological consequences of the chronic and recurrent stress police officers and combatants are exposed to may differ from those resulting from a single event, as is the case of the sarin gas attack. Furthermore, while PTSD in combatants and police officers may be either primary or secondary (i.e. resulting from witnessing traumatic events), that of the victims of the sarin attack was by definition primary. Finally, the influence of socio-cultural circumstances, such as differences in dietary habits, can not be excluded at this point (Tochigi et al., 2005).

Schnurr and Green (Schnurr & Green, 2004) posited a model in which PTSD is conceived as a mediator between trauma exposures and negative health outcomes. According to this model, a psychological trauma that triggers PTSD results in concomitant behavioral, physiological, and attentional changes that overburden the physical capacity of the individual to adaptively cope with his or her environment and contribute to allostatic load, i.e., the development of compensatory mechanisms in an effort to maintain homeostasis, resulting in a burden of “wear and tear” in a number of bodily functions involved in the stress response.

Overactivation of the sympathetic nervous system and alterations of the HPA axis are known to mediate the association between PTSD and adverse health outcomes (Schnurr & Green, 2004). As far as the disturbances in the lipid metabolism are concerned, these systems may either exert their effects independently or act in tandem. Increased catecholamine levels result in upregulation of lipoprotein lipase, leading to increased concentrations of free fatty acids (FFA) in the serum that are transformed by the liver into cholesterol and triglycerides. Cortisol, on the other hand, increases the deposition of abdominal fat, which is more sensitive to lipolitic agents and related to insulin resistance (Rosmond, 2005). Elevated lipid profiles in turn may mediate longer term deleterious effects on physical health including heart disease and stroke.

It must be noted that disturbances in lipid metabolism are not the only mechanisms through which stress hormones may lead to negative health outcomes. For example, while stress-related increases in plasma catecholamines result in elevated heart rate and blood pressure and activate atherogenic mechanisms, enhanced cortisol release causes weight gain, either directly or indirectly through CRF- related insomnia (Schnurr & Green, 2004).

Seen in a wider perspective, the association between post-traumatic stress and abnormal serum lipid profiles, a tendency towards higher BMI, and increased use of beta blockers for hypertension suggests that individuals with PTSD may be at increased risk for developing metabolic syndrome, with its typical components, such as visceral obesity, hypertension and dyslipidemia.

Several limitations of our study should be acknowledged. We used only a self-report screening tool to assess the prevalence of PTSD and the number and the type of traumatic events were not recorded. The cross-sectional design prevents us from establishing any causality. We used a nutritional interview instead of established scales to assess alimentary habits, tobacco or alcohol consumption. Furthermore, we might have underestimated the prevalence of PTSD since we did not assess officers on sick leave. Lipid levels were not available for 25% of the full sample. The small size of our sample may have contributed to the loss of statistical significance for LDL-C in the linear regression.

Further studies designed to screen for serum lipid abnormalities in patients with PTSD in different settings are needed to expand scientific knowledge in this area. Low-cost and simple biological assessments such as the measurement of serum lipid concentrations may turn out to be invaluable tools for assessing stress-exposed populations and developing strategies aimed at preventing the deterioration of their general health.

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Table 1

Socio-demographic characteristics, body mass index, serum lipid parameters, beta-blockers use, smoking, and alcohol consumption in a sample of police officers with and without PTSD symptoms.

Variables	PTSD Negative (n = 90)	Partial PTSD (n = 17)	Full PTSD (n = 11)	P value*
	Mean (SD) %	Mean (SD) %	Mean (SD) %	
PCL-C total scores	24.4 (5.37)	39.2 (7.37)	51.0 (9.9)	< 0.001
Age	33.11 (5.38)	33.18 (4.69)	35.73 (7.12)	0.14
Education				
*Did Not Graduate From High School	20%	23.5%	27.3%	0.69
*Graduated From High School	80%	76.5%	72.7%	
Marital Status				
Single	17.8%	17.6%	0%	
Married	80%	76.5%	72.7%	0.002
Divorced	2.2%	5.9%	27.3%	
Body mass index	25.61 (3.31)	25.29 (3.29)	27.38 (4.0)	0.09
Tobacco smoking	19.2%	18.8%	9.1%	0.68
Alcohol use	52.8%	64.7%	54.5%	0.66
Betablocker use	1.1%	0%	18.2%	0.03
Cholesterol (mg/dL)	183.1 (39.5)	188.0 (42.8)	217.4 (54.1)	.001**
LDL-C (mg/dL)	110.4 (33.0)	117.5 (39.5)	134.6 (45.2)	.003**
HDL-C (mg/dL)	49.5 (12.7)	46.3 (7.6)	44.8 (13.3)	.26**
Triglycerides (mg/dL)	122.4 (80.3)	127.3 (53.7)	224.8 (160.8)	.004***

* PTSD Negative vs. Full PTSD,

** t-test,

*** Mann-Whitney test.