

Spiritual Well-Being, Cortisol, and Suicidality in Croatian War Veterans Suffering from PTSD

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Abstract We present our preliminary results of work that aims to observe the relationship between the cortisol level, the level of spiritual well-being, and suicidal tendencies in Croatian war veterans suffering from PTSD. The survey was conducted on 17 PTSD veterans who completed the Spiritual Well-Being Scale and the Beck Hopelessness Scale. The plasma cortisol level was obtained by venepunction at 8.00, 12.00, 13.00, 16.00, and 22.00 h. Results showed that veterans with higher spiritual well-being scores had lower cortisol levels, and evening cortisol levels showed significant correlation with suicidal risk. The results of the present study could be a stimulus for further investigation into spiritually based interventions, exploring their impact both on mental status and physical health.

Keywords Spiritual well-being · Cortisol · PTSD · Suicidality

Introduction

Cortisol levels have generally been found to be high in conditions of acute and chronic stress and in certain types of psychiatric disorders that are associated with stress. On the other hand, some authors (Mason et al. 1986; Yehuda et al. 1990, 1995, 2006) have found that PTSD patients reveal a lower level of plasma cortisol than healthy subjects. One research outcome on a population of Croatian combat veterans with PTSD showed higher serum cortisol concentrations in PTSD veterans than in healthy subjects (Gotovac et al. 2003).

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PTSD veterans represent a group of patients with chronic and severe psychiatric illness with a significant lifetime risk for somatic disturbances (Boscarino 2004; Jakovljević et al. 2006) and for both suicide attempts and completed suicides (Farberow et al. 1990; Hendin and Haas 1991; Marčinko et al. 2006). Because of its relationship with stress, cortisol can be used as a predictor of suicide risk in some populations of patients (Jokinen and Nordström 2008, 2009). For example, Lindqvist et al. (2008) found an association between suicidal behavior and low HPA axis activity that could be due to an exhausted HPA axis in suicidal patients. Furthermore, some findings suggest that individuals who measure high in religiosity/spirituality may experience a protective effect against the neuroendocrine consequences of stress. Carrico et al. (2006) examined associations between spirituality and 24-h urinary-free cortisol output in depressed patients. Tartaro et al. (2005) found that participants with higher composite religiosity/spirituality scores showed lower cortisol levels. In our previous research, we found a strong correlation between suicidality (measured by SUAS) and spiritual well-being (measured by SWB scale), especially with its subscale: existential well-being in veterans with chronic PTSD (Nađ et al. 2008). Several authors have reported that spiritual well-being is associated with lower levels of hopelessness and suicidal ideations (McClain et al. 2003; McCoubrie and Davies 2006; Oquendo et al. 2005).

The aim of our present study was to observe the relationship of cortisol secretion with suicidal risk and the level of spiritual well-being in PTSD veterans. We hypothesize the existence of linkage between these parameters in Croatian PTSD veterans, i.e., an inverse relationship between cortisol levels and spirituality, cortisol levels and suicidal risk, and spirituality and suicidal risk.

Methods

Participants

The study included Croatian male war veterans, inpatients treated at the Department for Psychiatry, University Hospital Zagreb in the period from March 2007 to September 2007. There were 23 veterans included whose diagnoses of PTSD were verified by experienced psychiatrists using the Structured Clinical Interview for DSM-IV Diagnoses (First et al. 1995). Another inclusion criterion was the score on the MPTSD scale of more than 107 (author of the scale recommended ≥ 107 as the cutoff value for the diagnosis of PTSD; Keane et al. 1988). Also, we included only those veterans who did not confirm the existence of childhood trauma. This was necessary to eliminate the possibility of long-lasting neurobiological effects from childhood trauma (Bremner et al. 2003; Flory et al. 2009). Three participants were excluded because of severe somatic illnesses—one with adipositas (TT > 120 kg, BMIcca38), the second had nephrocarcinoma, and the third had prolactinoma. Three veterans refused to participate because of the fear of the needle used for venepunction. All participants ($n = 17$) gave their written consent after a full explanation of the purpose of the study was provided. The participants included were taking SSRI antidepressants. Previous research has not been consistent in showing a significant impact of antidepressants on cortisol level (Ahrens et al. 2007; Beluche et al. 2009; Horstmann et al. 2009; Tucker et al. 2004).

We used a comparison group for comparing cortisol secretion pattern with war veterans only. The comparison group consisted of healthy volunteers recruited from the medical staff of the Department for Psychiatry, University Hospital Zagreb who were willing to

participate and who had not participated in combat during the Fatherland War in Croatia (1991–1995). They all had a negative history of psychiatric disorders. They gave their written consent only for three measures a day (at 8, 16, and 22 h).

Measurements

The level of suicidal risk was determined by the Beck Hopelessness Scale (BHS; Beck et al. 1988)—a 20-item self-report inventory developed by Dr. Aaron T. Beck that was designed to measure three major aspects of hopelessness: feelings about the future, loss of motivation, and expectations. Range of results is from 0 (no suicidal risk) to 20 (high suicidal risk); according to these results, veterans were divided into two groups—with low and high suicidal risk with cutoff at 9 scores.

We measured spirituality using the Spiritual Well-Being Scale (SWB; Paloutzian and Ellison 1982; Frey et al. 2005), which consists of two subscales: the religious well-being (RWB) subscale refers to one's sense of well-being in relation to God, while the existential well-being (EWB) subscale refers to a sense of purpose in life and satisfaction with life, with no specific reference to religiosity. Each subscale comprises ten six-point Likert-type scale items, with answers ranging from *strongly agree* to *strongly disagree*. The two subscales together form a 20-item measure of spiritual well-being (SWB total). The total score range is from 20 to 120, with higher scores indicating better spiritual well-being. According to the results, participants were divided into two groups—those with spiritual well-being scores up to 68 or below and those with higher (above 68) spiritual well-being scores.

Serum cortisol concentration was determined by the immunoenzymometric assay (IEMA) with luminiscent substrate on automat Vitros Eci (Ortho-Clinical Diagnostics, Inc Rochester, New York). The sensitivity of the assay was <3 nmol/l. Referral values: morning serum 138–690 nmol/l, afternoon serum 55–248 nmol/l (NCCLS 1992).

Procedure

Cortisol from heparinized blood samples was collected by venepuncture from the cubital vein in fixed Vacutainer tubes (Becton–Dickinson Vacutainer System Europe, Grenoble, France) at 8.00, 12.00, 13.00, 16.00, and 22.00 h from war veterans, and at 8.00, 16.00, and 22.00 h from healthy volunteers. We got an excretion curve for every examinee. Before venepuncture, participants had to remain in a peaceful state for 30 min with a needle in their vein. War veterans, who were inpatients, filled out the Beck Hopelessness Scale and Spiritual Well-Being scale the day before taking the blood samples. They get braunille in the cubital vein at 7.00 and took them off after the last measurement at 22.00.

Statistical Analyses

We used the Kolmogorov–Smirnov test to examine whether distributions of our data were significantly different from normal distribution and whether our analyses resulted in statistically insignificant differences (Table 1). We used the Chi-square test, the Student's *t* test, and the repeated measures test to assess the differences between the groups. Correlations were determined using Pearson's coefficient of correlation. SPSS 13.0 Statistical Package (SPSS Inc, Chicago, IL, USA) was used for all statistical analyses.

Table 1 One-sample kolmogorov–Smirnov test for cortisol, SWB, and BHS

	Cortisol 8 h	Cortisol 12 h	Cortisol 13 h	Cortisol 16 h	Cortisol 22 h	SWB	BHS
<i>N</i>	25	17	17	25	25	17	17
Kolmogorov–Smirnov	.531	.618	.870	.626	1.132	.630	.529
Asymp. sig. (2-tailed)	.940	.840	.436	.829	.154	.822	.942

N number of participants, *SWB* spiritual well-being, *BHS* beck hopelessness scale

Results

Sociodemographic Characteristics

For assessing the differences between war veterans and the comparison group (healthy volunteers) in sociodemographic characteristics (Table 2), we used the Chi-square test. There was a statistically significant difference in average age of participants where war veterans were older than the control group ($t = 4.65$, $df = 23$, $P = .000$). Also, controls were more educated ($\chi^2 = 7.76$, $df = 2$, $P = .01$), were employed in greater proportion ($\chi^2 = 14.16$, $df = 1$, $P = .000$), and had less attempts at suicide ($\chi^2 = 4.52$, $df = 1$, $P = .01$). There was no difference between the above-mentioned groups in marital status ($\chi^2 = 4.00$, $df = 1$, $P = .069$) and denomination ($\chi^2 = 0.60$, $df = 1$, $P = .407$).

Cortisol

Between PTSD veterans and healthy volunteers, there were no significant differences in cortisol levels at different time points (cortisol at 8 h: $t = 0.23$, $df = 23$, $P = .782$; cortisol at 16 h: $t = -1.46$, $df = 23$, $P = .159$; cortisol at 22 h: $t = -1.25$, $df = 23$, $P = .226$). We compared the level of cortisol in different time points in day in the overall sample of participants. There were significantly different levels of cortisol during the day ($F = 55.59$, $df = 4$, $P = .000$). There was a significant difference between all time points in cortisol levels in the day except between 12 and 13 h and 13 and 16 h (Table 3).

SWB-Cortisol

There was a significant difference in level of morning and evening cortisol in participants with lower SWB, in comparison with participants with higher SWB (8-h cortisol: $t = 2.63$, $df = 15$, $P = .019$; 22-h cortisol: $t = 2.45$, $df = 15$, $P = .027$; Table 4). Participants with lower SWB had higher values of cortisol in the morning and in the evening, while during the middle of the day (12, 13, and 16 h), there was no difference between these groups (Fig. 1). Only evening cortisol (22.00 h) in war veterans inversely correlates with SWB ($r = -.516$; $P = .034$), while in other daytimes the level of cortisol showed no significant correlation with spiritual well-being.

SWB-Suicidal Risk

The relationship between SWB and suicidality had significant inverse correlation ($r = -.641$, $P = .006$). Participants with higher suicidal risk measured by BHS showed lower

Table 2 Participants' sociodemographic characteristics

	War veterans with PTSD (<i>n</i> = 17)	Healthy volunteers (<i>n</i> = 8)
Mean age ^a (years)	44.12 (32 ± 58)	34.25 (30 ± 41)
Married	15	4
Number of children ^a	2.66 (1 ± 4)	1.62 (0 ± 6)
Catholics	15	6
Atheists	2	2
Elementary school	2	0
High school	15	5
University education	0	3
Employed	2	8
Retired	15	0
Family history of suicide	All negative	All negative
Suicide attempts		
Yes	9	0
No	8	8
Age of onset of PTSD ^a (years)	32.70 (20 ± 46)	
Age of onset of psychiatry treatment ^a (years)	35.23 (21 ± 50)	
Duration of PTSD ^a (years)	11.42 (3 ± 17)	
Number of hospitalizations	2.64	
Wounding (yes/no)	4 Yes/13 no	

^a Values represent mean (Min ± Max)

Table 3 *t*-test for all day cortisol

	<i>t</i> -test	<i>df</i>	<i>p</i>
cort8–cort12	7.427	16	.000**
cort8–cort13	7.543	16	.000**
cort8–cort16	11.698	24	.000**
cort8–cort22	14.941	24	.000**
cort12–cort13	.556	16	.586
cort12–cort16	2.200	16	.043*
cort12–cort22	6.338	16	.000**
cort13–cort16	1.551	16	.141
cort13–cort22	5.775	16	.000**
cort16–cort22	5.524	24	.000**

* $P < .05$; ** $P < .01$

scores on total SWB scale. In accordance with correlation, *t*-test scores showed a significant difference ($t = 2.74$, $df = 15$, $P = .015$) between participants with low spiritual well-being scores showing higher results on BHS ($M = 13.0$, $SD = 4.69$) in comparison with participants with high SWB that have lower results on BHS ($M = 7.4$, $SD = 3.10$; Table 4).

Table 4 SWB, cortisol, and BHS—*t*-test

	Low SWB (<i>N</i> = 10)		High SWB (<i>N</i> = 7)		<i>t</i> -test	<i>df</i>	<i>P</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Cortisol level at 8 h	428.4	95.27	293.7	115.27	2.63	15	.019*
Cortisol level at 22 h	62.2	29.86	32.3	14.23	2.45	15	.027*
BHS score	13.0	4.69	7.4	3.10	2.74	15	.015*

* *P* < .05

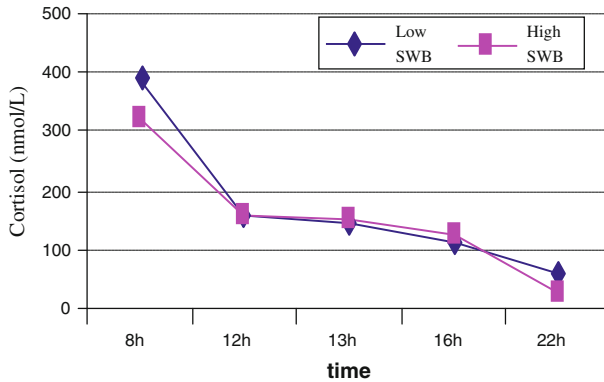


Fig. 1 Relationship between spiritual well-being and cortisol level in different time points. Participants with lower SWB had higher values of cortisol in the morning and in the evening, while during the middle of the day (12, 13, and 16 h), there was no difference between these groups

Suicidal Risk-Cortisol

The differences between groups with low and high suicidal risk were statistically significant only in evening cortisol (22 h: *t* = 2.62, *df* = 15, *P* = .015) where participants with low suicidal risk had lower cortisol values (*M* = 31.4, *df* = 13.16) in comparison with the high suicidal risk group (*M* = 62.8, *df* = 29.5; Fig. 2). In accordance with that result is the correlation of suicidal risk measured by BHS and evening cortisol (22 h; *r* = 0.741; *P* = 0.01).

Discussion and Conclusion

Our study confirmed our hypothesis of the inverse relationship between cortisol and spiritual well-being (SWB), cortisol and suicidality, and suicidality and spiritual well-being in PTSD veterans. Veterans with lower SWB have higher values of cortisol in the morning and in the evening, and evening cortisol (22.00 h) inversely correlates with SWB. This is in line with some studies that show the protective effect of spirituality/religiosity against the neuroendocrine consequences of stress (Carlson et al. 2004; Tartaro et al. 2005; Walton et al. 1995). In our work, we defined spirituality as consisting of a sense of purpose in life and satisfaction with life, with and/or without specific reference to religiosity.

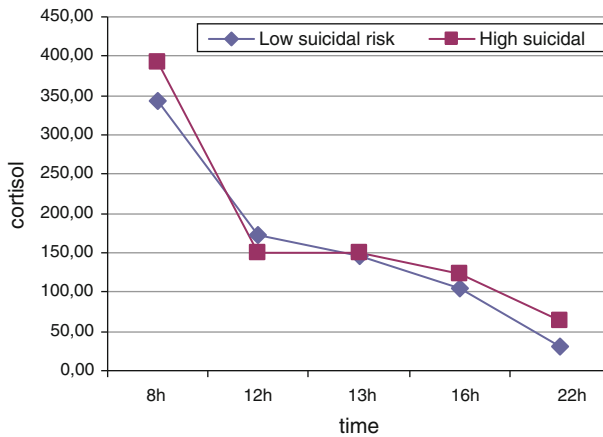


Fig. 2 Cortisol—suicidal risk (measured by BHS). The differences between groups with low and high suicidal risk were statistically significant only in evening cortisol (22 h: $t = 2.62$, $df = 15$, $P = .015$) where participants with low suicidal risk had lower cortisol values ($M = 31.4$, $df = 13.16$) in comparison with the high suicidal risk group ($M = 62.8$, $df = 29.5$)

Carrico et al. (2006) have shown that, in relationship to cortisol output, spirituality was associated with higher positive reappraisal coping and greater benefit finding. Furthermore, spiritual well-being, as an indicator of inner belief systems and values, could be a mediating factor for mitigation of psychic and somatic symptoms related to posttraumatic stress disorder observed more frequently among suicide cases. Variability in spirituality/religiosity among people could be determined by environmental and cultural differences, and genetic and biological variations also (Borg et al. 2003; Bouchard et al. 1990). The findings of the present study may provide support for a biological underpinning specifically related to the HPA axis.

In our previous research on a population of PTSD veterans (Nađ et al. 2008), we found that suicidality measured by SUAS (Suicide Assessment Scale) is higher in veterans with lower scores on the Spiritual Well-Being scale, especially with its Existential Well-Being subscale. Now, we have confirmed this kind of association—PTSD veterans with lower spiritual well-being are under greater suicidal risk measured by the Beck Hopelessness Scale. Other authors found that chronic PTSD could be associated with general feelings of hopelessness, demoralization, and suicidal behavior (Fontana and Rosenheck 1995), so these patients are in great need of secondary prevention of suicidal attempts. We think that enhancing spiritual well-being can be helpful against suicidality, and the association between hopelessness/suicidal risk and spiritual well-being is supportive of that statement.

The pattern of cortisol excretion in our participants did not differ from the pattern in the comparison group, with the gradual decline from morning to evening having the lowest level in the evening. Cortisol concentrations did not differ significantly between PTSD veterans and healthy volunteers. Other Croatian authors found higher values of cortisol in PTSD veterans in comparison with healthy volunteers (Gotovac et al. 2003; Vidović et al. 2007). These authors emphasized the time duration between trauma and cortisol measurement as the influencing factor on cortisol level in PTSD veterans. On the other side, Yehuda et al. (1995, 2006) found that PTSD patients' cortisol is lower in comparison with healthy volunteers, which can be explained by hypersensitivity of HPA axis being a consequence of long-term hyperarousal. Although this was not the main topic of our

research, we consider that nonexistence of differences in cortisol values in our participants is the result of time elapsed between war trauma and cortisol measurement. The time elapsed in our research was about 12 years (Table 2), which is more than in our Croatian colleagues and less than in Holocaust survivors and Vietnam veterans in studies from Yehuda. This could also be considered as an indicator of intermediate time passed, with HPA axis at the start of its exhaustion.

Yehuda et al. (2009) showed that cortisol levels can be possible predictors of psychotherapeutic response. Since biological, psychological, and spiritual factors are associated in many ways, the spiritual principles could be included in psychotherapeutic programs for PTSD veterans. For example, Sigmund (2003) emphasized the spiritual aspects of trauma and explored new approaches in PTSD treatment (e.g. twelve steps of Alcoholics Anonymous, and its concept of a “higher power” offered a useful format for veterans to confront dysfunctional attitudes and try out new behaviors of relating to themselves, to God, and to their community). In our previous research (Nađ et al. 2008), we also suggest inclusion of spirituality in traditional psychotherapy for PTSD. These new spiritual kinds of therapeutic programs could be conducted through clubs for PTSD veterans (Koić et al. 2005) in small groups or in a more individual approach.

One limitation of our study is its small sample size. In our Clinic, there was no possibility to measure salivary cortisol which could have resulted in a bigger sample due to a simpler technique for collection. Because of the need in our study of all day fixed intravenous braunille for our subjects, patients and volunteers did not respond in greater numbers. Volunteers allowed only three venepunction. Due to the small sample size, results from this study are more indicative than conclusive. Also, its cross-sectional nature limited us in establishing causal conclusions. Results are still preliminary, and further investigations into larger samples are essential.

In conclusion, we have shown in the present study, an inverse relationship between spiritual well-being and cortisol levels, and an inverse relationship between spiritual well-being and suicidal tendencies. We see in our data a linear relationship between suicidal risk and cortisol level. Exploring the linkage between spirituality and the psychobiology of PTSD may contribute to the development of new interventions and prevention of suicidal behavior in PTSD. The results of the present study could be the stimulus for further investigation into spiritually based interventions exploring their impact both on mental status and on physical health. Delineating the role of spiritual factors on PTSD suicidality by exploring the linkage with psychobiology of PTSD may contribute to the development of new interventions and prevention of suicidal behavior in PTSD veterans.

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