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AVOIDANCE COPING AND LYMPHOCYTE COUNT

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SUMMARY – Stress is the key psychological activator of the hypothalamic-pituitary-adrenal axis and therefore an important risk factor for diminished immunocompetence. The aim of the study was to assess the connection between the strategies of coping with stress and lymphocyte counts in soldiers. Coping strategies were evaluated in 61 Slovenian Army members using the Coping Responses Inventory. White blood cell count with detailed lymphocyte analysis by use of flow cytometry was assessed in 33 soldiers. Factor analysis identified two factors of coping, i.e. avoidance coping and approach coping. Statistically significant negative correlations were recorded between avoidance strategies and monocyte, lymphocyte and T-lymphocyte concentrations. Approach strategies, which are thought to be more adaptive, did not correlate with the immune system measures. These findings support the notion that each person's individual coping styles are reflected in their immune characteristics. We presume that avoidance coping might be an important mediating variable influencing the effects of stress on immune measures.

Key words: S*tress, psyhological; Military personnel – psychology; Adjustment disorders – diagnosis; Defense mechanisms; Anxiety – psychology; Adaptation, psychological; Avoidance learning*

Introduction

Stress is considered as the most prevalent modern disease and a risk factor for the development of somatic and psychiatric illnesses. Since the study by Ader and Cohen[1], which showed that the immune system functions could be conditioned, psychoneuroimmunology has emerged as a new field of scientific research. In the last decade, a wide range of literature has been published on the psychological modulation of the immune function[2]. The limbic-hypothalamic-pituitary-adrenal (LHPA) axis has been identified as the principal path of the bidirectional communication between the immune system and the central nervous system, with stress being its most significant psychological activator[3]. It is therefore important to define the important factors predisposing to or protecting from stress and its consequences. Coping strategies are a process of adaptation in an individual, which are aimed at maintaining a state of equilibrium. Events and situations that shift the individual from his/her area of stability represent stress. The impact depends on the success of the coping strategies. The stress process model explains that choosing the right coping strategy in a given situation is an important mediating factor in perceived stress and its implications for health[4].

It must also be taken in consideration that certain types of coping with stress represent only a temporary avoidance of disturbing stressful emotions and can be detrimental at long run. For instance, people with repressive coping strategy, defined as a strategy of defensive avoidance of disturbing cognitions, have a higher level of salivary cortisol as well as of physiological arousal when stressed, while reporting a smaller subjective feeling of stress[5]. Hence, there are individuals with specific coping strategies who have a higher

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risk of stress-related disorders and who nevertheless report a lower level of stress and anxiety.

Many studies have shown avoidance strategies to predict distress[6]. Research into the influence of stress and stress-related coping on the immune system is commonly found in literature on human immunodeficiency virus (HIV) disease. Goodkin *et al.*[7] found a positive relationship between natural killer (NK) cell cytotoxicity and active coping in a sample of 62 infected homosexual men. An examination of coping strategies in homosexual men receiving a notification they were HIV-positive showed that those using denial coping and behavioral discharge had a lower T-helper cell count after one year[8]. Avoidance strategies also predicted faster progression to acquired immunodeficiency syndrome (AIDS)[9].

The aim of our study was to assess the relationship between coping styles and immune system characteristics, i.e. peripheral lymphocyte populations.

Subjects and Methods

Subjects and procedure

Data for the study were collected from 61 subjects that were selected (after medical, physical and psychological examinations) to participate in a foreign country mission. There were 59 male and two female subjects, mean age 28.5 (SD=5.6) years and mean education period of 12 (SD=1.6) years. Study subjects completed a questionnaire booklet. Due to financial limitations, samples for immunologic tests were collected from only 33 subjects randomly selected from the whole sample. All study subjects were professional soldiers employed in the Slovenian Army and were involved in military training for a foreign mission. Therefore, all subjects had a similar dietary regime and underwent similar physical training. During the time of testing, they were dislocated to a military camp undergoing preparation for a mission in a foreign country. The subjects underwent extensive medical check-up by specialists of laboratory medicine and internal medicine, according to the general foreign mission military protocol. No medical condition that could affect the immune system was detected in the study subjects. They had normal C-reactive protein and erythrocyte sedimentation rate. Immunologic assessment was carried out in a separate session on the same day as personality assessment. The study was performed as a research project of the Slovenian Ministry of Defense and was approved by the Slovenian Medical Research Ethics Committee. An informed consent was obtained from all study subjects.

Measures

Psychological assessment

We used the Coping Responses Inventory (CRI)-Adult questionnaire created by Moos[10]. The questionnaire is designed to measure strategies of coping with stressful life events. It measures participants' answers on eight scales, i.e. logical analysis, which measures cognitive attempts to understand the stressor as well as the effort to prepare mentally for the stressor and its consequences. Positive appraisal includes efforts to explain and reshape the problem in a positive way, as well as to accept the reality of the situation. Seeking guidance and support includes behavioral attempts to seek information, guidance and support. Problem solving includes behavioral attempts to take action and tackle the problem directly. Cognitive avoidance measures cognitive attempts to avoid realistic thinking about the problem. Acceptance includes cognitive attempts to respond to the problem by accepting it. Searching for alternative rewards includes behavioral attempts of engaging in new activities and creating new sources of satisfaction. Emotional discharge includes behavioral attempts to release the tension by expressing negative emotions.

Table 1. Division of individual Coping Responses Inventory-Adult scales

	Approach strategies	Avoidance strategies
Cognitive	1 Logical analysis	5 Cognitive avoidance
	2 Positive appraisal	6 Acceptance
Behavioral	3 Seeking guidance and support	7 Seeking alternative rewards
	4 Problem solving	8 Emotional discharge

The first four strategies represent approach coping (problem-focused), whereas the last four strategies represent avoidance coping (emotion-focused). In addition, they can be divided into cognitive and behavioral strategies, as presented in Table 1.

Each scale is composed of 6 items, bringing the whole questionnaire to a total of 48 items. Participants respond to items on a 4-level scale (from "Never" to "Very often"), related to how often they use individual strategies. There is very low correlation between scales and social desirability. The scales' Cronbach Coefficient Alpha of internal consistency ranges between 0.60 (for the scale seeking guidance and support) and 0.74 (for the positive-appraisal scale)[10]. The author quotes numerous researches confirming the construct validity of the CRI questionnaire.

Immunologic assessment

Peripheral blood leukocytes were collected by the venepuncture procedure and collected into EDTA vacutainers (Becton Dickinson, Mountain View, CA). The samples (100 μl of blood) were incubated with 10 μl of the appropriate monoclonal antibody (MoAb) for 15 to 30 min at room temperature in the dark and then washed twice with cold PBS buffer (Becton Dickinson). Red blood cells were eliminated by adding 2 mL of lysing PBS solution, mixed and centrifuged for 5 min at 1600/min. The supernatant was removed and 1 mL of PBS was added again. The samples were then ready for flow cytometry analysis. If the analysis was not performed immediately, the closed test-tubes were stored at 4 °C in the dark. As a rule, analyses were completed within 24 h.

All MoAbs were labeled directly with fluorescein isothiocyanate or phycoerythrin. Antibodies against the following cell surface structures were used: CD3, CD4, CD8, CD19, HLA-DR, and NK CD14/CD56 (Becton Dickinson, Mountain View, CA). Two-parameter analysis was performed to determine the proportion of T cells (CD3+), T helper cells (CD3+CD4+) and cytotoxic T cells (CD3+CD8+). Isotype controls (Becton Dickinson, Mountain View, CA) and a control of viable cells (LIVE/DEAD kit, Molecular Probes, OR) were included. At least 2000 gated viable cells were analyzed *per* test, and signals from two light scatters and four fluorescence parameters were analyzed with the Becton Dickinson Lysis II software.

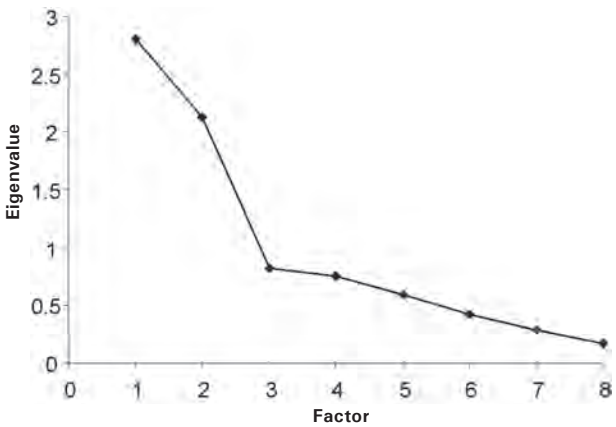

Fig. 1. Graphic illustration of eigenvalues for Coping Responses Inventory factors.

Factor analysis of CRI questionnaire

Factor analysis could be performed because according to the Kaiser-Mayer-Olkin criteria, correlations between coping strategies in the CRI questionnaire are high enough for factorization (KMO statistics is 0.66). In addition, the Bartlett test of sphericity shows that correlations are suitable for factorization (approximately χ^2 (28)=167.538; P=0.000). Exploratory factor analysis of eight strategies in CRI showed a factor structure with two factors showing eigenvalue above one. Also, Cattell's scree test would give the same number of factors, as seen in Figure 1. Factors 3 to 8 are spread (out evenly) in an approximately linear fashion. The two factors together explain 61.8% of variance. After Varimax rotation, the first factor explains 34% and the second 27.8% of variance.

A two-factor internal structure was accepted, in accordance with/in relation to the theoretical basis on which the CRI questionnaire was designed[10]. Analyzing the factors in Table 2, the first factor can be seen to load on logical analysis, positive appraisal, seeking guidance and support as well as problem solving, which all are approach strategies. The second factor loads more on the items for cognitive avoidance, acceptance and emotional discharge, which all are emotion-focused avoidance strategies according to the author's terminology. Therefore, we decided to name the first factor "approach strategies" and the second factor "avoidance strategies". The seeking-alternative-reward factor, which is supposed to be an avoidance strategy, had unexpectedly a somewhat higher loading

Table 2. Rotated factor matrix of factor loadings for individual strategies from Coping Responses Inventory when two factors are extracted

Strategy	Factor	
	Approach strategies	Avoidance strategies
Logical analysis	0.890	-0.009
Positive appraisal	0.704	0.002
Seeking guidance	0.668	0.396
Problem solving	0.844	-0.303
Cognitive avoidance	0.037	0.814
Acceptance	-0.034	0.778
Seeking alternative rewards	0.516	0.279
Emotional discharge	0.096	0.792

on the approach factor. We supposed that it was due to a small *numerus* (n=59) and that it might load on the avoidance-strategies factor if analyzed on a bigger sample.

Results

Correlations between coping strategies and measures of the immune system

We tried to determine if coping strategies were connected with quantitative immune system variables. Table 3 shows the factor of avoidance strategies to be negatively associated with the concentration of white blood cells. Significant correlations were found with the concentration of monocytes, lymphocytes and lymphocytes T. Approach strategies did not show significant correlations with the immune measures.

Discussion

In this study, we focused on the connection between the process of coping and the immune system on the example of soldiers. We hypothesized that the use of avoidance strategies would negatively correlate with the measures of the immune system. As shown in Table 4, we found statistically significant negative correlations between avoidance strategies and monocyte, lymphocyte and lymphocyte T concentrations. These findings support the notion that each person's individual coping styles are reflected in his/her immune characteristics. It should also be stressed that the interpretation of correlations between psychological variables and immune measures is quite complex. A reduction in the concentration of lymphocyte T cells has been associated with a greater risk of developing postoperative infections[11,12]. A reduction in lympho-

Table 3. *Spearman Rho correlation coefficients between the factors of Coping Strategies (Coping Responses Inventory) and immune measures*

Immune cell concentrations (cells/L)	Approach strategies	Avoidance strategies
Granulocyte	0.066	-0.228
Monocyte	0.222	-0.409*
Lymphocyte	0.060	-0.362*
Lymphocyte T	-0.002	-0.368*
T-helper cell	-0.035	0.220
Cytotoxic lymphocyte	-0.108	-0.107
Lymphocyte B	0.214	0.030
NK cell	0.226	-0.038

*$P<0.05$; n=31 (two participants were excluded from correlation analysis due to missing values in their Coping Responses Inventory protocol)

cyte T, typical of old age, was shown to be connected with a significantly increased risk of inflammation[13].

Avoidance strategies are focused on reducing unpleasant emotions and cognitions (for example, by retreating into imagination, abusing drugs, repressing feelings, distracting oneself by different chores, etc.). This is often inefficient, since they only act as a temporary emotional disburdening. The stress is enhanced at long run as the stressor is not eliminated and will be repeated[6]. The most common model in the literature linking psychological factors with the immune system proposes that such long-term stress may lead to chronic hyperactivity of the autonomic, neuroendocrine systems, the HPA axis and subsequent cortisol release with implications for immune functioning[5]. Stress is the key psychological activator of the HPA axis and therefore an important risk factor for diminished immunocompetence[14]. Avoidance coping might be an important mediating variable influencing the effects of stress on immune measures. High use of avoidance coping was found to be related to psychopathology and maladjustment in forensic settings[15]. In our study, approach strategies, which are thought to be more adaptive, did not correlate with the immune system measures. We assume that in practice, it might be important to find a way to reduce non-adaptive avoidance strategies.

Our study had quite a few limitations, the most prominent one being the small *numerus* of participants. It was taken into account that soldiers represent a specific type of population with distinctive exposure to stress. Therefore, these findings cannot be applied to the general population. Additional research in greater/more extensive samples of healthy individuals exposed to stress is warranted to assess the possible connection between coping styles and immune system characteristics.

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Sažetak

OVLADAVANJE STRESOM IZBJEGAVANJEM I BROJ LIMFOCITA

A. Ožura i *A. Ihan*

Stres je ključni psihološki aktivator hipotalamo-pituitarno-adrenalne osi te je time važan čimbenik rizika snižavanja razine imune sposobnosti. Cilj ove studije bio je procijeniti vezu između strategija ovladavanja stresom i broja limfocita kod vojnika. U studiju je bio uključen 61 član slovenske vojske, kod kojih su se strategije ovladavanja stresom procjenjivale pomoću instrumenta poznatog kao Coping Responses Inventory. Bijela krvna slika je određena kod 33 vojnika uz podrobnu analizu limfocita pomoću protočne citometrije. Faktorska analiza je utvrdila dva čimbenika ovladavanja: ovladavanje izbjegavanjem i pristupno približavanjem. Nađene su statistički značajne negativne korelacije između strategija izbjegavanjem i koncentracija monocita, limfocita i T-limfocita. Strategije približavanjem koje se smatraju prilagodljivijima nisu korelirale s mjerama imunog sustava. Ovi nalazi govore u prilog shvaćanju prema kojem se načini ovladavanja pojedine osobe odražavaju u njenim imunim svojstvima. Pretpostavljamo da bi ovladavanje izbjegavanjem moglo biti važna posrednička varijabla koja utječe na učinke stresa na imune značajke.

Ključne riječi: *Stres, psihološki; Vojno osoblje – psihologija; Poremećaji prilagodbe – dijagnostika; Obrambeni mehanizmi; Anksioznost – psihologija; Adaptacija, psihološka; Učenje izbjegavanja*