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# Czy zmienne psychologiczne mogą mieć związek z poziomem istotnych dla przebiegu ciąży parametrów immunologicznych?

# Can psychological variables be related to the level of the immunological parameters essential in the course of pregnancy?

**Streszczenie**

**Cel.** Prezentowane badanie stanowi próbę określenia związku pomiędzy ilością leukocytów we krwi obwodowej kobiet ciężarnych a następującymi zmiennymi psychologicznymi: poczuciem koherencji, lękiem jako stanem i cechą oraz stylami radzenia sobie ze stresem.

**Materiał i metoda.** Grupę badawczą stanowiło 64 kobiet w ciąży. Do określenia wybranych zmiennych psychologicznych użyto: Inwentarza Stanu i Cechy Lęku (STAI), Kwestionariusza Styli Radzenia Sobie Ze Stresem (CISS), Kwestionariusza Orientacji Życiowej (SOC-29). Morfologię krwi oznaczono stosując licznik hematologiczny.

**Wyniki.** Pogłębiona analiza sugeruje, iż między ilością leukocytów a unikającym stylem radzenia sobie ze stresem istnieje istotna relacja. Najrzadziej styl ten stosowany był przez kobiety w ciąży, które miały największą średnią liczbę leukocytów. Stwierdzono brak istotnej zależności między ilością leukocytów a poczuciem koherencji i lękiem.

**Słowa kluczowe:** leukocyty, lęk, poczucie koherencji, style radzenia sobie, ciąża, immunologia rozrodu.

**Abstract**

**Aim.** The presented investigation attempts to describe the relation between the number of leukocytes in the peripheral blood of pregnant women and the following psychological variables: the feeling of coherence, anxiety as a state and as a trait, and styles of coping with stress.

**Material and methods.** The study group consisted of 64 pregnant women. The following tests were used in describing the psychological variables: State-Trait Anxiety Inventory (STAI), Coping Inventory for Stressful Situations (CISS), Sense of Coherence Questionnaire (SOC-29). The hematological meter was used to describe the morphology of blood.

**Results.** A scrupulous analysis suggests the existence of significant correlation between the quantity of leukocytes and the avoiding style of coping with stress. This method was least often used by the women who had the smallest average number of leukocytes. No high correlation between the number of leukocytes and the sense of coherence and/or anxiety has been observed.

**Key words:** leukocytes, anxiety, feeling of coherence, styles of coping with stress, pregnancy, immunology of reproduction.

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## INTRODUCTION

Until the 1960s in the world of science there existed a belief in the absolute autonomy of the immune, hormonal and nervous systems [1]. With time, various scientific hypotheses and a constantly growing number of research reports have finally disproved this belief. There appeared scientific bases for the development of new disciplines, such as psycho-neuro-immunology or psychosomatic medicine. The discovery of biological dependencies between the aforementioned systems provided strong evidence to many scientists, which confirmed the need to change the paradigm and introduce the so-called bio-psychosocial model into the field of medicine; a model that equally highlights the importance of the influence of the human psyche and the environmental variables on an organism [2].

It could be said that the experiments carried out at the moment in various fields of science indirectly discover the dependencies between the human psyche and the body. Among others, there appeared ample research proving that the negative psychic state of pregnant women may result in health complications during pregnancy. They show that mothers who struggle with depression reveal a doubled risk of premature labour since a considerable level of adrenaline released in stress causes earlier contractions of the uterus. It appears that the excess of the stress hormones in an organism results in the shrinking of blood vessels. This, in turn, decreases the circulation of blood and restricts the supply of oxygen as well as the nutritional substances essential to the development of the fetus. The increased concentration of cortisol (hydrocortisone) in women blocks the secretion of progesterone, informally called the "pregnancy hormone." This causes the decrease in the concentration of the so-called PIBF (progesterone-induced blocking factor). It is responsible for the simulation of the production of antibodies, which prevent the mother's organism from rejecting the cells of her own child as foreign antigens [3-5].

## AIM

This work attempts to find an answer to the following research question: Is there a relation between the number of leukocytes in the peripheral blood and the experienced feeling of coherence, anxiety as a state and as a trait, and the styles of coping with stress in women between 21-40 years of age?

## MATERIAL AND METHODS

Research group: The research encompassed sixty-four women between 21 to 40 years of age. They have all been patients of the Department of Pathology of Pregnancy of the Clinical Hospital SPSK4 of the Medical University of Lublin. The women under health care regularly attended medical checkups. They were either in their third or fourth trimester of pregnancy.

Variables: The estimated parameter of the immune system – leukocytes (white blood cells) constitute one of the most important protective factors of the human organism. Making use of various mechanisms, those cells protect us from pathogens and foreign antigens, which could pose a threat to people's health and life. There exist a number of subpopulations among leukocytes, every one of which has specific protective functions. Neutrally staining granulocytes (neutrophil granulocytes), which may process phagocytosis and destroy microbes and antigens, constitute the largest group. Lymphocytes are the second largest group and may be further divided into i.e. auxiliary cells, cytotoxic cells, regulatory cells, etc. They are able to recognize and destroy antigens foreign to a particular organism. Macrophages play an important role as well; apart from being able to process phagocytosis, they may present appropriately transformed antigens to the T lymphocytes. The number of leukocytes which is made up of the above mentioned cells of the immune system is an important indicator of the functioning of the immune system as well as a sensitive exponent of various dangers our organism is exposed to. An increase in the number of white blood cells in the peripheral blood to more than 10000 / μl is related to the reaction of the immune system to the danger posed by such factors as i.e. contact with pathogen, presence of a large amount of cancerous cells and the reaction to intense stress [6]. The monitoring of the number of leukocytes circulating in the peripheral blood is essential for assessing the proper functioning of the organism also during pregnancy.

Style of coping is a permanent inclination of a given subject to a characteristic reaction when dealing with stress. This term describes stable and typical for a given individual inclinations, setting a definite direction and shape to the whole process of coping with stress [7]. Endler and Parker characterized three styles of coping: focused on the task (undertaking attempts in order to solve a difficult situation), focused on the emotions (inclination towards wishful thinking and daydreaming or fantasizing, centered on one's emotions) and focused on avoidance (refraining from thinking about, feeling or experiencing the stressful event).

The sense of coherence (SOC) is a quality with emotional-cognitive-motivational characteristics, which enables people to experience everyday realities as completely clear, meaningful and manageable. It describes "the global orientation of a man indicating the degree to which he possesses a dominant, permanent and yet dynamic sense of certainty that the stimuli coming from the internal and external environment are structured, predictable and explainable, that there are resources which allow one to meet the demands posed by those stimuli and that those demands are a challenge worth the effort and the commitment" [8]. The sense of coherence entails: comprehensibility (the ability to ascribe "order, structure, consistency and clarity" to the stimuli an individual responds to, which makes them cognitively clear and predictable), resourcefulness (self-confidence of an individual in that he possesses the necessary attributes or resources, which allow for and facilitate the successful coping with stressors in various circumstances), sensibleness (the belief in the importance

of one's existence, in the purposefulness of one's decisions, in opposing the hardships of everyday life as well as in the shaping of one's life). We may distinguish people with a low sense of coherence and those with a high sense of coherence, the latter possessing greater and more varied resistance recourses and the ability to "exploit" them skillfully and in accordance with the situational demands. As proved by research, a deeply developed SOC determines the successful approach towards stress and the possessed resistance resources. People with a strong SOC are more successful at dealing with hardships, are more likely to assess the stress-causing factors as not dangerous or not important. Moreover, they avoid situations that could endanger one's health [9].

The conducted experiment was based on the operationalization of the concept of anxiety by. Spielberg [10]. This author referred to the distinction between anxiety as a state and anxiety as a trait introduced by Catell and Scheier. Anxiety as a state is an emotional response characterized by subjective nonspecific feeling of tension and fear and the activation of the autonomous nervous system resulting from it. Its length varies and may change under the influence of risk factors. Anxiety as a trait is an individual permanent inclination to react with fright and to experience various situations as dangerous and detrimental – even though objectively the level of danger they might pose is quite insignificant. This is an acquired trait and is the result of the learning process.

The measurement of variables: one ml of blood was extracted from the ulnar vein into the vials with EDTA (Becton-Dickinson, USA), from patients in fasting state. The blood samples were stored at room temperature for no longer than three hours after they had been taken. The percentage and the smear of the white blood cells (leukocytes) were determined with the help of the hematological meter Coulter Counter (Beckman-Coulter, USA).

Due to the intended measurement of the parameters of the immune system only those who fulfilled the following criteria were included in the experiment: they have not suffered from any disorders of the immune system, they had not undergone any infectious diseases two weeks prior, had no history of alcohol abuse, did not smoke habitually, did not take any medications which would influence the activity of the immune system.

The following research tools were used to determine the estimated psychological variables: The CISS Questionnaire (Coping Inventory for Stressful Situations) of N. Lendler and J. Parker, consisting of forty-eight statements which constitute three subscales describing the three styles of coping with stress: the style focused on the task, on emotions and on avoidance; the State-Trait Anxiety Inventory (STAI) of C.D. Spielberg, J. Strelau, M. Tysarczyk, K. Wrześniewski describing the two sides of anxiety (as a state and as a trait) – built of two scales (20 statements each); the Questionnaire for Life Orientation (Sense of Coherence-29, SOC-29) by A. Antonovsky which enables the assessment of the global sense of coherence and its individual constituents, described by three scales: comprehensibility, resourcefulness, sensibleness; comprising 29 tests altogether. The research tools used apply to the fundamental principles of psychometrics and are recommended as accurate and reliable measurement methods.

The organization of research: The questionnaire data was accumulated at Department of Pathology of Pregnancy of the Clinical Hospital SPSK4 of the Medical University of Lublin. Only the women who expressed their voluntary wish to participate were included in the research. Each participant was instructed on the formal side of the project and assured of her complete anonymity despite the individual character of the researched information (the surveys were marked with a specific numeric code). The venous blood was extracted from patients. The samples taken from patients were stored in accordance with all medical standards. On the basis of the accumulated research material the important estimate parameters of the immune system have been marked. It is worth mentioning that filling in the questionnaires and the extraction of samples took place consecutively.

## RESULTS

In order to assess the dependencies between the styles of coping, the feeling of coherence, anxiety as a state and as a trait and the extracted immunological parameter the Pearson correlation factor has been defined. The researched patients were identified as people with a high or low number of leukocytes in the peripheral blood by the assignation of the mean on the raw results of an average number of the white blood cells. Then the comparison of the contrasts of means was used.

The analysis of the data proved lack of statistically significant differences between the average number of leukocytes within the norm and outside of it and the high, average or low escalation of the following psychological variables: the sense of coherence (SOC), anxiety as a state and as a trait (STAI) as well as the task-oriented and emotional styles of coping with stress (CISS) in the group of pregnant women ($F<1$).

**TABLE 1. The level of leucocytes and the escalation of the avoiding style of coping with stress (CISS, SSU) in pregnant women.**

| (I) SSU-ASSESSMENT | (J) SSU-ASSESSMENT | Average remainder (I-J) | Importance |
|---|---|---|---|
| Low | Average | 1.25163* | .044 |
| | High | 1.24723* | .045 |
| Average | Low | -1.25163* | .044 |
| | High | -.00440 | n.i. |

n.i.- not important

The research found no important relation between the number of white blood cells within the norm (and beyond it) and the avoiding style of coping. However, a deeper analysis based on the raw results proved the existence of important dependencies between the average number of white blood cells (within the norm) and the high, average and low intensification of the avoiding style of coping in the researched group (Table 1). This style was least often used by pregnant women who had the highest congestion of leukocytes in the peripheral blood ($F=1.883$; $p<0.05$).

## DISCUSSION

In this study several interesting dependencies between the parameters of the immune system (the number of leucocytes in the peripheral blood) and the chosen psychological variables in the researched group of pregnant women have been noted. Firstly, lack of the important differences between the number of leukocytes in the peripheral blood, within the norm and beyond it, and the sense of coherence (SOC), anxiety as a state and as a trait (STAI), and the task-oriented and emotional style of coping with stress (CISS) has been ascertained in the researched group. Women with a low and high intensification of the above-mentioned factors do not differ significantly when it comes to the average number of leukocytes. Such a result suggests the absence of correlation between the highlighted psychological variables and the number of white blood cells in the organism of a pregnant woman between 21 and 40 years of age. It still requires further confirmation through consecutive research with the use of the same factors.

A deeper analysis showed an important correlation between the number of leukocytes and the avoiding style of coping. The largest amount of white blood cells was noted in women who least often chose this style of coping with stress. This proves a certain analogy between the biological and psychological resistance mechanisms. On the physiological level the organism of pregnant women is prepared for a possible fight and protection of the system and the fetus against the pathogenic factors. This is further proved by the increased, yet still fitting within the physiological norms, number of leukocytes. When it comes to the psychological level, such pregnant women do not use any avoidance defensive strategies. They are ready to face stress-causing factors. The research with the use of the above-mentioned factors is worth continuing in order to finally establish the conclusions on this matter.

It must be noted that in this research very specific criteria have been used in choosing its participants, favorable to the scientific aims assumed by the researchers. This allowed excluding the fact that the number of leukocytes reached a particular level due to the uncontrolled disruptive factors such as: taking immune-stimulating or immunosuppressive drugs, the abuse of alcohol and habitual smoking, infectious diseases or ailments connected with the disorders of the immune system.

The obtained results were referred to the bibliography discussing the same issue. In the books of reference, there was no mention of the attempt to look for correlation between such factors as: the sense of anxiety or coherence versus the number of leukocytes. However, there existed investigations in which the relation between the styles of coping with stress and the parameter of the immune system estimated by us were discussed. Though there are not too many of those. No research was found in which the same variables in an identical, when it comes to the demographic characteristics, test (women, pregnancy) would be controlled. It should be stressed that despite substantial literature describing the influence of stress on the hormonal and immune system, there is a much smaller amount of research describing the relationship between the styles of coping with stress and the measures of immunology.

In one of these [11] the HIV sufferers have been examined. Also different criteria were used in order to eliminate the possible anticipated influence of the disruptive factors on the carried medical measurements. The participants were forbidden to consume any type of stimulants, exercise or take any medication one day prior to blood extraction. The researches aimed at checking the correlations between the life stressors and coping with the immune measures, such as: the relationship of the auxiliary T4 lymphocytes and the T8 suppressors, the amount of T4 cells, the cytotoxicity of the NK cells, and the general number of lymphocytes. The styles of coping were determined using the Million Behavioral Health Inventory (MBHI) and divided into active and passive. It revealed that i.e. the added number of lymphocytes and T4 cells was larger in people choosing the active styles of coping than in those with the passive styles. It should be mentioned that the presented research was only a preliminary pilot one, and the HIV infected group consisted only of 11 people, which is why the results should be approached warily.

Goodkin together with his co-workers (1992) continued this research as well as his study on the relation between the psychosocial factors and the immunological indicators in the HIV-1 infection. He examined a group of 62 sero-positive carriers of this virus with a battery of tests measuring life stressors, styles of coping as well as social support. The control of the variables connected with the lifestyle and the absorbed nutritional substances and stimulants was retained. It noted the positive correlation between coping and the functioning of the cytoxic NK cells. The persons choosing an active style of coping had a greater amount of NK in relation to those who gave vent to their emotions (venting emotions) [12].

Jamner, Schwartz and Leigh, in their work, looked for the confirmation of the so-called opioid peptide hypothesis of repression, which assumes that the repressive style of coping is related to the increase in the level of endogen peptide opioids in the brain. This may lead to the fall of the immune-competence of the immune system and hyperglycemia [13]. This theory is "supported" by many tests, which proved the role of the endorfinergic system in modulating the human mood and well-being. In the random test on 312 patients of the Yale Behavioral Medicine Clinic suffering from stress-related disorders, the researchers tried to find the correlation between coping and the parameters of the immune system. The styles of coping were described with the use of: The Marlowe-Crowne Social Desirability (MC) and the Taylor Manifest Anxiety (Bending Form; MAS) Scales. The carried research showed that the patients characterized by the repressive way of reacting to stress factors had a significantly decreased number of monocytes in comparison to the people characterized by lowered anxiety levels ("low-anxious patients") as well as a greater amount of eosinophils than the participants with high or low anxiety styles (high-and-low anxious). What is more, people characterized by a defensive high anxiety styles (defensive high-anxious) showed a smaller amount of

monocytes than those with the "high or low anxiety" [14]. Yet, according to some sources there is a high probability that the repressive patients used the antihistamine medicine, which significantly impedes the interpretation of this research [15].

One research [16] indicated the correlation of the styles of coping and the psychic strains with the subpopulation of T-lymphocytes and the concentration of interferon-γ and interleukin-4. The test consisted of 71 men between 18 to 60 years of age. The styles of coping were characterized using the answers given in the Stress Scale of the Japanese version of The Stress and Coping Inventory (SCI). It was observed that among men reporting a higher psychic strain the positive style of coping was correlated with the increase of IFN-γ and IFN-γ/IL-4. Whereas among men declaring lower psychic strain the positive style of coping was associated with the decrease in the number of CD8+ lymphocytes and a smaller congestion of IFN-γ and IL-4.

Other researchers [17] observed that the escape-avoidance style of coping is connected with the decrease in the percentage of T- and B-lymphocytes and CD4+ cells in the family members of the patients undergoing the bone marrow transplant surgery. It is worth mentioning that they have noted the important relation between anxiety as a trait and the number of T-lymphocytes and CD4+ cells [17]. However, the researched group consisted of only 24 people.

The psycho-neuro-immunological research carried out on people often makes use of the questionnaire methods. When examining the results of scientific research, one should not forget about the faults and limitations of such a methodological approach. In the aforementioned research, different tools have been used defining the styles of coping in various ways. This is why from the point of view of text analysis the experimental tests carried out on animals provide an interesting field in which the answers to similar issues are researched.

Koolhaas described a very interesting correlation between coping and resistance based on an animal model. He referred to the behavioral tests on certain vertebrates, which allow for the determining of two styles of coping as long-lasting, permanent and physical reactions of animals to the danger factors, repeated in various situations at different times. They bear great significance for the dynamic of the population and the adaptation of species to the surrounding environmental conditions. The aggressive animals are characterized by a style based on active protection and stressor manipulation whereas nonaggressive ones, when put in a stressful situation, react in a passive way choosing passive acceptance and submissive reactions [18]. As proved by the results of the research carried out in natural conditions there is correlation between the styles of coping and the neuroendocrine reaction to stress. The active style of coping is associated with a high sympathetic reactivity to stressors, while a more passive style connected with a higher reactivity to HPA. Meanwhile, the mediators of the immune system modulate this main route of the neuroendogenic reaction to stress [18]. The author quotes plenty of interesting experimental research on animals, in which important correlations between the styles of coping and resistance have been determined.

## CONCLUSION

Psychoimmunology constitutes a scientific discipline which shows that the experienced stress has an impact on the functioning of the immune system. The scientific research carried with the use of its methods proves that the psychological variables "have their own input" in the relation between stress and resistance. Among the factors suggested as those which may function as mediators in the changeability of the immune system in response to stressors are: personality, anxiety, the feeling of coherence, as well as the styles of coping with stress [19, 20].

The research presented above attempted to find the relation between the specific psychological variables and the parameters of the immune system. An important correlation has been established between the number of leukocytes in the examined women and the intensification of the avoiding style of coping. This style of coping was least often exercised by women who had the highest average number of leukocytes (yet still within the physiological norms). Moreover, lack of any relation between the number of leukocytes and the sense of coherence or anxiety as a state and a trait has been noted.

On the basis of the empirical experiments as well as the researched literature one must assume that the results of the research with reference to coping with stress as well as to the immunological parameters are promising, but require further analyses. Such exploration is worth continuing in order to determine more definite conclusions on this matter. Successive research in this area will allow for the affirmation of the importance of the discovered interrelations of the immune system – psychological factors, as well as evaluate whether therapeutic and behavioral interventions might influence the improvement of the immunological disturbances connected with psychological variables.

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