

*Original Contribution***TRAIT AND STATE ANXIETY AS FACTORS OF THRESHOLD AND TOLERANCE TO EXPERIMENTALLY INDUCED PAIN****B. Petrova, K. Mineva, M. Petkova, V. Nikolov, M. Minev, R. Strebkova**Department of Medical Psychology and Foreign Languages, Faculty of Medicine
Trakia University, Stara Zagora, Bulgaria**ABSTRACT**

Pain is an experience that has physical, psychological and social aspects. Sensitivity to pain is individual and depends on psychological factors. Studies have shown that anxiety is associated with the perception of experimentally induced pain. **PURPOSE:** The purpose of the present study is to examine the relationship between anxiety, threshold and tolerance to experimentally induced pain in healthy persons. **METHODS:** 35 healthy persons at the age from 19 to 39, 20 women and 15 men were examined. Methods: Spielberger's questionnaire, Cold pressor test, Visual Analog Scale for Pain, Descriptive statistics, Correlation analysis, Mann-Whitney's Test. **RESULTS:** Significant differences in tolerance to pain were identified depending on the levels of state anxiety ($U=12.5$, $P=0.037$). The state anxiety was greatly related to the intensity of the pain experienced. (Spearman $\rho=0.49$, $P=0.008$). Significant differences were not found in threshold, tolerance and intensity of pain depending on the levels of trait anxiety in the examined people. **CONCLUSIONS:** The increased levels of state anxiety in healthy persons exposed to experimentally induced pain suggest a weaker endurance to pain and perceiving it as stronger.

Keywords: cold pressor test, pain threshold, pain tolerance, state and trait anxiety

INTRODUCTION

Pain is associated with illness or physical trauma and is the most common symptom in patients seeking medical care. It is a cognitive-affective condition including "a sensory and emotional experience of discomfort" (1). The individual sensitivity to pain may vary among the examined persons. In patients having the same illness, the sense of pain covers the whole range starting from "no pain" to "the most terrible pain we can imagine". All this necessitates the study of various types of factors in order to identify the processes involved in the occurrence, the keeping and the reduction of the pain response. Understanding the causes of individual differences in sensitivity to pain can be crucial to its prevention and treatment and to be useful in the diagnostic process.

Anxiety is related to fears of impending harm and expectations of an indefinite or uncontrollable threat. It has cognitive, emotional and locomotor (including vegetative and physiological) components. Anxiety is associated with a state of tension and vegetative excitement (for example, increase of heart rate), an experience of uncertainty,

helplessness, readiness to respond to danger and tendency to avoidance behavior. (2). Spielberger, Krasner (1972) distinguished anxiety as a state and a trait. The state anxiety is the present level of anxiety of the individual characterized with physiological excitement and a feeling of tension. It is influenced by situational factors and varies in intensity and duration. The trait anxiety is an individual sustainable tendency to be restless or "a tendency to uneasiness". The trait anxiety is associated with the state anxiety and the attention paid to threatening stimuli. People with higher trait anxiety are inclined to perceive most of the situations as threatening and experience a stronger sudden anxiety than people with lower trait anxiety (3).

Studies with experimentally induced pain show that anxiety influences pain perception and an increased state anxiety are associated with higher intensity (4), lower threshold (5) and tolerance to pain (6). The pain threshold refers to the lowest intensity of the stimulus perceived as painful and the tolerance to pain – to the maximum intensity of the pain that a person can endure. The methods for experimentally induced pain in healthy people

propose a way to identify the effect of the anxiety on the pain perception which is difficult to be achieved with a clinical group.

PURPOSE OF THE STUDY

The purpose of the present study is to examine the relationship between anxiety, threshold and tolerance to experimentally induced pain in healthy people.

EXAMINED PERSONS

35 healthy persons at the age from 19 to 39, 20 women and 15 men, were examined. In the course of the study, we strictly observed the rules of the local ethical committee at Trakia University and the principles of the Declaration of Helsinki (1964). An informed consent was obtained from all participants before initiation of the experimental procedures. They were informed that they could discontinue the study whenever they wanted and without giving any reason for their decision. In the beginning of the study, the participants filled in an anonymous questionnaire with socio-demographic information as well as a physiological questionnaire and after that they underwent the cold pressor test. After making the cold pressor test, the examined people evaluated the severity of the pain experienced by means of VAS.

METHODS

1. Questionnaire of Spielberger, adapted for Bulgarian conditions for persons over 13 years of age (7). It consists of 40 statements in two subscales: *state anxiety* and *trait anxiety*. Each statement is evaluated by a 4-degree Likert-type scale.

2. Cold pressor test (CPT) is an experimental technique for inducing a painful experience. The examined people put their hand in a water container with floating ice cubes and communicate the parameters of their sensory experiences - the appearance of pain (pain threshold) and intolerable pain (tolerance) after that the study is ceased (8).

3. Visual Analog Scale for Pain (VAS Pain)

The VAS pain is a continuous scale comprised of a horizontal line, usually 10 centimeters in length. For pain intensity, the scale is most commonly anchored by "no pain" (score of 0) and "pain as bad as it could be" or "worst imaginable pain". The pain VAS is a single-item scale with individual scores in mm (9).

4. Statistical methods

Descriptive statistics, Correlation analysis, Mann-Whitney's Test. The data from the

empirical study were statistically processed with IBMSPSS Statistics, V.19.0.

RESULTS AND DISCUSSION

In the present study, it was found out there are statistically significant differences in the pain tolerance of the examined people depending on the level of their state anxiety (Mann-Whitney $U=12.5$, $P=0.037$) and a lack of differences in the pain threshold ($P>0.05$). The persons with lower state anxiety had higher tolerance to experimental pain compared to those with higher anxiety. Jones and Zachariae (23) in a study of 80 healthy students with a cold pressor test also found that the state anxiety influences considerably the tolerance to experimental pain. This effect of anxiety, however, was found in men only. Men with lower levels of anxiety had a considerably higher tolerance to pain compared to those with high level of anxiety as well as compared to women (10).

Based on the correlation analysis, the state anxiety was found to correlate moderately and positively with the severity of the pain as measured with VAS (Spearman $\rho=0.49$, $P=0.008$). In an experimental study of 32 healthy persons with electrical pain stimuli, Tang and Gibson (2005) confirmed the relationship between state anxiety and pain intensity but did not find such with the pain threshold (11). One possible explanation of this opposite result is in the use of consecutive electrical stimuli with increasing intensity which was reported to excite all afferent paths in an unnatural, synchronized way and could have changed the pain threshold (12). Bement and co-author (2010) also confirmed the relation of the state anxiety with the pain intensity but unlike our study they found a relation with the pain threshold. The authors examined 22 healthy students with experimentally induced mechanical pain as part of them (an experimental group) were exposed to additional stress influence (stress session) while the other part (a control group) did not have such influence (free session). The pain perception was measured before the beginning and at the end of the sessions. It was found out that during the initial exposure to experimental pain, the starting level of the state anxiety correlated positively with the intensity and negatively with the pain threshold in both groups (control and experimental ones). The individuals with higher levels of anxiety were more inclined to communicate stronger pain and had higher sensitivity to it compared to those with lower levels of anxiety. Anxiety correlated not only with the initial pain

threshold and intensity but also with changes occurring in them during repeated exposure to pain. As a consequence of the stress session with the experimental group, an increase in the anxiety levels was observed. The increased anxiety of the experimental group was significantly associated with a reduced pain threshold and an increased intensity of the reported pain compared to their initial levels (13). In conclusion, these studies showed that anxiety was a physiological factor related to increased pain sensitivity in otherwise healthy people and to their more negative emotional experiences during experimental procedures causing pain.

It has been also found that the anxiety has a negative impact on the pain perception and in clinical environment. Diagnostic and operative medical interventions increase the levels of state anxiety in patients (14). In turn, the increase anxiety in patients before an intervention relates positively to the strength of the reported pain and distress (15) and significantly predicts the reporting of more severe pain not only during the manipulation but also after it (16,17). These results show that controlling the anxiety state before manipulations, causing pain, could increase the patients' endurance to pain, to reduce the judgement of its severity and of the distress caused by them.

From the analysis made with the Mann-Whitney's test, statistically significant differences were not found in pain threshold and tolerance depending on trait anxiety as well as significant correlation between the evaluation of the experimental pain intensity and the trait anxiety ($p > 0.05$).

Literature provides convincing evidence that lower levels of anxiety in patients are associated with a judgement of lower pain severity, with decreased distress and with increased pain threshold (18) but the experimental studies of healthy people do not firmly confirm this effect. For example, similarly to our result, other studies of healthy people ascertain that trait anxiety is not related to pain threshold and tolerance to cold pressor pain (19, 20) as well as to pain from thermal stimuli (20). During a study of 32 healthy persons exposed experimentally to electrical pain stimuli, Tang and Gibson (2005) also did not find differences in the pain threshold depending on the anxiety but found a considerable impact of the anxiety on the pain intensity. The participants with higher trait anxiety reported more severe pain during the experiment (11). Contrary to these results,

James and Hardardottir (2002) found that the tolerance to cold pressor pain is higher for people with lower trait anxiety compared to those with higher trait anxiety. Furthermore, distraction from the pain during the experimental procedure increased the pain tolerance in people with lower anxiety but not in those with higher anxiety (21). The more expressed anxiety, in addition to reducing the endurance to pain, also increased the tendency of the examined people to direct their attention to possible negative effects of the pain after the study was ceased. Some studies highlight that anxiety is associated with pain perception in men but not in women. While studying 140 healthy persons with a cold pressor test, Jones and co-authors (2003) ascertained that people with higher levels of anxiety had considerably lower tolerance to pain and higher pain severity compared to those with lower levels of anxiety; however, these differences were found in men (22).

In our study, statistically significant differences by gender were not found in threshold and tolerance to experimental pain, even though there is evidence in the literature that women have lower threshold to cold pressor pain, thermal, electrical and mechanical pain (23) and lower tolerance to experimental pain (24) compared to men. Other studies, however, have ascertained that gender does not influence the perception of experimental pain but is a significant moderator on the effect of anxiety (10, 22) i.e. there are differences in the way anxiety impacts the perception of pain in men and women. Further studies are necessary to examine this relation, as well as, the psychosocial and psychological mechanisms that could explain these differences.

CONCLUSIONS

1. State anxiety in healthy people is related to intensity and tolerance to experimentally induced pain but not with pain threshold.
2. Increased levels of state anxiety suggest reduced endurance to pain and perceiving it as stronger.
3. Trait anxiety in healthy people does not have an impact on whether a particular sensation is perceived as a pain and on how long the pain could be endured.

ACKNOWLEDGMENT

This study was supported by Grant 8/2013 from the Medical Faculty, Trakia University, Stara Zagora, Bulgaria.

REFERENCES

1. Andersson, H., Ejlertsson, G., Leden, I. & Rosenber, C., Chronic pain in a

- geographically defined general population: studies of differences in age, gender, social class, and pain localization. *The Clinical Journal of Pain*, 9:174-182, 1993.
2. Spielberger, C., Anxiety. Current Trends in Theory and Research: vol 1. New York, NY, Academic Press, 1972.
 3. Spielberger, C., Krasner, S., The assessment of state and trait anxiety. In: Noyes RJr, Roth M, Burrows GD (eds), *Handbook of Anxiety, Classification, Etiological Factors and Associated Disturbances*. Elsevier, Amsterdam, The Netherlands,. pp 31-51, 1988.
 4. Jones, A., Spindler, H., Jorgensen, M., Zachariae, R., The effect of situation-evoked anxiety and gender on pain report using the cold pressor test. *Scand J Psychol*, 43:307-313, 2002.
 5. Michelotti, A., Farella, M., Tedesco, A., Cimino, R., Martina, R., Changes in pressure-pain thresholds of the jaw muscles during a natural stressful condition in a group of symptom-free subjects. *J Orofac Pain*, 14:279-285, 2000.
 6. Carter, L., McNeil, D., Vowles, K., Sorrell, J., Turk, C., Ries, B., Hopko, D., Effects of emotion on pain reports, tolerance and physiology. *Pain Res Manage*, 7:21-30, 2002
 7. Shtetinski, D., Paspalanov, I., Methods for work with the Bulgarian format of the anxiety evaluation questionnaire of Ch. Spielberger (STAI – form Y). Sofia: BAS – Institute of Psychology, 1989.
 8. Walsh, N. E, Schoenfeld, L., Ramamurthy, S., Hoffman, J., Normative model for cold pressor test, 68:6-11, 1989.
 9. Hawker, G. A, Mian, S., Kendzerska, T., French, M., Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP), 63:240-52, 2011.
 10. Jones, A., Zachariae, R., Investigation of the interactive effects of gender and psychological factors on pain response. *Br J Health Psychol*, 9: 405-18, 2004.
 11. Tang, J., Gibson, S., A Psychophysical Evaluation of the Relationship Between Trait Anxiety, Pain Perception, and Induced State Anxiety. *The Journal of Pain*, 6:612-619, 2005.
 12. Handwerker, H., Kobal, G., Psychophysiology of experimentally-induced pain *Physiol Rev*, 73:639-671, 1993
 13. Hoeger Bement, M., Weyer, A., Keller, M., Harkins, A., Hunter, S., Anxiety and stress can predict pain perception following a cognitive stress. *Physiology & Behavior*, 101: 87-92, 2010.
 14. Bolukbas, I., Erbil, N., Kahraman, A., Determination of the anxiety level of women who present for mammography. *Asian Pac J Cancer Prev*, 11:495-8, 2010.
 15. Baser, E., Togrul, C., Ozgu, E., Esercan, A., Caglar, M., Gungor, T., Effect of pre-procedural state-trait anxiety on pain perception and discomfort in women undergoing colposcopy for cervical cytological abnormalities. *Asian Pac J Cancer Prev*, 14:4053-6, 2013.
 16. Tokmak, A., Kokanali, M., Güzel, A., Taşdemir, Ü., Akselim, B., Yilmaz, N., The effect of preprocedure anxiety levels on postprocedure pain scores in women undergoing hysterosalpingography. *Journal of the Chinese Medical Association*, 78: 481–485, 2015.
 17. Kokanali, M., Cavkaytar, S., Guzel, A., Topçu, H., Eroğlu, E., Aksakal, O., Doğanay, M., Impact of preprocedural anxiety levels on pain perception in patients undergoing office hysteroscopy. *Journal of the Chinese Medical Association*, 77: 477-481, 2014.
 18. Adler, G., Gattaz, W., Pain perception threshold in major depression. *Biol Psychiatry*, 34:687-689, 1993.
 19. Sullivan, M., Thorn, B., Rodgers, W., Ward, L., Path model of psychological antecedents to pain experience: experimental and clinical findings. *Clin J Pain*, 20:164-73, 2004.
 20. Thibodeau, M., Welch, P., Katz, J., Asmundson, G., Pain-related anxiety influences pain perception differently in men and women: A quantitative sensory test across thermal pain modalities. *Pain*, 154: 419-426, 2003.
 21. James, J., Hardardottir, D., Influence of attention focus and trait anxiety on tolerance of acute pain. *British Journal of Health Psychology*, 7: 149–162, 2002.
 22. Jones, A., Zachariae, R., Arendt Nielsen, L., Dispositional anxiety and the experience of pain: gender-specific effects. *Eur J Pain*, 7:387-395, 2003.
 23. Bartley, E., Fillingim, R., Sex differences in pain: a brief review of clinical and experimental findings. *BJA: British Journal of Anaesthesia*, 111: 52–58, 2013.
 24. Greenspan, J., Craft, R., LeResche, L., et al, for the Consensus Working Groups of the Sex, Gender, and Pain SIG of the IASP. Studying sex and gender differences in pain and analgesia: A consensus report. *Pain*. 132:26–45, 2007.