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Gender Differences in Perception of Pain and Body Awareness in Athletes and Normally Active Subjects

Miroslava PETKOVA[1*], Valeri NIKOLOV[2]

Abstract

According to numbers of present studies pain perception is modifiable by physical activity. This result is important for establishing and using of non-invasive methods with few side effects for patients with chronic pain conditions. The PURPOSE of this study is to examine the gender differences in relationship between physical activity, body awareness and pain perception. METHODOLOGY: Psychological Questionnaires: Body Awareness Questionnaire that asks subjects to rate, on a 4 point scale, the degree to which they were currently experiencing symptoms of sympathetic arousal, State Trait Anger Scale, and State Trait Anxiety Scale. Objective methods (cold pressure test) are used only to determine the pain sensation and pain tolerance thresholds. The (VAS) represents pain as a continuum and is sensitive to change. OWN CONTRIBUTION AND RESULTS: The results of investigation support the idea of significant interaction between body awareness, perception of pain and physical activity. This relationship depends significantly on gender. The female non-athletes estimate the pain through VAS during cold pressor test as more intensive in comparison to female athletes and men from both groups. CONCLUSIONS: The complex, multi-element method for measuring pain used in this study is a useful model for studying effects of exercise on the perception of pain.

Keywords: *Gender, pain, body awareness, physical activity, anxiety.*

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1. Introduction

Perception of pain is related not just to the intensity of pain stimuli but also to psychological factors. There are a number of studies that prove the meaning of emotions and motivations to the onset and intensity of pain. For example, studies of animals show that fear lower the pain reactivity [20], [19]. That phenomenon also known as 'stress induced analgesia' is related to endorphin production [21]. Studies of the latter phenomenon conducted on humans though show ambiguous results where pain either increases or decreases. That poses the need for further studies of the factors and circumstances associated with pain.

There is significant amount of studies in the past decades that prove the correlation between fear and anxiety and pain perception including pain tolerance and threshold. At the same time, there has not been much effort to describe the concurrent and contributing factors. They could be personality traits that have a high correlation factor with anxiety as well as stable behavior models such as control over the personal excitement and focus. Those models often are well established in athletes during working out and/or racing.

The term body awareness can be described as focus on internal body sensations. This term is traditionally been used in studies of panic disorders. In this connection body awareness has been used as a marker for hypochondriasis, anxiety and somatization [7]. In addition there are studies which support the idea that females are more attentive to their bodies and that feelings accompanying this focus are more negative than are those among males [13].

2. Problem Statement

2.1. Anxiety

Anxiety causes hyperalgesia than analgesia [9]. Contemporary theories of pain based on studies conducted on animals stress the role of fear and anxiety.

The model Perception-Defense-Recovery supports the thesis that fear suppresses pain because any pain related behavior obstructs other defense mechanisms such as fight or flight. In 1994, Walters comes up with an adaptive model in which he studies the anxiety role [30]. That model says that when there is a high probability of being hurt, the state of fear suppresses pain and when the probability is low, that leads to hyperalgesia. Supporting that model there is a study showing that temperature pain reaction is inhibited in

rats when having exposed them to a shock while hyperalgesia is observed when exposing them to moderately intense shock [22].

According to a number of theories, factors of attributing and attention relate to the effect of fear and anxiety on pain [2], [3]. Those theories use terminology fear and anxiety interchangeably. According to the attribution theory, the pain reduction happens when anxiety is not related to a pain causing event and its intensity becomes higher when anxiety is related [1]. From that point of view one emotional state cannot lead to increase or reduction of pain. It is crucial whether the individual considered that related to pain or not.

According to the theories that accentuate attention [15], [16] moderate levels of fear/anxiety increase pain while high levels of fear/anxiety lessen the pain. According to the authors of those articles, average levels of anxiety increase the attention to obvious events such as pain and that is how increase its intensity. High levels of fear dominate pain and in this case, fear would lower the pain perception. In 1979, Wall suggests the role of arousal in relation to pain but does not say anything about attention [28]. It looks like being through a shock leads to an extreme state of fear which takes attention away from the cause and that leads to increase in pain sensitivity. And moderate levels of anxiety increase attention to environment stimuli and that reduces pain. It is also worth mentioning that the state of anxiety deviate attention from the onset of pain which can lead to its reduction. All those arguments pose the question for the influence between potency of emotion and arousal as factors that influence perception of pain. Probably those dimensions have contrary effect on pain where the negative ones are hyperanalgesive and the positive ones are analgesic. It is possible that they interact and thus lead to different result according to their consequences (for example, weak consequences lead to a different result while strong ones to analgesia) [28], [30]. It seems like there is a need for further research which would clarify as to how the emotional state alter the sensory and affect dimensions of pain [14].

2.2. Anger

The term anger is used to designate an emotion which varies in its intensity from annoyance to rage. The anger is characterized with a physiological excitement, a typical facial expression and an impulse to aggression. It is generally accepted as a transitional state occurring in response to an attitude or damage perceived to be unfair. The reactions of anger could be adaptive, especially when expressed in a constructive manner,

but the chronic ones are often non-adaptive because they result in interpersonal conflicts and chronic sympathetic excitement.

When exploring pain, various authors point out that it is related to the emotional states, including depression, anxiety, fear and anger. The studies in most cases have found out that the higher levels of negative emotions are connected with more intensive, severe and chronic pain [17]. The way to deal with anger is related to severe and chronic pain at the same time [6]. Recent studies suggest that the way to deal with the outwardly expressed anger may influence the sensation of severe pain and that effect could be strongly seen with provoked anger [6]. During the review of the bibliography, it turned out that the trend to deal with anger through direct verbal or physical expression (outwardly expressed anger trait) is related to increased sensitivity to severe and chronic pain [4].

2.3. Athletes

There are researches proving that competitive athletes have a higher pain tolerance. Nevertheless, most of them ignore the question whether the survey results of experiment induced pain mimic pain in real life. For example, it turns out that athletes tolerate dangerous toxic sensory stimuli but they can be ignored completely while competing. There is a need for a detailed clarification of terms threshold and tolerance of pain because the reduced awareness of pain could not be equated to its tolerance.

Possible reasons for high pain tolerance in athletes.

It is possible that the high pain tolerance reflects the high motor and muscle competency of athletes but also probably factors are experience and motivation not just physiology. Athletes often have significant experience with pain bouts during the workout process. It can be expected that this experience can lessen their fear of possible pain. Even more, they are pressured by their coaches and team mates to endure higher levels of pain and the result is that they see pain as an affirmation that the workout was enough. In this sense, it turns out that pain can be some way of satisfaction of the highly motivated athletes [25].

Changes in pain tolerance in athletes can occur as a result of systematic exposure to intense but limited pain [23]. Characteristics of such type of adaptation lead to conclude that there is an important neuron-hormonal mechanism such as the endogenous opiate system. Experiments with rats show that it can be a learned behavior and it could be a key to understanding the high tolerance for pain in systematically stressed athletes.

2.4. Body awareness

The notion one has, concerning their body condition, as well as their own exercise capacity. It is formed through the realization of the internal body perceptions and the different physical feelings (e.g. feeling of the heart's activity, limbs' posture, and some complex syndromes like pain, feeling of relaxation and physical signs of emotions). Body awareness is thought to be a product of dynamic processes constantly interacting with each other, connected with: a) afferent, efferent, forward and back-projecting neural activities, b) cognitive estimates and subconscious influences and c) the thoughts, beliefs, and experience of the subject in a social and cultural environment

The strong body awareness could be either adaptive, or maladaptive. Patients, suffering from chronic pain, post-traumatic stress or obesity are often subjected to body awareness improvement. For example, it has been found that focusing on the sensor components of the pain, rather than suppressing awareness and even distraction from the pain is more effective in treatment of patients suffering from chronic low-back pain [5]. Furthermore, diverting from the pain during pain increasing activities, could lead to its increase upon finishing.

Distinguishing different types of attention emphasizes on a key significance in the held tests: in spite of the fact that the pain has the function of diverting the attention (from an external focus to the pain areas) hyper-vigilance is related to pain increase and apparently has a negative influence over cognitive functioning [10]. In this connection the authors conclude that emotionally focused vigilance is maladaptive but the monitoring "of certain details of bodily sensations" is adaptive [7], [8].

3. Research Questions/Aims of the research

The purpose of this study is to examine the gender differences in relationship between physical activity, body awareness and pain perception in connection of anger and anxiety. We studied athletes and compared them to a control group of moderately active people so we can account for the correlation between fitness and ability to endure pain as part of the workout process as well as the ability to recognize and control one's own bodily functions which we expect to be more expressed in athletes

The second task of this study is to create test battery, that will be helpful to identify factors that might contribute to the individual's pain

experience - personality factors (anger, trait anxiety), cognitive factors – body awareness and behavioral factors (connected with physical activity).

On the other hand, above mentioned evidences allows us to conclude that the better understanding of the pain threshold and tolerance in athletes could be useful in creating working therapeutic models aimed at people in chronic pain. Pain cannot be eradicated in them but efforts could be aimed at increasing their threshold and tolerance. Obviously, one of the possible paths is to examine increasing the pain threshold in athletes by systematically exposing them to it.

4. Research Methods

4.1 Cold Pressor Test

The dominant hand was immersed up to the wrist in ice-chilled water (1.5 ± 0.5°C). The participants were instructed to hold their left hand in the ice water as long as possible. Each subject was instructed to say "painful" when the cold stimulus first became painful [29].

Pain threshold – The time (sec) until the participant first reported pain.

Pain tolerance - The time (sec) until the participant withdrew his/her hand from the water due to that pain became too intensive.

Systolic and diastolic blood pressure – measured on the arm before, during and after each intervention.

Heart rate was determined.

4.2 Body Awareness

Subjective ratings of physiological arousal were assessed by the Body Awareness Questionnaire that asks subjects to rate, on a 4 point scale, the degree to which they were currently experiencing symptoms of sympathetic arousal. Questionnaire for body awareness is meant to assess the sympathetic arousal [24]. Both groups of tested people filled up the questionnaire after doing the cold pressor test. The difference is that non-athletes were tested at the end of their school/work day whereas athletes – at the end of their school/work day but before the beginning of the training session.

4.3 VAS

The most commonly used scale is the descriptive Visual Analogue Scale (VAS). It is a numerical scale with the 10 cm line where the examined

person notes the current pain intensity. The ends of the line denote "no pain" and "maximum pain" characteristics.

4.4 State-Trait Anger Expression Inventory [26].

4.5 State-Trait Anxiety Expression Inventory [27].

In order to verify eligibility for participation, subjects completed the Medical History Questionnaire.

Study participants:

1. Athletes group: 130 volunteers – Athletes - students at the Trakia University and students in last grade of High school. All of them are active - entered in-to the card-index of basketball and volleyball teams. Age - 18 and 28 years. Male – 76, female - 54.

2. Non-athletes group: 130 volunteers – non-athletes students at the Trakia University and students in last grade of High school. Age - 18 and 28 years. Male – 68, female - 62.

In all the study, we strongly 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.

5. Findings

5.1. Blood Pressure and Heart Rate

The physiological data demonstrated significant effects for sex and athletic status in systolic and diastolic blood pressure. There was a main effect of sex in systolic blood pressure (F (1, 17)=7.44, p<.05) and an interaction between sex and athletic status (F (1, 16)=9.86, p<.05). Systolic blood pressured did not differ between male athletes (M=126.05, SD=3.78) and male non-athletes (M=132.34, SD=3.75) but a difference did exist between female athletes (M=129.94, SD=3.68) and non-athletes (M=114.22, SD=3.79). Female non-athletes had significantly lower systolic blood pressure than all other groups. An interaction for sex and athletic status was also observed in diastolic blood pressure (F (1, 17)=13.83, p<.05). Female non-athletes (M=69.09, SD=2.92) diastolic blood pressure was significantly lower than female athletes (M=85.62, SD=2.88).

A significant main effect of athletic status on heart rate (F (1, 15)=14.33, p<.05) indicated that non-athletes have a higher resting heart rate (M=79.22) than athletes (M=67.07)

5.2 Body Awareness

The following results indicate a higher tolerance to experimentally driven pain and, simultaneously, a higher body awareness rates amongst athletes, compared to non-athletes healthy subjects (Table 1.).

The results confirm the hypothesis that factors connected with the better cardio-vascular condition of the athletes, with the pain, perceived as an invariable part of the training process and in connection with their higher body awareness, altogether increase the resistance to pain and/or specifically change the perception towards it.

Table 1. Body awareness rates amongst athletes, compared to non-athlete healthy subjects

Group	M	SD	t	p
Athletes	27.25	0.67		
Non-athletes	24.80	0.78	3.16	<0.05

5.3. Control Pain Measurements

In experimentally induced pain studies, the majority of studies show that women are comparatively less tolerant and more sensitive to noxious stimulation than men [11], [12]. However, not all studies report this result.

The results of this study confirm:

Pain threshold - There aren't significant differences between male and female ($t=0.36$; $p<0.4$).

Pain tolerance – Male subjects presents higher pain tolerance than women ($t=2.90$; $p<0.05$). Female athletes presents higher pain tolerance than female non-athletes ($t=3.17$; $p<0.05$)

Pain intensity (VAS) - female athletes pain ratings ($M=68.8$, $SD=6.80$) were significantly lower than female non-athletes ($M=113.10$, $SD=7.26$) but male athletes ($M=89.48$, $SD=6.96$) did not differ from male non-athletes ($M=84.37$, $SD=7.44$)

5.4. Anxiety and Anger

Women shows higher levels of anxiety, which increase their sensibility and decrease especially their pain tolerance ($t=2.67$;$p<0.05$). There aren't any considerable differences in the results of the anger state and the anger trait by the gender. However, the anger behavior is shown more by

men rather than women and by women athletes rather than women – non athletes.

6. Discussions

This study was conducted in compliance with ethical standards, concerning the research on human subjects and the principles of the Declaration of Helsinki (1964). All participants have expressed their informed consent in participating in this research, and Trakia University Research Ethics Committee has approved the research methodology.

The present test repeats the sex effects in the systolic blood pressure, as established by other authors [18]. If we included the sports status, it turns out that female non-athletes have the lowest rates of systolic blood pressure, amongst the four groups. Athletes as a whole, have a lower heart rate as opposed to non-athletes. Such results were expected, owing to the fact that athletes are in a better cardio-vascular condition than non-athletes.

The Effects of Sex and Athletic Status.In the present test there is an analysis of the alteration of pain sensitivity and subjectively perceived physiological arousal depending on the sex and sport status of the participating subjects. The female non-athletes estimate the pain through VAS during cold pressor test as more intensive in comparison to female athletes and men from both groups. Based on this result, it can be made the assumption that the low estimates of pain intensity are connected with the practiced physical activity and better sports form amongst athletes.

Threshold scores for the athletes, and normally active subjects were not significantly different. In addition there were no significant differences between the threshold scores of men and women.

There aren't any considerable differences in the results of the anger state and the anger trait by the gender. However, the anger behavior is shown more by men rather than women and by women athletes rather than women – non athletes. The possible reason could be that the behavior may be influenced by social and cultural norms which are different for men and women in view of how and when to express their emotions. These data could be as a result of sex-role stereotypes since in our society men's bursts of anger are more easily accepted while for the women it is accepted to hold the anger in themselves. Men more often resort to direct verbal or physical expression of anger.

The higher tolerance to experimentally driven pain and, simultaneously, a higher body awareness rates amongst athletes, compared to non-athletes healthy subjects was found. In addition, in this study was

found that male subjects presents higher pain tolerance than women and that only in female group there is a difference between athletes and non-athletes in pain tolerance. On the other hand, there are a above mentioned studies which supports the idea that female are more attentive to their bodies and that feelings accompanying this focus are more negative than are those among males. In this connection we can make a suggestion for significance of athletic status as a compounding factor in relationship between pain tolerance and body awareness. When high body awareness meets high motor and muscle competency, and motivation more attentive to their bodies female subjects can improve their pain tolerance.

7. Conclusions

1. Male and female athletes are in better cardio-vascular condition than non-athletes.
2. Female subjects express high levels of anxiety than male subjects but female athletes shows higher pain tolerance than female-non-athletes.
3. Female non-athletes show lower pain tolerance than female athletes but there is a not difference in it between male athletes and non-athletes.
4. Further investigations needed to find reasons for the significant differences in pain tolerance between female athletes and non-athletes and for lack of such differences between male athletes and non-athletes.
5. The complex, multi-element method for measuring pain used in this study is a useful model for studying effects of exercise on the perception of pain.
6. All this evidence allows us to conclude that the better understanding of the pain threshold and tolerance in athletes could be useful in creating working therapeutic models aimed at people in chronic pain.

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