

“Effect of gender differences on pain parameters and galvanic skin resistance in response to acute cold pain.”

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Abstract:

Introduction: Pain is complex neuro-physiological and psychological process. Several animal studies have also shown an association between pain parameters, galvanic skin resistance and gender.

The present study was planned to study and compare pain threshold, pain tolerance and galvanic skin resistance in male and females.

Methods and Material: Our study was a cross sectional study with the sample size of 100 including 50 male and 50 female from first MBBS students. Acute cold pain was induced by cold pressor test. Pain threshold was measured as the time interval between exposure to painful stimulus and first reporting of pain sensation by the subject. Pain tolerance was measured as the time interval between exposure of painful stimulus and withdrawal of hand from water. Change in GSR was recorded by the instrument known as Psychogalvanoscope. Statistical analysis was done by using Paired ‘t’ test.

Results: Results showed that females have statistically significant lower pain threshold but significantly higher pain tolerance than males ($p < 0.05$). When we analysed GSR, we found statistically significant fall in GSR and the mean fall in GSR in females (628.5 ± 300.83) was higher than the mean fall in males (457.14 ± 194.99).

Conclusions: Our GSR findings point towards autonomic adjustments suggesting more of sympathetic over activity during cold induced acute pain. Also from our findings it appears that the sympathetic system is more dominant in females than males.

Key-words:

Gender difference, pain parameters, galvanic skin resistance, acute cold pain

Introduction: Different factors concerning with, in the patients variations regarding pain tolerance was a part of interest to the physicians. Majority of the routine chronic

pain conditions like migraine, backache etc. are more prevalent in females. Psychological stress associated with sympathetic dominance has been implicated in the process of developing of such conditions. The various studies in the past has shown conflicting interpretations and results.

The present study was planned to understand the relationship between gender differences in pain parameters which could probably shed some light on the mechanisms for variety of chronic pain.

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Methods and Material: Our study was a cross sectional study with the sample size of 100 including 50 male and 50 female first MBBS students. Students having symptoms of pain, ingestion of analgesics were excluded from study. Recording of parameters in female students were taken on 7th day of their menstrual cycle.

Acute cold pain was induced by cold pressor test. The subject was asked to immerse his hand in a beaker containing ice water of 4 degree Celsius. A thermometer was kept in the beaker to monitor the temperature continuously. At this point two stop watches were started. Subject was asked to inform when he started feeling the pain. When informed about the pain, the first stop watch was stopped. Then the subject was informed to remove his hand from the cold water when the pain became unbearable. At this point the second stop watch was stopped. Since Pain threshold is measured as the time interval between exposure to painful stimulus and first reporting of pain sensation by the subject, therefore the duration recorded by the first stop watch was considered as a pain threshold. And the pain tolerance is the time interval between exposure of painful stimulus and withdrawal of hand from water, therefore the time recorded by second stop watch was considered as pain tolerance.¹

Their difference gave the pain sensitivity.

Recording of GSR :

The subject was made to sit on a wooden chair and two plywood pieces were kept beneath his feet. The subject was asked to wash his hands with soap and water, then a little amount of cardijelly (BPL) was applied on the dorsal and volar surface of the last two phalanges of the middle finger. Electrodes of Psychogalvanoscope (Anand Agencies, Pune) were fixed by wrapping round the finger (Right hand) a piece of adhesive tape. Care was

taken that the electrodes do not touch each other. Placing the electrodes on the joint immobilized them and a firm contact was established. Volar electrodes being small made good contact with the skin surface and were convenient for recording of GSR (Galvanic Skin Response).⁽⁵⁵⁾

Statistical analysis: Statistical analysis was done by using paired t test.

Results:

Results showed that females have statistically significant lower pain threshold but significantly higher pain tolerance than males ($p < 0.05$). (table 1,2 and figure 1,2) When we calculated GSR, we found statistically significant fall in GSR and the mean fall in GSR in females (628.5 ± 300.83) was higher than the mean fall in males (457.14 ± 194.99). (table 3, figure 3)

Discussion:

Our results showed (table 1,2 and Figure 1,2) pain threshold is more in males but pain tolerance is more in females. Similar studies were conducted by various researcher and they found the similar results.²⁻⁷ but in contrary, some studies have also shown that both the pain threshold and pain tolerance is more in males as compared to that of females.⁸⁻¹³

Studies have shown that there is difference in imaging pattern of the brain in men and women in the spatial pattern and intensity of response to acute pain.^[2] Some studies have also shown that the μ receptors in healthy brain are activated differently in response to pain in both males and females.^[3]

It has also been proved that testosterone has a masking effect on the perception of pain.^[4] It has also been shown that males release more endorphin than females. Endorphins are the endogenous analgesic substances which causes activation of analgesic system of body. Thus increase quantity of endorphin in the males greatly increases their

pain threshold.^[5]

Study by Hashmi et al has shown that females reported more pain than males at the outset of the first exposure to pain, but then experienced less pain and annoyance than males as a painful stimulus was sustained and with repeated stimulation.^[6] Progesterone increases excitability of spinal neurons by altering the permeability of ion channels. Thus it decreases pain threshold in the females. It has also been shown that LH surge which occurs 2 days prior to ovulation in females decreases analgesic response in females by desensitizing brain opiate receptors.^[7]

Some of the studies have shown that these gender differences were explained, to some extent but not completely. This shows that physiologic mechanisms, including baroreceptor activation and opioid activity, may underlie sex differences in pain perception^[14]. Thus we can say that males have higher pain threshold and lower pain tolerance than females.

Galvanic Skin Resistance (GSR) is one of the several electro dermal responses (EDRS). EDRS are changes in the electrical properties of a person's skin caused by an interaction between environmental events and the individual's psychological state. The Phasic changes are often known as GSRs. Phasic conductance is type that change when events take place. Discrete environmental stimuli will evoke time related changes in the skin conductance.

The most widely accepted model of skin conductance is the sweat circuit model proposed by **Edelberg (1972)**. According to this model, the phasic changes in the skin conductance occur when the sweat ducts in the epidermis fill and skin conductance recovers to tonic levels when the moisture is deposited on the skin or reabsorbed by the

sweat glands.

The sweat ducts act as variable resistors, their resistance lowers (conductance increases) as they fill with sweat. The amplitude of the change in conductance depends on the amount of sweat delivered to the ducts and on the number of sweat glands which are activated. This activation is controlled by the brain via the sympathetic division of the autonomic nervous system. Human sweat glands receive primarily signals from sympathetic cholinergic fibers that use the neurotransmitter, acetylcholine .

Pain and stress are known to influence sweat production which can be monitored by measuring the psycho galvanic response of the skin.

Conclusions & Summary:

From our present study, we may conclude that pain parameters are influenced^[14] by gender. We may also like to say that continued research at the genetic and receptor level may suggest the need for developing gender specific drug therapies specially analgesics. It should also be taken into consideration while doing any research on pain parameters.

Our GSR findings pointed towards autonomic adjustments suggesting more of sympathetic over activity during cold induced acute pain. Also from our findings it appears that the sympathetic system is more dominant in females than males.

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Figure 1 : Comparison of pain threshold(seconds) in male and female subjects

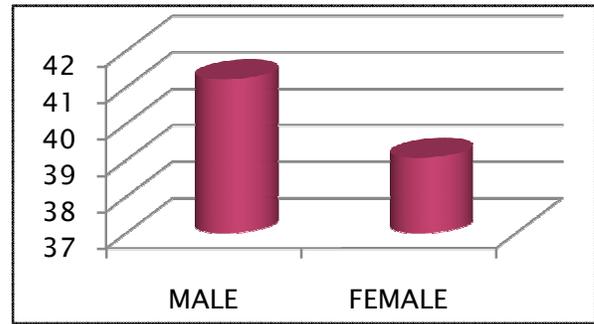


Figure 2 : Comparison of pain tolerance(seconds) in male and female subjects

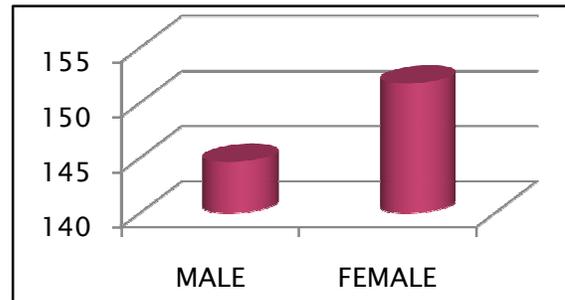


Figure 3: Comparison of fall in galvanic skin resistance (Ohms) in male and female subjects

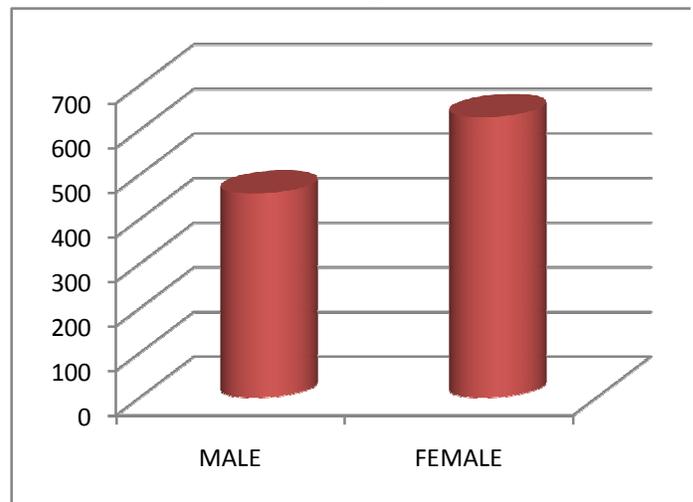


Table 1 : Comparison of physical characteristics of male and female subjects

	MALES N = 50 Mean ± SD	FEMALES N = 50 Mean ± SD	p value
AGE in years	18.14 ± 0.77	18 ± 0.96	> 0.05
Height in cm	169.43 ± 7.19	160.03 ± 4.15	> 0.05
Weight in Kg	62.93 ± 7.53	57.07 ± 11.62	> 0.05

Table 2 : Comparison of pain parameters of male and female subjects

	MALES N = 50 Mean ± SD	FEMALES N = 50 Mean ± SD	p value
Pain threshold in Sec	41.21 ± 17.16	34.06 ± 18.79	< 0.05
Pain tolerance in sec	144.64 ± 47.66	151.75 ± 59.63	< 0.05
Pain sensitivity in Sec	103.43 ± 37.62	112.69 ± 56.38	< 0.05

Table 3: Comparison of galvanic skin resistance response in male and female subjects

	Fall in GSR during acute cold pain (Ω)
Male n = 50	457.14 ± 194.99
Female n = 50	628.5 ± 300.83

The mean fall in GSR in females (628.5 ± 300.83) was higher than the mean fall in males (457.14 ± 194.99).

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