

# PAIN THRESHOLD IN RELATION TO SEX HORMONES

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**Summary :** Pain threshold to mechanical stimulus was determined in 140 subjects comprising of healthy volunteers of both sexes and of different ages, females taking oral contraceptives and bilaterally oophorectomised females. Pain threshold was observed to be low in oophorectomised females, boys and girls and intermediate in healthy males. It was high in menstruating females aged 18-21 years.

There was a marked fluctuation in pain threshold in menstruating females. It was low at menstrual phase. In females taking oral contraceptives it was high at pre and midmenstrual phases. In females not taking oral contraceptives it was low at pre-menstrual and high as mid-menstrual phases.

**Key words :** pain threshold                      mechanical stimulus                      oophorectomised  
healthy females                      children                      male                      oral contraceptives

## INTRODUCTION

Hormonal and metabolic changes are known to follow castration (3). Removal of testis has been reported to increase pain threshold and testosterone treatment to restore it to its previous level in castrated male rats (4). Testosterone administration to albino rats of either sex decreased morphine, paracetamol and indomethacin induced analgesia. Gonadectomised animals showed the same response but to a lesser degree. In gonadectomised rats naloxone increased pain threshold, enhanced morphine induced analgesia but had no effect on morphine analgesia in testosterone treated control rats (5,6).

In view of these observations it was felt proper to investigate the influence of sex hormones on pain threshold in human volunteers.

## MATERIAL AND METHOD

Pain threshold to the mechanical stimulus was determined by using a metallic aerated water bottle cap and a sphygmomanometer. The cuff was tied over the cap placed with

serrated edge on the flexor surface of the forearm, midway between the wrist and the elbow. The sphygmomanometer was kept in such a way that the subjects were unable to see the mercury column. The pressure was increased in a step wise manner, each time by 4 mm of Hg, leaving it at each level for 5 sec till the subject experienced pricking pain.

The onset of pricking pain was determined 3 times at an interval of 10 min and the average 9 such readings was taken as a measure of pain threshold and expressed as mm of Hg. (7).

The subjects chosen for the study were physically and mentally healthy. Their consent was obtained informing them of the procedure of the experiment, the type of pain they would feel and to signal the onset of pain. Following groups were used; (a) 25 females of the age group 18-21 years, studying medical laboratory technology course; (b) 20 females (30-40 years), housewives and working women; (c) 25 females (25-41 years), attending family planning centre and taking oral contraceptive pills (Norethisterone acetate 1 mg + Ethinylestradiol 30  $\mu$ g); (d) 20 females (30-40 years), who had undergone bilateral oophorectomy atleast one month earlier and who were not taking any hormonal replacement and were mentally healthy; (e) 25 males (20-22 years) medical students; (f) 13 boys of 8-13 years; (g) 12 girls of 8-13 years.

The pain threshold was determined in all menstruating females at three phases of the menstrual cycle as under 0-5 days, phase I; 15-18 days, Phase II and 25-30 days, Phase III.

In all other subjects the pain threshold was determined at 10 days interval for three successive months. The mean of 9 readings was taken into consideration. Care was taken to ensure that no subject consumed an analgesic, an antidepressant, anxiolytic drug or any hormone during the period of study. The observations were statistically analysed using Student's 'T' test.

## RESULTS

The results are shown in Table I and II. Pain threshold was observed varying from one individual to another. Considering the value of pain threshold when recorded 3 times during a month at 10 days interval it remained constant for certain groups while in others it showed variation related to age and menstrual cycle. In males and non-menstruating females, it did not show changes. It was found to vary in females at different ages and phases of menstrual cycle. It was high at pre and mid menstrual phase in females taking oral contraceptives while high only at midmenstrual phase in females not taking oral contraceptives.

TABLE I : Mean pain threshold in mms of Hg±SE in females and males (In females pain threshold in menstrual (I), mid-menstrual (II) and premenstrual (III) phases. In males, boys and girls figures refer to pain threshold at 10 days interval in a month for 3 months).

Subject	Age	Pain		
		I	II	III
1. Girls n-12	8-13	73.35±2.2	75.85±2.3	74.32±1.8
2. Females n-25	18-21	107±0.23	124±0.14**	109±0.17
3. Females n-20	30-40	75.12±0.48	85±0.33**	73±0.40
4. Boys n-13	8-13	80.19±2.2	81.28±1.9	79±1.2
5. Males n-25	20-22	92.4±0.92	94±0.14	95.2±1.13

P\* < 0.01, \*\* < 0.001

Groups compared : 1 and 2, 3, 4; 4 and 5; 2 and 5; 1 and 4

I, II, III in 1 to 5

TABLE II : Mean pain threshold in mms of Hg±SE (In females in menstrual (I) midmenstrual (II) and premenstrual (III) phases. In oophorectomised at 10 days interval in month for 3 months).

Subjects	Age in yrs	Pain		
		I	II	III
1. Control n-20	30-40	75.12±0.48	85±0.33**	73±0.4
2. After bilateral Oophorectomy n-20	30-40	71.0±0.3	74±1.43	68±0.89
3. Control n-20	25-40	88.56±1.88	104.5±2.36**	90.5±2.6
4. On oral contraceptives n-25	25-41	76.0±1.2*	88±0.98	89.18±0

P\* < 0.01, \*\* < 0.001

Groups compared : 1 and 2; 3 and 4; I, II and III of 1, 2, 3, 4.

## DISCUSSION

Pain threshold was observed to be low in boys and girls of age 8-13 and oophorectomised females when compared to males of 20-22 years and females of 18-21 years. It was found to be intermediate in males of 20-22 years and high in females of 18-21 years. Amongst the females studied pain threshold was observed to be the lowest in those who had undergone bilateral oophorectomy. Apparently this may be due to absence of hormones from the ovaries but castrated male rats showed increased pain threshold and administration of testosterone in normal rats decreased pain threshold (4). It may therefore be postulated that the lower pain threshold in oophorectomised females may be due to lack of mutual antagonism. Higher levels of oestrogen and progesterone in early puberty (18-21 years) associated with the process of maturation and development (2) could be considered to partly contribute to the elevation of pain threshold in these women. Females of age group 30-40 years who are known to have relatively lesser sex hormonal levels (2) have shown lower pain threshold.

If pain threshold is considered in healthy females of 18-21 and 30-40 years, it is higher at the midmenstrual period but lower during menstrual and premenstrual phases. If this is considered with respect to levels of oestrogen at the midmenstrual phase, it coincides with the higher pain threshold while low hormonal levels at pre and during menstruation correspond to lower pain threshold (9).

In females taking oral contraceptives the pain threshold was higher at pre and midmenstrual phases when plasma oestrogen and progesterone levels are elevated and lower at menstrual phase when they are not medicated with oestrogen and progesterone.

A conspicuous absence of fluctuations in the pain threshold determined at three intervals was observed in oophorectomised females, children and males. In all these the sex hormonal levels are steady and the association may partly be related.

There was no difference in pain threshold between boys and girls. Lower pain threshold in children may be due to increased sensitivity to pain a developing apparatus concerned with pain perception and relatively lower concentration of the sex hormones besides other factors (8).

Pain threshold in females of 18-21 years was higher as compared to males of 20-22 years. It is for consideration if the high pain threshold in females is related to circulating oestrogen and progesterone and lower pain threshold in males to testosterone besides other factors.

Sex hormones appear to play some role in sensitising the pain perceiving apparatus in brain. Oestrogen and progesterone may be desensitizing the pain apparatus, lack of these or relative lowering of these hormones, therefore, decreases the pain threshold and vice versa. Thus, the females in the same age range appeared to tolerate pain better than males. Testosterone seems to have an opposite action, it sensitises the apparatus and presence of it decreases pain threshold and lack of it increases pain threshold. The pain threshold in children is less as compared to males and females of 20-22 years. One wonders if this is related to sensitivity of negative feed back system before and after puberty. The negative feed back of gonadotrophin secretions present before puberty is not only operative but highly sensitive. A change in sensitivity occurs during sexual maturation; levels of gonadotrophins and gonadal steroids progressively increase (8).

The present study, though a limited one, suggests a relationship between the pain threshold and sex hormonal levels. This inference is in accordance with the concept of steroidal hormones as one of the neuromodulator in central nervous system (1). This is not to say that other factors do not operate in determining threshold to pain.

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