Gender specific difference of belonephobia and pain associated with fingerpricking in haematology laboratory: An overlooked diagnosis

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Received: 5th December, 2018 **Accepted:** 5th March, 2019

Abstract

Introduction: Needle phobia, clinically termed as belonephobia is a sub-type of blood-injury-injection phobia (BII phobia). Heightened sensitivity to experimentally induced pain, clinical pain and pain-related distress is greater in women compared with men. In reproductive age women gonadal hormone levels also have a substantial impact on pain perception and analgesic response. So, this study was conducted with the objective to compare any difference in pain and symptoms felt by males and females after pricking with hypodermic needles.

Materials and Methods: This longitudinal study was conducted in hematology laboratory of physiology department. A total of 216 subjects (120 females and 96 males) in the age group of 18 to 23 years were selected. The participants were asked to fill up the questionnaire based on pain and phobia associated with fingerpricking on first and tenth exposure with hypodermic needle. Assessment of pain was done by rating on numerical pain rating scale (NPRS).

Results: Females reported more fear of pain due to fingerprick compared to males (68.3% vs 49%, P<0.05). On first exposure with needle, females reported symptoms of sweaty, palpitations and dizziness significantly more than males (P<0.05). On tenth exposure, shortness of breath was more in males than females (5.2% vs 0.8%) but, there was no significant association in any other symptom between males and females. On tenth exposure, there was increase in mild grade of pain score and reduction in moderate and severe grade on NPRS (P<0.001) in both groups and significant reduction was more in females than males (P=0.01).

Conclusion: It was concluded that females were more needle phobics than males and with subsequent exposures, i.e., on 10th exposure with hypodermic needle there was reduction in pain and symptoms after finger-prick in both groups. Also, female students need more assistance during pricking.

Keywords: Needle phobia, Medical students, Gender, Fingerpricking pain, Haematology laboratory.

Introduction

Phobia is persistent fear of an object or situation. It is a type of anxiety disorder. Needle Phobia is characterized by feelings of irrational and excessive fear of needles and other sharp objects, such as pins, knives and razors. It is clinically known as Belonephobia and in general population approximately 10% of individuals are affected.[1] It has recently been included in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) within the diagnostic category of Blood-Injection-Injury Phobia.[2]

Common among belonephobics are wide range of physiological reactions like palpitations, shortness of breath, dizziness, nervousness, irritability, insomnia, loss of appetite, muscle tension, generalised sweating and fainting.[3,4]

Heightened sensitivity to experimentally induced pain, clinical pain and pain-related distress is greater in women compared with men. In reproductive age women gonadal hormone levels also have a substantial impact on pain perception and analgesic response.[5,6]

Haematology laboratory is a necessary part of Physiology subject in first year undergraduate medical students. For most haematological examinations done routinely in clinical settings two types of blood samples are commonly used -capillary (peripheral) blood and venous blood. Capillary blood is obtained commonly by pricking the finger either with hypodermic needle or lancet.

Finger pricking is a mechanical pain stimuli that elicits fast pain carried by A δ fibres which occurs in about 0.1 seconds after the stimulus is applied. This sudden painful stimulus often gives a double pain sensation as transmission of pain occurs through two routes – fast and slow pain fibers. The degree to which a person reacts to pain varies tremendously. This results partially from the capability of the brain itself to suppress input of pain signals to the nervous system by activating pain control system called an analgesia system.[7]

To the best of my knowledge, there are relatively less scientific reports available for finger pricking pain. Only two studies have been done regarding the assessment of pain allied with finger pricking and its determinants among medical students.[8,9]

Researchers working for lancing devices manufacturing companies have done majority of researches related to needle phobia. So academic research aspect which is most important is always overlooked.[10,11]

So, this study was conducted with the aim to assess pain and symptoms felt by students due to fingerprick during Physiology practical and to assess the gender difference in pain and symptoms.

Materials and Methods

The study was conducted in the Haematology laboratory during the laboratory hours in Physiology department at Subharti Medical College Meerut. It was a longitudinal study conducted from October 2016 to October2017. A total of 216 newly admitted first year under graduate medical students were taken. Sample was selected by purposive sampling technique.

Inclusion Criteria

Both Males and females (irrespective of their menstrual cycle phase) in the age group of 18-23 years, with normal BMI (18.5-22.5 Kg/m^2) and who were apparently healthy were included.

Exclusion Criteria

Those who received injections frequently, did regular blood testing, were hyper sensitive to needle prick, had scar or callus or burn injury on the ring finger, were recreational drug users, had disease (like, skin disease, liver disease, generalized anxiety disorder, depression and any other psychiatric disorder, autonomic neuropathy, bleeding disorders, diabetes, sickle cell anaemia and thalassemia.) or were not vaccinated for hepatitis B were excluded.

Methodology

Questionnaires: Printed copies of questionnaires, based on phobias and pain associated with finger pricking were distributed to the participants. Each subject was asked to fill out a semi- structured questionnaire regarding fear of injections after the experiment. The purpose of the study was explained to the subject. Hearing the explanation and agreeing to fill out the questionnaire constituted informed consent. Demographic characteristics were inquired and each study subject was asked in native language a combination of 18 close-ended type questions, regarding their fear of needles, by single volunteer. Questionnaire was adapted from a study[8] and few questions were added, that explored study subject's behavior towards needles.

Assessment of pain was done by numerical pain rating scale.[12] Students had to indicate the intensity of pain level on a scale of 0 (no pain) to 10 (worst pain imaginable).

A demonstration was done for the entire procedure using sterilized disposable needle (24 gauge). Standard pricking method was followed. Distal digit of ring finger of non-dominant hand on its palmar surface, about 3 to 5 mm lateral to nail bed was used for pricking purpose. After cleaning the finger with sprit swab, and letting it dry, the participants were instructed to prick their own finger by a single stabbing action just deep enough (about 2-3 mm) to give free flowing blood. They wiped away the first drop and collected the sample when blood was flowing spontaneously.[13]

After about 10 labs conducted weekly involving finger pricking experiment they were asked to complete the questionnaire again.

Counselling of Students

In small groups of 5 to 10 students, again the method was explained and it was tried to reduce their phobia and encouraged them to prick their finger themselves for the experiment.

Statistical Analyses

Analysis was done using statistical package for the social sciences (SPSS) windows version 19 and Microsoft excel. x^2 test was applied. Frequency tables and graphs were made. Values were considered significant for a $P< 0.05$ with a confidence interval of 95%.

Ethics

Ethical approval was obtained from the Ethics committee of the institution. Informed written consent was taken from the participants prior to the administration of questionnaire after explaining them about the purpose of the study.

Results

Out of total 225 subjects, 216 participated giving a response rate of 96%. From these 216 subjects, 120 (55%) were females and 96 (45%) were males. Mean age of students was 19.06±0.99 years. The questionnaire response revealed that female students had more fear of injections, (47.5%vs 37.3%, P<0.05). An important gender effect was seen with history of fainting following injection significantly more in females as compared to males (8.3% vs 1.0%, P<0.05). History of hospitalization was more in males compared to females (32.3% vs 17.5%, P<0.05). Females were more scared of seeing nurse prepare injection, see other people receive injection and scared of injection due to pain (P<0.05). On first exposure with needle, factors linked with needle phobia show that out of 216, smell in the haematology room was a fear factor for fewer students (5.09%) and we observed it more in females (5.8%), compared to males (3.2%). Following factors were more in females compared to males- hearing the teacher or lab assistant discussing with students about finger pricking causes fear (37.5% vs 25%, P<0.05), fear among students while watching other students during pricking procedure (29.2% vs 15.6%, P<0.05), panic when blood oozes out from finger tips (18.3% vs 6.3%, P<0.05) and fear of pain due to finger prick (68.3% vs 49%, P<0.05) On tenth exposure, less number of students now panicked after watching other students pricking (23.1% on N-1 vs 12.03% on N-10) or after seeing blood oozing from fingertips (12.9% on N-1 vs 6.9% on N-10). But still there was more panic by these factors in females than males (P=0.001). On first exposure with needle, females reported symptoms of sweaty, palpitations and dizziness significantly more than males (P<0.05). However, males reported significantly more symptom of dry mouth than females (P<0.05). On tenth exposure, shortness of breath was more in males than females (5.2% vs 0.8%) but, there was no significant association in any other symptom between males and females on tenth exposure. Total number of symptoms were significantly reduced in females (37.5% on N-1 vs 18% on N-10, P<0.001). In males also, there was a slight reduction from 31% to 21%. On tenth exposure, there was increase in mild grade of pain score and reduction in moderate and severe grade on NPRS (P<0.001) and significant reduction was more in females than males (P=0.01).

Discussion

Blood-injury and injection phobia (BII) involves a diphasic autonomic nervous system response which makes it different from other specific phobias.[14] While similarity is that fear involves activation of the sympathetic nervous system (SNS) which is associated with the fight or fight response,[15] and response of the body to stresses is co-oridnated.[16] In BII phobia there is activation of parasympathetic nervous system also,[17] which causes sudden and severe fall in blood pressure and heart rate, increase in blood glucose, cortisol, and human growth hormone and decrease in noradrenaline.[18] Due to fall in blood pressure, a fainting episode (or vasovagal syncope may occur).[19]

Socio-demographic Influences and Early Experiences Allied with Needle Phobia

Age for start of blood phobia was 21.1 years in the Starceivic and Bogojevic[20] study while Ost found a much earlier age of onset 8.8.[21] In our study an important gender effect was seen with history of fainting following injection and fear of injections significantly more in females as compared to males which agrees with some other studies showing female predominance of fear responses and anxiety especially in younger age.[4,22] A study reported needle phobics were more likely to be women (68.1% vs 48.9% $P<0.001$).[22] More assistance is needed by female students in this context and they might develop an aversion towards surgery in future. Similar findings were reported by Roy et al. where female students preferred medicine more than surgical specialties.[23]

In our study history of hospitalization was more in males compared to females (32.3% vs 17.5%, $P<0.05$). History of early hospitalization may reduce needle phobia. Research work by Andrews GJ explained how hospitalization causes fear responses to clinical procedures with needles and their insertion by healthcare professionals.[24] But hospitalization can also improve their own professional development.[25]

Factors Linked with Needle Phobia in Haematology Laboratory

Previous Study demonstrated that certain room smell was a determinant factor for injection phobia ($P<0.0001$).[4] Our students were less sensitive to smell which may be due to repeated exposure. In our study we found students to be fearful of discussion with teachers about fingerpricking. Milovanic et al, also reported voice of nurse while preparing injection in the vaccination room was a significant factor of fear among patients.[9]

A significant association was found between fear factor and watching other people receive their vaccines by earlier researchers.[4] 47% of the respondents reported that the sight of the injection needle created a panic for them in a dental clinic research work.[26] Our present study also supports this.

Some researchers suggest that the fainting reaction observed in BII phobia occurs only in response to disgust.[27] We found few students to panic when blood oozes out from finger tips, females panicked more than males. There are no studies however whether the strength of disgust from one's own blood is similar to the sight of other fellow's blood.

Males pricked more deeply than females on first exposure. In a study it was reported that depth of penetration is directly related to pain.[28]

Symptoms showed after Exposure to Hypodermic Needle

The main symptoms of needle phobia are those of anxiety.[29] The sufferer experiences elevated sensations of anxiety whenever they come into contact with the feared object. These symptoms can be divided into three groups: physical, cognitive, and behavioural symptoms.

A series of irrational and incoherent thoughts like, danger or threat from certain objects are the cognitive symptoms of a phobia. People with needle phobia have negative and anxious thoughts about needles and other pointed instruments, which causes a state of persistent alertness. Fear is reinforced by anxious thoughts about objects which leads to appearance of phobia, further strengthening the physical response and increasing anxiety.

Sufferer's behavior also changes. So, a belonephobic always avoids using sharp objects and can go to the extent to even avoid being near them.

Gender Differences in Pain Perception

Pain response has been associated with gender roles, with increased tolerance of pain among masculine gender, whereas pain is a normal part of life in feminine gender and they are more permissive of pain expression.[30]

Differences in the distribution, expression or sensitivity of μ- opioid receptors in regions of the central nervous system involved in nociceptive processing can result in sex differences. During rest, μ- opioid receptor binding in various cortical and subcortical brain regions is higher in women. Whereas in men, this binding is more in response to experimentally induced muscle pain compared to women.[31] These sex differences contribute to difference in basal pain perception and in different sensitivity to μ– opioid medications.

Also, some data indicate sex differences in dopamine active transporter (DAT, SLC6A3) function. This transporter plays a critical role in regulating dopaminergic function. There is a central role for dopaminergic neurotransmission in modulating pain perception and natural analgesia within supraspinal regions, including the basal ganglia, insula, anterior cingulate cortex, thalamus and periaqueductal gray area. DAT is a membrane-spanning protein that pumps the neurotransmitter dopamine out of the synaptic cleft back into cytosol. In the cytosol, other transporters sequester the dopamine into vesicles for storage and later release. Dopamine reuptake via DAT provides the primary mechanism through which dopamine is cleared from synapses. The density of DATs are greater in female versus male rats and clinical reports have shown greater densities of DATs within healthy adult women versus men.[32] Such sex differences may be related to estrogens.

In year 1999, Riley et al, concluded that pain thresholds for mechanical, thermal, and ischemic muscle pain were higher during the follicular phase of the menstrual cycle (low to moderated levels of estradiol and progesterone), than during perimenstrual phases of the cycle (decreasing levels of estradiol and progesterone) and the effect sizes were generally small to moderate.[33] In 2005, Gazerani et al reported greater capsaicin-induced pain, allodynia, and mechanical hyperalgesia during the menstrual versus the luteal phase.[34]

BII Phobia and Gender Specific Brain Difference

The research shows that there are considerable differences in the brain of males and females either in structure, organization or expression of genes. This variability might lead to the variation in the vulnerability of different brain disease. Females have almost double the prevalence of blood phobia compared to males. A study of postmortem histologic examination revealed that in the neocortex neurons are more in men whereas synapses are more in women.[35]

Many workers have further elaborated sex specific differences in the brain. It has been proved that testosterone and its metabolites which act in the developing brain, cause variation in brain structure and gene expression in a sex specific faishion.[36] Different functions and expression patterns in males and females have appeared to be X- and Y-homologues of three genes in particular, Usp9x/y, Ube1x/y and Eif2s3x/y.[37]

Histone demethylases JARID1C and UTX are some of the chromatin enzymes which are coded by X-linked genes and are not X-inactivated in females. So the sex differences in brain development and behavior could be due to higher expression of JARID1C and UTX in females.[38] Variations in the fainting experiences between males and females can also be due to such type of changes.

Factors Linked with Improvement after Subsequent Exposures

Emotion is the conjoint product of both physiological arousal and cognitive or perceptual factors. In a study it was reported that when the experience of pain is compounded by fear and anxiety then systematic desensitization is well suited to alleviate the pain of hypodermic needle.[39]

Depending on the age of the person and severity of the condition, effectiveness of behavior management of needle-related fear varies greatly. In mild fear of needles relaxation techniques (i.e., muscular relaxation, imagery relaxation, deep breathing, and autogenic training) might be useful.[40]

Education seems to be effective in reducing procedure anxiety in older children but seems to have a negative effect on younger children's anxiety.[40] Older children and adolescents have stronger rational defenses, making it possible for the child to think through and rationalize the procedure.[41] Teaching – learning pattern followed in our laboratory might have caused an improvement on tenth exposure.

Observations and Results

Table 1: To show the questionnaire used in the study

Q.1 Any traumatic Experience
Q.2 Taking Regular injection
Q.3 History of Fainting Following injection
Q.4 History of bad Experience after injection
Q.5 Any Hospitalization
Q.6 Scared of Smell in Room
Q.7 Scared of Hearing Nurse Talk About injection
Q.8 Scared of Seeing Nurse Prepare injection
Q.9 Scared to see other people Receive injection
Q.10 Scared of injection due to pain
Q.11 Taken any meal atleast 2 hours before
Q.12 Fear of pain during finger prick
Q.13 Smell in the Haematology room is a fear factor
Q.14 Hearing the teacher or lab Assistant discussing with students about fingerpicking causes fear
Q.15 Watching other students pricking causes fear
Q.16 Seeing blood oozing out from the fingertip makes you panicky
Q.17 Symptoms after exposure to needle:
(A) Sweaty
(B) Shortness of Breath
(C) Palpitations
(D) Dizziness
(E) Feeling to pass out
(F) Dry Mouth
(G) None
Q. 18. Depth of Finger Prick

Table 2: Association of variables between male and female on 1st exposure of needle (N-1)

Variables	N1				P-Value
	Female (n=120)		Male (n=96)		
	Freq	%	Freq	%	
Q.1	18	15.0	11	11.5	0.448
Q.2	3	2.5	1	1.0	0.430
Q.3	10	8.3	1	1.0	0.015*
Q.4	22	18.3	16	16.7	0.749
Q.5	21	17.5	31	32.3	0.012*
Q.6	15	12.5	6	6.3	0.169
Q.7	39	32.5	20	20.8	0.056
Q.8	50	41.7	24	25.0	0.010**
Q.9	40	33.3	15	15.6	0.033*
Q.10	57	47.5	30	31.3	0.033*
Q.11	82	68.3	57	59.4	0.172
Q.12	82	68.3	47	49	0.012*
Q.13	7	5.8	4	4.2	0.580
Q.14	45	37.5	24	25	0.050*
Q.15	35	29.2	15	15.6	0.019*
Q.16	22	18.3	6	6.3	0.018*
Q.17A	24	20	7	7.3	0.008**
Q.17B	8	6.7	5	5.2	0.654
Q17C	14	11.7	2	2.1	0.008**
Q.17D	11	9.2	1	1	0.010**
Q17E	3	2.5	4	4.2	0.492
Q.17F	8	6.7	16	16.7	0.020*
Q.17G	75	62.5	66	68.8	0.338
Q.18	75	62.5	60	62.5	1.0

Frequency distribution of only "yes" option has been shown for Q.1-17 and option "deep" for Q.18 has been shown *P<0.05; **P<0.01

Table 3: Association of variables between male and female on 10th exposure of needle (N-10)

Variables	N10				P-Value
	Female (n=120)		Male (n=96)		
	Freq	%	Freq	%	
Q.11	74	61.7	53	55.2	0.338
Q.12	44	36.7	15	15.6	0.001***
Q.13	6	5	2	2.1	0.259
Q.14	13	10.8	6	6.3	0.237
Q.15	22	18.3	4	4.2	0.001***
Q.16	13	10.8	2	2.1	0.012*
Q.17A	8	6.7	3	3.1	0.239
Q.17B	1	0.8	5	5.2	0.05*
Q17C	4	3.3	2	2.1	0.579
Q.17D	1	0.8	2	2.1	0.496
Q17E	4	3.3	3	3.1	0.929
Q.17F	4	3.3	9	9.4	0.064
Q.17G	98	81.7	76	79.2	0.645
Q.18	92	76.7	81	84.4	0.154

Frequency distribution of only "yes" option has been shown for Q. 11-17 and option "deep" for Q.18 has been shown *P<0.05; ***P<0.001

Table 4: Frequency distribution of symptoms (table no. 1) in both gender groups during 1st exposure of needle (N-1) and 10th exposure of needle (N-10)

Symptom	N-1				N-10			
	Female		Male		Female		Male	
	n= 120	%	n=96	%	n=120	%	n=96	%
Present	45	37.5	30	31	22	18	20	21
Absent	75	62.5	66	69	98	82	76	79
Total	120	100	96	100	120	100	96	100

Table 5: Chi square test for association of variables (symptoms) within the same group and between 2 groups during N-1 and N-10 exposure

Association between	X^2 - value	P- value
N-1 Male Vs. female	0.919	0.338
N-10 male Vs. female	0.213	0.645
Female N-1 Vs. N-10	10.95	0.0009***
Male N-1 Vs. N-10	2.70	0.1

***P<0.001

Table 6: NPRS in both groups during 1st exposure of needle (N-1) and 10th exposure of needle (N-10)

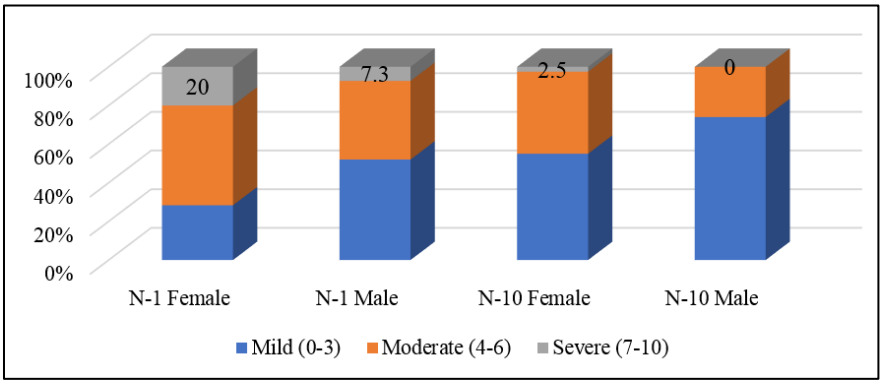
Grading	N-1				N-10			
	Female		Male		Female		Male	
	n=120	%	n=96	%	n=120	%	n=96	%
Mild (0-3)	34	28.33	50	52.1	66	55	71	74
Moderate (4-6)	62	51.66	39	40.8	51	42.5	25	26
Severe (7-10)	24	20	7	7.3	3	2.5	0	0
Total	120	100	96	100	120	100	96	100

Table 7: Chi-square test for association of pain grading by NPRS within the same group and between 2 groups during 1st exposure of needle (N-1) and 10th exposure of needle (N-10)

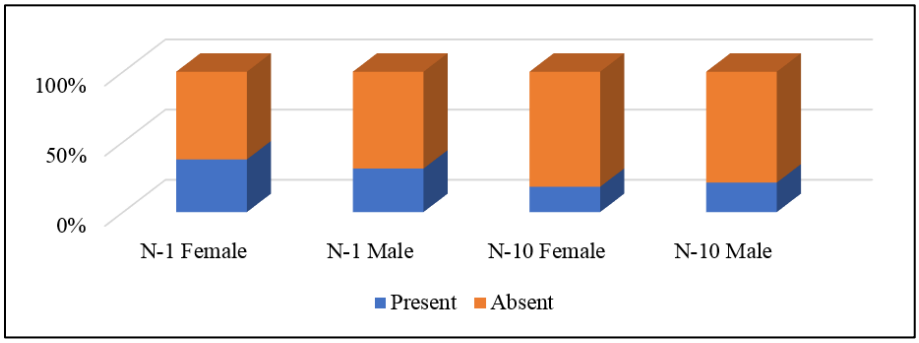
Association between	X^2 - value	P- value
N-1 Male Vs. female	15.127921	0.0005***
N-10 male Vs. female	9.53	0.009 **
Female N-1 Vs. N-10	27.64413	0.0000***
Male N-1 Vs. N-10	13.707128	0.001***

**P<0.01; ***P<0.001

Graph 1: Comparison of NPRS grading in both the groups during first exposure (N-1) and tenth exposure (N-10) with needle



Graph 2: Comparison of symptoms in both the groups during first exposure (N-1) and tenth exposure (N-10) with hypodermic needle



Conclusion

It was concluded that females were more needle phobics than males and with subsequent exposures, i.e., on 10th exposure with hypodermic needle there was reduction in pain and symptoms after finger-prick.

More assistance is needed by female students. Teaching faculty should adopt positive approach to alleviate this fear and anxiety. Systemic exposure and counselling is a successful treatment for belonephobia. Cognitive behavior therapy is implicated to retrain the brain not to engage neural pathways that lead to creation of mental disturbance after exposure to needle so, it may be helpful in this context.[42] Anti-anxiety drugs in severe condition may be used with clinicians guidance.

Muscle tension is a physical technique in which individuals are taught to: (1) tense there muscles (eg, abdominal, legs, arms) to raise their blood pressure and combat the vasovagal response; (2) recognize prodromal signs of impending vasovagal syncope (eg, visual disturbances, feeling dizzy, or clammy); and (3) apply the technique when prodromal signs occur.[43]

Other treatment for belonephobia include – ethyl chloride spray or other freezing agents, iontophoresis, jet injectors, EMLA (eutectic mixture of local anaesthetic), ametop, nitrous oxide or laughing gas, lidocaine or tetracaine patch, inhalational general anaesthesia, benzodiazepine.

Conflict of Interest: None.

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How to cite this article: Gangwani N, Singh K, Archana. Gender specific difference of belonephobia and pain associated with fingerpricking in haematology laboratory: An overlooked diagnosis. *Indian J Clin Anat Physiol* 2019;6(2):193-200.