International Journal of Medical Research Professionals
P-ISSN: 2454-6356; E-ISSN: 2454-6364
DOI: 10.21276/ijmrp

IJMRP

Original Research Article.

Study of Changes in Cognition and Mood in Participants with Premenstrual Syndrome (PMS)

Vibha A. Bhide[1], Anand R. Bhide[2*], Henal R. Shah[3], Shipra Singh[4]

[1]Assistant Professor, Department of Psychiatry,
Rural Medical College of Pravara Institute of Medical Sciences, Ioni, Maharashtra, India.
[2*]Assistant Professor, Department of Community Medicine,
Rural Medical College of Pravara Institute of Medical Sciences, Ioni, Maharashtra, India.
[3]Additional Professor, Department of Psychiatry,
Topiwala National Medical College & BYL Nair Charitable Hospital, Mumbai, Maharashtra, India.
[4]Senior Resident, Department of Psychiatry, Dr. R.M.L Hospital & PGIMER, Delhi, India.

ABSTRACT

Introduction: Apart from physical disturbances during menstruation women also experience symptoms related to mental and emotional health like anger, irritability, fatigue and mood swings. This broad group of emotional, behavioral and physical symptoms that occur for several days to several weeks before menses and subside following the menstrual period is called Premenstrual Syndrome (PMS). Hence, this study is the attempt to study the changes in this major domain of cognition and mood which affects social functioning and performance of a woman in her daily life.

Materials and Methods: The present study was conducted among women diagnosed with Premenstrual Syndrome. The study and control group were assessed for cognition in luteal (15 to 28 days i.e. 2 weeks prior to menstruation) and in follicular phase (1 to 13 days of menstrual cycle). Also these subjects were assessed for mood in which depression and anxiety was assessed using Hamilton Depression Rating Scale and Hamilton Anxiety Rating Scale respectively twice in follicular and luteal phase. Data obtained was assessed by Independent T test, Wilcoxon signed rank test, Mann Whitney test.

Results: Women in Moderate to severe PMS and PMDD in luteal phase have more depression and anxiety and cognitive impairment in luteal phase compared to women with no PMS which improved in follicular phase. Symptoms were associated with impairment of functioning in luteal phase. Women with no PMS also have depression and anxiety and cognitive impairment in luteal phase which improved in follicular phase. However the depression and cognitive impairment was not associated with impairment of functioning in luteal phase and the symptoms do not include depressed mood. There was no relationship noted between mood symptoms and cognition.

Conclusion: General Physical symptoms may be present but depressed mood warrants clinical attention and appropriate treatment. Women should be made aware about the illness and early recognition of symptoms. General physicians should be trained for early recognition of symptoms and further management.

Keywords: Menstruation; Mood Swings; Premenstrual Syndrome; Women.

***Correspondence to:**

Dr. Anand R. Bhide,
Assistant Professor,
Department of Community Medicine,
Rural Medical College of Pravara Institute of Medical Sciences, Ioni, Maharashtra, India.

Article History:

Received: 05-08-2018, **Revised:** 03-09-2018, **Accepted:** 18-09-2018

Access this article online	
Website: www.ijmrp.com	Quick Response code
DOI: 10.21276/ijmrp.2018.4.5.025	

INTRODUCTION

Menstruation is the monthly shedding of endometrial layer of uterus leading to the discharge of blood from the uterus. This occurs once in every 28 ± 7 days. A menstrual cycle is the result of a hormonal dance between the pituitary gland in the brain and the ovaries. Every month the female sex hormones prepare the body to support a pregnancy, and when there is no fertilization menstruation occurs (a period). In this normal physiological phenomenon women experience several disturbances like dysmenorrrhoea, menorrhagia, oligomenorrhoea and polymenorrhea.[1] Apart from these physical disturbances women also experience symptoms related to mental and emotional health like anger, irritability, fatigue and mood swings.[2]

This broad group of emotional, behavioral and physical symptoms that occur for several days to several weeks before menses and subside following the menstrual period is called Premenstrual Syndrome(PMS). Severe form of premenstrual syndrome is called

premenstrual dysphoric disorder (PMDD).[3] Diagnostic and Statistical manual (DSM 5) places PMDD under depressive disorders. Depression is mood/affective disorder.[4] Mood is a pervasive and sustained emotion that colours the person's perception of the world.[5] Mood disorders include depression, bipolar disorder. Depression is also known to affect cognition.[6] Cognition is a term referring to the mental processes involved in gaining knowledge and comprehension. These processes include thinking, knowing, remembering, judging, and problem solving. These are higher-level functions of the brain and encompass language, imagination, perception, and planning.[7]

Cognitive complaints, including difficulty in concentrating, memory impairment, distractibility, lack of self-confidence when making decisions, or even indecision and mood disturbances like irritability, anger, fatigue, comprise the spectrum of symptoms associated with the premenstrual phase.[8]

There have been different studies worldwide to assess mood and cognition in women with PMS. However there have been very few Indian studies assessing the effect of PMS on mood and no study to see the effect on cognition. Hence, this study is the attempt to study the changes in this major domain of cognition and mood which affects social functioning and performance of a woman in her daily life.

MATERIALS AND METHODS

The present study was conducted in the Department of Psychiatry among students in undergraduate training in MBBS (interns), nursing, occupational therapy, physiotherapy who were screened by premenstrual symptom screen tool. The students diagnosed with moderate to severe PMS were confirmed by individual psychiatric interview. Those diagnosed and those included in control group were assessed for cognition in luteal (15 to 28 days i.e. 2 weeks prior to menstruation) and in follicular phase (1 to 13 days of menstrual cycle).The protocol approval was taken from the ethics committee for academic research projects (ECARP) and also permission from Dean was taken prior to implementation. From those diagnosed as moderate to severe PMS and willing to participate in study were taken for the study. The students who did not test positive on PSST and who gave consent were included in control group. Patients with major psychiatric illness, uncontrolled medical condition, pregnant women, individuals who were undergoing treatment for PMS and women using oral contraceptives were excluded from the study.

Subject and control group were then assessed twice during luteal phase (15 to 28 days i.e. 2 weeks prior to menstruation) and follicular phase (1 to 13 days of menstrual cycle). Date of last menstrual period was noted during screening and accordingly women were first assessed in luteal phase and then again in follicular phase. Follicular phase was confirmed by counting the days backward.

Also these students were assessed for mood in which depression and anxiety was assessed using Hamilton Depression Rating Scale[9] and Hamilton Anxiety Rating Scale[10] respectively twice in follicular and luteal phase.

Data obtained was classified and represented in form of frequency and percentage where ever necessary. Appropriate statistical tests were applied according to the type of data and association between variables was assessed by Independent T test, Wilcoxon signed rank test, Mann Whitney test. Quantitative data was represented using Mean ± SD and Median.

For regression of analysis, independent variables were simplified for better interpretation of results.

Table 1: Comparison of mean scores of HDRS, HARS, working memory and speed of processing in luteal phase in women of control and moderate to severe group

PARAMETERS	Group	N	Mean	Std. Deviation	Std. Error Mean	P value
LUTEAL HDRS SCORE	CONTROL	60	9.9667	3.96581	.51198	
	MODERATE TO SEVERE PMS	31	16.9032	3.77143	.67737	0.00
LUTEAL HARS SCORE	CONTROL	60	12.5667	5.31505	.68617	
	MODERATE TO SEVERE PMS	31	13.9032	4.61414	.82872	0.23
LUTEAL WORKING MEMORY	CONTROL	60	5.03	1.657	.214	
	MODERATE TO SEVERE PMS	31	5.26	1.316	.236	0.51
LUTEAL SPEED OF PROCESSING	CONTROL	60	83.68	5.258	.679	
	MODERATE TO SEVERE PMS	31	87.00	3.540	.636	0.00

Table 2: Comparison of mean scores of attention concentration and delayed memory in luteal phase in women of control and moderate to severe group

PARAMETERS	Group	N	Mean Rank	Sum of Ranks
LUTEAL ATTENTION CONCENTRATION	CONTROL	60	45.26	2715.50
	MODERATE TO SEVERE PMS	31	47.44	1470.50
	Total	91		
LUTEAL DELAYED MEMORY	CONTROL	60	59.33	3560.00
	MODERATE TO SEVERE PMS	31	20.19	626.00
	Total	91		

Table 3: Comparison of mean scores of HDRS, HARS, working memory, delayed memory and speed of processing in luteal phase in women of control and PMDD group

PARAMETERS	Group	N	Mean	Std. Deviation	Std. Error Mean	P value
EAL HDRS SCORE	CONTROL	60	9.9667	3.96581	0.51198	0.00
	PMDD	29	17.8621	3.17045	0.58874	
LUTEAL HARS SCORE	CONTROL	60	12.5667	5.31505	0.68617	0.00
	PMDD	29	16.4483	3.05411	0.56713	
LUTEAL WORKING MEMORY	CONTROL	60	5.03	1.657	0.214	0.292
	PMDD	29	4.66	1.396	0.259	
LUTEAL DELAYED MEMORY	CONTROL	60	11.15	3.914	0.505	0.00
	PMDD	29	4.59	1.842	0.342	
LUTEAL SPEED OF PROCESSING	CONTROL	60	83.68	5.258	0.679	0.069
	PMDD	29	85.79	4.609	0.856	

Table 4: Comparison of mean scores of attention concentration in luteal and follicular phases in women of control and PMDD group

Group		N	Mean Rank	Sum of Ranks
LUTEAL ATTENTION CONCENTRATION	CONTROL	60	44.75	2685.00
	PMDD	29	45.52	1320.00
	Total	89		

RESULTS

Table 1 shows comparison of mean scores of HDRS, HARS, working memory and speed of processing in luteal phase in women of control and moderate to severe group. According to Independent Samples Test, Mean HDRS score of women in moderate to severe PMS group (16.90) in luteal phase is greater than mean HDRS score of women in control group(9.96) and the difference is statistically significant(p=0.0). Mean HARS score of women in moderate to severe PMS group(13.90) in luteal phase is greater than mean HARS score of women in control group(12.56) and the difference is not statistically significant(p=0.23). Mean working memory score of women in moderate to severe group was (5.26) in luteal phase which is greater than mean working memory score of women in control group (5.03) in luteal phase. The difference is not statistically significant (p=0.51). Mean speed of processing score of women in moderate to severe group is greater in luteal phase (87.00) than mean speed of processing score of women in control group (83.68) in luteal phase and the difference is statistically significant(0.0).

Table 2 shows comparison of mean scores of attention concentration and delayed memory in luteal phase in women of control and moderate to severe group. According to Mann-Whitney Test, Mean Attention concentration score of women in moderate to severe group is (47.44) in luteal phase which is greater than mean attention concentration score of women in control group (45.26) in luteal phase. The difference is not statistically significant (P=0.228). Mean delayed memory score of women in moderate to severe group is(20.19) in luteal phase which is less than mean delayed memory score of women in control group(59.33) in luteal phase and the difference is statistically significant(0.00). As the data was not normally distributed for the above two parameters, Mann whitney test was used.

Table 3 shows comparison of mean scores of HDRS, HARS, working memory, delayed memory and speed of processing in luteal phase in women of control and PMDD group. According to Independent Samples Test, Mean HDRS score of women in PMDD group (17.86) in luteal phase is greater than mean HDRS score of women in control group (9.96) in luteal phase. The difference is statistically significant (p=0.00) Mean HARS score of women in PMDD group (16.44) in luteal phase is greater than mean HARS score of women in control group (12.56) in luteal phase. The difference is statistically significant (P=0.0). Mean working memory score of women in PMDD group is (4.66) in luteal phase which is less than mean working memory score of women in control group (5.03) in luteal phase. The difference was not statistically significant (P=0.292). Mean delayed memory score of women in PMDD group is (4.59) in luteal phase which is less than mean delayed memory score of women in control group (11.15) in luteal phase. The difference being statistically significant (P=0.00). Mean speed of processing score of women in PMDD group is (85.79) in luteal phase which is greater than mean speed of processing score of women in control group (83.68) in luteal phase. The difference is not statistically significant (P=0.06).

According to Mann-Whitney Test, attention concentration mean rank score in PMDD group is (45.52) greater than attention concentration mean rank score of control group (44.75). The difference was not statistically significant (P=0.60) (table 4).

Table 5 demonstrates that there is statistically nonsignificant positive correlation between depression and attention concentration (p=0.126) (R=0.200). Also there is statistically nonsignificant positive correlation between depression and delayed memory (p=0.978) (R=0.004). Also there is statistically nonsignificant negative correlation between depression and working memory (p=0.123) (R=-0.201). There is statistically nonsignificant negative correlation between depression and speed of processing (p=0.342) (R=-0.125). There is statistically nonsignificant positive correlation between anxiety and attention concentration (p=0.519) (R=0.085). Also there is statistically nonsignificant positive correlation between anxiety and delayed

memory (p=0.233) (R=0.156). Also there is statistically nonsignificant negative correlation between anxiety and working memory (p=0.092) (R=-0.220). There is statistically nonsignificant positive correlation between anxiety and speed of processing (p=0.607) (R=0.068).

Table 6 demonstrates that there is statistically nonsignificant negative correlation between depression and attention concentration (p=0.267) (R=-0.205). Also there is statistically nonsignificant negative correlation between depression and delayed memory (p=0.415) (R=-0.152). Also there is statistically nonsignificant positive correlation between depression and working memory (p=0.892) (R=0.025). There is statistically nonsignificant positive correlation between depression and speed of processing (p=0.926) (R=0.017). There is statistically nonsignificant negative correlation between anxiety and attention concentration (p=0.901) (R=-0.023). Also there is statistically nonsignificant negative correlation between anxiety and delayed memory (p=0.466) (R=-0.136). Also there is statistically nonsignificant positive correlation between anxiety and working memory (p=0.708) (R=0.070). There is statistically nonsignificant negative correlation between anxiety and speed of processing (p=0.075) (R=-0.324).

Table 7 demonstrates that there is statistically nonsignificant positive correlation between depression and attention concentration (p=0.966) (R=0.008). Also there is statistically nonsignificant negative correlation between depression and delayed memory (p=0.172) (R=-0.261). Also there is statistically nonsignificant positive correlation between depression and working memory (p=0.913) (R=0.021). There is statistically nonsignificant positive correlation between depression and speed of processing (p=0.998) (R=0.00). There is statistically nonsignificant positive correlation between anxiety and attention concentration (p=0.614) (R=0.098). Also there is statistically nonsignificant negative correlation between anxiety and delayed memory (p=0586) (R=-0.105). Also there is statistically nonsignificant negative correlation between anxiety and working memory (p=0.422) (R=-0.155). There is statistically nonsignificant positive correlation between anxiety and speed of processing (p=0.594) (R=0.103). Table 8 presents summary of results revealed in the present study.

Table 5: Correlation table to study relationship between depression, anxiety and cognition in women of control group

PARAMETERS		LUTEAL ATTENTION CONCENTRATION	LUTEAL WORKING MEMORY	LUTEAL DELAYED MEMORY	LUTEAL SPEED OF PROCESSING
LUTEAL HDRS SCORE	R	.200	-.201	.004	-.125
	p Value	.126	.123	.978	.342
	N	60	60	60	60
LUTEAL HARS SCORE	R	.085	-.220	.156	.068
	p Value	.519	.092	.233	.607
	N	60	60	60	60

Table 6: Correlation table to study relationship between depression, anxiety and cognition in women of moderate to severe group

PARAMETERS		LUTEAL ATTENTION CONCENTRATION	LUTEAL WORKING MEMORY	LUTEAL DELAYED MEMORY	LUTEAL SPEED OF PROCESSING
LUTEA L HDRS SCORE	R	-.205	.025	-.152	.017
	p Value	.267	.892	.415	.926
	N	31	31	31	31
LUTEA L HARS SCORE	R	-.023	.070	-.136	-.324
	p Value	.901	.708	.466	.075
	N	31	31	31	31

Table 7: Correlation table to study relationship between depression, anxiety and cognition in women of PMDD group

PARAMETERS		LUTEAL ATTENTION CONCENTRATION	LUTEAL WORKING MEMORY	LUTEAL DELAYED MEMORY	LUTEAL SPEED OF PROCESSING
LUTEAL HDRS SCORE	R	.008	.021	-.261	.000
	p Value	.966	.913	.172	.998
	N	29	29	29	29
LUTEAL HARS SCORE	R	.098	-.155	-.105	.103
	p Value	.614	.422	.586	.594
	N	29	29	29	29

Table 8: Summary of present study

PARAMETERS	Control (Luteal vs Follicular)	Moderate to severe (Luteal vs Follicular)	PMDD(Luteal vs Follicular)	Control vs moderate to severe	Control vs PMDD
Depression	SIG	SIG	SIG	SIG	SIG
Anxiety	SIG	SIG	SIG	NS	SIG
Attention concentration	NS	NS	NS	NS	NS
Working memory	SIG	SIG	SIG	NS	NS
Delayed memory	SIG	SIG	SIG	SIG	SIG
Speed of processing	SIG	SIG	SIG	SIG	NS

SIG= Statistically significant; NS= Not statistically significant

DISCUSSION

The present study was conducted to assess changes in cognition and mood in women with Premenstrual Syndrome. A total of 120 participants in the age group of 18-26 years were found to be eligible for study. Based on Premenstrual Symptom Screening tool participants were classified into moderate to severe PMS and PMDD groups while participants with no PMS symptoms were classified as control group. Mean age group of control participants was 20.71, moderate to severe PMS was 20.64 and PMDD was 21.06. All the participants were assessed twice for mood and cognition i.e. first in luteal and second in follicular phase.

The present study found that normal women with no PMS scored high in depression scale in luteal phase which improved in follicular phase. Women who had depression had no depressive mood per se but had general somatic symptoms, subjective tension and irritability and slowness of speech and thought which made them score high in the scale. Also control women had significant anxiety in luteal phase and they improved in follicular phase.

Similar findings were reported by Laessle Tuschl et al[11] where they assessed 30 women in different phases by daily rating of psychological variables and also checking the blood levels of estrogen and progesterone to confirm the cycle phase. They found that none had depression per se but had significant somatic complaints and appetite changes present in the luteal phase. Also Gonda X et al[12] used Zung depression rating scale, State Trait anxiety inventory, symptom distress checklist for depression and anxiety and reported that there was statistically significant increase in scores related to neuroticism and depression in luteal phase and also in anxiety.

Participants were also assessed for cognitive performance and it was found that women had no significant change(p=0.65) in attention concentration task as assessed by digit span test over both the phases of menstrual cycle, even though there were subjective reports of the same by many. However when checked for working memory, delayed memory and processing speed, it was found women scoring better in follicular phase and the change in two phases being significant. Based on above observation we can conclude that there was significant improvement in depression and anxiety and cognitive parameters (working memory, delayed memory, speed of processing) in follicular phase compared to luteal phase except attention concentration which showed no significant change across the different phases of menstrual cycle despite subjective reports of the same.

Attention concentration was found to be significantly affected in luteal phase in a study by, Brugger et al[13] who used mental dice task to assess attention concentration. However the mean age group of the study was 30 years as against adolescent used in our study. Also Lord et al[14] used stroop colour word test, women were compared to 50 men and found worse performance in luteal phase in normal women. Phillips et al[15] used WMS test, and found no significant difference in the attention concentration across phases of menstrual cycle

The small molecule of estrogen has definite impact on neurocognitive tasks. Estrogen receptors are wide spread throughout the brain in pituitary, hippocampus, hypothalamus, midbrain structures. Estrogen has been shown to affect various neurotransmitters like GABA, dopamine, serotonin modulating their production and action. Highest estrogen receptors are present in hippocampus where memory consolidation occurs. Cyclical changes have been seen in hippocampus with changing estrogen level across menstrual cycle, with effect on memory and thereby influence acuity of working memory.[16] Also decline in estrogen levels in menopause has been shown to associated with significant mood and emotional disturbances, also there are studies which show improvement in mood with Estrogen Replacement Therapy.[17]

When assessed for mood symptoms in control and moderate to severe group in luteal phase, it was found that women in moderate to severe group were more depressed than control group and the difference being significant. However anxiety scores were not significantly different in two groups (table 1). In cognitive parameters, it was noted that control women were better in speed of processing speed (table 1) (p=0.0), and delayed memory (P=0.0) (table 2). However no significant difference was found in working memory (p=0.51) and Attention and concentration (P=0.228).

In our literature search, we found that there were inconsistent results in various studies, with Rapkin et al,[18] Keenan et al[19] and Morgan et al[20] reporting no significant change in attention concentration who used similar test of digit span as of our study. Also no significant difference was found in delayed memory in studies done by, Rapkin et al[18] who used incidental recall test and Keenan et al[19] who used WMS.

In working memory similar results were seen by Morgan et al, [20] Keenan et al[19] who used similar test as used in our study of digit symbol substitution test. Keenan et al[19] and Diener et al[21] reported worse performance in luteal phase. The study participants were of

middle age group in 30's as contrast to women in 20's in our study. When compared for mood between control and PMDD groups it was found that women in PMDD group were more depressed and anxious than control group which was statistically significant(p=0.00) (table 3).

Also in cognition, control group had better delayed memory in luteal phase than women in PMDD group with statistically significant difference of (p=0.00) (table 3), however there was no statistically significant difference found in other cognitive parameters of Attention concentration (p=0.60) (table 4), speed of processing (p=0.05) and working memory (p=0.292) (table 3). Thus, it was revealed that participants in PMDD group in luteal phase had depression and anxiety more than women in control group. There was no difference in attention concentration, working memory, speed of processing in women of two groups. Only delayed memory was better in women of control group in luteal phase.

It has been noted that there is complex interrelationship between the nervous system, autonomic nervous system, immune system which produces subtle but definite changes in mood and neurocognitive function. PMS represents an abnormal immune response to normal hormonal changes with far reaching consequences to physical and emotional health.[22]

As per our observation in this study and also other studies assessing similar such variables of depression and anxiety, there is common agreement of mood disturbances being present across different phases of menstrual cycle in women suffering from PMS.

However there is a lack of common agreement in the results of cognitive performance. The differences of reports may be accounted due to differences in various factors that were studied like the differences in sample size, different educational level, stress, different age group, use of oral contraceptives, also knowledge about the premenstrual symptoms which may lead to overestimation of symptoms. It is well known that depression, anxiety has effect on cognition. PMDD is included under depressive disorders in DSM5. Also PMS is known to have affective symptoms in premenstrual phase. However in our analysis, women in PMS though significantly having affective symptoms, there was no significant relationship between the affective symptoms and cognition in all the three groups of control, moderate to severe and PMDD as per the linear regression analysis done (table 6 and 7).

The limitation of present study was that the sample was hospital acquired sample. A population sample would yield more generalizable finding. The case control study design is a limitation as we cannot infer about causality; however, the study can be seen as a predecessor for future randomized controlled trials.

CONCLUSION

Women in Moderate to severe PMS and PMDD in luteal phase have more depression and anxiety and cognitive impairment in luteal phase compared to women with no PMS which improved in follicular phase.

Symptoms were associated with impairment of functioning in luteal phase. Women with no PMS also have depression and anxiety and cognitive impairment in luteal phase which improved in follicular phase.

However the depression and cognitive impairment was not associated with impairment of functioning in luteal phase and the symptoms do not include depressed mood. There was no relationship noted between mood symptoms and cognition. General Physical symptoms may be present but depressed mood warrants clinical attention and appropriate treatment. Women should be made aware about the illness and early recognition of symptoms. General physicians should be trained for early recognition of symptoms and further management.

REFERENCES

1. Hacker & Moore. Essentials of Obstetrics & Gynaecology. 3rd ed. Philadelphia. WB Suanders.

2. Dickerson LM, Mazyck PJ, Hunter MH, Premenstrual syndrome Am Fam Physician 2003 67(8):1743-52.

3. Bhatia SC, Bhatia SK. Diagnosis and treatment of premenstrual dysphoric disorder. Am Fam Physician. 2002 Oct 1;66(7):1239-48.

4. American Psychiatric Association.(2013). Diagnostic and statistical manual of mental disorders(5th ed.). Washington, DC

5. Fish's Clinical Psychopathology: Signs and Symptoms in Psychiatry, 3rd edition

6. Thomas AJ, Gallagher P, Robinson LJ, Porter RJ, Young AH, Ferrier IN, O'Brien JT. A comparison of neurocognitive impairment in younger and older adults with major depression. Psychological medicine. 2009 May 1;39(05):725-33.

7. Neisser, U. (1967) Cognitive psychology. Englewood Cliffs, NJ: Prentice-Hall

8. Souza EG, Ramos MG, Hara C, Stumpf BP, Rocha FL. Neuropsychological performance and menstrual cycle: a literature review. Trends in psychiatry and psychotherapy. 2012;34(1):5-12.

9. Hamilton M. A rating scale for depression. Journal of Neurology, Neurosurgery & Psychiatry. 1960 Feb 1;23(1):56-62.

10. Hamilton M. Diagnosis of anxiety states by rating. Br J Med Psychol. 1959;32:50-55.

11. Laessle RG, Tuschi RJ, Schweiger U, Pirke KM. Mood changes and physical complaints during the normal menstrual cycle in healthy young women. Psychoneuroendocrinology. 1990 Dec 31;15(2):131-8.

12. Gonda X, Telek T, Juhasz G, Lazary J, Vargha A, Bagdy G. Patterns of mood changes throughout the reproductive cycle in healthy women without premenstrual dysphoric disorders. Progress in Neuro-Psychopharmacology and Biological Psychiatry. 2008 Dec 12;32(8):1782-8.

13. Brugger P, Milicevic A, Regard M, Cook ND. Random-number generation and the menstrual cycle: preliminary evidence for a premenstrual alteration of frontal lobe functioning. Perceptual and motor skills. 1993 Dec 1;77(3):915-21.

14. Lord T, Taylor K. Monthly fluctuation in task concentration in female college students. Perceptual and motor skills. 1991 Apr 1;72(2):435-9.

15. Phillips SM, Sherwin BB. Variations in memory function and sex steroid hormones across the menstrual cycle. Psychoneuroendocrinology. 1992 Oct 31;17(5):497-506.

16. Sherwin BB. Estrogen and cognitive functioning in women. Endocrine reviews. 2003 Apr 1;24(2):133-51.

17. Genazzani AR, Pluchino N, Luisi S, Luisi M. Estrogen, cognition and female ageing. Human Reproduction Update. 2007 Mar 1;13(2):175-87.

18. Rapkin AJ, Chang LC, Reading AE. Mood and cognitive style in premenstrual syndrome. Obstetrics & Gynecology. 1989 Oct 1;74(4):644-9.

19. Keenan PA, Stern RA, Janowsky DS, Pedersen CA. Psychological aspects of premenstrual syndrome I: cognition and memory. Psychoneuroendocrinology. 1992 Jul 31;17(2):179-87.
20. Morgan M, Rapkin AJ, D'ELIA LO, Reading A, Goldman L. Cognitive functioning in premenstrual syndrome. Obstetrics & Gynecology. 1996 Dec 1;88(6):961-6.
21. Diener D, Greenstein FL, Turnbough PD. Cyclical variation in digit-span and visual-search performance in women differing in the severity of their premenstrual symptoms. Perceptual and motor skills. 1992 Feb 1;74(1):67-76.
22. Farage MA, Osborn TW, MacLean AB. Cognitive, sensory, and emotional changes associated with the menstrual cycle: a review. Archives of gynecology and obstetrics. 2008 Oct 1;278(4):299-307.

Source of Support: Nil. **Conflict of Interest:** None Declared.

Cite this article as: Vibha A. Bhide, Anand R. Bhide, Henal R. Shah, Shipra Singh. Study of Changes in Cognition and Mood in Participants with Premenstrual Syndrome (PMS). Int J Med Res Prof. 2018 Sept; 4(5):105-11. DOI:10.21276/ijmrp.2018.4.5.025