EFFECTS OF THE MENSTRUAL CYCLE ON WORKING MEMORY IN THE POSTMENSTRUAL AND PREMENSTRUAL PHASES

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Abstract

Background: At various times during her cycle, a woman experiencing her menstrual cycle may experience a number of physical and mental symptoms that may have differing effects on her working memory. This study was carried out on forty healthy female interns to assess working memory during the premenstrual and postmenstrual phases because the medical field places a premium on high levels of cognitive ability, particularly working memory, for the purpose of making challenging and time-sensitive decisions.

Methods: The Self-Ordered Pointing test and the Brown-Peterson task were utilised in this study to perform an evaluation of participants' working memories. In order to evaluate the difference in working memory between the two stages, a paired t test was carried out.

Results: The number of errors was significantly higher ($p = 0.022$) in the postmenstrual period (5.31.56) compared to the results of the test during the premenstrual phase when the results of the Self-Ordered Pointing test were analysed (4.31.15). The Brown Peterson task findings showed that the individuals' total number of letters remembered was significantly less ($p = 0.041$) in the postmenstrual period (26.32.16) than in the premenstrual phase (27.22.44).

Conclusion: According to the findings, working memory task performance was strong throughout the premenstrual phase. Since the findings of the current study are supported by earlier research, it is believed that oestrogen secreted in connection with the menstrual phase plays a role in maintaining sharp working memory during the premenstrual phase.

Keyword: Working memory, premenstrual phase, postmenstrual phase, and women

Introduction

In India, women make up roughly 48% of the population. Women's rights in India have advanced significantly since the country gained independence [1]. In today's society, women have advanced far beyond their traditional role as competent homemakers to acquire abilities and skills on par with those of their male counterparts [2-4]. On the other hand, there are between 150 and 300 different types of menstruation complaints, and women frequently feel both physical and mental symptoms during their periods. Additionally, it's said that 80–90% of women are aware of their menstrual symptoms for an endless period of time. Low work performance in the premenstrual phase is another aspect of the menstrual cycle that is frequently observed [5-7]. A fundamental cognitive ability known as working memory underpins a wide range of sophisticated skills like problem-solving and fluid intelligence. A fundamental cognitive skill is working memory. Working memory must be operational in situations like these where people are carrying out several tasks at once [8-10]. To put it another way, working memory entails carrying out important tasks in order to achieve a goal, while also processing other information and simultaneously retaining knowledge that is momentarily necessary [11-14]. Working memory in relation to the menstrual cycle has only been the subject of a small number of studies in the past. One study found that days 7 and 14 of the menstrual cycle showed better performance in terms of linguistic working memory than days 0 and 21 of the cycle [15-18]. Another study on the topic found that lower oestrogen levels in premenopausal women were associated with a decline in working memory. This study examined working memory task performance during the premenstrual and postmenstrual phases of the female menstrual cycle in order to gain important knowledge for managing the health and safety of women at work [19-23]. (Figure 1).

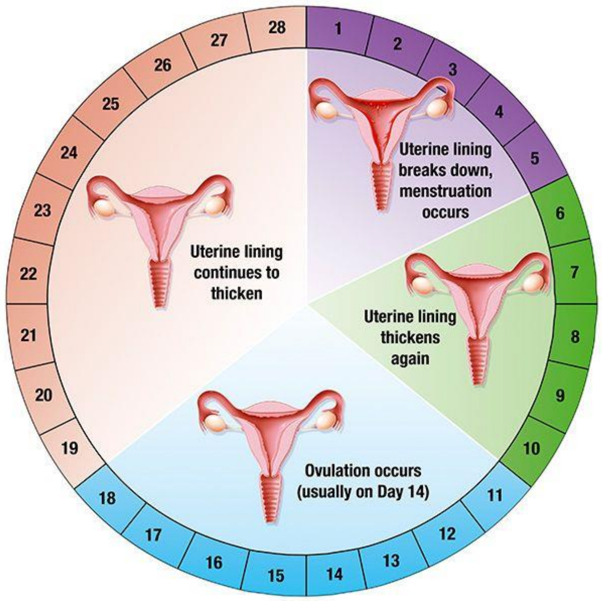

Figure 1. Phases of menstrual cycle

Methods

Study design

For the purpose of the present cross-sectional study, participants consisted of forty female interns who were right-handed, healthy, and between the ages of 23 and 26 (the mean age was 24.3 2.1 years). When the female participants were contacted, they were questioned about the phase of their menstrual cycle and the duration of their cycle, and then they were given a testing date. Through the process of earlier screening, only females who reported having normal cycle durations (range: 25–35 days, M = 29.0, SD = 1.8) and biphasic body temperatures were selected for the study. It was also established that the test subjects had never conceived a child, that they did not suffer from any gynaecological conditions at the present time, and that they had not taken any hormones, oral contraceptives, or any other medications intended for emergency use within the previous twenty-four hours prior to the experiment. It was also established that they had a sufficient amount of rest the night before the experiment and that they did not take any caffeine on the day of the trial. Before beginning the study, ethical approval was acquired from the institute, and written informed consent was collected from each participant in the study.

Measurements

In the subjects' houses, during perfect silence between the hours of 5 and 7, the experiment was done. The working memories of the individuals were tested twice: once in the premenstrual and once in the postmenstrual phases. The Brown-Peterson task and the Self-Ordered Pointing test (SOPT) were administered after a ten-minute pause during which participants were free to unwind.

Self-Ordered Pointing Test (SOPT)

The same set of stimulus objects were used in this test, but they were laid out in various ways on as many different pages as there are items. Subjects had to point to a different item on each page without pointing to the same thing twice. Additionally, there were equal numbers of pages and things. Sheets of paper measuring 8.5 inches by 11 inches, each displaying a unique type of stimulus, were provided to the participants in a binder (e.g., representational drawings). The book was divided into four sections that were clearly separated from one another and were followed by blank pages. There were, correspondingly, six, eight, ten, and twelve stimulation sheets in these parts. A different set of drawings have to be created for each of the four components. Each component used the same drawings, but the order in which they appeared on the various stimulus sheets was different. Each sheet of paper's pictures were placed in different places at random, but their arrangement remained the same (that is, for six-item, the layout was 2 x 3, and for eight-item, the layout was 2 x 4). The first six items, for instance, were divided across six sheets, each of which included the same six illustrations but in a different random order from the one on the sheet before it. There were a total of eight sections with eight pieces each. The first section had eight drawings, the second segment had eight, and so on. It was not permissible for the test subject to speak aloud about the things she was highlighting. The length of time was unrestricted. An error was recorded into the system each time the subject selected a picture that had already been chosen in that section. The total number of errors that were found across all four sections was recorded (6 to 1 sets of 2 items).

Brown-Peterson task

The standard task involves participants performing an interference task, which involves recalling a succession of things after varying delays (e.g., mental addition or subtraction). The individual was verbally given with a consonant trigram (e.g., GRX) at a rate of one letter per second, followed by a two- or three-digit random number (e.g., 167). For interval delays of 9, 18, or 36 seconds, which were chosen at random, the individual was instructed to count backward aloud in threes starting from this number. After the break, the individual was signalled to recollect the trigram by knocking on the table. There were delays of 2 to 5 seconds between each of the 5 trials for each delay interval. The total number of letters properly recalled at each of the three delay intervals served as dependent measures. For scoring purposes, the order of the consonants was not taken into account. At each delay interval, the top score was 15. (5 trials, 3 letters). The number of consonants successfully remembered on each trial is added to determine the final score. The highest possible score was 45. (3 delay intervals, 15 score for each delay interval).

Measured phases of the menstrual cycle and measurement period

The trial's data gathering took into account both the premenstrual and postmenstrual periods. Measurements were collected during the postmenstrual phase, when it was thought that the levels of female hormones were constant (3–7 days following the cessation of bleeding). Measurements were made during the premenstrual phase, when premenstrual syndrome (PMS) symptoms were most likely to appear (3–10 d before the onset of menstruation). The experiment started in April with the measurement of the subjects' basal body temperature. The measurement period was subsequently adjusted, the individuals were asked to report the first day of their periods, and the experiment was completed in a month and a half starting in July. The basal body temperature was tracked over the duration of the trial. For the aim of conducting the statistical analysis, SPSS version 16.0 was used. Working memory assessments conducted during the premenstrual and postmenstrual phases of a woman's menstrual cycle were compared using a paired t test. The statistical significance threshold for each test was set at p 0.05.

Results

Table 1 shows the results of the working memory tests known as the SOPT and the Brown Peterson task, as well as a comparison of those findings between the postmenstrual phase and the premenstrual phase of the menstrual cycle. The number of errors produced by the respondents in SOPT when they were in either the premenstrual or postmenstrual periods was statistically significant ($p = 0.022$). The number of errors committed during the postmenstrual period (5.31.56) was substantially higher than during the premenstrual phase (4.31.15). The total number of letters recalled by the respondents in all three delayed intervals of the Brown Peterson task was significantly lower in the postmenstrual phase (26.32.16) compared to the premenstrual phase (26.32.16). (27.22.44) This was a statistically significant change (p = 0.041).

Table1: Workingmemorytaskperformanceinpostmenstrualandpremenstrualphases

Task Given	Postmenstrual		Premenstrual		pvalue
	Mean	SD	Mean	SD	
Self-OrderedPointingtest(Nooferrors)	4.3	2.56	3.3	1.15	0.022*
Brown-Petersontask(Totalscore/45)	25.2	1.16	26.1	2.44	0.041*

Discussion

In this specific study, we found that the SOPT task error was significantly higher in the postmenstrual phase than in the premenstrual phase. The patient's performance on the Brown Peterson task was considerably lower in the postmenstrual phase than it had been in the premenstrual phase. The results revealed that working memory task performance was good during the premenstrual phase. The Rosenberg study is one of the few that has suggested improved performance during periods of the menstrual cycle that are marked by elevated oestrogen levels [24]. Additionally, Jacobs and D'Esposito discovered that working memory task performance was influenced by a connection between COMT Val158Met and estradiol levels. It was shown that carriers of the Val/Val genotype performed better cognitively when estradiol levels were increased (which putatively is associated with lower frontal dopamine levels). The prefrontal cortex's dopaminergic synaptic release is increased as a result of the increased demands placed on working memory [25]. It would seem that having a high estradiol load would be advantageous for verbal working memory. There is more proof that oestrogen therapy keeps postmenopausal women's verbal working memory intact. Oestrogen therapy, however, is not very effective when begun more than ten years after menopause. It is possible that the rapid hormonal changes that take place throughout the menstrual cycle make it impossible to detect an impaired performance in the relatively brief early follicular phase because extremely low estradiol levels (in the postmenopausal range) are not present in all women and, if they are, they are only present for a short period of time. This is especially true when you take into account how brief the early follicular period is. The results of a study in which gonadotropin releasing hormone agonists were administered to young women as treatment resulted in lower levels of estradiol, which can be considered as supportive evidence for the concept [26]. After a course of medicine lasting eight weeks, a suppression of estradiol was accomplished, which was connected with a decrease in working memory performance. Last but not least, working memory is another prefrontal cortex-dependent cognitive ability, and it appears to function best when oestrogen levels are high. One more study that supports the findings of the current study discovered that working memory task performance was satisfactory throughout the premenstrual phase, with a much decreased error rate for these tasks. The authors found that the functioning of working memory during the premenstrual period was unaffected by moderate premenstrual symptoms. It was previously thought that the indefinite menstrual complaint rather than the reproductive hormone oestrogen, which is released by the ovaries in accordance to the menstrual cycle, was involved in the working memory function. The production of oestrogen ranges from 10–200 pg/ml in the middle of the premenstrual phase to 10–80 pg/ml in the first half of the postmenstrual phase, with the premenstrual phase having a value that is up to 2.5 times higher than the postmenstrual phase [27]. However, oestrogen values were not measured in this study. Based on the information that supports the findings of the current study, it is anticipated that oestrogen that is released in relation to the menstrual phase is actively engaged in good working memory during the premenstrual period. According to the information above, it is important for medical professionals to practise self-care by becoming aware of the kinds of mistakes that can happen as well as the psychosomatic shifts that can happen as a result of the differences between the phases of the menstrual cycle. This will lessen the likelihood that they will make mistakes while providing care to patients. Administrators should also advocate for workplace health education from the standpoint of job safety. In a following study, measurements of oestrogen levels should be done in addition to investigating not only the premenstrual and postmenstrual phases but also all three phases, including the menstrual period.

Conclusion

The purpose of this study was to investigate the ability of medical professionals and interns to complete tasks effectively in terms of their working memories during the premenstrual and postmenstrual periods. The findings suggested that the task performance for the working memory function was satisfactory during the premenstrual phase.

Conflict of Interest: None

Funding Support: Nil

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ISSN 2515-8260 Volume 9, Issue 6, 2022

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