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PMS: CYCLICAL VARIATION IN ATTENTIONAL CAPACITY WITH PMS AND NON-PMS WOMEN

by

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in

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Contents

Abstract

The increasing need for women to have an expanded role in decision making capacities and in professional areas raises persistent questions concerning the effect of menstrual cycle fluctuations on performance, specifically, cognitive/intellectual functioning. A wide variety of recurring cyclical and emotional symptoms have been reported as common to women suffering from premenstrual syndrome (PMS). This study examined possible impairment of cognitive functioning during the PMS phase of the menstrual cycle using PMS and Non-PMS women. The two groups were compared over three menstrual cycles on a digit span task, a letter detection task, and a combination of the two. PMS sufferers were as accurate as Non-PMS women and did not exhibit performance deficits in the PMS phase of their cycle. However, the PMS subjects took longer on the letter detection task regardless of phase. The findings suggest that PMS women are not at a disadvantage during the PMS phase of their cycle and perform as accurately as Non-PMS women on specific cognitive tasks.

Introduction

Behaviors related to the menstrual cycle have supplied the text for myths throughout history, affecting the attitudes and beliefs towards menstruating women (Delaney, Lupton, & Toth, 1976). The increasing need for women to have an expanded role in decision-making and in professional areas raises persistent questions concerning the effects of menstrual cycle fluctuation on performance, specifically cognitive/intellectual functioning. Because the belief persists that intellectual functioning may be impaired premenstrually, it is important to address the question of cyclical variations in competence and the reliability of women during work.

Although it has often been assumed that women perform tasks less efficiently at certain phases of the menstrual cycle, there is very little evidence to support this. In a comprehensive review by Sommer (1982), the consensus seems to be that gross changes in cognitive and perceptual-motor performance is not affected by menstrual cycle phase.

However, a wide variety of recurring cyclical and emotional symptoms have been reported as common to women suffering from premenstrual syndrome (PMS). A constellation of affective and physical changes occur with a repetitive cyclical relationship to the luteal phase of the menstrual cycle (Days 14 - 26). The severity across cycles is variable, with some cycles being symptom-free. For many women, changes are of sufficient magnitude to cause functional impairment and distress (Harrison, Sharpe, & Endicott, 1985).

A frequently cited effect of PMS has to do with a decrement in cognitive/ intellectual functioning during the premenstrual phase of the menstrual cycle. Symptomology is experienced as difficulty in concentrating, forgetfulness, distractibility, confusion, indecisiveness and an overall decrease in performance and efficiency (Rubinow & Roy-Byrne, 1984). Others recount the effect of PMS on job performance as causing fluctuating levels of competence, confidence and professional interactions. Additional evidence, however, suggests that there is no significant cognitive nor intellectual impairment correlated with the distinct phases of the menstrual cycle (Graham, 1980; Sommer, 1973).

Although the cognitive functioning of PMS sufferers has not been extensively investigated, a number of studies have examined cognitive performance of randomly selected women without regard to whether PMS was present or not.

Sommer (1971) investigated the perceptual-motor performance of twenty college women over a full menstrual cycle. The tasks included: aiming, flexibility of closure, number facility, speed of closure, and visualization. Results indicated no changes in performance in relation to menstrual cycle fluctuation.

A dual task with primary and secondary priority tasks was designed by Slade and Jenner (1979) to introduce the possibility of mental overload in 13 college students. Limits in capacity were represented by omissions and errors. Overall variation in performance over different phases of the cycle did not reach significance, although as the difficulty of the task increased, some variation in performance was observed.

Another study on cognition and the cycle (Dalton, 1968, as cited in Asso, 1986) reported that schoolgirls' average marks on ordinary and advanced level examinations were lower in the premenstrual phase than intermenstrually. However, the data were not statistically analyzed and hence inconclusive. Several subsequent studies (Sommer, 1972; Bernstein, 1977; Walsh et al., 1983; Asso, 1986) investigating the effects of the menstrual cycle on academic examinations revealed no cyclical fluctuations of examination test performance within the cycle.

In a study of simple reaction time and movement, Pierson and Lockhart (1963) failed to find any significant relationship between the phases of the menstrual cycle and the measures. Loucks and Thompson (1968) also failed to find a cyclic effect after measuring reaction time on Days 1, 3, 6 and 20 of the cycle.

A study of effects of the premenstrual phase on psychology degree examination scores was conducted on 26 women by Asso (1986). Comparisons of premenstrual and nonpremenstrual marks were made between and within individuals . No indication of fluctuations within the cycle were evident. Asso reports that if there were any effects on high-level cognitive functioning, these effects were compensated for by the students in the specific situation.

Findings such as those above suggest that women are not at a particular disadvantage during the premenstrual phase of the cycle. However, self-report measures of perceptual-motor and cognitive behavior present an altered picture. Some women believe that their judgement and mental faculties are impaired during this time (Sommer, 1973). Surprisingly, for some women this phase of the cycle provides a source of attribution for emotional arousal and in turn such causal attribution can have a positive effect. Rodin (1976) states that women who attribute symptoms such as frustration and task-produced arousal to symptoms of menstruation perform better than equally aroused women who had no similar source of attribution. Additionally, some women even view the PMS arousal as a positive motivating factor.

One of the methodological limitations of the studies designed to measure the effects of the menstrual cycle on test performance was that the subjects used were not evaluated for PMS. Consequently, it is possible that the effects related to severe PMS were averaged out. Furthermore, the subjects were younger, and it has been determined that PMS symptoms, if present, increase in severity as a function of age with a peak between the ages of 30-45.

While a substantial amount of work has been done on the assessment of the affective changes associated with the menstrual cycle, a paucity of work exists with respect to the cognitive and intellectual behavior of premenstrual woman. There is little data available that addresses various performance dimensions, perception variables and cognitive functions. As a result of this lack of data, generalizations are based primarily on clinical data, rather than on controlled empirical research.

In addition to insufficient attention being given to cognitive alterations during the menstrual cycle, earlier cognitive studies have been divided into those using objective and those using self-report measures. These studies have looked primarily at psychological and academic performance in undergraduate and graduate students. Since PMS increases with age (Andersch, Wendestam, Hahn, & Ohman, 1986), results of studies using a homogeneous younger age group may not adequately reflect the relationship between PMS and cognition for the more severe older age PMS sufferers.

Golub (1976) found no relationship between phase of the menstrual cycle and cognitive test performance, mood changes or on reports of cognitive impairment. In a month long study using the Menstrual Distress Questionnaire [(MDQ) (Moos, 1985)] and Temporal

Disorganization Scales (TDS) to look at subjective cognitive disorganization, Kirstein, Rosenberg, and Smith (1981a, 1981b) discovered that although concentration disturbance, behavioral change and negative affect were rated highest premenstrually, 23 of the 46 women (50%) reported very little cognitive change. Thus, not all women experiencing normal hormonal shifts experience premenstrual changes. A predominantly non-student population was used (median age 32.4). This study suggests that women do subjectively experience cognitive variations at different phases of the menstrual cycle which may not necessarily be reflected in performance.

Biopsychosocial factors, personal expectations, and negative experiences at the time of menarche have all been implicated in the etiology of premenstrual syndrome, but the available evidence is contradictory. Several hypotheses have been offered including hormonal factors, electrolyte and endorphin imbalance, abnormalities of angiotensin and renin, and neuroticism. It has also been demonstrated that women with severe PMS possess higher levels of trait anxiety than those with mild or no symptomology. A study by Gianni, Price, Loiselle, and Gianni (1985) showed the association of

PMS with elevated pseudocholinesterase levels, thus lending support to the hypothesis that there is a dependent biochemical disorder causing this condition. Factors that may have led to the increased interest in PMS may include: 1) development of a biological basis and effective treatment for dysmenorrhea; 2) media exposure; and 3) conflicting career and family demands.

Premenstrual and menstrual phases are the times when circulating gonadal hormones (estrogen and progesterone) reach their lowest levels. Progesterone is secreted by the corpus luteum beginning in mid-cycle and reaches a peak four to seven days prior to menses, after which it falls off quite rapidly. The estrogenic build-up during the first half of the cycle is usually accompanied by a sense of well-being and alertness. The problem of determining the hormonal status of the subjects is a difficult one. Most studies are done under the assumption of a 28 day menstrual cycle, when in fact there is much variability. The requirement of a history of regular menstrual cycles for potential subjects results in the exclusion of some women who are irregular. Steps should be taken to avoid systematic exclusion of women with irregular cycles in studies of PMS since Hain et al (1978)Hain et al (1970) found cycle irregularity to be associated with premenstrual and menstrual symptomology.

Another methodological flaw present in previous studies is the lack of consistency of phase definition. "Premenstrual" refers to a phase which may range from the entire week preceding onset of menses to as few as two days prior, depending upon how it is defined in a particular study. Another problem involves subjective and objective factors and the vague quality of the reported symptoms such as "difficulty concentrating."

Furthermore, diagnostic tools need to be unambiguous and reliable, especially for longitudinal studies covering several cycles. The Moos Menstrual Distress Questionnaire (MDQ) is a 47 item self-report instrument which has been employed for several years as a reliable and valid measure for determining the absence or presence of PMS. The questionnaire measures eight areas of functioning, one of which is the concentration factor that addresses cognitive functioning (forgetfulness, lowered judgement, confusion, difficulty in concentrating and distractibility).

It might be possible to use a cognitive task as a diagnostic tool to better detect, assess, and summarize specific cognitive patterns premenstrually. This would lend further specificity to the definition of PMS, as well as providing additional understanding for professionals and PMS sufferers. There also needs to be longitudinal cognitive studies comparing PMS and Non-PMS women 30 and over, since these are the women who are affected most adversely by PMS.

The present study was designed to investigate cognitive functioning (attentional capacity) in PMS and Non-PMS women ranging in age from 32-43. Its purpose was to determine whether cognitive changes, as measured by attention tasks, vary across the cycle between the two groups and whether such changes are congruent with self-report. A task was designed to tap into high level, complex cognitive functioning, with the following purpose: 1) to follow the subjects longitudinally over three consecutive menstrual cycles in order to examine possible decrements in concentration, attention, recognition and reaction time correlated with menstrual phases; and 2) to investigate variations in performance between and within groups.

A computer program task was designed to assess cyclical variations of cognitive functioning. The rationale of the study was to see if decrements in concentration and attentional capacity existed during the PMS phase of the cycle, and to look at any variance in performance between the PMS and Non-PMS groups. Several measures were embedded in the task:

1. Performance on a selective attention task
2. Short term memory task
3. Combination of the two tasks

Method

Subjects

Participants in the experiment were 16 women volunteers. The subjects were recruited from psychology classes and from among the experimenter's friends. The subjects ranged in age from 27 to 43, with a median age of 36 years.

Subjects were selected and assigned to groups on the basis of interviews and self-report. Group assignment was later verified by scores on the MDQ. Summing the scores on the MDQ established the presence and severity of PMS. The cut off for the presence of PMS (60) was determined by the average premenstrual distress score. On the basis of this information, subjects were assigned to either the PMS or Non-PMS group. Due to a discrepancy between the self-report and scores on the MDQ, 6 of the subjects were reassigned (3 from each group). Eight of the women were assigned to the PMS group and 8 to the Non-PMS. An additional 7 subjects agreed to participate in the experiment but failed to complete the tasks. Six of the subjects attended half of the sessions, while one subject was eliminated due to onset of menopause. Each of the remaining subjects participated in 6 sessions over 3 consecutive months. The mean age for the PMS women was 37.6, and 34.5 for the Non-PMS.

Appointments were scheduled 5 days prior to menses (PMS phase 1) as estimated by the subjects, and 7 days following first day of menses (post-menstrual phase 2). An attempt was made for an equal number of subjects to begin each phase for counterbalancing. Of the subjects who completed the experiment, 6 began with the PMS phase and 10 began with the post PMS phase.

Apparatus

Presentation of stimuli, recording of responses and the measurement of response latencies were controlled by an Apple IIe microcomputer. Subjects were allowed to observe the computer display at the distance they found most comfortable.

Procedure

Upon entering the psychology laboratory the subject was greeted by a lab assistant, ushered into an adjacent room and seated in front of the computer. At the beginning of each session, instructions were presented on the screen. During the first session the research assistent answered questions about the task and familiarized the subject with the procedure. Following the instructions, the subject entered information data (subject number, age and condition) and was left to complete the task.

Subjects participated in a digit span task, a letter detection task and a combination of the two. The 48 trials for each task were randomly interspersed for a total of 144 trials for each session.

Digit span. Four to 9 digits were presented in the center of the screen at the rate of one per second. Subjects were asked to recall the digits in the order of presentation. Following the presentation of the last digit, there was a three second delay, followed by a display of blanks equal in number to the preceding series. If the subject noted an error in entering the series, she was able to correct her response until the last digit was entered. Forty-eight trials were presented, with the 6 different series lengths (4 -9 digits) randomly presented eight times each.

Letter detection. The letter detection task required the subject to detect an X in the field of similar letters. The task was similar to that employed by Neisser (1963, 1964). A matrix consisting of 6 lines of 4 letters was presented in the center of the screen. The letters VNKY were randomly placed throughout the matrix. The subject was to report whether a target X was displayed within the matrix. On 12 of the 48 trials, no X was present, and on 36 of the trials an X was present. The subject was to indicate whether the target was present by pressing the "D" (yes) or "K" (no) key, with the index finger of either the left, or right hand, as soon as the target was detected. Once the matrix was displayed, it remained on the screen until the subject responded or 2 1/2 seconds elapsed. If the response latency was longer than 2 1/2 seconds, the trial was aborted and immediately replaced by another trial.

Combined task. A third task was a combination of the above tasks. The initial display was the series of digits, followed by the letter detection task and then the recall of the digits. The length of the series of digits varied randomly. The target was systematically varied throughout the matrix for each series length.

The subjects were informed by a message on the screen when half of the trials had been completed and were instructed to take a short break if they so desired. The entire procedure took about 45 minutes.

Results

Digit Span Task

An Analysis of variance (ANOVA) was performed on the percentage-correct data from the digit span task. Variables included in the analysis were presence of PMS, phase (either luteal or follicular(post-menstrual)], the presence or absence of the letter detection task (LDT), the size (number of digits), and the session number (1-6) [PMS x Phase x LDT x Size x Session x Subjects within PMS].

The mean percentage of correct responses on the digit span task for PMS and Non-PMS women in both phases of the cycle are displayed in Table 1. There was no main effect of PMS [$F(1,14)$, $p<1$] nor any significant interaction of PMS with any other factors. There were no significant PMS by phase [$F(1,15) = 1.85$, $p>.05$], PMS by LTD [$F(1,15)$ $p<1$], nor PMS by size [$F(5,75)$ $p<1$] interactions.

Table 1

Insert Table 1 about here

The main effect of phase approached significance [$F(1,15) = 3.14$, $p < .10$] unexpectedly, with better performance during the luteal phase, as did the phase by size [$F(5,75) = 2.16$, $p < .10$] and phase by LDT [$F(1,15) = 3.59$, $p < .10$] interactions. There were also significant phase by session [$F(5,74) = 16.00$, $p < .001$] and Phase x LDT x Session [$F(5,75) = 2.52$, $p < .05$] interactions. Unfortunately, phase and session were confounded. Attrition of subjects resulted in a greater number of subjects beginning in the follicular phase. This may have contributed to a practice effect which resulted in percentage correct in the luteal phase being on average greater than in the follicular phase (for the first two sessions).

The main effect of LDT was significant [$F(1,15) = 26.37$, $p < .001$]. The presence of the letter detection task greatly reduced performance on digit span. Further tests evaluating the LDT by size [$F(5,75) = 4.64$, $p < .001$] revealed significance.

Session main effects were statistically significant [$F(5,75) = 5.72$, $p < .001$. However, there was no consistent pattern of improvement in performance after the first two sessions. Mean percentage of correct responses for the entire population (average of PMS and Non-PMS subjects) for each session is seen in Table 2.

Table 2

Insert Table 2 about here

Letter Detection Task

Data for trials which the target was present were analyzed separately from the no-target trials. Separate ANOVAS (PMS x Phase x DST x Size x Session) were performed on reaction time (RT) and percent correct for both of these kinds of trials [See Table 3].

Table 3

Insert Table 3 about here

Reaction time. When no target was present, the effect of PMS was statistically significant [$F(1,14) = 6.82$, $p<.05$]. Subjects with PMS were slower than subjects without PMS [PMS = 2082 ms; Non-PMS = 1608 ms]. Contrary to expectation, subjects in the follicular phase were significantly slower [$F(1,15) = 4.71$, $p<.05$]

than in the luteal phase [luteal phase = 1813 ms; follicular phase = 1877 ms]. The presence of the digit span task significantly increased RT [$F(1,15) = 7.28$, $p<.05$]. No interactions were significant.

With the target present statistically significant effects of PMS [$F(1,14) = 6.48$, $p<.05$], and digit span [$F(1,15) = 7.25$, $p<.05$] were seen. No phase effect [$F(1,15) = 2.39$, $p>.05$] or interactions were significant.

Percentage correct. The same two analyses (target present and target absent) were performed on the percentage correct data. PMS subjects were slightly more accurate than non-PMS women, but this difference was not statistically significant. The only statistically significant effect was the effect of the presence of the digit span task when target was not present [$F(1,15) = 9.26$, $p<.05$]. The effect of digit span on RT for target present and target absent trials is shown in Table 4.

Table 4

Insert Table 4 about here

In summary, PMS women did not do any worse on the digit span task than their Non-PMS counterparts. However, the PMS subjects took longer on the letter detection task regardless of phase. Neither PMS nor Non-PMS women showed performance deficits during the luteal phase of the menstrual cycle.

Discussion

This study was conducted to determine if PMS women exhibit decrements in concentration during the PMS phase of their cycle. We also looked at possible decrements in intellectual functioning as measured by attentional capacity. Earlier studies suggest no cyclical fluctuation nor cognitive impairment correlated with the different phases of the menstrual cycle. In the present study, subjects' performance did not vary across the cycle. There were no differences between PMS and Non-PMS on digit span task. PMS subjects took slightly longer on LDT but were as accurate as Non-PMS subjects.

The digit span task tested the subjects' capacity. None of the subjects were consistently able to remember the longest series of digits. However, no significant differences were seen between groups or across the cycle on this task. This is surprising because difficulty in concentrating and memory are considered symptomatic in PMS.

On the letter detection task there was a difference between the groups. This difference was seen in the response latency of the PMS women across both phases. Although the RT was slower, there was no phase effect, nor did accuracy vary across the cycle. It is possible that PMS women are more careful. What may be peculiar to PMS women is that they learn to compensate during the PMS phase of the cycle and this cognitive style is adopted even during the Non-PMS phase.

A task was designed with the intent to be able to detect distractibility or difficulty concentrating for premenstrual subjects. If not detected, then one might conclude that either the task was not sensitive to variations within the menstrual cycle or subjects are able to compensate for the difficulty of the task. The results show that if there is any decrement in performance during the premenstrual phase, this is a small effect even in those who complain of mood changes and self-reported PMS (congruent with Kirstein et al., 1981). It appears that the intrinsic ability to perform difficult tasks is not itself impaired. Nevertheless, many women report decreased ability to concentrate just prior to and during menstruation (Kirstein et al., 1981). This perceived deficit may be attributable to a negative self-evaluative bias rather than an actual cognitive deficit.

Subjects for the most part were successful professionals, who must have compensated for any cognitive deficits attributable to PMS in order to reach their positions. The same might be true for the majority of successful students. If there are women genuinely incapacitated by PMS symptoms they were not included in this study. Thus, this study may have selected subjects who have learned to function at a high level despite their symptoms.

Motivation in a test situation where subjects were attempting to do their best must also be considered. The subjects were highly motivated and approached this task as a challenge to their abilities and self-esteem. It is possible that such highly motivated performance is not typical functioning.

Our investigation suggests that PMS women will not exhibit performance decrements at the PMS phase of their cycle. This may be due primarily to the fact that PMS women are able to attribute cognitive difficulties to PMS and are able to compensate for any problems they may have at this phase of their cycle. To increase the sensitivity of the measures in the present study the focus was upon 5 days prior to onset of menses and 7 days after the onset of menses (Endicott, Nee, Cohen, & Halbreich, 1986). These two time periods were selected because the 5 days prior to menses will usually include the most severe changes, and the week following the onset of menses (the follicular phase, Days 3-13) will usually result in a return to a baseline level.

The rationale for this study was based in part on the literature which suggests that women have more difficulty concentrating and attending to complex cognitive tasks during the premenstrual phase of the menstrual cycle. Evidence to date concerning a possible relationship between the menstrual cycle and cognitive performance is largely negative. However, the research has been limited in that tasks used have not required full cognitive capacity.

Furthermore, since earlier studies indicate that women in their 30's and 40's experience more cognitive decrements as opposed to younger women who report more somatic complaints, our investigation used a 27-43 age sample. The results support previous research which suggests PMS women, while reporting cognitive decrements, exhibit stable performance across various stages of the menstrual cycle on complex tasks.

Although this study was designed as three separate tasks [digit span, letter detection, and a combination of the two forementioned tasks] to detect whether women have difficulty holding one task in memory while performing the second, it is possible that the two tasks became one, as in the combination. The results suggest that women can selectively attend/focus on one task [hold this in memory, perform a second task, and recall the first task] and maintain consistent performance levels at two phases of the cycle. In addition, there appears to be little variability of performance between the PMS AND Non-PMS groups, with the exception of response latency during the LDT task.

In this study, subjects were scheduled at different hours of the day to perform the tasks. Future studies might look at cognitive performance with the time of day held constant to address a possible correlation between circadian rhythm, cognitive performance, and peak periods of the hormonal levels. A future investigation might extend the post menstrual phase by taking the second measure 10 days following the onset of menses instead of 7.

One idiosyncratic finding of our study was the verbal reports of the research assistants concerning the behavior of the PMS women during the PMS phase of their cycle. The reports suggest that the PMS women at the PMS phase of their cycle were excessively rude, impatient and un-cooperative. It might be interesting to design a study whereby the women's behavior in the reception area would be monitored by blind rater/observers, prior to the subjects' performing a mock task, in which the pretrial behavior, not the task, would be the focus of study. Such a study would be informative. Another good source of information might be gathered by "significant others" in the subjects lives, i.e. family members, friends, and colleagues.

Clinicians are faced with increasing numbers of patients who are requesting diagnosis and treatment for premenstrual distress. Clinical description as well as the search for correlates of premenstrual changes would be enhanced if diagnostic tools were available to better detect and discern underlying cognitive changes and their possible impact on functioning.

The results of this study, which revealed no significant cognitive impairment premenstrually can be interpreted as positive. Contrary to previous beliefs that some high level position should not be filled by women because of their inability to maintain consistency in performance throughout their menstrual cycle, the present study suggests that such is not the case. The results are consistent with some prior research which indicate that PMS sufferers are able to compensate adequately and perform as well as Non-PMS women on a variety of tasks.

References

Andersch, B., Wendestam, C., Hahn, L., & Ohman, R. (1986). Premenstrual complaints: Prevalence of premenstrual symptoms in a Swedish urban population. Journal of Psychosomatic Obstetrics and Gynaecology, 5, 39-49.

Asso, D. (1986). Psychology degree examinations and the premenstrual phase of the menstrual cycle. Women & Health, 10, 91-104.

Bernstein, B. E. (1977). Effect of menstruation on academic performance among college women. Archives of Sexual Behavior, 6, 289-296.

Dalton, K. (1968). Menstruation and Examinations. Lancet, 2, 1386-1388.

Delaney, J., Lupton, M. J., & Toth, E. (1976). The curse: A cultural history of menstruation. NY: New American Library.

Endicott, J., Nee, J., Cohen, J., & Halbreich, U. (1986). Premenstrual changes: patterns and correlates of daily ratings. Journal of Affective Disorders, 10, 127-135.

Gianni, A. J., Price, W. A., Loiselle, R. H., & Gianni, M. C. (1985). Pseudocholinesterase and trait anxiety in premenstrual tension syndrome. Journal of Clinical Psychiatry, 46(4), 139-140.

Golub, S. (1976). The effect of premenstrual anxiety and depression on cognitive function. Journal of Personality and Social Psychology, 34, 99-104.

Graham, E. A. (1980). Cognition as related to menstrual cycle phase and estrogen level. In A. J. Dan, E. A. Graham, & C. P. Beecher (Eds.), The menstrual cycle. (Vol.1, pp. 190-208). NY: Springer Publishing Company.

Hain, J. D., Linton, P. H., Eber, H. W., & Chapman, M. M. (1970). Menstrual irregularity, symptom, and personality. Journal of Psychosomatic Research, 14, 81-87.

Harrison, W., Sharpe, L., & Endicott, J. (1985). Treatment of premenstrual symptoms. General Hospital Psychiatry, 7, 54-65.

Kirstein, L., Rosenberg, G., & Smith, H. (1981a). Cognitive changes during the menstrual cycle. The International Journal of Psychiatry in Medicine, 10(4), 339-346.

Kirstein, L., Rosenberg, G., & Smith, H. (1981b). Cognitive changes during the menstrual cycle.

International Journal of Psychiatry in Medicine, 10, 339-346.

Loucks, J., & Thompson, H. (1968). Effect of menstruation on reaction time. Research Quarterly, 39, 407-408.

Moos, R. H. (1985). Perimenstrual symptoms: A manual and overview of research with the menstrual distress questionnaire. Social Ecocology Laboratory, Department of Psychiatry and Behavioral Sciences, Stanford University and Veterans Administration Medical Center. Palo Alto, CA.

Neisser, U. (1963). Decision-time without reaction-time: Experiments in visual scanning. American Journal of Psychology, 76, 376-385.

Neisser, U. (1964). Visual search. Scientific America, 210(6), 94-102.

Pierson, W. R., & Lockhart, A. (1963). Effect of menstruation on simple reaction and movement time. British Medical Journal, 1, 796-797.

Rodin, J. (1976). Menstruation, reattribution and competence. Psychosomatic Medicine, 34, 263-269.

Rubinow, D. R., & Roy-Byrne, P. (1984). Premenstrual Syndromes: Overview from a methodological perspective. The American Journal of Psychiatry, 141(2), 163-172.

Slade, P., & Jenner, F. A. (1979). Performance Tests in Different Phases of the Menstrual Cycle. Journal of Psychosomatic Research, 24, 5-8.

Sommer, B. (1971). Perceptual-motor performance, mood, and menstrual cycle. Presented at the meeting of Western Psychological Association, Portland , Oregon.

Sommer, B. (1972). Menstrual cycle changes and intellectual performance. Psychosomatic Medicine, 34, 263-269.

Sommer, B. (1973). The effect of menstruation on cognitive and perceptual-motor behavior: A review. Psychosomatic Medicine, 35, 515-534.

Sommer, B. (1982). Cognitive Behavior and the Menstrual Cycle. In R. Friedman (Ed.), Behavior and the menstrual cycle. (pp. 101-127). NY: Marcel Dekker.

Walsh, R. N., Budtz-Olsen, I., Leader, C., & Cummins, R. A. (1981). The menstrual cycle, personality, and academic performance. Archives of General Psychiatry, 38, 219-221.

Table 1

Mean Percentage of Correct Responses for PMS and Non-PMS Women in Phase 1 and Phase 2 in digit span task.

	PMS	Non-PMS
Phase I	.614	.667
Phase 2	.611	.640

Table 2

Mean Correct Responses of PMS and Non-PMS Subjects for Each Session.

	Mean % correct	SD
For PMS & Non-PMS	.633	.360
Session		
1	.576	.368
2	.616	.365
3	.655	.359
4	.638	.356
5	.652	.350
6	.661	.356

Table 3

Reaction Time (RT) of PMS and Non-PMS Subjects During Trials in which Target was Present and Target was not Present.

	Reaction time			
	Target present		Target not present	
	Phase 1	Phase 2	Phase 1	Phase 2
PMS	1116	1200	2038	2126
Non-PMS	961	1006	1588	1629