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Title: Multivariate Profile Analysis of Premenstrual Symptomatology.

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Data regarding the severity of premenstrual symptoms were collected from three groups of women: women over age 24 years seeking care from a gynecological practitioner, undergraduates at OSU living in student dormitories, and graduate students enrolled at OSU. The symptoms evaluated were depression, tiredness, irritability, anxiety, headache, breast swelling and tenderness, craving for sweets, craving for salty foods, binge eating, and acne. Symptoms were rated on a scale of zero (not present) to three (severe). Multivariate profile analysis was used to evaluate the hypothesis that the profiles formed by the mean vectors of these premenstrual symptoms were parallel with regard to symptom severity, age, consumption of caffeinated beverages and refined sugar, maternal history of premenstrual syndrome (PMS) and recent use of oral

contraceptives. Parallel profiles were further evaluated for coincidence. Results of the analysis indicated that in each of the three samples of women studied, the presence of premenstrual symptomatology was indicated by one pattern of symptom severity, and that this pattern remained constant as symptoms became more severe. The variability in the premenstrual symptoms could be explained by the inherent variability of the women studied, a finding which does not support the existence of multiple subtypes of PMS. Evidence of a positive association between age and increasing symptom severity was found only in the graduate student group. High levels of consumption of caffeine were shown to exacerbate premenstrual symptoms among the graduate students, and frequent consumption of refined sugar and "junk food" were shown to exacerbate symptoms among older women. Increased symptom severity of premenstrual symptoms in women whose mothers suffered from PMS was noted only among undergraduate students. No evidence was found to implicate oral contraceptive use in the exacerbation or amelioration of premenstrual symptoms.

Multivariate Profile Analysis of Premenstrual Symptomatology

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Introduction

The first systematic description of premenstrual syndrome (PMS) is credited to Robert Frank, an American physician. In 1931, he described "a large number of women who are handicapped by premenstrual disturbances of a manifold nature" (Frank, 1931). He was, however, unable to provide a precise definition for PMS.

The definition of PMS has remained vague and has come to refer to "a collection of disturbances in mood or physical symptoms that occur regularly and repetitively before menses and remit once menses begins" (Spitzer, Severino, Williams, et. al., 1989). Attempts to refine this definition have been made to provide standardization for health professionals and the research community.

The etiology of PMS is not known. Many hypotheses have been suggested, addressing potential psychological, cultural and biological causes. It has been suggested that several subtypes of PMS may exist, each the result of a distinct pathophysiologic process. Several schemes for

categorizing subtypes of PMS have been proposed. However the issue of whether variation in premenstrual symptoms is attributable to multiple processes or the individualized expression of one underlying process remains unresolved.

The goal of this study is to investigate the manner in which premenstrual symptoms which characterize the syndrome and to determine whether age, consumption of caffeinated beverages and refined sugar, maternal history of PMS and recent use of oral contraceptives affect the patterns in which these symptoms are present.

Diagnosis of PMS

In 1983, the National Institute of Mental Health (NIMH) formulated guidelines for the diagnosis of PMS. The NIMH gudielines recommended that "a diagnosis of premenstrual syndrome (PMS) should be made when symptom intensity changes at least 30% in the premenstrual period (6 days before menses) compared with the intermenstrual period (days 5-10 of the cycle)" for two consecutive months. The guidelines did not specify which symptoms were to be evaluated, but did specify the intensity and timing of the symptoms in diagnosis (Anderson, Severino, Hurt, et. al., 1988).

More than 150 different symptoms have been associated with the menstrual cycle. The most commonly reported affective symptoms are depression, irritability, tension, mood lability and lethargy. The most commonly reported physical symptoms are breast tenderness, headache and edema (Gitlin and Pasnau, 1989).

In an attempt to provide further standardization to the definition of PMS for mental health professionals and the research community, five diagnostic criteria for late luteal phase dysphoric disorder (LLPDD) were included as an appendix to the *DSM-III-R*. The term "PMS" was avoided since this term is often used to describe premenstrual

disturbances limited to physical symptoms. The term "LLPDD" acknowledges that nonmenstruating women with intact ovaries may experience symptoms. The first criterion specifies the temporal relationship between LLPDD and phase of the menstrual cycle. The second criterion lists ten symptoms: marked affective lability; persistent and marked anger or irritability, marked anxiety, tension, feelings of being "keyed up," or "on edge"; markedly depressed mood, feelings of hopelessness, or self-deprecating thoughts; decreased interest in usual activities; easy fatigability or marked lack of energy; subjective sense of difficulty in concentrating; marked change in appetite, overeating, or specific food cravings; hypersomnia or insomnia; and other physical symptoms, such as breast tenderness or swelling, headaches, joint or muscle pain, a sensation of "bloating," and weight gain. Five of these symptoms must be present for a diagnosis of LLPDD to be made, at least one of which must be a mood disturbance. Physical symptoms are given less weight than the behavioral symptoms. The third criterion specifies that the symptoms must be severe enough to impair functioning, interfering with work or with usual social activities and relationships with others. The fourth criterion requires that the symptoms not be an exacerbation of another disorder, allowing for differential diagnosis of LLPDD. The fifth criterion requires confirmation by daily ratings. Studies have shown that in many women reporting severe premenstrual syndrome, the symptoms are not as

severe in prospective daily ratings as when they are reported retrospectively and that the symptoms do not remit with the onset of menses (Endicott and Halbreich. 1982; Rubinow, Roy-Byrne, and Hoban, 1984). The requirement for daily self-ratings serves to verify the timing, severity, and consistency of the symptoms. Prospective daily records are used to confirm a diagnosis of PMS, not to quantify the level to which it may be present. The *DSM-III-R* criterion state that without prospective record-keeping, only a provisional diagnosis may be made (Spitzer, Severino, Williams, et. al., 1989).

Studies have suggested that when the syndrome is strictly and carefully defined, it is relatively rare. One study reported a prevalence of 4.6 per cent (Rivera-Tovar and Frank, 1990). It has also been suggested that retrospective data may lead to overestimation of the prevalence of PMS. Rubinow and Roy-Byrne (1984) and Halbreich and Endicott (1985) found that in approximately 50 per cent of women reporting histories of premenstrual changes, the changes could not be confirmed with prospective daily record-keeping. However, the validity of prospective daily records has been questioned because such detailed record-keeping requires highly cooperative motivated women, who may not be representative of the general population (Dennerstein and Burrows, 1979).

The process of prospective record-keeping itself may influence the reported severity of premenstrual symptoms. Gise, Lebovits, Paddison and Strain (1990) found that 81% of women with prospectively confirmed PMS improved significantly during the prospective evaluation period. They noted that after one month of evaluation, some women's symptoms had improved to the extent that they no longer felt it necessary to continue the evaluation. The authors speculate that women may be better able to control premenstrual symptoms once they become aware of exactly what the symptoms are and how they are correlated with the menstrual cycle. Since confirmation of the diagnosis of PMS with daily ratings may have a tendency to ameliorate the condition, reports of symptom severity based on such ratings may be biased.

It has been suggested that retrospective reports may provide a more general description of a woman's overall experience than prospective data, particularly when the prospective data is derived from one atypical cycle. Hart, Coleman, and Russell (1987) found that marked inter-cycle variability was present in prospective daily ratings and noted that when daily symptom ratings for more than one cycle are not feasible, retrospective symptom ratings may be clinically useful in diagnosing PMS and relatively valid.

Literature Review

Severity of Symptoms

PMS has been defined as a "constellation of mood, behavior, and/or physical symptoms that have a regular cyclical relationship to the luteal phase of the menstrual cycle; are present in most (if not all) cycles; and remit by the end of menstrual flow with a symptom-free interval of at least one week per cycle" (Gitlin and Pasnau, 1989). This definition is vague, and allows for much variation in the manner in which the syndrome manifests. Patterns in symptomatology have been difficult to detect, since researchers have not always evaluated similar subsets of symptoms. It has been suggested that for most women, changes in negative affect occur randomly throughout the menstrual cycle, not only in the premenstrual phase (Slade, 1984).

The reported severity of premenstrual symptoms may be affected by the method by which symptom severity ratings are collected: retrospectively or prosepectively. Endicott and Halbreich (1982) found that retrospective reports of PMS were most likely to be confirmed with prospective daily records among women reporting severe symptoms retrospectively. They found that after a period of daily record-keeping, the pattern of premenstrual symptom

severity was similar to that reported prior to the daily record-keeping, but that the severity levels tended to be lower.

Some researchers question the presence of one type of premenstrual syndrome. Moos (1969) found eight symptom clusters which he hypothesized represented distinct subtypes of PMS. Moos hypothesized that different subtypes of PMS were present in the women he observed since some women exhibited high scores in one symptom cluster but low in others. Abraham (1983) has divided PMS into four distinct subtypes: PMT-A, associated with premenstrual anxiety, irritability, and nervous tension, PMT-H, associated with symptoms of water and salt retention, bloating and weight gain, PMT-C, characterized by increased craving for sweets, and PMT-D, associated with depression, withdrawal, insomnia, forgetfulness and confusion. However, Hargrove and Abraham (1982) found that only 50% of patients 702 women studied could be classified into one pure subtype. The remaining women had symptoms associated with two, three, or even all four subtypes.

Halbreich and Endicott (1985) differentiated between several subtypes of premenstrual changes: impairment in social functioning, "organic" mental syndrome, impulsive syndrome, water retention syndrome, general discomfort

syndrome, and increased well-being syndrome. The authors noted, however, that the manner in which the subjects were obtained probably increased the prevalence women exhibiting depressive changes above that of randomly selected women. In general, women who seek treatment for PMS suffer symptoms of greater intensity and duration, and these symptoms are sufficient to meet criteria for typological categories with greater frequency than those of an average sample from the general population (Gerstein, Reznikoff, Severino, and Hurt,1989).

The presence of different subtypes of PMS would imply that several pathophysiologic processes were at work. However, since researchers have been unable to demonstrate a scheme of subtypes that are mutually exclusive, it is quite possible that the different manifestations of premenstrual symptoms reflect individual differences in the expression of a single pathophysiologic process.

Age

Gough (1975) found age to be positively correlated with premenstrual distress. Lloyd (1963) reported that PMS is most prevalent in women over age 30.

The belief that PMS occurs more frequently in women over 30 years of age may be due to peculiarities in the sample populations studied, which were often taken from gynecological outpatient clinics in which older women were predominant (Reid, 1985). Other studies have not demonstrated that age is a predisposing factor (Kessel and Coppen, 1963; Rivera-Tovar and Frank, 1990; Banks and Beresford, 1979; Halbreich, Endicott and Nee, 1983; Ainscough, 1990).

Laessle, Tuschl, Schweiger and Pirke (1990) evaluated mood changes and physical complaints in healthy young women during normal menstrual cycles. They concluded that in most healthy young women, cycle-related hormonal fluctuations were not accompanied by marked affective changes, but that specific physical complaints were present during the premenstrual phase.

Caffeine consumption

Rossignol (1989) found that tea consumption was strongly related to the prevalence of PMS in data collected in the People's Republic of China. Rossignol (1990) also found that, among women with severe premenstrual symptoms, the prevalence odds ratios for PMS increased with the amount of caffene-containing beverage consumed per day. In the latter study, the effects were observed in both caffeine-containing coffee/tea consumers and in caffeine-containing soda consumers.

One suggested mechanism explaining the relationship of caffeine consumption and PMS involves the interaction of caffeine and progesterone. Caffeine antagonizes the depressant action of adenosine, a purine released by neurons in the cerebral cortex. The depressant effect of adenosine is potentiated by progesterone, which inhibits its reuptake into nerve and glial cells. As progesterone levels fall during the premenstrual period, the stimulant actions of caffeine become more powerful, which may account for the increases in tension, anxiety, and irritability that occur premenstrually in many women (Phillis, 1989).

Refined sugar and "junk food" consumption

It has been suggested that increased caloric intake during the premenstrual phase of the menstrual cycle exacerbates premenstrual symptomatology. Giannini, Price, Loiselle and Giannini (1985) found that among 20 young women, more severe premenstrual symptomatology was associated with increased caloric intake during the premenstrual phase. Wurtman, Brzezinski, Wurtman and Laferrere (1989) found that women whose daily caloric intake increased by approximately 500 calories per day during the premenstrual phase demonstrated markedly increased depressive symptomatology premenstrually, while women whose did not suffer from premenstrual mood changes exhibited no change in caloric intake. They found that consumption of a carbohydrate-rich, protein poor evening meal during the late luteal phase reduced depression, tension, anger, confusion, sadness, fatigue scores, and increased alertness and calmness scores.

Carbohydrate craving may be the result of decreased serotonin availability. Serotonin, a derivative of tryptophan, regulates both mood and the amount of carbohydrate an individual chooses to eat. When foods rich in carbohydrate, but poor in protein, are consumed, insulin is secreted which facilitates the uptake of tryptophan into the brain. When protein is consumed, the

concentrations of other, competing amino acids are increased, resulting in decreased conversion of tryptophan into serotonin within the brain (Wurtman, 1990).

Maternal history of PMS

Chern, Gatewood and Anderson (1980) found that certain menstrual traits, such as age at menarche, appear to be inherited, while others, such as menstrual interval and duration of flow, may be more influenced by factors other than genetics. Kantero and Widholm (1971) found age at menarche, premenstrual tension, duration of flow and dysmenorrhoea to be highly correlated between mothers and their daughters.

Oral Contraceptive Use

Warner and Bancroft (1988) found that women using oral contraceptives were less likely to report a decrease in feelings of well-being during the premenstrual phase than were women not using oral contraceptives. Graham and Sherwin (1987) found established oral contraceptive users report less severe, less frequent premenstrual symptoms. Walker and Bancroft (1990) found that among two groups of oral contraceptive users and a control group not using oral contraceptives, the only variable assessed that showed a

clear difference among groups was "breast tenderness:" the monophasic group (women established on low dose "combined" pills with stable levels of estrogen and progestagen) showed less premenstrual breast tenderness than women in the triphasic group (women established on low dose pills with escalating progestagen dosage) or in the group of women not using oral contraceptives.

Methods and Methodology

The data for this study consist of responses to a questionnaire which requested information about the respondent's premenstrual symptoms, menstrual symptoms, sugar and fluid intake, past history of parity, endometriosis and gynecological surgical procedures. A copy of the questionnaire, the Women's Health Survey, is included in Appendix 1. The questionnaire was administered to three groups of women: 1,419 undergraduates at Oregon State University (OSU) living in student dormitories, 895 graduate students enrolled at OSU, and women over age 24 years seeking care from gynecological practitioners. The surveys were mailed to the OSU undergraduate students in 1988-89, and to graduate students in 1990-91. If no response was received within three weeks, a followup request was mailed. The women seeking care from a GYN practitioner received the survey at the practitioners' offices in 1990-91. Eight hundred sixty-nine undergraduate students (61 percent), 638 graduate students (71 percent), and 478 older women returned the survey. The median age of the undergraduate students was 19 years (range 17-35). The mean age of the graduate students was 30 years (range 24-53). The median age of the older women was 35 years (range 25-51).

Among the data collected were severity ratings of ten premenstrual symptoms: depression, tiredness, irritability, anxiety, headache, breast swelling and tenderness, craving for sweets, craving for salty foods, binge eating, and acne. These symptoms were rated on a scale of zero to three, with zero signifying not present and three signifying severe. These symptoms are standardly used to diagnose PMS. A subset of 43 women were also asked to complete prospective daily ratings. The daily ratings were consistent with the responses given by these same women to the Women's Health Survey for women who experienced no or many premenstrual symptoms, but were less consistent for other women. Throughout the analyses, cases were deleted in which a past or unknown history of endometriosis, hysterectomy or oophorectomy were indicated. Cases in which the value of the stratifying variable was unknown were deleted from that section of the analysis only.

The premenstrual symptoms were separated into two categories: an affective component, consisting of (1)depression, (2)tiredness, (3)irritability and (4)anxiety, and a physical component, consisting of (5)headache, (6)breast swelling and tenderness, (7)craving for sweets, (8)craving for salty foods, (9)binge eating, and (10)acne. In the figures throughout this thesis, these symptoms appear in this order.

The premenstrual symptoms of the three groups of women were compared. In each section of the analysis, the population under evaluation was divided into groups, either by presence or absence of, or level of a particular attribute. A mean vector was computed for each group. All mean vectors for a particular analysis are shown graphically in the figures, to facilitate visualization of the relationships.

The severity of premenstrual symptoms was assessed by calculating one overall measure, labelled *"pmsscore"*. *Pmsscore* was obtained by adding the symptom values for the ten premenstrual symptoms evaluated.
That is, *pmsscore* = Σ premenstrual symptoms, for i=1(depression), i=2(tiredness), i=3(irritability), i=4(anxiety), i=5(headache), i=6(breast swelling and tenderness), i=7(craving for sweets), i=8(craving for salty foods), i=9(binge eating), and i=10(acne).
The *pmsscores* were divided into five groups: *0-4, 5-9, 10-14, 15-19,* and *20-28* (for undergraduate students), *20-26* (for graduate students) or *20-29* (for older women).
Affective and physical symptom profiles were compared separately among groups. Each symptom profile first was compared with the profile of the next to observe the progression of the symptom profiles with increasing severity of symptomatology. The profiles are expected to

increase in height with increases in values for *pmsscore*. Such increases in height may be due to increasing severity of symptoms in one component, either the affective or physical, or both. The profile for *pmsscore 5-9* was used as a reference profile, against which *pmsscore 15-19* and *pmsscore 20-28* (for undergraduate students, *20-26* for graduate students and *20-29* for older women) were compared. *Pmsscore 0-4* was not used as a reference profile since by definition the syndrome is not present in these women.

Multivariate profile analysis was used to evaluate these data. In multivariate profile analysis, a battery of p treatments (here, survey questions) is administered to two or more groups of subjects (Johnson and Wichern, 1988). The responses for the different groups are assumed to be independent. Evaluation of the equality of population mean vectors is accomplished through three steps:

(1) evaluation of parallel profiles,
(i.e., $H_{01}: \mu_{1i} - \mu_{1i-1} = \mu_{2i} - \mu_{2i-1}$, $i=2,3, \ldots p$);

(2) given parallel profiles, test for coincidence,
(i.e., $H_{02}: \mu_{1i} = \mu_{2i}$, $i=1,2, \ldots p$);

(3) given parallel and coincident profiles, test for flatness,
(i.e., $H_{03}: \mu_{11} = \mu_{12} = \ldots = \mu_{1p}$).

When sample sizes are relatively large, normal theory methodology may be used with integer data. Computational details are given in Appendix 2.

The first step, evaluation of parallel profiles, is used to search for evidence of effect modification. When the profiles of different levels of a potential modifier retain the same shape, but differ by a constant distance, there is evidence that an effect may be present. The second step allows testing for equality of mean population vectors. Two profiles that are parallel and also coincident are equal. The third step, testing for flatness, is of little interest in our analysis, since by definition, extremely low ratings will produce a flat profile, with each component approaching zero (not present) and extremely high ratings will produce a flat profile, with each component approaching the maximum rating of three (severe).

P-values for testing the hypothesis of parallel profiles and coincident profiles are given. The symbol "~=" is used to signify "approximately equal to."

Results

Severity of Premenstrual Symptoms

The profiles for the five levels of *pmsscore, 0-4, 5-9, 10-14, 15-19, and 20+* were compared.

Undergraduate Students

The affective and physical symptom profiles for the five *pmsscore* groups among the OSU undergraduate students are shown in Figure 1. The symptoms of 824 women were evaluated in this section of the analysis. The median value for the variable *pmsscore* was 8. The minimum value for *pmsscore* was 0; the maximum was 28. The P-values calculated in assessing parallel and coincident profiles are given in Tables 1 and 2.

In the affective component, the profiles for *pmsscore 0-4* versus *pmsscore 5-9* were not parallel ($p<10^{-15}$). The profiles for *pmsscore 5-9* versus *pmsscore 10-14*, *pmsscore 10-14* versus *pmsscore 15-19*, and *pmsscore 15-19* versus *pmsscore 20-28* were parallel, but not coincident. In the comparison with the affective profile for *pmsscore 5-9*, the profiles for *pmsscores 15-19* and *20-28* were not parallel ($p\sim=.010$ and $p<10^{-3}$).

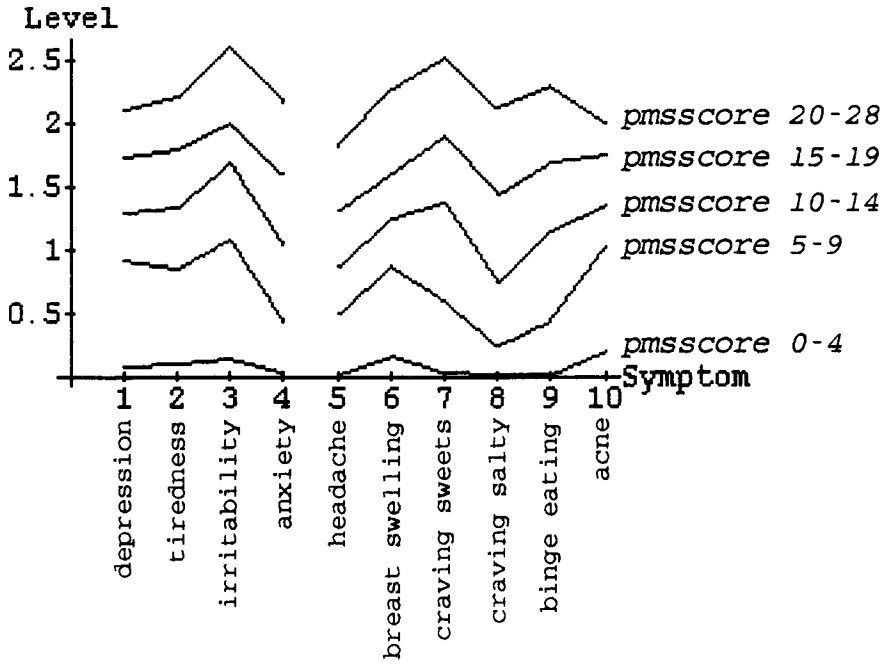

Figure 1. Symptom Profiles for Undergraduate Students by *Pmsscore*.

Table 1. Summary of P-values for Comparisons of Affective Symptom Profiles in Undergraduate Students by *Pmsscore*.

Pmsscore	*5-9*	*10-14*	*15-19*	*(n=65) 20-28*
0-4 (n=284)				
p-value parallel	$<10^{-15}$			
p-value coincident				
5-9 (n=159)				
p-value parallel		0.059	0.010	$<10^{-3}$
p-value coincident		$<10^{-11}$		
10-14 (n=132)				
p-value parallel		0.210		
p-value coincident		$<10^{-11}$		
15-19 (n=153)				
p-value parallel			0.272	
p-value coincident			$<10^{-11}$	

Similar relationships occurred in the physical symptom profiles. The profiles in the comparison *pmsscore 0-4* versus *pmsscore 5-9* were not parallel ($p<10^{-18}$). The profiles in the comparison *pmsscore 5-9* versus *pmsscore 10-14* were not parallel ($p\sim=.03$). The profiles in the comparisons *pmsscore 10-14* versus *pmsscore 15-19* and *pmsscore 15-19* versus *pmsscore 20-28* were parallel and not coincident. In the comparisons with *pmsscore 5-9*, *pmsscores 15-19* and *20-28* were not parallel ($p<10^{-4}$ and $p<10^{-8}$).

Table 2. Summary of P-values for Comparisons of Physical Symptom Profiles in Undergraduate Students by *Pmsscore*.

Pmsscore	*5-9*	*10-14*	*15-19*	*(n=65) 20-28*
0-4 (n=284)				
p-value parallel	$<10^{-18}$			
p-value coincident				
5-9 (n=159)				
p-value parallel		0.033	$<10^{-4}$	$<10^{-8}$
p-value coincident		$<10^{-11}$		
10-14 (n=132)				
p-value parallel			0.309	
p-value coincident			$<10^{-11}$	
15-19 (n=153)				
p-value parallel				0.103
p-value coincident				$<10^{-24}$

Graduate students

The affective and physical symptom profiles of the OSU graduate students are shown in Figure 2. The responses of 482 women were included in this section of the analysis. The median value for the variable *pmsscore* was 5. The minimum value of *pmsscore* was 0; the maximum was 26. P-values calculated in the evaluation of parallel and coincident affective and physical symptom profiles are given in Tables 3 and 4. As in the profiles for the undergraduate students, the affective symptom profiles in the comparison *pmsscore 0-4* versus *pmsscore 5-9* were not parallel ($p<10^{-10}$), but the profiles in the comparisons *pmsscore 5-9* versus *pmsscore 10-14*, *pmsscore 10-14* versus *pmsscore 15-19* and *pmsscore 15-19* versus *pmsscore 20-26*

were parallel, but not coincident. In addition, when compared with *pmsscore 5-9*, *pmsscore 15-19* and *pmsscore 20-26* were parallel, but not coincident.

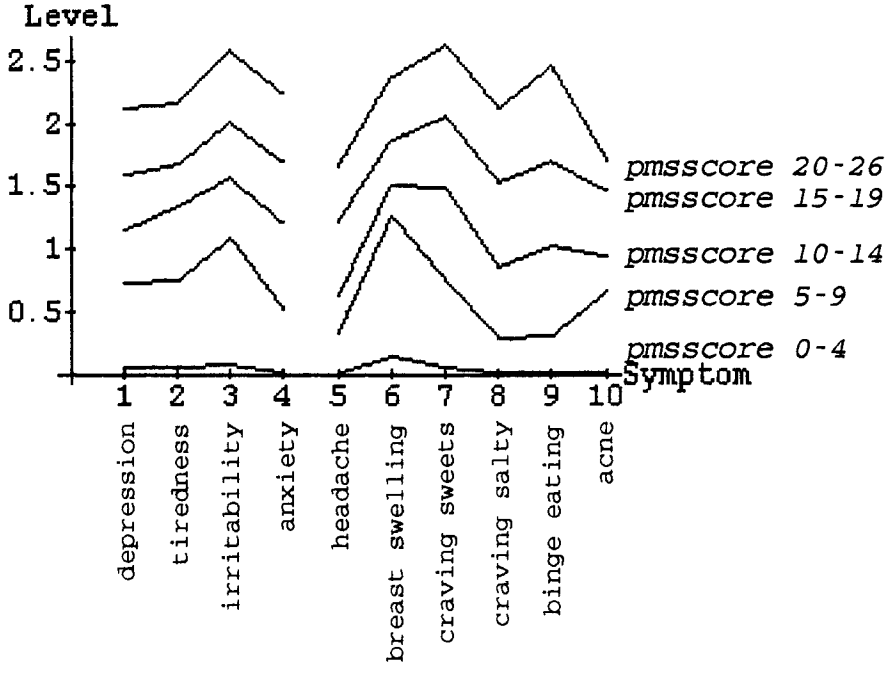

Figure 2. Symptom Profiles for Graduate Students by *Pmsscore*.

Table 3. Summary of P-values for Comparisons of Affective Symptom Profiles in Graduate Students by *Pmsscore*.

Pmsscore	*5-9*	*10-14*	*15-19*	*(n=24) 20-28*
0-4 (n=224)				
p-value parallel	$<10^{-10}$			
p-value coincident				
5-9 (n=113)				
p-value parallel		0.120	0.187	0.234
p-value coincident		$<10^{-11}$	$<10^{-11}$	$<10^{-11}$
10-14 (n=83)				
p-value parallel			0.930	
p-value coincident			$<10^{-5}$	
15-19 (n=40)				
p-value parallel				0.280
p-value coincident				$<10^{-4}$

In the physical component, *pmsscore 0-4* and *pmsscore 5-9* were not parallel ($p<10^{-22}$). The profiles in the comparison *pmsscore 5-9* versus *pmsscore 10-14* were borderline parallel ($p\sim=.05$); assuming they were parallel, they were not coincident. The profiles in the comparisons *pmsscore 10-14* versus *pmsscore 15-19* and *pmsscore 15-19* versus *pmsscore 20-26* were parallel and not coincident. In the comparisons with *pmsscore 5-9*, *pmsscores 15-19* and *20-26* were not parallel ($p\sim=.005$ and $p<10^{-4}$).

Table 4. Summary of P-values for Comparisons of Physical Symptom Profiles in Graduate Students by *Pmsscore*.

Pmsscore	*5-9*	*10-14*	*15-19*	*(n=24) 20-28*
0-4 (n=224)				
p-value parallel	$<10^{-22}$			
p-value coincident				
5-9 (n=113)				
p-value parallel		0.048	0.005	$<10^{-4}$
p-value coincident		$<10^{-11}$		
10-14 (n=83)				
p-value parallel			0.827	
p-value coincident			$<10^{-11}$	
15-19 (n=40)				
p-value parallel				0.611
p-value coincident				$<10^{-9}$

Undergraduate and Graduate Students

The affective symptom profiles for the undergraduate students with *pmsscore 5-9* and *pmsscore 10-14* were borderline parallel (p~=.054 and p~=.057), compared to the corresponding profiles for the graduate students. In the remaining comparisons, all profiles were parallel and coincident (Table 5).

Table 5. Summary of P-values for Comparisons of Affective Symptom Profiles in Undergraduate and Graduate Students by *Pmsscore*.

Graduate Students' *Pmsscores*	Undergraduate Students' *Pmsscores* 0-4	5-9	10-14	15-19	20-28
0-4					
P-value parallel	0.251				
P-value coincident	0.118				
5-9					
P-value parallel		0.054			
P-value coincident		0.313			
10-14					
P-value parallel			0.057		
P-value coincident			0.740		
15-19					
P-value parallel				0.518	
P-value coincident				0.640	
20-26					
P-value parallel					0.910
P-value coincident					0.996

The physical symptom profiles of the undergraduates and graduate students were more dissimilar. *Pmsscores 0-4, 5-9,* and *10-14* were not parallel ($p<10^{-4}$, $p<10^{-4}$, and $p<10^{-3}$). The profiles for *pmsscore 15-19* and *20-26 and 20-28* were parallel and coincident.

Table 6. Summary of P-values for Comparisons of Physical Symptom Profiles in Undergraduate and Graduate Students by *Pmsscore*.

Graduate Students' *Pmsscores*	Undergraduate Students' *Pmsscores* 0-4	5-9	10-14	15-19	20-28
0-4					
P-value parallel	$<10^{-4}$				
P-value coincident					
5-9					
P-value parallel		$<10^{-4}$			
P-value coincident					
10-14					
P-value parallel			$<10^{-3}$		
P-value coincident					
15-19					
P-value parallel				0.476	
P-value coincident				0.663	
20-26					
P-value parallel					0.447
P-value coincident					0.753

Older Women Visiting a Gynecological Practitioner

The affective and physical symptom profiles for 285 women 24 years of age and older who completed the Women's Health Survey after receiving it during a visit to their gynecological (GYN) practitioners are shown in Figure 3. The median value for the variable *pmsscore* for this group of "older women" was 12. The minimum value for *pmsscore* was 0; the maximum was 29. The reasons for their visits are summarized in Table 7.

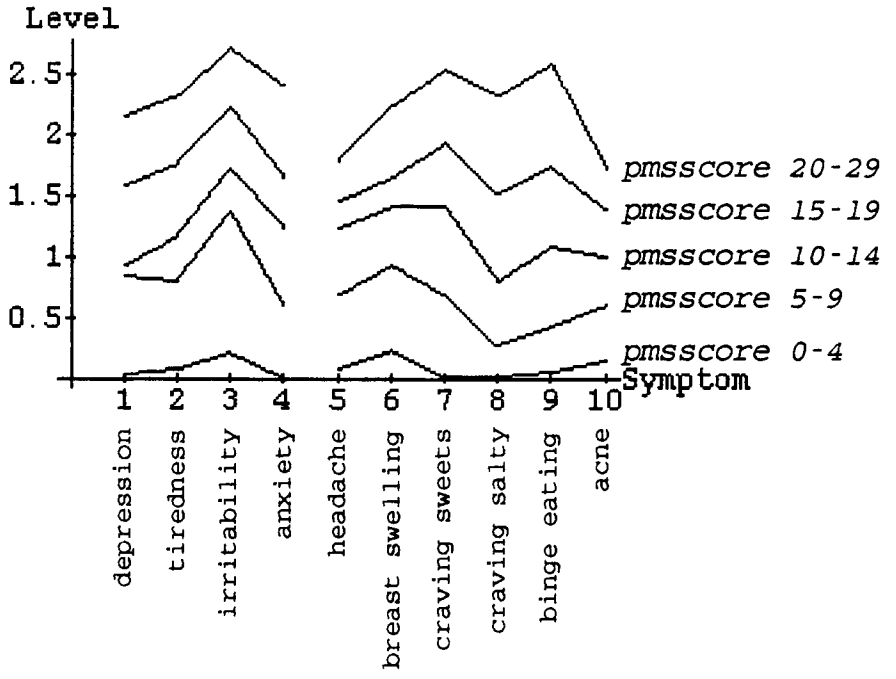

Figure 3. Symptom Profiles for Older Women by *Pmsscore.*

Table 7. Reasons for Visit to GYN Practitioner.

Reason	Frequency	Percent
Checkup	194	68.1
Consultation	10	3.6
Miscellaneous	72	25.3
PMS	9	3.2
Total		100.0

The P-values for the affective and physical symptom profile comparisons are given in Tables 8 and 9.

The affective symptom profiles of *pmsscore 0-4* and *pmsscore 5-9* were not parallel ($p<10^{-4}$). The profiles for *pmsscores 5-9* and *10-14*, *pmsscores 10-14* and *15-19*, and

pmsscores 15-19 and *20-29* were parallel but not coincident. The profiles for *pmsscores 5-9* and *15-19* were parallel but not coincident. The profiles for *pmsscores 5-9* and *20-29* were borderline parallel ($p \sim = .05$).

Table 8. Summary of P-values for Comparisons of Affective Symptom Profiles in Older Women by *Pmsscore*.

Pmsscore	*5-9*	*10-14*	*15-19*	*(n=44) 20-29*
0-4 (n=78)				
p-value parallel	$<10^{-4}$			
p-value coincident				
5-9 (n=47)				
p-value parallel		0.947	0.356	0.051
p-value coincident		$<10^{-3}$	$<10^{-11}$	$<10^{-11}$
10-14 (n=47)				
p-value parallel			0.591	
p-value coincident			$<10^{-11}$	
15-19 (n=69)				
p-value parallel				0.357
p-value coincident				$<10^{-11}$

As with the undergraduate students and the graduate students, the physical symptom profiles for *pmsscores 0-4* and *5-9* were not parallel (p~=.007), but the profiles in the comparisons *pmsscore 5-9* and *10-14*, *pmsscore 10-14* and *15-19*, and *pmsscore 15-19* and *20-29*, the profiles were parallel, but not coincident. In the comparison with *pmsscore 5-9*, *pmsscore 15-19* and *pmsscore 20-29* were not parallel (p~=.027 and $p<10^{-4}$).

Table 9. Summary of P-values for Comparisons of Physical Symptom Profiles in Older Women by *Pmsscore*.

Pmsscore	*5-9*	*10-14*	*15-19*	*20-29 (n=44)*
0-4 (n=78)				
p-value parallel	0.007			
p-value coincident				
5-9 (n=47)				
p-value parallel		0.805	0.027	$<10^{-4}$
p-value coincident		$<10^{-11}$		
10-14 (n=47)				
p-value parallel			0.339	
p-value coincident			$<10^{-11}$	
15-19 (n=69)				
p-value parallel				0.100
p-value coincident				$<10^{-11}$

Graduate Students and Older Women

The symptom profiles of graduate students and older women were compared by *pmsscore* to compare the symptom profiles of women of similar age groups (24 years and older). In the affective component, with the exception of *pmsscore 0-4*, the profiles at all levels were parallel and coincident with the next.

Table 10. Summary of P-values for Comparisons of Affective Symptom Profiles in Graduate Students and Older Women by *Pmsscore*.

Older Women's *Pmsscores*	Graduate Students' *Pmsscores* *0-4*	*5-9*	*10-14*	*15-19*	*20-26*
0-4					
P-value parallel	0.006				
P-value coincident					
5-9					
P-value parallel		0.179			
P-value coincident		0.463			
10-14					
P-value parallel			0.125		
P-value coincident			0.500		
15-19					
P-value parallel				0.481	
P-value coincident				0.445	
20-29					
P-value parallel					0.503
P-value coincident					0.921

The physical symptom profiles follow the same general pattern as in the comparison of undergraduate and graduate students. The physical symptom profiles for *pmsscore 0-4* were not parallel (p~=.003). The profiles for *pmsscore 5-9* and *pmsscore 10-14* were borderline parallel (p~=.051 and p~=.055); given that they were parallel, they were also coincident (p~=.863 and p~=.093). The profiles for *pmsscores 15-19* and *20+* were parallel and coincident.

Table 11. Summary of P-values for Comparisons of Physical Symptom Profiles in Graduate Students and Older Women by *Pmsscore*.

Older Women's *Pmsscores*	Graduate Students' *Pmsscores* 0-4	5-9	10-14	15-19	20-26
0-4					
P-value parallel	0.003				
P-value coincident					
5-9					
P-value parallel		0.051			
P-value coincident		0.863			
10-14					
P-value parallel			0.055		
P-value coincident			0.093		
15-19					
P-value parallel				0.479	
P-value coincident				0.656	
20-29					
P-value parallel					0.610
P-value coincident					0.514

Age

In this section of the analysis, the data were stratified by age, in five-year increments.

Undergraduate Students

The data were divided into two groups: age 17 to 20 years and age 20-23 years. The symptom profiles for these two groups are shown below. The profiles were parallel and coincident.

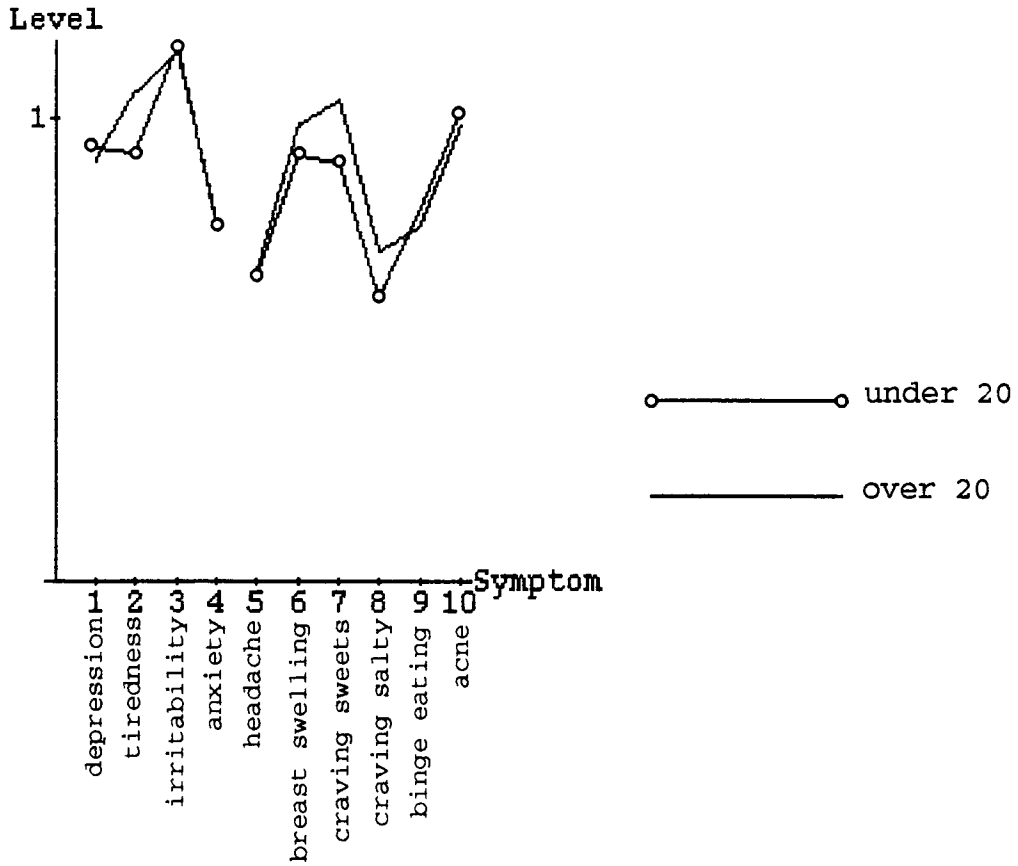

Figure 4. Symptom Profiles for Undergraduate Students by Age Groups.

Table 12. Summary of P-values for Comparisons of Affective and Physical Symptom Profiles in Undergraduate Students by Age Group.

	Under 20 (n=605)	
	Affective	Physical
Over 20 (n=189)		
P-value parallel	0.106	0.132
P-value coincident	0.708	0.493

Graduate Students

The graduate students were divided into the following age groups: *25-29, 30-34, 35-39, 40-44, 45-49,* and *50+*. There were too few observations in the *50+* group (n=8) to satisfy the assumption of multivariate normality. No comparisons were made using this group. The affective and physical symptom profiles are shown in Figure 5, below.

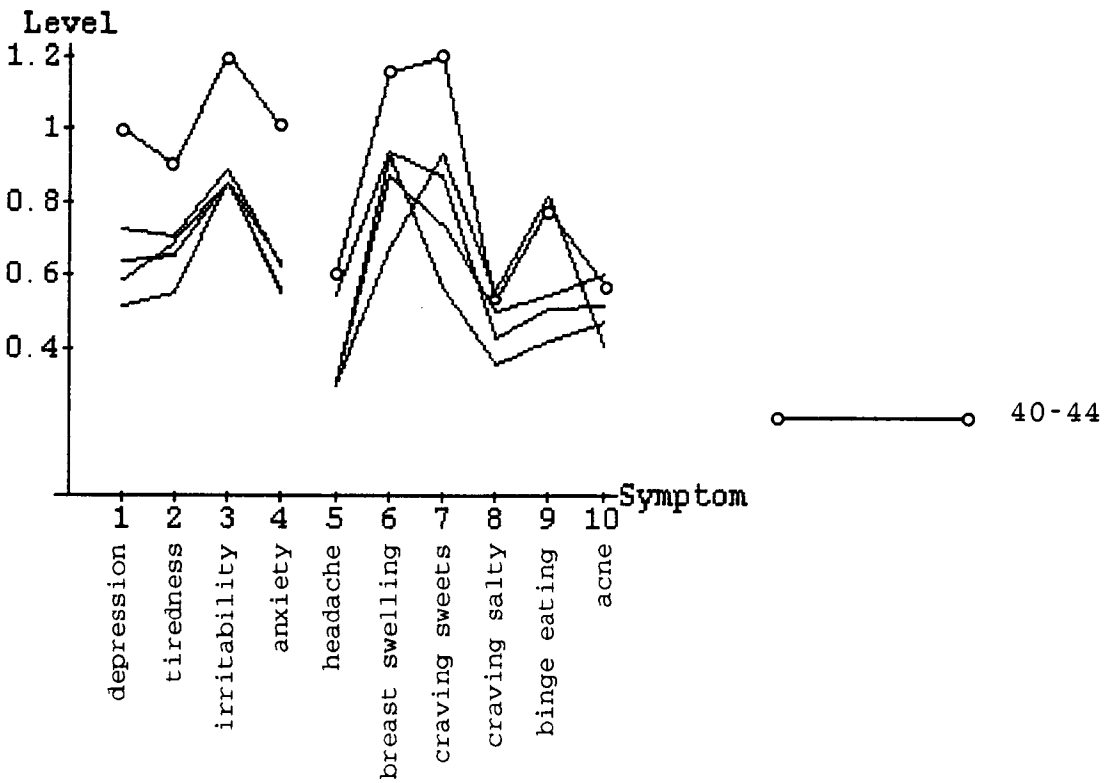

Figure 5. Symptom Profiles for Graduate Students by Age Groups.

The affective symptom profiles were all parallel with the profile of the contiguous age group. The profiles for the age group comparisons *25-29* versus *30-34* and *30-34* versus *35-39* were parallel and coincident. The profiles for age groups *35-39* and *40-44* were parallel and borderline coincident ($p \sim = .052$). The profile for age group *40-44* was parallel but not coincident with the profiles for age groups *25-29* and *45-49*. The profile for age group *25-29* was parallel and coincident with the profile for age group *45-49*.

Table 13. Summary of P-values for Comparisons of Affective Symptom Profiles in Graduate Students by Age Groups.

Age	*30-34*	*35-39*	*40-44*	*45-49 (n=27)*
25-29 (n=175)				
p-value parallel	0.739	0.954	0.649	0.500
p-value coincident	0.961	0.584	0.010	0.472
30-34 (n=114)				
p-value parallel		0.437		
p-value coincident		0.591		
35-39 (n=77)				
p-value parallel			0.782	
p-value coincident			0.052	
40-44 (n=40)				
p-value parallel				0.840
p-value coincident				0.040

The physical symptom profiles were parallel and coincident with the profiles of the following age group. When compared to a fixed reference profile, the profile for age group *25-29*, the profile for age group *35-39* was not parallel ($p\sim=.016$) and the profile for age group *40-44* was not parallel at ($p\sim=.006$).

Table 14. Summary of P-values for Comparisons of Physical Symptom Profiles in Graduate Students by Age Groups.

Age	30-34	35-39	40-44	(n=27) 45-49
25-29 (n=175)				
p-value parallel	0.273	0.016	0.006	0.085
p-value coincident	0.302			0.888
30-34 (n=114)				
p-value parallel		0.096		
p-value coincident		0.174		
35-39 (n=77)				
p-value parallel			0.684	
p-value coincident			0.181	
40-44 (n=40)				
p-value parallel				0.206
p-value coincident				0.279

Older Women

The older women were divided into the same age categories as the graduate students. The symptom profiles for these groups are shown in Figure 6.

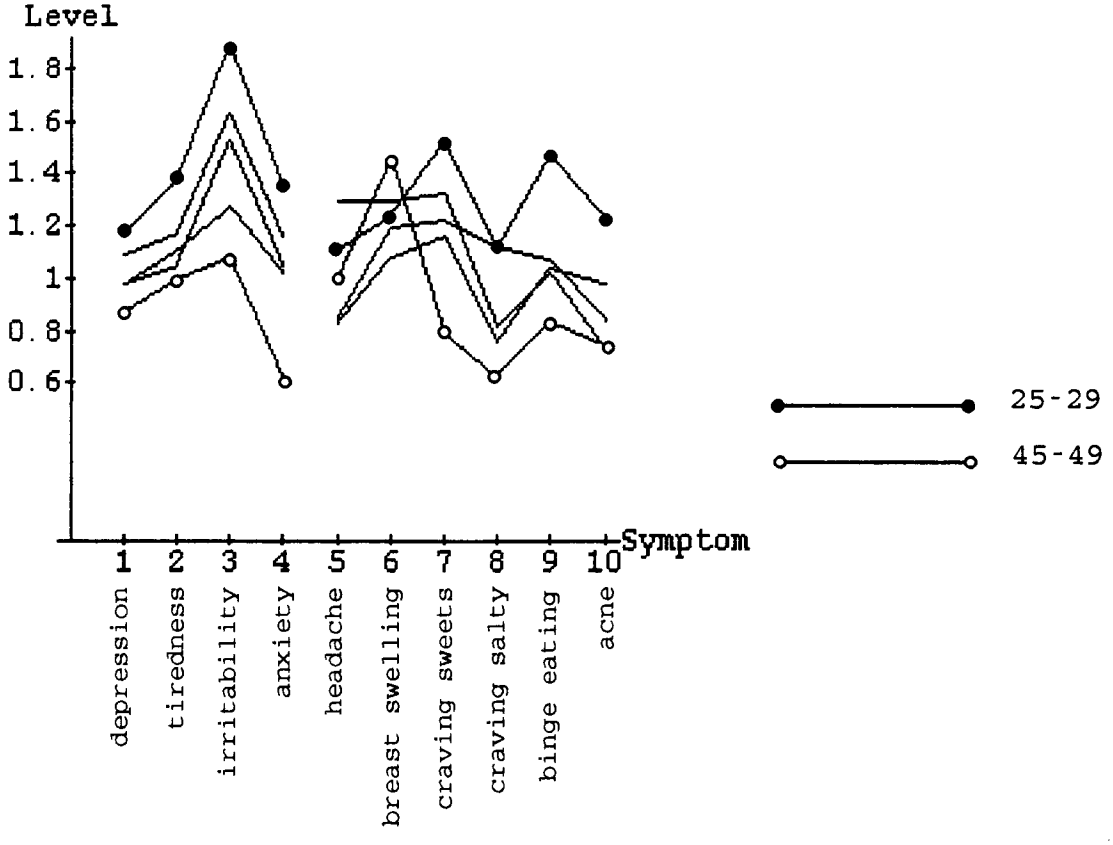

Figure 6. Symptom Profiles for Older Women by Age Groups.

The affective symptom profiles were parallel and coincident with the profiles of the contiguous age groups. When compared to a fixed reference profile (age group *25-29*), the profile for age group *35-39* was parallel and coincident, the profile for age group *40-44* was borderline parallel (p~=.056) and borderline coincident (p~=.061), and the profile for age group *45-49* was not parallel at (p~=.022).

Interestingly, the height of the affective symptom profiles generally decreased with age. The physical symptom profiles showed this same trend, with the profile for *25-29* being the highest, and the profiles for *45-49*, the lowest.

In the physical component, the profiles for age group *25-29* and age group *30-34* were parallel, but not coincident (p~=.012). The profiles for age groups *35-39* and *40-44* were not parallel (p~=.039 and p~=.039). The profiles for the age groups *40-44* and *45-49* were parallel and coincident. In the comparisons with the fixed reference profile (age group *25-29*), the profiles for age groups *35-39*, *40-44* and *45-49* were borderline parallel (p~=.077, p~=.054, and p~=.063).

Table 15. Summary of P-values for Comparisons of Affective Symptom Profiles in Older Women by Age Groups.

Age	30-34	35-39	40-44	45-49 (n=24)
25-29 (n=45)				
p-value parallel	0.711	0.711	0.056	0.022
p-value coincident	0.072	0.268	0.061	0.012
30-34 (n=86)				
p-value parallel		0.996		
p-value coincident		0.429		
35-39 (n=80)				
p-value parallel			0.213	
p-value coincident			0.334	
40-44 (n=44)				
p-value parallel				0.332
p-value coincident				0.363

Table 16. Summary of P-values for Comparisons of Physical Symptom Profiles in Older Women by Age Groups.

Age	30-34	35-39	40-44	(n=24) 45-49
25-29 (n=45)				
p-value parallel	0.888	0.077	0.054	0.063
p-value coincident	0.039	0.129	0.238	0.070
30-34 (n=86)				
p-value parallel		0.039		
p-value coincident				
35-39 (n=80)				
p-value parallel			0.012	
p-value coincident				
40-44 (n=44)				
p-value parallel				0.216
p-value coincident				0.396

Caffeinated Beverages

Consumption of caffeinated beverages was measured as the number of cups of caffeine-containing tea, soft drink, and coffee consumed during a typical day. Caffeine consumption was categorized into four levels: *none* (0 cups/day), *low* (1-3 cups/day), *moderate* (4-6 cups/day), and *high* (more than 7 cups/day).

Undergraduate Students

The symptom profiles for the undergraduate students, stratified into four levels of caffeine consumption, are

shown in Figure 7. Although the height of the affective profiles increased as caffeine consumption increased, there was not sufficient evidence to reject the null hypothesis of coincident profiles. The same was true for the physical symptom profiles, which also increased in height with increases in caffeine consumption (with the exception of an inversion of the values of variable 9, binge eating, in the *moderate* and *high* profiles). P-values for the comparisons are given in Tables 17 and 18.

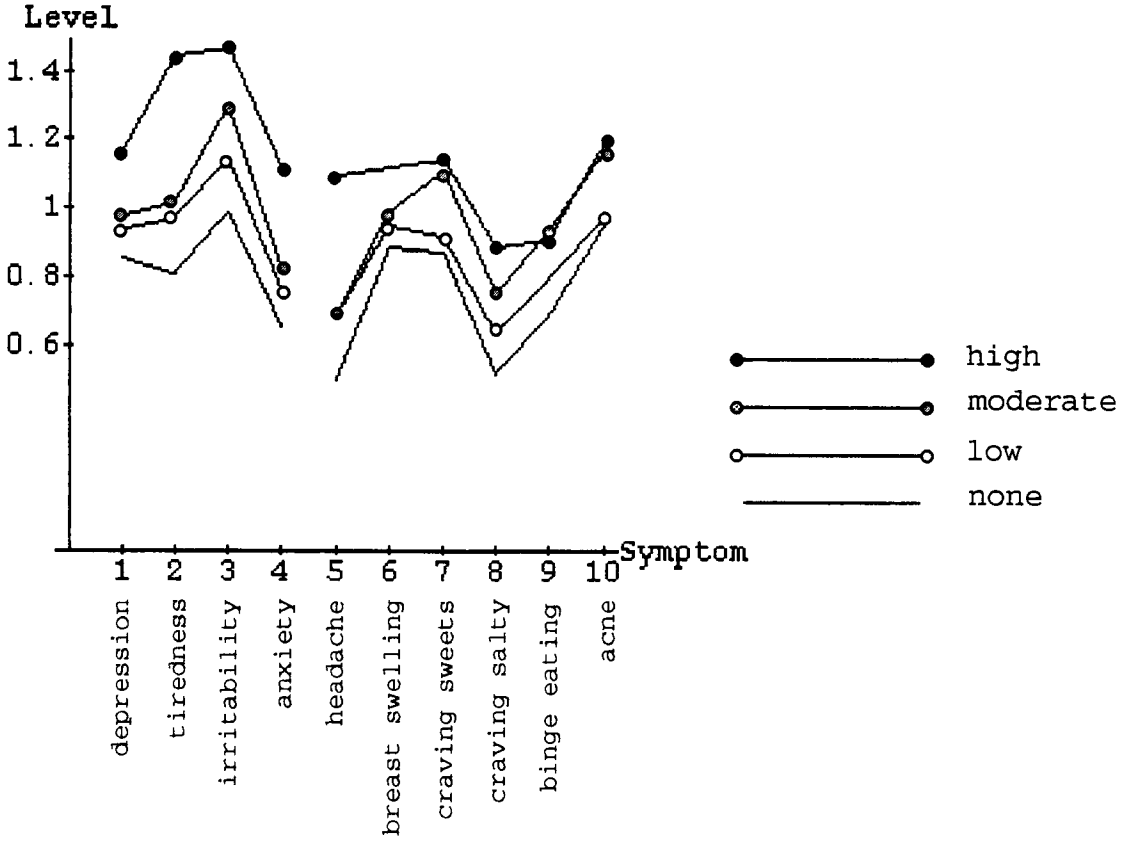

Figure 7. Symptom Profiles of Undergraduate Students by Level of Caffeine Consumption.

Table 17. Summary of P-values for Comparisons of Affective Symptom Profiles in Undergraduate Students by Level of Caffeinated Beverage Consumption.

	(n=234)		
Caffeine Level	*None*	*Low*	*Moderate*
Low (n=418)			
P-value parallel	0.583		
P-value coincident	0.060		
Moderate (n=124)			
P-value parallel		0.456	
P-value coincident		0.397	
High (n=43)			
P-value parallel			0.308
P-value coincident			0.080

Table 18. Summary of P-values for Comparisons of Physical Symptom Profiles in Undergraduate Students by Level of Caffeinated Beverage Consumption.

	(n=234)		
Caffeine Level	*None*	*Low*	*Moderate*
Low (n=418)			
P-value parallel	0.250		
P-value coincident	0.127		
Moderate (n=124)			
P-value parallel		0.298	
P-value coincident		0.143	
High (n=43)			
P-value parallel			0.220
P-value coincident			0.428

Graduate Students

The affective and physical symptom profiles for the four levels were all parallel with the next, higher level (Figure 8). In addition, the profiles for *none* and *low*, and *low* and *moderate* were coincident. The affective and physical profiles for *high* were not coincident with *moderate*. P-values for these comparisons are given in Tables 19 and 20.

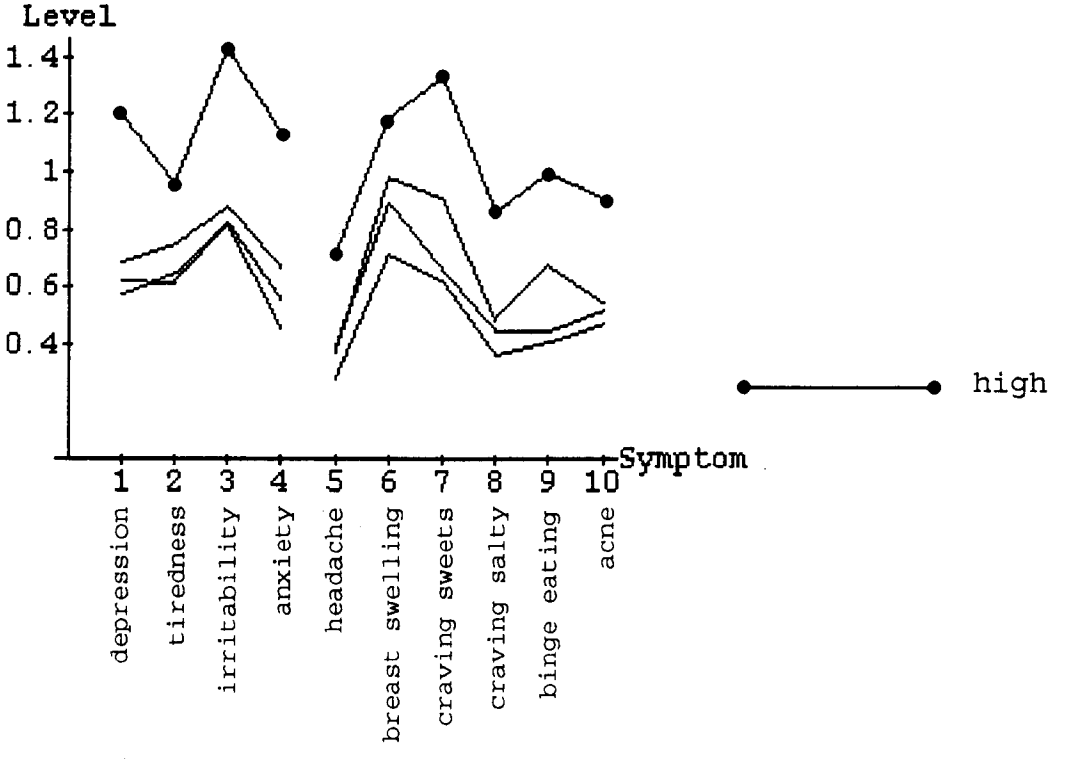

Figure 8. Symptom Profiles for Graduate Students by Level of Consumption of Caffeinated Beverages/Day.

Table 19. Summary of P-values for Comparisons of Affective Symptom Profiles in Graduate Students by Level of Caffeinated Beverage Consumption.

	(n=129)		
Caffeine Level	*None*	*Low*	*Moderate*
Low (n=254)			
P-value parallel	0.861		
P-value coincident	0.272		
Moderate (n=80)			
P-value parallel		0.196	
P-value coincident		0.752	
High (n=21)			
P-value parallel			0.439
P-value coincident			0.003

Table 20. Summary of P-values for Comparisons of Physical Symptom Profiles in Graduate Students by Level of Caffeinated Beverage Consumption.

	(n=129)		
Caffeine Level	*None*	*Low*	*Moderate*
Low (n=254)			
P-value parallel	0.065		
P-value coincident	0.153		
Moderate (n=80)			
P-value parallel		0.799	
P-value coincident		0.306	
High (n=21)			
P-value parallel			0.861
P-value coincident			0.001

Older Women

The symptom profiles for the older women are shown in Figure 9. In the affective profiles, the height of variable 3, irritability, increased with the level of caffeine consumption. Each profile, however, was statistically parallel and coincident with the profile of the next level of caffeine consumption in both affective and physical components. P-values for the comparisons are given in Tables 23 and 24.

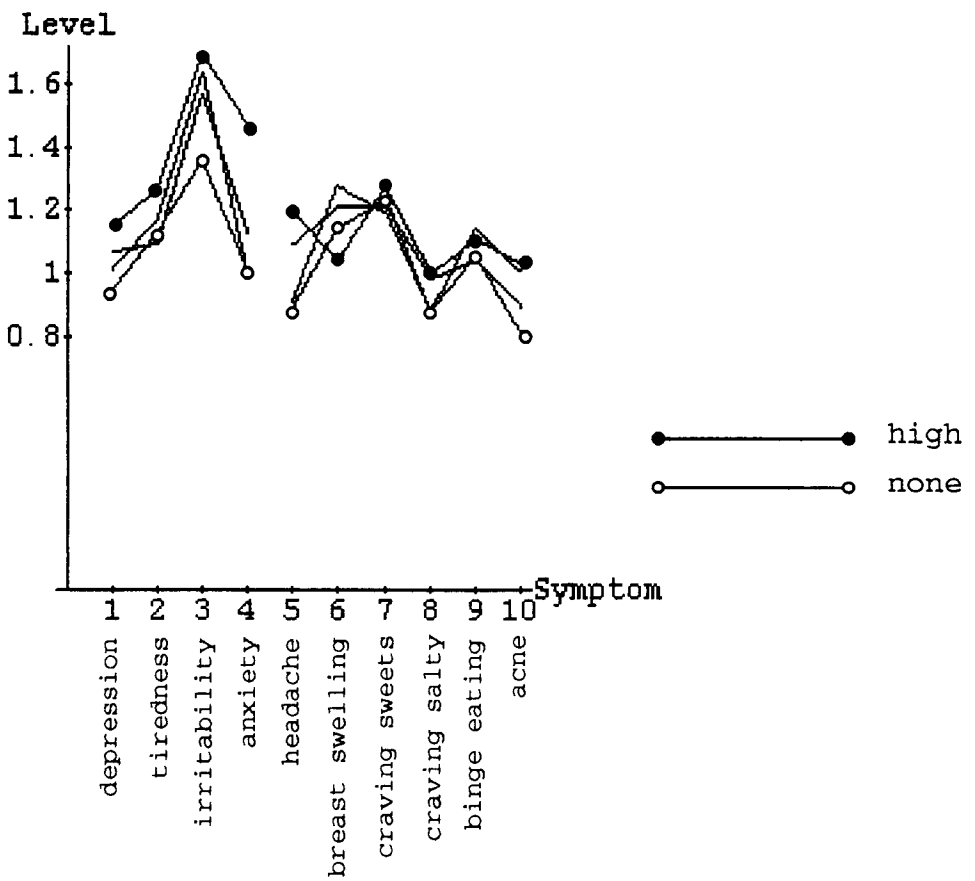

Figure 9. Symptom Profiles for Older Women by Level of Caffeine Consumption.

Table 21. Summary of P-values for Comparisons of Affective Symptom Profiles in Older Women by Level of Caffeinated Beverage Consumption.

	(n=88)		
Caffeine Level	*None*	*Low*	*Moderate*
Low (n=106)			
P-value parallel	0.210		
P-value coincident	0.400		
Moderate (n=65)			
P-value parallel		0.399	
P-value coincident		0.920	
High (n=26)			
P-value parallel			0.218
P-value coincident			0.368

Table 22. Summary of P-values for Comparisons of Physical Symptom Profiles in Older Women by Level of Caffeinated Beverage Consumption.

	(n=88)		
Caffeine Level	*None*	*Low*	*Moderate*
Low (n=106)			
P-value parallel	0.331		
P-value coincident	0.807		
Moderate (n=65)			
P-value parallel		0.768	
P-value coincident		0.672	
High (n=26)			
P-value parallel			0.812
P-value coincident			0.842

Refined Sugar

Women completing the Women's Health Survey were asked: About how many times during a typical day do you eat "sweets" or junk food? The data was categorized into five levels: *none, once a day, twice a day, three times a day,* and *four or more times a day.*

Undergraduate Students

In the affective profiles, the group not eating any junk food had the lowest affective profile. The profile was not statistically distinct, however, from the group eating junk food once a day. In the physical profiles, the group eating junk food four or more times a day had the highest profile, but again, this profile was not statistically distinct from the profile for the group eating junk food three times a day ($p\sim=.073$ for coincidence). P-values for the comparisons are given in Tables 23 and 24.

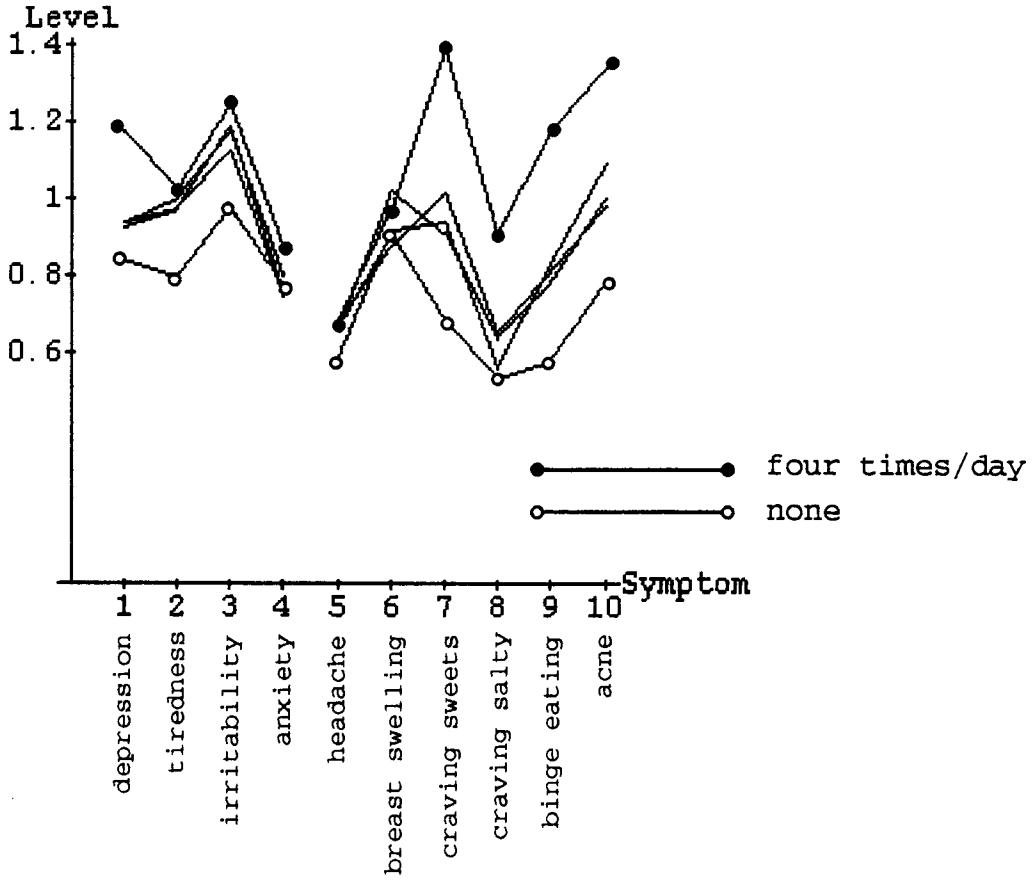

Figure 10. Symptom Profiles of Undergraduate Students by Level of Junk Food Consumption.

Table 23. Summary of P-values for Comparisons of Affective Symptom Profiles in Undergraduate students by Level of Junk Food Consumption.

Junk Food Level	*(n=83)* *None*	*Once/day*	*Twice/day*	*Three times/ day*
Once/day (n=334)				
P-value parallel	0.091			
P-value coincident	0.270			
Twice/day (n=262)				
P-value parallel		0.789		
P-value coincident		0.764		
Three times/day (n=100)				
P-value parallel			0.971	
P-value coincident			0.729	
Four or more times/day (n=41)				
P-value parallel				0.507
P-value coincident				0.513

Table 24. Summary of P-values for Comparisons of Physical Symptom Profiles in Undergraduate Students by Level of Junk Food Consumption.

Junk Food Level	*(n=83) None*	*Once/day*	*Twice/day*	*Three times/ day*
Once/day (n=334)				
P-value parallel	0.338			
P-value coincident	0.106			
Twice/day (n=262)				
P-value parallel		0.123		
P-value coincident		0.991		
Three times/day (n=100)				
P-value parallel			0.412	
P-value coincident			0.888	
Four or more times/day (n=41)				
P-value parallel				0.358
P-value coincident				0.073

Graduate Students

The affective and physical profiles of the graduate students consuming junk food four or more times a day were higher than the profiles for the groups eating junk food fewer times a day. As in the undergraduate student profiles, however, this difference did not achieve statistical significance. The p-values for coincidence of profiles for women consuming junk food four or more times a day and women consuming junk food three times a day were lower than those in the other comparisons (affective: p~=.074; physical: p~=.183). P-values for the comparisons are given in Tables 25 and 26.

p~=.074; physical: p~=.183). P-values for the comparisons are given in Tables 25 and 26.

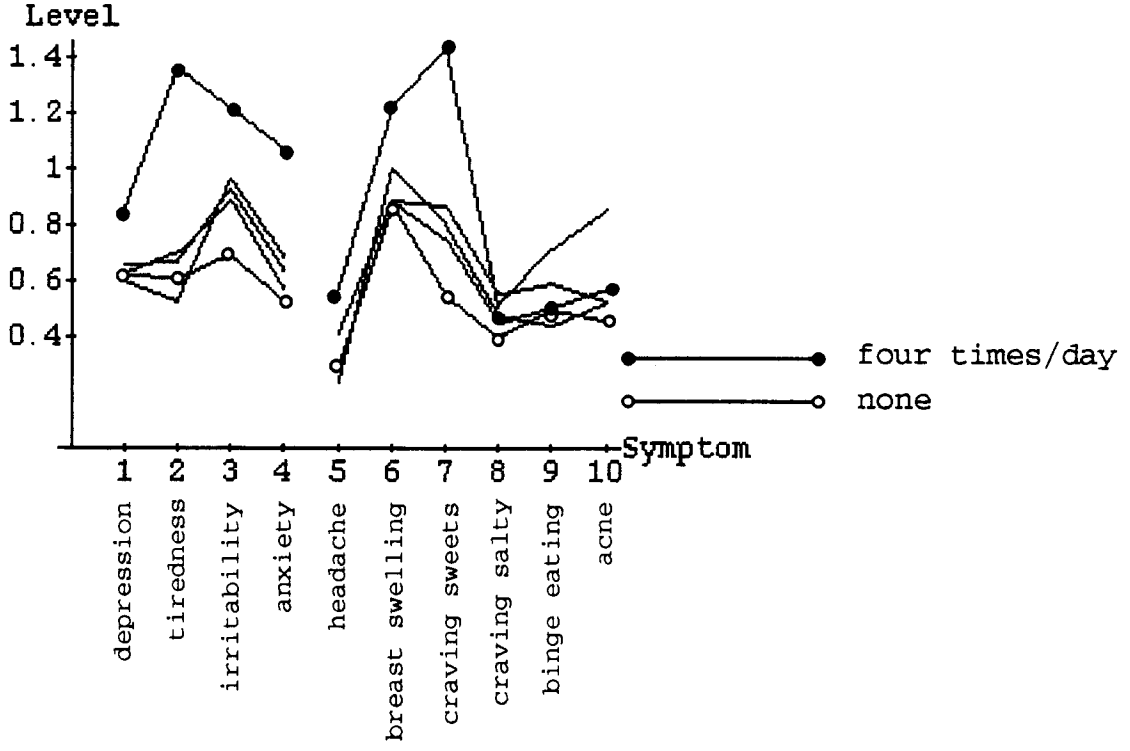

Figure 11. Symptom Profiles of Graduate Students by Level of Junk Food Consumption.

Table 25. Summary of P-values for Comparisons of Affective Symptom Profiles in Graduate Students by Level of Junk Food Consumption.

Junk Food Level	*(n=106) None*	*Once/day*	*Twice/day*	*Three times/ day*
Once/day (n=240)				
P-value parallel	0.126			
P-value coincident	0.384			
Twice/day (n=100)				
P-value parallel		0.767		
P-value coincident		0.752		
Three times/day (n=25)				
P-value parallel			0.697	
P-value coincident			0.842	
Four or more times/day (n=14)				
P-value parallel				0.085
P-value coincident				0.074

Table 26. Summary of P-values for Comparisons of Physical Symptom Profiles in Graduate Students by Level of Junk Food Consumption.

Junk Food Level	*(n=106) None*	*Once/day*	*Twice/day*	*Three times/ day*
Once/day (n=240)				
P-value parallel	0.168			
P-value coincident	0.255			
Twice/day (n=100)				
P-value parallel		0.669		
P-value coincident		0.604		
Three times/day (n=25)				
P-value parallel			0.827	
P-value coincident			0.719	
Four or more times/day (n=14)				
P-value parallel				0.599
P-value coincident				0.183

Older Women

The older women were stratified into only three groups. Only ten women could be classified as consuming junk food four or more times a day, so this category was not used. The affective and physical profiles for the group consuming junk food three times a day were higher than the profiles for the group consuming junk food twice a day; these profiles were parallel, but not coincident (affective: $p \sim = .002$; physical: $p < 10^{-3}$, for coincidence).

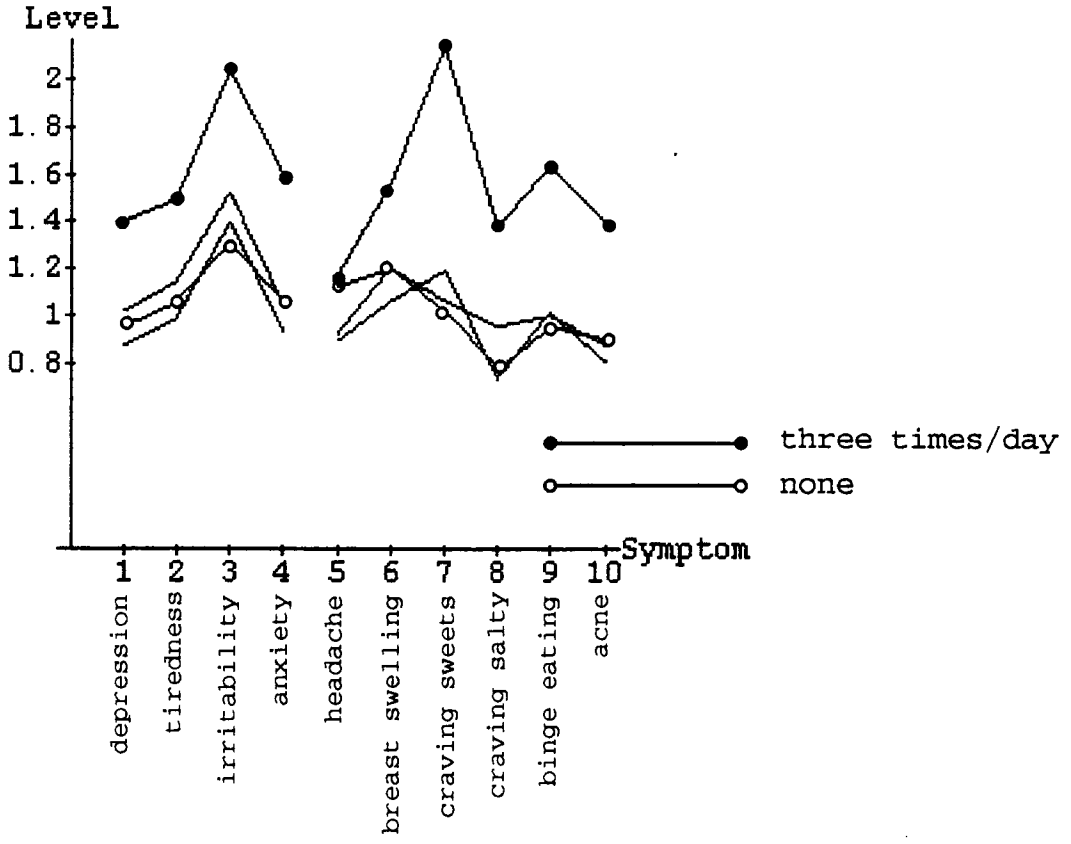

Figure 12. Symptom Profiles of Older Women by Level of Junk Food Consumption.

Table 27. Summary of P-values for Comparisons of Affective Symptom Profiles in Older Women by Level of Junk Food Consumption.

Junk Food Level	*(n=40)* *None*	*Once/day*	*Twice/day*	*Three times/ day*
Once/day (n=129)				
P-value parallel	0.381			
P-value coincident	0.585			
Twice/day (n=76)				
P-value parallel		0.981		
P-value coincident		0.319		
Three times/day (n=30)				
P-value parallel			0.789	
P-value coincident			0.002	

Table 28. Summary of P-values for Comparisons of Physical Symptom Profiles in Older Women by Level of Junk Food Consumption.

Junk Food Level	*(n=40)* *None*	*Once/day*	*Twice/day*	*Three times/ day*
Once/day (n=129)				
P-value parallel	0.595			
P-value coincident	0.976			
Twice/day (n=76)				
P-value parallel		0.103		
P-value coincident		0.647		
Three times/day (n=30)				
P-value parallel			0.175	
P-value coincident			$<10^{-3}$	

Maternal History of PMS

Undergraduate Students

The affective and physical profiles of women whose mothers had PMS versus those whose mothers did not were parallel, but not coincident ($p<10^{-3}$ for both). In both the affective and physical components, women whose mothers had PMS had higher profiles.

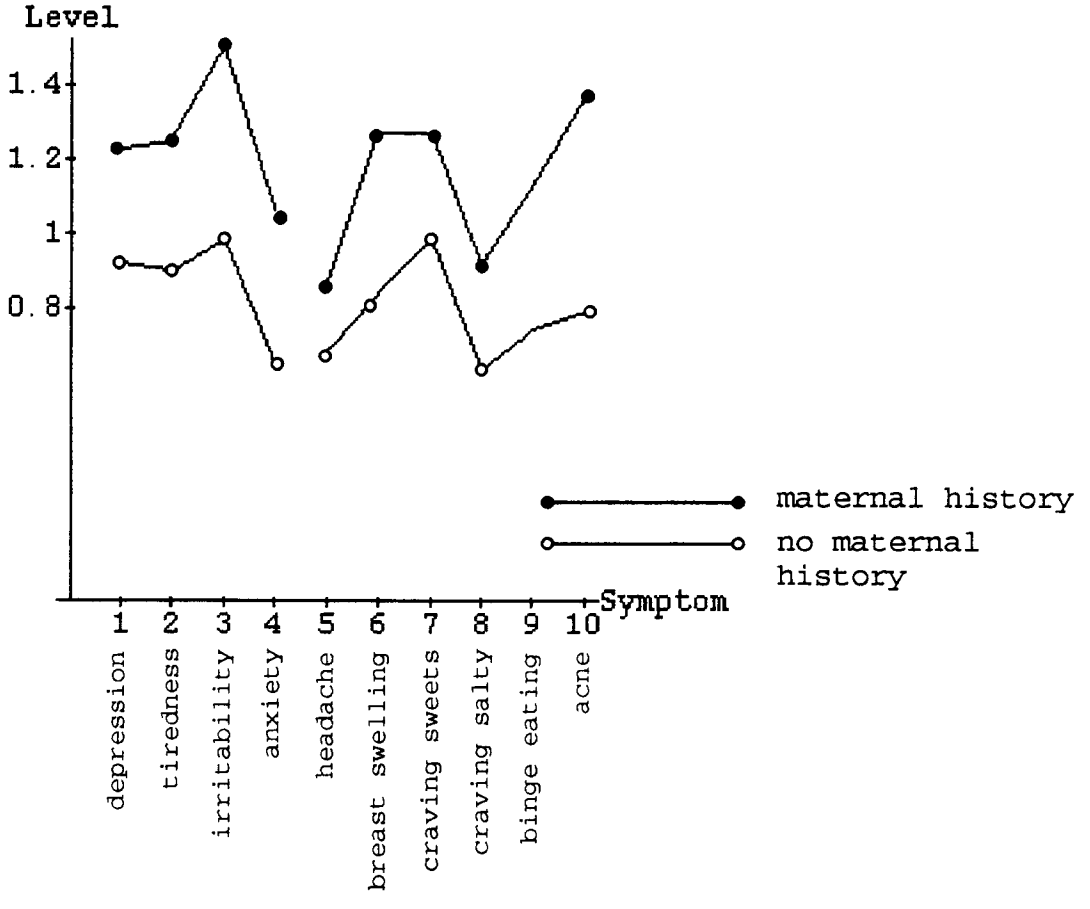

Figure 13. Symptom Profiles for Undergraduates by Mothers' PMS.

Table 29. Summary of P-values for Comparison of Affective and Physical Profiles of Undergraduate Students by Maternal History of PMS.

Positive History of Maternal PMS (n=322)	*No Maternal History of PMS (n=77)* Affective	Physical
Affective		
P-value parallel	0.281	
P-value coincident	$<10^{-3}$	
Physical		
P-value parallel		0.058
P-value coincident		$<10^{-3}$

Graduate Students

In the graduate students, the affective profiles of women whose mothers had PMS versus those whose mothers did not, were not parallel. The affective profile of women whose mothers had PMS was higher than the profile of those whose mothers do or did not. The physical profiles were parallel and not coincident, again with higher symptom values for women whose mothers had PMS.

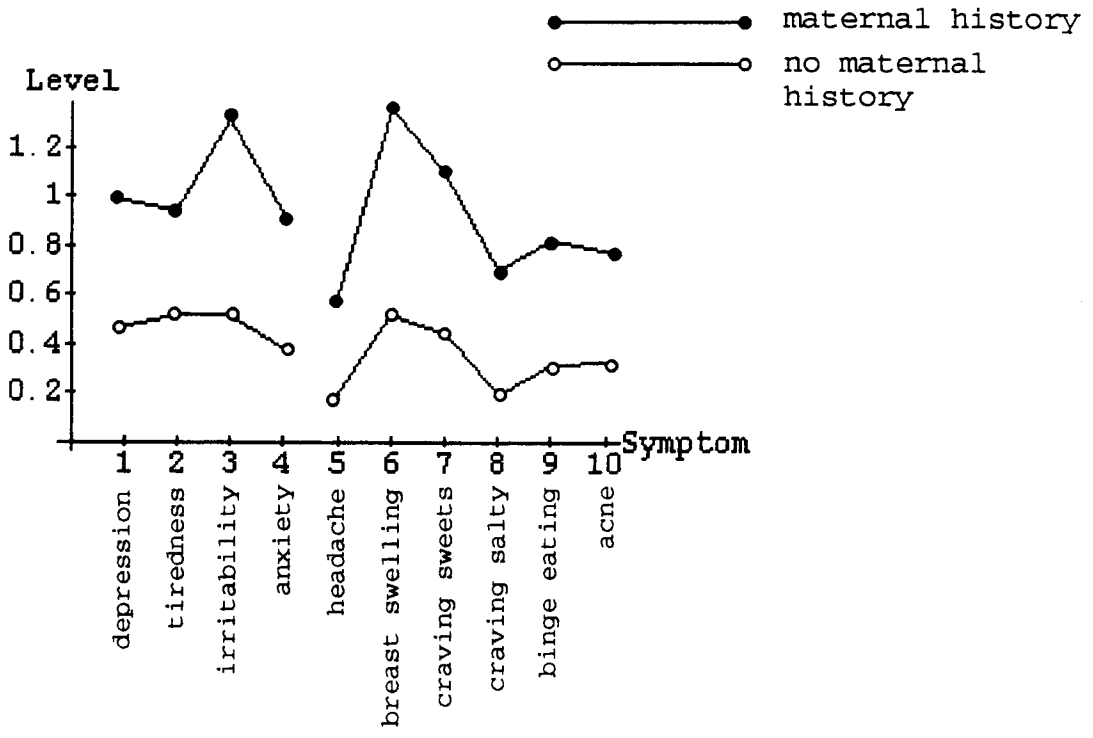

Figure 14. Symptom Profiles for Graduate Students by Mothers' PMS.

Table 30. Summary of P-values for Comparison of Affective and Physical Profiles of Graduate Students by Maternal History of PMS.

Positive History of Maternal PMS (n=91)	*No Maternal History of PMS (n=74)* Affective	Physical
Affective		
P-value parallel	0.008	
P-value coincident		
Physical		
P-value parallel		0.077
P-value coincident		$<10^{-7}$

Older Women

The affective profile for the women whose mothers had PMS was higher than the affective profile for women whose mothers did not. With the exception of symptom 5, headache, the physical profile for the women whose mothers had PMS was also higher. Both affective and physical profiles, however, were parallel and coincident.

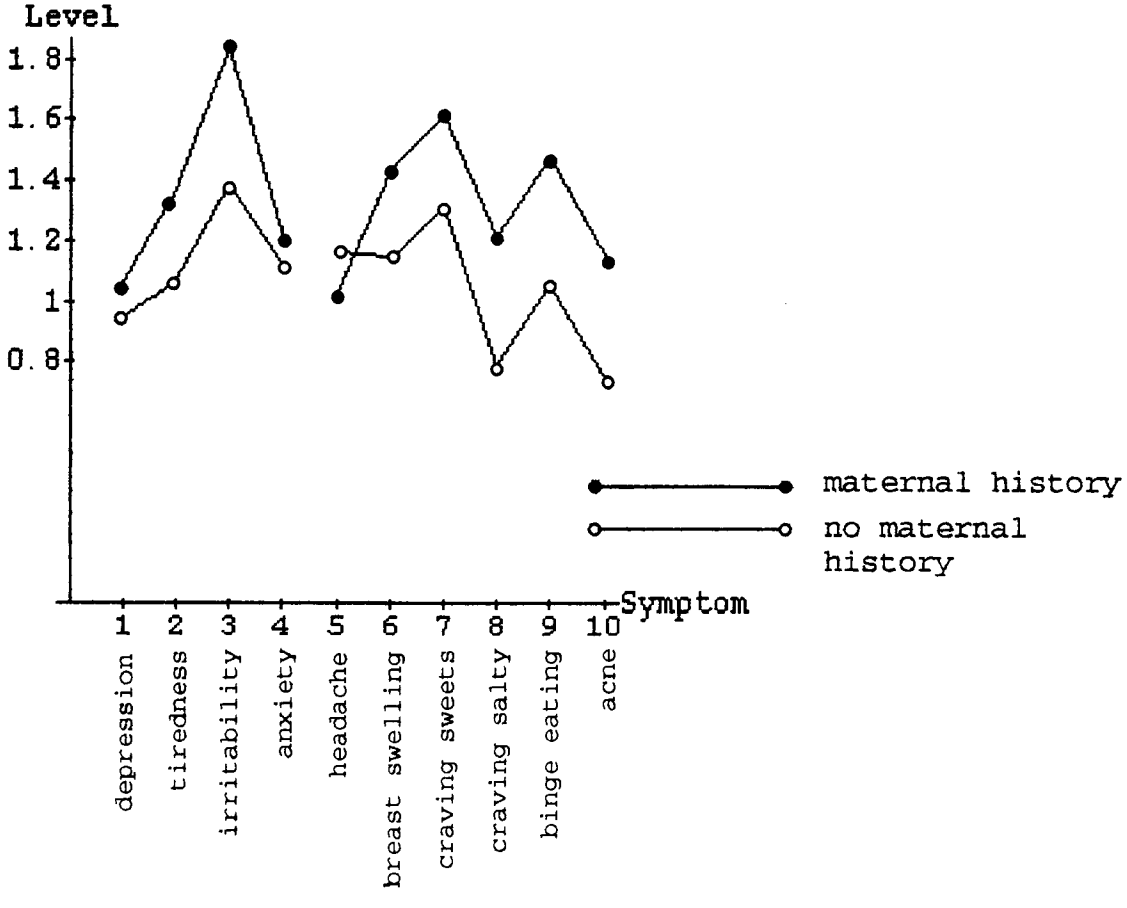

Figure 15. Symptom Profiles for Older Women by Mothers' PMS.

Table 31. Summary of P-values for Comparison of Affective and Physical Profiles of Older Women by Maternal History of PMS.

Positive History of Maternal PMS (n=49)	*(n=42) No Maternal History of PMS* Affective	Physical
Affective		
P-value parallel	0.159	
P-value coincident	0.192	
Physical		
P-value parallel		0.356
P-value coincident		0.092

Oral Contraceptive (OC) Use

Respondents to the Women's Health Survey were asked to indicate whether or not they had used oral contraceptives during the prior three months.

Undergraduate Students

The affective and physical symptom profiles for the undergraduate students were parallel and coincident; the p-value for coincidence in the affective component was borderline (p~=.062).

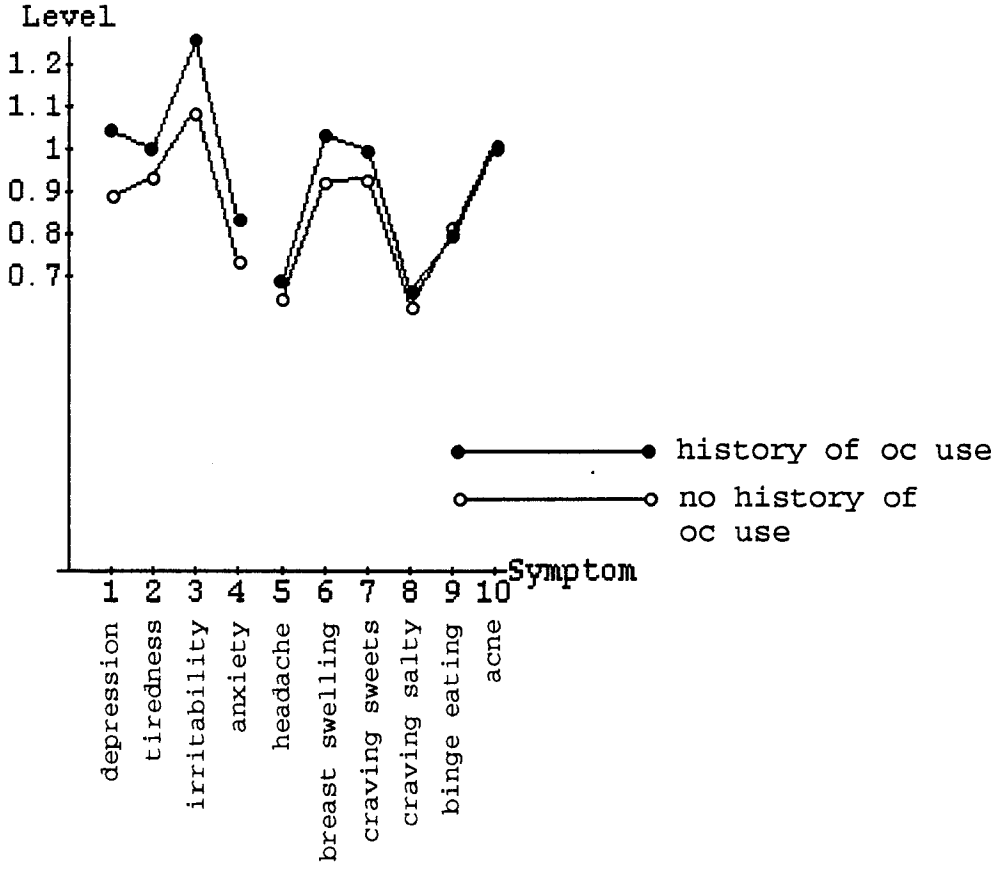

Figure 16. Symptom Profiles for Undergraduate Students by Use of Oral Contraceptives.

Table 32. Summary of P-values for Comparison of Affective and Physical Profiles of Undergraduate Students by Use of Oral Contraceptives During Prior Three Months.

Used Oral Contraceptives (n=259)	*No Oral Contraceptive Use (n=562)* Affective	Physical
Affective		
P-value parallel	0.370	
P-value coincident	0.062	
Physical		
P-value parallel		0.564
P-value coincident		0.512

Graduate Students

The affective and physical symptom profiles for the graduate students were also parallel and coincident. As in the undergraduate profiles, the p-value for coincidence in the affective component was borderline (p~=.058).

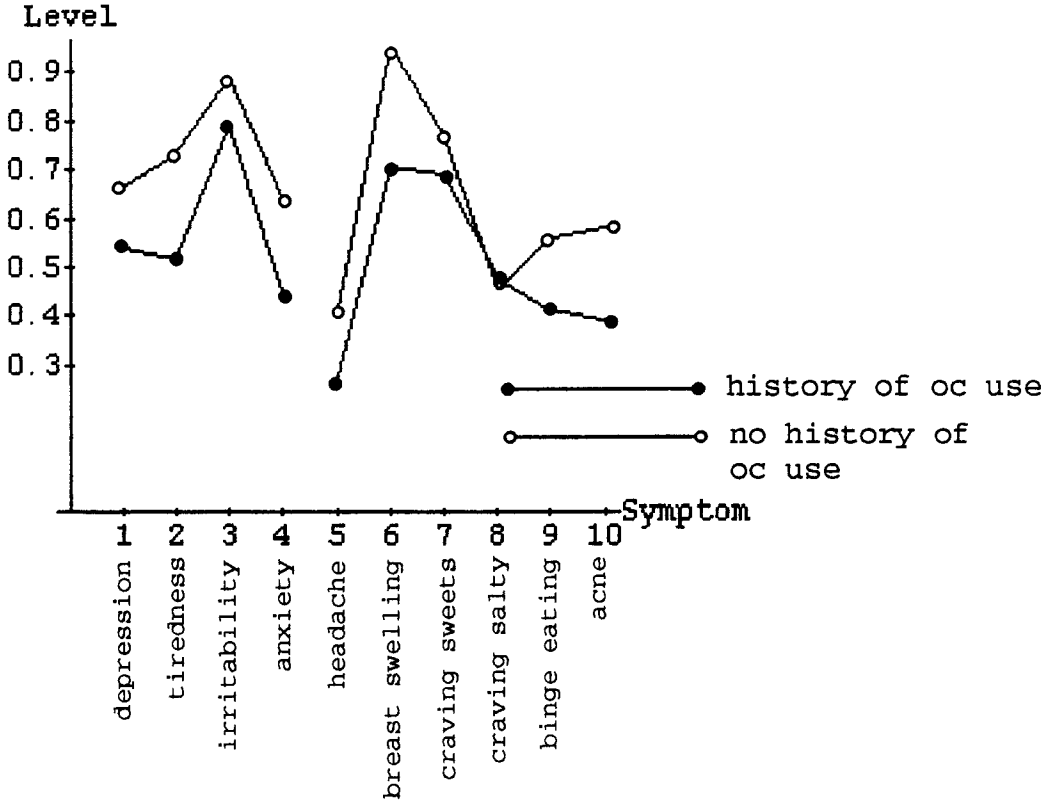

Figure 17. Symptom Profiles for Graduate Students by Use of Oral Contraceptives.

Table 33. Summary of P-values for Comparison of Affective and Physical Profiles of Graduate Students by Use of Oral Contraceptives During Prior Three Months.

Used Oral Contraceptives (n=110)	*No Oral Contraceptive Use* (n=374) Affective	Physical
Affective		
P-value parallel	0.393	
P-value coincident	0.058	
Physical		
P-value parallel		0.115
P-value coincident		0.074

Older Women

The affective and physical symptom profiles for the older women were parallel and coincident.

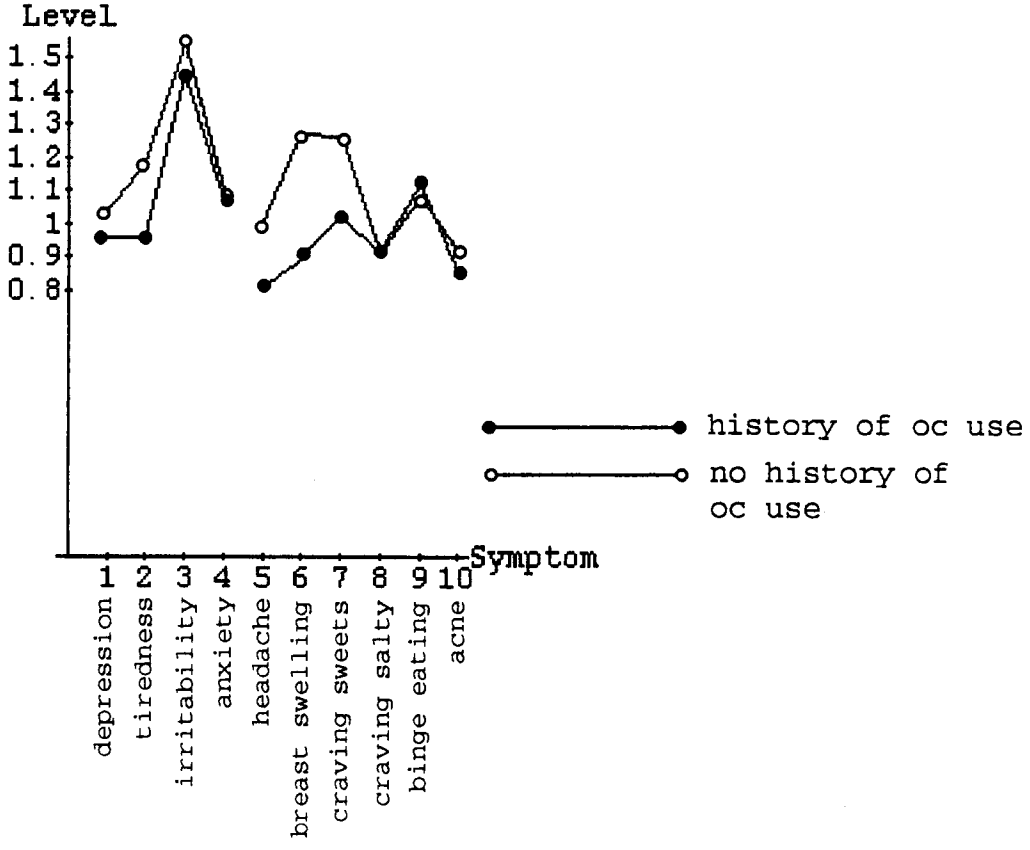

Figure 18. Symptom Profiles for Older Women by Oral Contraceptive Use.

Table 34. Summary of P-values for Comparison of Affective and Physical Profiles of Older Women by Use of Oral Contraceptives During Prior Three Months.

Used Oral Contraceptives (n=49)	*No Oral Contraceptive Use* (n=236) Affective	Physical
Affective		
P-value parallel	0.590	
P-value coincident	0.455	
Physical		
P-value parallel		0.117
P-value coincident		0.276

Discussion

Severity of Symptoms

The affective and physical symptom profiles for all three groups of women, undergraduate students, graduate students, and older women, share a very distinct pattern. In the affective component, in all three groups, only for *pmsscore 0-4* versus *pmsscore 5-9* could the null-hypothesis of parallel profiles be rejected ($p<10^{-15}$, $p<10^{-10}$, $p<10^{-4}$). The profiles for the remaining groups, *pmsscores 5-9, 10-14,* and *15-19* were parallel and not coincident with the profile for the next level. When the affective symptom profiles of the undergraduate and graduate students were compared, the profiles were parallel and coincident for all levels of *pmsscore.* When the graduate students were compared with the older women, with the exception of *pmsscore 0-4,* the affective profiles for all levels were parallel and coincident.

In the physical component, in all three groups, the symptom profiles for *pmsscore 0-4* and *pmsscore 5-9* were not parallel ($p<10^{-4}$ for undergraduate and graduate students, $p\sim=.007$ for older women). In all three groups, *pmsscores 10-14 and 15-19* and *pmsscore 15-19 and 20-26,* the profiles were parallel, but not coincident. In the undergraduate and

graduate students, the profiles of *pmsscore 5-9* and *10-14* were not parallel ($p\sim=.033$ and $p\sim=.048$).

These data suggest that PMS may be present in very low severity levels, and that the mean population vectors rise in a fixed pattern as symptoms become more severe. Evidence of different types of premenstrual syndromes was not present.

Age

The affective and physical symptom profiles for the undergraduates younger and older than 20 years of age were parallel and coincident. Among the graduate students, the affective profiles were parallel and coincident until age *40-44 years*, after which they remained parallel, but not coincident. Among the older women, the affective profiles of age groups *40-44 years* and *45-49 years* were not parallel with the baseline profile for *25-29 years*. However, the height of the profiles generally decreased with age.

The physical symptom profiles for the two age groups of undergraduates were parallel and coincident. For the graduate students, when compared with the baseline profile for *25-29* year olds, *35-39* ($p\sim=.016$) and *40-44* were not parallel ($p\sim=.006$). Among the older women, comparisons of

the physical symptom profiles showed a lack of parallelism between age groups *30-34* and *35-39*, and between age groups *35-39* and *40-44*.

The graduate student data suggest that the affective symptom profiles in women over 24 retain a fairly constant shape, but show a spike in intensity at age 40. The data for older women, however, does not verify this pattern; the profiles for age groups *30-34* and *35-39* are not parallel with the profiles for age groups *35-39* and *40-44*, with a generalized decrease in the intensity of symptoms. One reason for this discrepancy may be selection bias. The older women received the survey from their GYN practitioners who may have been selective in requesting that patients complete the survey. Another reason for this discrepancy may be that the older women represent a different population with different patterns of symptomatology.

Caffeinated Beverages

The affective and physical symptom profiles of the undergraduates and older women consuming increasing levels of caffeinated beverages were parallel and coincident . Among the graduate students, affective profiles remained parallel, but no longer coincident with high levels of

caffeinated beverage consumption. This profile suggests that if caffeine is a factor that exacerbates premenstrual symptoms, the effect is not realized until high levels of consumption.

Analysis of caffeinated beverage consumption is somewhat problematic because of the varying levels of caffeine beverages contain. A woman drinking several cups of a strongly caffeinated beverage will consume more caffeine than a woman drinking weaker beverages, even though the total amount of fluid consumed may be equal.

Refined Sugar

There was evidence that the number of times a day junk food was consumed influenced the affective and physical symptom profiles in older women only. The profiles for the undergraduate and graduate students remained parallel and coincident as the number of times increased. In the older women, the profiles remained parallel and coincident until the category, *twice/day.*

Actual sugar consumption may be higher than indicated by responses to times per day junk food was consumed. For example, a woman drinking beverages containing sugar would consume more sugar than was indicated by her junk food

consumption. In the question regarding soft drink consumption, sugar-free and sugar-containing beverages were not distinguished.

These data indicate that junk food consumption exacerbates premenstrual symptoms when eaten often, that is, twice a day or more.

Maternal History of PMS

The affective and physical symptom profiles for undergraduate students whose mothers had PMS versus those whose mothers did not were parallel, but not coincident. Among the graduate students, the affective profiles were not parallel ($p\sim=.008$), but the physical symptom profiles were parallel and not coincident. Among the older women, the affective and physical symptom profiles were parallel and coincident.

The undergraduate student data may be a more accurate assessment of the relationship than the data for the other groups. The undergraduate students are younger, with more recent contact with their mothers. The mothers of the undergraduates also are younger, and have a more current awareness of PMS which was not as freely discussed years ago as it is now.

Oral Contraceptive Use

No evidence was found to indicate that use of oral contraceptives within the past three months exacerbated or prevented premenstrual symptoms. The affective and physical symptom profiles in all three groups of women were parallel and coincident.

Conclusion

A weakness of multivariate profile analysis is that effect modification from only one source or combination of sources can be evaluated at a time. When the population is stratified using multiple constraints (e.g. women 25-29, consuming 5-9 cups of caffeinated beverage/day, with maternal history of PMS. . .) the number of observations used to derive the profile is reduced drastically, leading to a violation the assumption of multivariate normality. Even if these multiple constraints could be taken into account, there may be a number of unknown parameters affecting the severity levels of the premenstrual symptoms.

The analyses of the affective and physical symptom profiles derived from retrospectively collected data indicate that PMS is a continuous process, whose mean vector has a fixed shape that rises as PMS becomes more severe. This pattern was observed in both the affective and physical components. The regularity of the profiles suggests that PMS can be characterized by one pathophysiologic process. Had multiple underlying subtypes been present in significant numbers of the women studied, it is unlikely that the regularity in the profiles that was exhibited throughout these analyses would have been present. Individual variability in the severity of

premenstrual symptomatology can be explained by the inherent variability of the groups of women studied.

Previous studies have shown that retrospectively collected data may overestimate the severity of premenstrual symptoms when compared to prospective daily ratings. Were prospective data used in this analysis, the results may have been diluted; however, the patterns of the profiles, rather than their heights, lead to the conclusion of one underlying pathophysiologic process.

It is also unlikely that the patterns observed have been induced by the survey instrument. It is unlikely that all subtypes of PMS would respond in the same biased manner, particularly when factors such as age, caffeine consumption, and refined sugar intake have been controlled for in the analysis.

Age increased the severity of premenstrual symptoms, with women 40 years of age and older showing changes in the profile pattern. Caffeine and refined sugar consumption may also increase the severity of premenstrual symptoms, as well as maternal history of PMS. There was no evidence that use of oral contraceptives influenced the symptom profiles.

The results of this study have both diagnostic and therapeutic implications. If PMS is indeed a continuous process, diagnostic efforts should be made to determine the extent to which it is present, rather than to determine whether it is or is not present, as is the current dichotomous, diagnostic practice. Rather than diagnose and treat subtypes with their own individualized therapeutic techniques, it may be effective to develop more general treatments. Gise, Lebovits, Paddison and Strain (1990) suggest that merely participating in the prospective evaluation process may give some women adequate tools to cope effectively with PMS. The presence of low levels of premenstrual symptomatology also indicates that prevention programs may be indicated, to prevent exacerbation of premenstrual symptoms to the extent that they interfere with daily functioning and interpersonal relationships.

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Appendices

Appendix 1

WOMEN'S HEALTH SURVEY

Please leave blank.

GENERAL INFORMATION

1. What is your age? _____ /__/__/ 4,5

2. What is your height? _____ /__/__/ 6,7

3. What is your weight? _____ /__/__/__/ 8-10

4. What is the reason for your visit?_____ /__/ 11
   _____

PREMENSTRUAL AND MENSTRUAL HEALTH

5. Do you experience premenstrual syndrome? No___ Yes___
   (Premenstrual syndrome is an array of symptoms beginning approximately one week prior to each menstrual period and usually ending a couple of days prior to your period. Premenstrual syndrome is different from menstrual symptoms, which occur at the time of your period. Many of the most common symptoms of premenstrual syndrome are listed in question 6.) /__/ 12

6. If you do experience premenstrual syndrome, circle the severity of each the following symptoms you experience. (If you do not experience premenstrual symptoms on a regular basis each month, skip to question 11.)

   Depression ___ Mild Moderate Severe /__/ 13

   Tiredness ___ Mild Moderate Severe /__/ 14

   Irritability ___ Mild Moderate Severe /__/ 15

   Anxiety ___ Mild Moderate Severe /__/ 16

   Bloating and weight gain___ Mild Moderate Severe /__/ 17

   Headaches ___ Mild Moderate Severe /__/ 18

   Breast swelling, tenderness ___ Mild Mod Severe /__/ 19

   Craving for sweet foods ___ Mild Moderate Severe /__/ 20

   Craving for salty foods ___ Mild Moderate Severe /__/ 21

   Binge eating ___ Mild Moderate Severe /__/ 22

   Skin acne ___ Mild Moderate Severe /__/ 23

   Other (please specify) _____ Mild Mod Sev /__/ 24

Please leave blank.

7. About how many days before your menstrual period do the premenstrual symptoms circled in question 6 occur? _____ /__/ 25

8. Would you say that your premenstrual symptoms (described in question 6) overall are mild, moderate, or severe? _____ /__/ 26

9. Are your premenstrual symptoms severe enough to cause you to miss work or interfere with your daily housework? No___ Yes___ /__/ 27

10. Are your premenstrual symptoms severe enough to cause you to take aspirin or other medications? No___ Yes___ /__/ 28

11. Does (did) your mother experience premenstrual syndrome? No___ Yes___ Unknown___ /__/ 29

12. Does your sister(s) experience premenstrual syndrome? No___ Yes___ Unknown___ No sisters___ /__/ 30

13. Circle the severity of the following menstrual symptoms which you regularly experience at the time of your period.

Cramps ___ Mild Moderate Severe /__/ 31

Headache ___ Mild Moderate Severe /__/ 32

Tiredness ___ Mild Moderate Severe /__/ 33

Other (please specify) _____ Mild Mod Sev /__/ 34

Do not experience discomfort or any of the above symptoms during menstrual period (skip to question 16) _____ /__/ 35

14. Would you say that your menstrual symptoms (described in question 12) overall are mild, moderate, or severe? _____ /__/ 36

15. Are your menstrual symptoms severe enough to cause you to miss work or interfere with your daily housework? No___ Yes___ /__/ 37

16. Have you ever been told by a doctor that you have endometriosis? No___ Yes___ /__/ 38

17. Have you used oral contraceptives (birth control pills) within the past three months? No___ Yes___ /__/ 39

18. How many full-term pregnancies have you had? _____ /__/ 40

19. Which, if any, of the following procedures have you had?

Tied tubes____ Ovaries removed____ None____ /__/ 41

Hysterectomy____ Other (please specify)_____

DIETARY HABITS

20. Are you taking any medications? Yes___ No___ If yes, list all medications you currently take, including any vitamins._____ /__/ 42

21. About how many times during a typical day do you eat "sweets" or junk food? _____ /__/ 43

22. How many of the "sweets" or junk food consumed during a typical day (question 21) contain chocolate? _____ /__/ 44

23. About how many cups of each of the following beverages do you drink during a typical day? (One "cup" is equal to about eight ounces, or one measuring cupful.)

Water _____ /__/ 45

Fruit juice _____ /__/ 46

Milk _____ /__/ 47

Caffeine-free soft drink _____ /__/ 48

Caffeine-containing soft drink _____ /__/ 49

Hot chocolate _____ /__/ 50

Decaffeinated coffee _____ /__/ 51

Caffeine-containing coffee _____ /__/ 52

Herbal tea (non-caffeine-containing tea) _____ /__/ 53

Caffeine-containing tea _____ /__/ 54

Milk shake, ice cream soda _____ /__/ 55

Other beverages (note that alcoholic drinks are listed in question 24) _____ /__/ 56

Please leave blank.

24. About how many drinks of each of the following beverages do you consume during a typical week?

Beer (one can) _____ /__/ 57

Wine (six ounces)_____ /__/ 58

Hard liquor (one ounce)_____ /__/ 59

25. Would you be willing to be interviewed in person to provide more detailed information about your premenstrual and menstrual health, and about your dietary habits? No___ Yes___ If yes, please provide your name, address, and/or telephone number. /__/ 60

_____

THANK YOU VERY MUCH FOR PARTICIPATING IN

THE WOMEN'S HEALTH SURVEY

Appendix 2

MULTIVARIATE PROFILE ANALYSIS

Multivariate profile analysis is appropriate where a battery of *p* treatments (survey questions, in this case), are administered to two groups of subjects. The responses of the two groups are assumed to be independent of one another. Responses must be expressed in like units.

The test for equality of population mean vectors has three steps:

(1) test for parallel profiles; i.e.,
$H_{01}: \mu_{1i} - \mu_{1i-1} = \mu_{2i} - \mu_{2i-1}$,
$i = 2, 3, \ldots, p$;

(2) test for coincident profiles; i.e.,
$H_{02}: \mu_{1i} = \mu_{2i}$, $i = 1, 2, \ldots, p$; and

(3) test for flat profiles, i.e.,
$H_{03}: \mu_{11} = \mu_{12} = \ldots = \mu_{1p} = \mu_{21} = \mu_{22} = \ldots = \mu_{2p}$.

As discussed in the methods section, only (1) and (2) are of interest in this thesis.

Given two normal populations, with sample sizes of n_1 for population 1 and n_2 for population 2, sample mean vectors

$$\text{xbar1} = \begin{pmatrix} x_{11} \\ x_{21} \\ . \\ . \\ x_{p1} \end{pmatrix},$$

$$\text{xbar2} = \begin{pmatrix} x_{12} \\ x_{22} \\ . \\ . \\ x_{p2} \end{pmatrix},$$

pooled sample covariance matrix

$$\mathbf{S}_n = \begin{pmatrix} s_{11} & s_{12} & . & . & . & s_{1p} \\ s_{21} & s_{22} & . & . & . & s_{2p} \\ . & . & . & . & . & . \\ s_{p1} & s_{p2} & . & . & . & s_{pp} \end{pmatrix},$$

and contrast matrix

$$\mathbf{C}_{(p-1)\ x\ p} = \begin{pmatrix} -1\ 1\ 0\ 0 \ldots\ 0\ 0 \\ 0\ -1\ 1\ 0 \ldots\ 0\ 0 \\ . \\ 0\ 0\ 0\ 0 \ldots -1\ 1 \end{pmatrix},$$

we reject H_{01}: $\mathbf{C}\mu_1 = \mathbf{C}\mu_2$ at level α if

$$T^2 = (\text{xbar1}-\text{xbar2})'\mathbf{C}'\left(\frac{1}{n_1} + \frac{1}{n_2}\,\mathbf{C}\,\mathbf{S}_{\text{pooled}}\,\mathbf{C}'\right)^{-1}$$
$$\mathbf{C}(\text{xbar1}-\text{xbar2}) > c^2$$

where

$$c^2 = \frac{(n_1+n_2-2)(p-1)}{(n_1+n_2-p)} F_{p-1;\ n_1+n_2-p}(\alpha).$$

If the profiles are parallel, we test for coincidence. We reject H_{02}: $\mathbf{1}'\mu_1 - \mathbf{1}'\mu_2$ at level α if

$$T^2 = \mathbf{1}'\,(\text{xbar1-xbar2}) \left(\frac{1}{n_1} + \frac{1}{n_2}\,\mathbf{1}'\,\mathbf{S}_{\text{pooled}}\,\mathbf{1}\right)^{-1} \mathbf{1}'(\text{xbar1-xbar2}) > F_{1;\; n_1+n_2-2}\;(\alpha)$$

where $\mathbf{1} = \begin{pmatrix} 1 \\ 1 \\ . \\ . \\ 1 \end{pmatrix}$.

P-values were calculated using the equation

$$\text{p-value} = 1 - \int_0^{F\text{calc}} \frac{\Gamma[(m+n)/2]}{\Gamma(m/2)\Gamma(n/2)} \left(\frac{m}{n}\right)^{m/2} \frac{x^{((m-2)/2)}}{\left(\frac{mx}{n}\right)^{(m+n)/2}} dx,$$

for an F-distribution with m degrees of freedom in the numerator and n degrees of freedom in the denominator.

The sample variance-covariance matrices and simple statistics were calculated using SAS on a Sun-4 Workstation. Matrix algebra and integrals were computed using *Mathematica* on a Macintosh IIcx.