H24/3148

MONASH UNIVERSITY
THESIS ACCEPTED IN SATISFACTION OF THE
REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
ON..... 12 April 2002.....
.....[redacted].....
for Sec. Research Graduate School Committee

Prospectively Reported Premenstrual Symptom Change: Relationship To Personality, Demographic And Menstrual Cycle Characteristics

Catriona Kirsty Ross, B.B.Sc. (Hons.)

This thesis is submitted for the degree of
Doctor of Philosophy

Department of Psychology
Monash University
Melbourne, Australia

March 2001

ABSTRACT

It is well established that many women experience cyclical changes in somatic, behavioural and affective symptoms in relation to the menstrual cycle. Studies of the pattern, incidence and risk factors of premenstrual change, however, have yielded inconsistent results. Several methodological limitations have pervaded menstrual cycle research hence contributing to the confusion. Key problems include the use of retrospective data, and the failure to consider baseline levels of menstrual cycle symptoms. This study was designed in light of methodological considerations to examine the relationship between premenstrual symptom change, and various personality, demographic and menstrual cycle variables.

In part I of the study, 187 women from the general community (mean age 30 years) completed a modified version of the Moos Menstrual Distress Questionnaire (MMDQ) daily for 70 days. Principal components analysis of the MMDQ items revealed a factor structure comparable to that originally obtained by Moos, and thus the standard six factors of negative affect, cognitive symptoms, behaviour change, fluid retention, somatic symptoms and autonomic reactions were used to summarise the data. All symptom sub-scales fluctuated significantly across the menstrual cycle. Symptoms were at their lowest during the follicular phase and increased premenstrually. Somatic symptoms peaked menstrually and fluid retention peaked premenstrually. In general, however, symptom severity changed little from the premenstrual to the menstrual phase. A very high incidence of premenstrual change was noted, with in excess of 40% of women demonstrating a 30% premenstrual increase in each symptom sub-scale. Close to 50% of women experienced increases in negative affect and over 70% experienced increases in fluid retention. Oral contraceptive (OC) use did not alter the incidence or severity of premenstrual *change*. Overall differences in *symptom severity*, however, were noted, with monophasic OC users reporting higher levels of fluid retention and somatic symptoms than the triphasic OC group.

In part II of the study, 109 women from the original sample completed the NEO Personality Inventory Revised in addition to detailed general information, and menstrual history, forms. Sequential multiple regression models were used to identify predictors of premenstrual symptoms both before and after controlling for baseline (follicular) symptom levels. Neuroticism accounted for a significant amount of variation in premenstrual negative affect both before and after controlling for follicular scores. This indicates that neuroticism exerts a generalised influence on affective symptoms, in addition to an effect that is specific to the premenstrual phase. The relationship between neuroticism and negative affect could not be linked to any particular facet (e.g. anxiety, depression) of neuroticism. The only other personality factor to predict premenstrual symptomatology was extraversion. Women with lower extraversion scores reported more autonomic reactions throughout the menstrual cycle, in addition to greater premenstrual increases in symptomatology. Much of this relationship was attributable to the extraversion facet "activity".

The cognitive, behavioural, somatic and fluid retention symptom sub-scales were predicted almost exclusively by menstrual pain and marital status. Severity of menstrual pain showed a very clear pattern of predicting premenstrual but not follicular symptoms. As a result of this, menstrual pain was strongly related to the extent of premenstrual change. The relationship between marital status and premenstrual symptoms was more complicated, with single women reporting more cognitive, behavioural, autonomic and somatic symptoms during both the premenstrual and follicular phases. When variance attributable to baseline scores was held constant, marital status continued to predict premenstrual behaviour change and autonomic reactions only.

The results of this research suggest that women respond to the occurrence of normal neuroendocrine events associated with the menstrual cycle. Certain factors appear to increase vulnerability to these changes. In particular, personality characteristics (e.g. high neuroticism and low extraversion) in addition to social situational variables (e.g. being single) render women more reactive to premenstrual physiological changes.

The outcomes of the study are discussed in terms of a bio-psycho-social model of premenstrual change, and the utility of cognitive-behavioural treatment approaches.

DECLARATION

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other institution. To the best of my knowledge, this thesis contains no material previously published or written by another person, except where due reference is made in the text.

The research contained in this thesis was conducted with the approval of the Monash University Standing Committee on Ethics in Research on Humans (project number: 97/009). The project was deemed to conform to NH&MRC guidelines.

Catriona K. Ross

ACKNOWLEDGEMENTS

First and foremost I would like to thank my supervisor, Professor Grahame Coleman, for his guidance and advice throughout the duration of this project. Grahame's ideas challenged me to explore various theoretical, methodological and statistical frameworks, and his input is greatly appreciated.

My sincere thanks to all the women who participated in this study and who so candidly shared their experiences with me. Without their interest and commitment, this research would not have been possible.

I would like to thank my two "office-mates", Alanna Sawyer and Margaret Hall for their terrific company, and for their friendship. Their encouragement, belief in my abilities, and knack of making the ordinary fun, helped keep me sane. On the technical side, I owe a huge debt of gratitude to Alanna for her endless patience in dealing with my computing problems. Her expertise and willingness to help saved me much time and frustration.

To other PhD students in the department, most notably Margaret Hay, Kaye Salmon, Jane Fletcher, David Goble, Andrew Jago and Debbie Howells, I would like to extend my sincere thanks. Having a group of people with whom to discuss ideas, as well as the hardships of a PhD!, was invaluable.

I am grateful to my family and friends who have supported and encouraged me in pursuit of this degree. To my Mum in particular, thank-you for your strength and wisdom, and for always being there for me.

Finally a very special thanks to my friend and fellow PhD student, Clara, for her significant contribution to this thesis, and for her encouragement, support and understanding. Throughout the duration of my candidature, Clara and I spent considerable amounts of time discussing all aspects of a PhD, from font size to

strategies for maintaining motivation. The value of sharing the experience of a PhD with such a good friend was inestimable, and I wish to extent my deepest gratitude.

ABBREVIATIONS

ANOVA	Analysis of variance
DSM-III-R	Diagnostic and Statistical Manual of Mental Disorders, third edition revised
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, fourth edition
DV	Dependent variable
EPI	Eysenck Personality Inventory
GHQ	General Health Questionnaire
IV	Independent variable
LLPDD	Late Luteal Phase Dysphoric Disorder
MANOVA	Multivariate analysis of variance
MDQ	Moos Menstrual Distress Questionnaire
MJQ	Menstrual Joy Questionnaire
MMDQ	Modified Moos Menstrual Distress Questionnaire
NEO PI-R	NEO Personality Inventory Revised
NOC	Non oral contraceptive (i.e. NOC group refers to non-oral contraceptive group)
NS	Non-significant
OC	Oral contraceptive
PAF	Premenstrual Assessment Form
PDD	Premenstrual Dysphoric Disorder
PMC	Premenstrual Change
PMS	Premenstrual Syndrome

PMT	Premenstrual Tension
POMS	Profile of Mood States
SES	Socio-economic status

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

OVERVIEW OF THESIS

This thesis is presented in three parts. Part one (chapter one through four) provides a critical review of the theoretical and empirical literature. Part two (chapters five and six) details the empirical research and discusses the outcomes of the study. Part three (chapter seven) provides an integration and summary of the results.

Issues related to the definition and measurement of symptom change across the menstrual cycle are discussed in chapter one. Methodological issues are highly relevant to the study of premenstrual changes and have implications for the interpretation of previous research and theory. Accordingly, relevant issues are discussed in order that past research findings can be evaluated in light of the methodology on which they were based. The discussion of definition and measurement issues in this chapter also serves to provide a rationale for the design of the current study.

Chapter two details previous research on the pattern and incidence of symptom change across the menstrual cycle. Factors that have been postulated to influence the pattern and incidence are also discussed, with an emphasis on demographic characteristics, menstrual cycle variables, and oral contraceptive use. The inconsistencies in empirical research findings are noted, and are discussed in the context of methodological practices. The importance of accurate data on the pattern, incidence and risk factors of premenstrual symptoms is discussed. The need for large, methodologically sound studies is outlined.

Major aetiological theories of PMC are evaluated in chapter three. Biological and psychosocial influences are briefly discussed with a view to providing a context for the research outcomes. The primary emphasis of this chapter is the relationship between personality and premenstrual symptoms. Previous research on the role of personality in premenstrual change is discussed. The five-factor model of personality

was selected to provide the framework for personality measurement in this research. The rationale for this decision, and an overview of the model, are provided.

A brief summary and integration of the literature is presented in chapter four. The rationale for the present research is outlined. The aims of the study are presented, and the manner in which the aims were realised, is documented. Specific hypotheses are noted.

Chapter five constitutes the first of the empirical research chapters. This chapter details the method, results and discussion from the first part of the study. Results of a factor analysis of the Moos Menstrual Distress Questionnaire are presented. Symptom change across the menstrual cycle in each symptom factor is evaluated by comparing symptom scores at three menstrual cycle phases. This pattern of change is compared in non-users of oral contraceptives, triphasic oral contraceptive users and monophasic oral contraceptive users. The incidence of various magnitudes of premenstrual change for each of these oral contraceptive groups is also presented. The results are discussed in the context of previous research.

Chapter six constitutes the method, results and discussion for part II of the study. The prediction of menstrual cycle symptoms from various demographic (age, marital and employment status, number of children), menstrual cycle (menstrual cycle length and regularity, menses duration, age of menarche, menstrual pain) and personality variables (neuroticism, extraversion, openness, agreeableness, conscientiousness) is examined. The extent to which these variables predict symptomatology is investigated using sequential multiple regression models. In order to distinguish between premenstrual symptoms and premenstrual change, the prediction of premenstrual symptoms is examined both before and after controlling for baseline (follicular) scores. The outcomes are discussed in the context of previous research.

The final chapter presents an integration and summary of the results. Major findings are reiterated. The contribution of the results to theories of aetiology is discussed.

Implications of the findings for the treatment of premenstrual change are presented. The generalisability of the results is considered, and suggestions for future research proposed.

PART ONE

LITERATURE REVIEW

CHAPTER 1

DEFINITION AND MEASUREMENT OF PREMENSTRUAL CHANGES

1.1 Definition of Premenstrual Changes and The Premenstrual Syndrome

The menstrual cycle is a biological rhythm designed to favour conception and reproduction. Hormones of the hypothalamic-pituitary-gonadal system fluctuate predictably over an average cycle length of 28 days throughout a woman's reproductive life (Gomel, Munro & Rowe, 1990; Copeland, 2000). In addition to these hormonal changes, a variety of psychological, somatic, behavioural and cognitive changes have also been postulated to occur.

The commonly reported finding of adverse physical and psychological changes during the late luteal phase of the menstrual cycle was described as early as in writings of the Greek physicians of the Hippocratic period who described symptoms including headache and a sense of heaviness (Ricci, 1950). It was not until 1931, however, that these symptoms were defined when Frank coined the term "premenstrual tension" (PMT) to describe "a feeling of indescribable tension from 7 to 10 days preceding menstruation which, in most instances, continues until the time that the menstrual flow occurs" (Frank, 1931, p. 1054). Frank is generally recognised as the first to have systematically studied premenstrual symptoms, and in the seven decades since the publication of his paper there have been many published reports of cyclical changes in somatic, behavioural and affective symptoms in relation to the menstrual cycle (e.g. Rees, 1953; Coppen & Kessel, 1963; Moos, 1968; Moos, 1969; Englander-Golden, Whitmore & Dienstbier, 1978; Haskett & Abplanalp, 1983; Rubinow, Roy-Byrne, Hoban, Gold & Post, 1984; Endicott, Nee, Cohen & Halbreich, 1986; Magos, Brincat & Studd, 1986; Rapkin, Chang & Reading, 1988; Freeman, Rickels, Sondheimer & Polansky, 1990; Gallant, Popiel, Hoffman, Chakraborty & Hamilton, 1992a; Cerin, Collins, Landgren & Eneroth, 1993; Facchinetti, Genazzani,

Martignoni, Fioroni, Nappi & Genazzani, 1993; Christensen & Oei, 1995a; Sveinsdóttir, 1998). While some studies do not concur with these findings and report an absence of symptom cyclicity across the menstrual cycle (Brockway, 1976; Markum, 1976; Abplanalp, Donnelly & Rose, 1979; Vila & Beech, 1980; Golub & Harrington, 1981; Lahmeyer, Miller & DeLeon Jones, 1982; Ainscough, 1990), most show reasonable consistency in reporting an increased occurrence of symptoms during the late luteal phase of the menstrual cycle in at least 30% (Kessel & Coppen, 1963; Moos, 1968; Sheldrake & Cormack, 1976; Clare & Wiggins, 1979; N.F. Woods, Most & Dery, 1982b; Merikangas, Foeldenyi & Angst, 1993) and often in excess of 50% of women (Halbreich, Endicott, Schacht & Nee, 1982; Hargrove & Abraham, 1982; Yuk, Jugdutt, C.E. Cumming, Fox & D.C. Cumming, 1990; High & Marellino, 1995) (see section 2.2). A number of researchers have reported the presence of additional symptoms during the mid-luteal (e.g. Sanders, Warner, Bäckström & Bancroft, 1983) or menstrual phases (e.g. Herrera, Gómez-Amor, Martínez-Selva & Ato, 1990) but most report the follicular phase to be comparatively symptom free (e.g. van der Ploeg & Lodder, 1993). Differences in results across studies appear to reflect, in part, methodological inconsistencies, most notably the varied application of criteria for both inclusion of research participants, and for establishing symptom cyclicity (refer section 1.2).

Premenstrual syndrome or PMS has now replaced PMT as the most frequently employed nomenclature to describe premenstrual symptoms. This term was applied in recognition of the diversity of symptoms other than tension that have been reported to occur premenstrually. Use of the term has been criticised, however (Bancroft, 1993; Choi, 1995) on the grounds that "syndrome", which implies an abnormal or disease state, is inappropriate as a description of symptoms that are not uncommon, and in most women, are not debilitating. A further difficulty with the term is the lack of any meaningful definition specifying inclusion and exclusion criteria based on the type, pattern and severity of symptoms that constitute the syndrome. This issue will be discussed in sections 1.1.1 through 1.1.4. Section 1.1.5 will outline the manner in which premenstrual changes have been conceptualised in this thesis.

1.1.1 Type of Symptoms

More than 150 diverse symptoms have been reported to occur, or become exacerbated, premenstrually (Dalton, 1964; Moos, 1968; Halbreich et al., 1982). There do, however, appear to be commonly reported symptoms of both an affective and somatic nature that emerge consistently across studies. The most distressing symptoms appear to be those that are affective in nature (Corney & Stanton, 1991), the most commonly reported being irritability, tension and depression. Women are more likely to seek help for these emotional symptoms (Siegel, 1987; Rubinow & Schmidt, 1989). Somatic complaints predominantly include breast tenderness, abdominal bloating, headache and backache. Other relevant symptoms include changes in behaviour (e.g. avoidance of social contacts), cognition (e.g. decreased concentration), appetite (e.g. food cravings) and motor coordination (e.g. clumsiness).

1.1.2 Timing of Symptoms

A further difficulty with the definition of PMS is the disagreement as to what constitutes the onset and duration of the symptomatic and asymptomatic phases. Estimates of the onset and duration of the symptomatic phase range from only a few days prior to the onset of menses to inclusion of the entire luteal phase. Reports regarding the cessation of symptoms have also been contradictory. H. Sutherland and Stewart (1965) argue that, by definition, amelioration of premenstrual symptoms must occur with the onset of menstruation; Dalton (1964; 1977; 1984) however refers to the symptomatic period as "the paramenstruum" which she defines as four days before and four days following menses onset.

Related to symptom timing is the issue of the nature and length of the asymptomatic period. Dalton (1964; 1977; 1984) maintains that there must be a true symptom-free period and that women who experience premenstrual exacerbation of symptoms are not suffering PMS but what she terms "menstrual distress". This excludes a large group of women who have some mild complaints throughout the cycle and is of

importance because, as Clare (1983) has pointed out, the most prevalent symptoms (e.g. anxiety) are not uncommon in women during the reproductive years. Thus, to expect women to be completely symptom-free at all times other than during the premenstrual period may be too restrictive.

1.1.3 Severity of Symptoms

Failure to consider the severity of premenstrual symptoms is an ongoing problem but was particularly so prior to the mid 1980's. In a 1984 paper, Rubinow and Roy-Byrne summarised some of the main issues:

"the question of symptom severity has hardly been addressed. Problems in this area have included failure to measure the severity of symptoms, attribution of clinical importance to statistically significant but clinically insubstantial changes in symptoms (from nonexistent to very mild), and use of a scale with insufficient sensitivity to differences in severity and reflecting categories rather than dimensions" (Rubinow & Roy-Byrne, 1984, p. 164).

These problems appear to have diminished over the last decade and a half, with a number of investigators recognising the importance of measuring symptom severity. Many researchers now routinely use a comprehensive four- to six- point scale (no symptoms to debilitating symptoms), and thus distinguish between women experiencing only mild change and those experiencing severe change. Unfortunately some widely cited studies, particularly those estimating prevalence rates (e.g. Sheldrake & Cormack, 1976; High & Marcellino, 1995), did not assess symptom severity.

1.1.4 Late Luteal Phase/Premenstrual Dysphoric Disorder

An attempt to standardise the definition of premenstrual symptoms was made by including a listing of "late luteal phase dysphoric disorder" (LLPDD) and "premenstrual dysphoric disorder" (PDD) in the Diagnostic and Statistical Manual of Mental Disorders third edition, revised, and fourth edition (DSM-III-R & DSM-IV) (American Psychiatric Association, 1987, 1994) respectively, in the appendix listing axes requiring further study. Criteria for both listings include: impairment of daily functioning; the presence of five of nine emotional and physical symptoms during the late luteal phase (including at least one affective symptom); remission of symptoms shortly after menses onset; and the absence of symptoms during the rest of the cycle. Diagnosis requires severity comparable to a major depressive episode so the disorder applies only to a very small proportion of women who experience premenstrual changes (Rivera-Tovar & Frank, 1990; Hurt, Schnurr, Severino, Freeman, Gise, Rivera-Tovar & Steege, 1992), and cannot be used to describe the more commonly experienced mild symptoms (American Psychiatric Association, 1987, 1994). Rivera-Tovar and Frank prospectively assessed the incidence of LLPDD and found fairly low rates of three to four percent to be associated with the syndrome. Sveinsdóttir and Bäckström (2000a) obtained comparable results finding that two to six percent of a random sample of Icelandic women met the DSM-IV criteria for PDD.

1.1.5 Conceptualisation of PMC, and Meaning of Terms Used in this Thesis

It is thus apparent that there is great variability in the conceptualisation of premenstrual symptoms, both in terms of symptom type and severity, and in the timing of symptoms. The difficulties this creates in terms of comparison of studies are clearly of paramount importance to the study of menstrual cycle changes and should be given serious consideration. In the absence of an established definition of PMS, it is necessary to describe the consequential details of previous work in order that the meaning and validity of research findings can be evaluated.

It seems clear that a small proportion of women experience premenstrual symptoms, of a primarily affective nature, which are sufficiently severe to interfere with their daily functioning. This is encapsulated in the DSM-IV listing of PDD. Most women, however, do not meet these criteria but experience milder cyclic changes of various types, which may or may not affect daily activities, but do not cause severe disablement. Although these changes do not necessarily give the impression of a pathological process, they are distressing to women and, given their incidence, have considerable social, economic and political relevance. These changes are generally referred to as premenstrual changes (PMC) (e.g. Hamilton, Parry, Alagna, Blumenthal & Herz, 1984) or PMS. At this stage it is not clear whether PDD and PMS are distinct disorders or represent one end of a spectrum of premenstrual changes experienced by a majority of women. Given the DSM-IV specified criteria for PDD, it could arguably be viewed as constituting a discrete phenomenon. However, there exists little evidence that *PMS* is used to describe symptom experience that differs qualitatively from that described by PMC. Jorgensen, Rossignol and Bonnlander (1993) employed multivariate profile analysis and concluded that premenstrual symptomatology is a continuous process with variability in severity (from mild to clinical) resulting from individual variations in the manifestation of a single underlying process. The authors argue that study of the full range of symptoms is more productive than using the current dichotomous diagnosis of PMS or no PMS.

The focus of this thesis will thus be premenstrual changes and the term PMC will be used wherever possible in preference to PMS. There are several reasons for this decision. The term PMS is not associated with a well-established definition, and its usage is hence not particularly meaningful. Further, given that "premenstrual/late luteal dysphoric disorder" is now being used in the literature to describe pathological premenstrual symptoms, the term PMS may be redundant and confusing. In addition, as noted by a number of researchers (e.g. Bancroft, 1993; Choi, 1995), the term "syndrome" has connotations which are not appropriate for the majority of women who are referred to as having PMS. Finally, as indicated above, there is little evidence

that (with the exception of PDD) premenstrual changes represent anything but a continuum.

Thus, for the purpose of the research outlined in this thesis, the outcomes will be described in terms of premenstrual symptoms and premenstrual change, with reference to severity of these changes. When referring to previous literature, however, because many authors have used the term PMS, their nomenclature will be preserved and the method of determining PMS will be indicated where necessary. The majority of researchers have used a criterion of a 30% increase in symptoms from the follicular to the luteal phase to diagnose PMS; any use of markedly different criteria will be noted. Wherever possible the type of symptoms studied will be described to indicate any differences between psychological and somatic symptoms. Most authors, in describing the premenstrual period, refer to the five days before menstruation, and study the menstrual phase quite separately as the first three to five days of menstruation. Any studies using a longer premenstrual period and/or including ovulation in the premenstrual phase will be noted, as will any studies considering a single symptomatic phase as the late luteal and early menstrual phases. Given the commonality of some premenstrual symptoms (e.g. anxiety) during other menstrual cycle phases, it appears reasonable to accept some baseline symptomatology as normal, and to consider PMC as a meaningful increase in symptoms during the premenstrual phase. Any studies, however, in which the sample may be expected to have higher than average baseline symptoms, will be noted.

1.2 Measuring Premenstrual Changes

Although the relevant literature with regard to premenstrual symptoms and PMC is considerable, it is in many regards contradictory. Part of this confusion reflects the many methodological problems associated with menstrual cycle research. As outlined above (see section 1.1), one of the primary problems is that there is no widely accepted definition of PMS. Other major difficulties relate to the selection of participants for research, and the reliability and validity of methods used to measure

symptom cyclicity across the menstrual cycle. The purpose of this section is to discuss the contribution of methodological problems to the lack of understanding of PMC, and to consider the steps that can be implemented to upgrade the quality of work.

1.2.1 Selection of Research Participants

The participants selected for inclusion in studies of PMC can have a considerable influence on the research outcomes. As many investigators select participants largely on the basis of convenience, common participant groups include university students (e.g. Moos, 1968; Parlee, 1973; Koeske & Koeske, 1975; Brooks, Ruble & Clark, 1977; Olasov & Jackson, 1987; Picone & Kirkby, 1990), women attending PMS (e.g. Morse & Dennerstein, 1988b; C.E. Cumming, Krausher, Jugdutt, Grover, Fox & D.C. Cumming, 1994) or family planning clinics (e.g. Bains & Slade, 1988), women responding to advertisements for sufferers of premenstrual symptoms, (e.g. van der Ploeg, 1987), women visiting their general practitioner or gynaecologist complaining of premenstrual symptoms (e.g. Mira, Vizzard & Abraham, 1985) and various specific employment or demographic groups (e.g. workers in textile factories – Marván & Escobedo, 1999; military wives – Rosen, Moghadam & Endicott, 1988, 1990; employed nurses – Lee & Rittenhouse, 1992). Halbreich and Endicott (1985) also report that the type of participants recruited by written advertisements depends on the phrasing of the advertisement. They noted that participants who have milder changes are more likely to respond to advertisements for menstrual cycle research that *do not* emphasise the premenstrual period. While the use of convenient samples can be quite valid, care must be taken not to generalise from these limited groups to include all women. Unfortunately, the conclusions from some areas of investigation are based heavily on women from certain demographic groups (discussed where relevant in later sections), and there is still a need for studies utilising representative samples.

When selecting participants, additional factors that can create variability or act as confounds need also be considered. Most researchers routinely eliminate from study women who are pregnant or breast-feeding, women with psychiatric disorders or irregular menses, and women taking significant medications. Oral contraceptive (OC) users are either eliminated or studied as a separate group. In 1983, Abplanalp suggested that criteria for participant inclusion should include clear descriptions of: 1) participant recruitment methods; 2) age limitations; 3) contraception and medical information; 4) marital status; 5) parity; 6) race; 7) menstrual history data; 8) assessment instruments; 9) operational definition of PMC; 10) psychiatric history data; 11) assessment of current psychological state; 12) criteria for symptoms severity assessment; 13) criteria for establishing the occurrence of ovulation; 14) cut off criteria for unsuitable participants. While these criteria are increasingly observed (with the exception of establishing ovulation), a number of investigators still fail to provide adequate information, making it difficult to evaluate research outcomes.

1.2.2 Assessment of PMC

Comparability of studies in the area of PMC is made problematic by the range of assessment techniques currently in use. Several different methods of assessing premenstrual symptoms have been utilised over the years, with the most common method now involving pen and paper self-rating reports. Alternative and earlier methods of assessments have involved the analysis of various types of psychoanalytic material including dream content, free association (Benedek & Rubenstein, 1939), and analysis of verbal samples (Gottschalk, Kaplan, Gleser & Winget, 1962), as well as semi-structured psychiatric interview (Andersch, Hahn, Wendestam, Ohman & Abrahamson, 1978). Various self-report instruments have been applied to PMC, some designed for other purposes, some modified to assess PMC and some designed specifically for menstrual cycle research.

Of those designed for the purposes of assessing and confirming premenstrual symptoms, the Moos Menstrual Distress Questionnaire (MDQ) (Moos, 1968) is

undoubtedly the most widely recognised and used. The MDQ consists of 47 items from which eight symptom groups (pain, concentration, behaviour change, autonomic reactions, water retention, negative affect, arousal, control) emerge after factor analysis. Each symptom is rated on a six-point scale (from 1, no experience of the symptom, to 6, acute or partially disabling experience of the symptom) with respect to either current feelings (MDQ-T) or three phases (menstrual, intermenstrual, premenstrual) of the most recent cycle (MDQ-C).

The MDQ-T has been reported to have satisfactory test-retest (0.88) and split-half (0.92) reliability (Markum, 1976). Form C of the MDQ, however, has been subject to serious criticism on the grounds that its retrospective nature causes bias (Parlee, 1974). Parlee (1974) found that the MDQ-C elicited similar responses from both men and women when men were asked to rate women's experiences. It was argued that this indicated that the MDQ was assessing stereotypic conceptions of PMS. Evidence in support of this criticism has subsequently accrued (see section 3.2).

A modified version of the MDQ (MMDQ) developed by Clare and Wiggins (1979) consists of 34 items representing six of Moos' (1968) eight original sub-scales. The omitted sub-scales "control" and "arousal" contain items shown by Moos not to vary across the menstrual cycle (Moos, 1968). Respondents are restricted to rating each symptom on a four-point scale from 0 (no experience of the symptom) to 3 (severe experience of the symptom). The questionnaire appears to have good reliability (Clare & Wiggins, 1979) and has been widely used (e.g. Hart, Coleman & Russell, 1987; Bains & Slade, 1988; Picone & Kirkby, 1990; van den Akker, Sharifian, Packer & Eves, 1995). The predictive validity of the questionnaire has been examined using the well-established Profile of Mood States (POMS). Eighty-one women completed the MMDQ daily and the POMS weekly. The predictive validity of three previously established MMDQ symptom clusters (negative affect, tension and cognition) (Hart et al., 1987) was examined by correlating (canonical and bivariate) the MMDQ with the POMS and comparing the ability of the two tests to discriminate between complainers of PMS and non-complainers. Results showed good overall correlations between the

tests and good correlations between comparable sub-scales of the tests. The MMDQ, but not the POMS, was found to differentiate complainers from non-complainers (Russell, Coleman & Hart, 1988).

A number of more recent rating scales for the assessment of PMS were developed primarily in the 1980's. Steiner, Haskett and Carroll (1980) developed a rather narrow modified version of the MDQ. They distinguished eight primary mood and behavioural symptom groups of which five must be present for a diagnosis of PMS. Somatic symptoms were not considered. Their delineation is thus a relatively restrictive one which yields a more homogenous group but may not adequately account for the diversity of premenstrual symptoms.

Halbreich, Endicott, and colleagues (1982) developed the Premenstrual Assessment Form (PAF), a self-report questionnaire of 95 items with specific criteria for inclusion in a number of sub-groups. It measures changes in affect, behaviour and somatic symptoms in terms of six-point bipolar scales of the amount of change. It is thus a good measure by which to select relatively homogenous groups of participants. A retrospective version rates symptom severity for the previous three cycles, while a prospective daily ratings form requires the completion of a shortened version of, usually, 21 items (Endicott et al., 1986).

The PMS diary was designed to provide a concise measure of the core symptoms of PMS (Thys-Jacobs, Ceccarelli, Bierman, Weisman, Cohen & Alvir, 1989; Alvir & Thys-Jacobs, 1991). The questionnaire comprises 17 symptoms with four factor scales measuring negative affect, fluid retention, pain, and food (appetite changes and cravings). Symptoms are measured on a four-point scale from 0 (absent) to 3 (severe) and the factors appear to be internally consistent. The total symptom score in the PMS diary has been demonstrated to correlate highly with both the total score of the MDQ (0.77) and the PAF daily ratings form (0.67). The correlation between the MDQ and the daily ratings form was 0.81. Correlations between scales measuring similar constructs were also generally high (Thys-Jacobs, Alvir & Fratarcangelo, 1995).

1.2.3 Factor Structure of the MDQ

Despite the number of instruments now available to assess premenstrual symptomatology, the MDQ remains the most widely used. The MMDQ is also popular and has been used in a number of studies where a shorter questionnaire is desirable (e.g. Hart et al., 1987). Both of these questionnaires have demonstrated reliability and validity (see section 1.2.2) and usage facilitates comparison to previous research. One aspect of the MDQ, however, that has received little attention, is its factor structure. Although a number of researchers have attempted to replicate the original factor structure obtained by Moos (1968), results have been inconsistent, and much of the work has been based on either retrospective reports of symptomatology, or single-day prospective reports. The factor structure reported by Moos was determined by factor analysing (principal components analysis with orthogonal rotation (method not specified)) the responses of 839 women who completed the MDQ retrospectively, reporting how they felt during their worst and their most recent follicular, menstrual and premenstrual phases (Moos, 1968). The eight factors and their constituent symptoms are as follows:

1. pain (muscle stiffness, headache, cramps, backache, fatigue, general aches and pains)
2. concentration (insomnia, confusion, forgetfulness, lowered judgement, difficulty concentrating, distractible, accidents, lowered motor coordination)
3. behaviour change (lowered work/school performance, take naps/stay at home, avoid social activities, decreased efficiency)
4. autonomic reactions (dizziness/faintness, cold sweats, nausea/vomiting, hot flashes)
5. water retention (weight gain, painful breasts, swelling, skin disorders)
6. negative affect (crying, loneliness, anxiety, restlessness, irritability, mood swings, depression, tension)
7. arousal (affectionate, orderliness, excitement, feelings of well-being, bursts of energy)

8. control (feelings of suffocation, chest pains, ringing in the ears, heart pounding, numbness/tingling, blind spots/fuzzy vision).

These factors, however, have not been entirely supported by subsequent analyses of the MDQ. Siegel, Myers and Dineen (1987) factor analysed the responses of 156 women who were undergoing treatment for PMS. Participants were instructed to complete the MDQ two days prior to expected menses. Symptoms from Moos' (1968) control factor were omitted from the analysis. Principal components analysis with varimax rotation revealed five distinct factors:

1. withdrawn mood (confusion, concentration problems, decreased efficiency, forgetfulness, poor judgement, lowered work performance, distractibility, fatigue, accidents, avoidance of social activities, absence from work, restless sleep)
2. anxious/tense mood (depression, mood swings, irritability, tension, anxiety, crying)
3. physical discomfort (cold sweats, muscle stiffness, aches and pains, cramps, hot flashes, backache, dizziness/faintness, nausea)
4. water retention (clumsiness, swelling, food cravings, headaches, weight gain, breast tenderness)
5. arousal (bursts of energy, excitement, feelings of well-being, orderliness, affectionateness).

While this factor structure does not replicate that of Moos (1968), given the differences in the methodology of the studies, the results are reasonably similar. The primary difference appears to be the collapsing of what Moos refers to as the concentration and behaviour change sub-scales into one factor, "withdrawn mood". Symptoms of Moos' autonomic reactions were also distributed among other factors, but generally loaded most highly on the physical discomfort factor.

Van der Ploeg (1990) used factor analysis (extraction technique not specified) with varimax rotation to analyse responses from a Dutch adaptation of the MDQ. Seven

hundred and two women who complained of PMS completed the prospective version of the questionnaire on days 12, 18, 22 and 26 of the menstrual cycle. Factor analyses were conducted separately for the data collected on each of these days and for various combinations of days. Four factors were found:

1. negative affect (crying, irritability, mood swings, depression, tension, loneliness, restlessness, wordy quarrel)
2. concentration (confusion, avoid social activity, lowered judgement, difficulty concentrating, accidents, distractible, decreased efficiency, clumsiness)
3. pain (lowered performance, headache, stay in bed, cramps, apathy, backache, fatigue, feeling sick)
4. water retention (weight gain, painful breasts, swelling, swelling of feet, impulse for activity, change eating habits)

These results are similar to those of Siegel et al. (1987) with a combination of Moos' (1968) concentration and behaviour change symptoms forming one factor, "concentration". Again, there is no factor that could sensibly be named "autonomic reactions", and while the Dutch version of the MDQ does not contain all of the autonomic symptoms, van der Ploeg (1990) reports that factor analysis of the MMDQ also yielded four factors which could be named as above. (Symptoms constituting these four factors of the MMDQ were not provided by van der Ploeg).

Clare (1983) applied an unrotated principal axis analysis to the responses of 521 women who completed the MMDQ retrospectively. Seven factors were extracted which accounted for 61.1% of the variance: (Note that Clare did not provide names for these factors; the names given below are those adopted by Moos (1968) for his factors and are provided here to increase clarity).

1. concentration (forgetfulness, confusion, difficulty concentrating, difficulty making decisions, decrease in efficiency)

2. negative affect (depression, mood swings, irritability, tension, anxiety, crying spells, restlessness, tiredness, loneliness)
3. autonomic reactions (hot flushes, cold sweats, feeling sick or vomiting, difficulty sleeping, dizziness/faintness)
4. pain (general aches and pains, stomach pains, backache, muscle stiffness)
5. fluid retention (feeling swollen/bloated, weight gain)
6. behaviour change (lowered work performance, taking naps, avoiding social activities)
7. factor 7 (clumsiness, accidents)

As noted by Clare (1983), these factors are remarkably similar to those derived by Moos (1968). The most notable differences in Clare's solution are the presence of an additional factor comprising the symptoms clumsiness and accidents, and the failure of skin disorder and tender breasts to load on any factor.

Thus, although different factors have emerged as a result of analysis of the MDQ, a general pattern is apparent. The results of these studies indicate the presence of affective/behavioural factors in addition to groups of somatic symptoms. There appear to be two factors of affective/behavioural symptoms, the first relating to symptoms such as concentration difficulties, withdrawn mood, confusion, and lethargy, and the other with anxiety/tension as the prominent feature. Two somatic factors also emerge fairly consistently, one featuring symptoms of general pain such as headache, backache and nausea, and the other featuring typical symptoms of water retention. When positive symptoms are included in the analyses, these appear to form an addition "arousal" factor. Symptoms comprising arousal, however, do not appear to have much impact on the overall experience of premenstrual women (Siegel et al., 1987). The primary differences in the results of different researchers appear to be with regard to the factors of behaviour change, concentration and autonomic reactions. Moos (1968) and Clare (1983) both found these three symptom groups to form distinct factors, whereas Siegel et al. and van der Ploeg (1990) observed symptoms of behaviour change and concentration to constitute a single factor. They also failed to

find a factor constituting symptoms of autonomic reactions. While the reason for such differences is not clear, it is interesting to note that the solutions of Moos and Clare are based on retrospective data, while Siegel et al. and van der Ploeg collected data prospectively, albeit on a single day of the premenstrual period only. Further research is needed to resolve these issues, and it would be interesting to examine the factor structure of data collected prospectively throughout the menstrual cycle.

There is thus some question as to the number and structure of factors which constitute the MDQ. This issue is an important one, not just in terms of the validity of the questionnaire, but also because it has implications for the manner in which PMC is measured and conceptualised. In view of the large number of relatively disparate symptoms that have been linked to the menstrual cycle, a number of investigators have suggested that the premenstrual syndrome be more correctly described as a set of syndromes, each potentially with different aetiological factors. The fact that the MDQ can be reduced to a reliable number of factors is one line of evidence that is used in support of this hypothesis. A number of other questionnaires have also been subjected to factor analysis with a view to testing this hypothesis. Results from these studies will not be discussed here, but are summarised in Table 1.1. These findings further suggest the possibility that PMC consists of distinguishable sub-types.

To date there has been little work investigating the possibility that sub-types of PMC result from different causal factors. A number of studies examining the role of oestrogen and progesterone in PMC, however, provide some evidence in support of an association between specific symptoms and different hormonal parameters. A group of women with premenstrual anxiety were found to have relatively high oestrogen:progesterone ratios (Bäckström & Cartensen, 1974; Bäckström & Mattson, 1975), while a carefully selected group of women with premenstrual depression were not (S.L. Smith, 1975). In addition, Cullberg (1972) found that women with premenstrual irritability suffered adverse reactions to oestrogen dominated OCs but not to progesterone dominated OCs. Conversely, adverse reactions were more

Table 1.1

Premenstrual Symptom Sub-scales Derived from Factor Analysis of Questionnaires other than the MDQ

Authors	Method of data collection	Participants	Derived Symptom sub-scales				
Schechter, Bachmann, Vaitukaitis, Phillips & Saperstein (1989)	Prospective responses to the Daily Life Experiences Questionnaire	19 women with prospectively confirmed perimenstrual mood change	**Mood and cognition** e.g.: - depression - anxiety	**Physical condition** e.g.: - breast pain - abdominal pain	**Energy level** e.g.: - fatigue - more sleep	**Appetite** e.g.: - food cravings	**Sociability** e.g.: - avoidance of social activities
Endicott et al. (1986)	Prospective responses to the Daily Ratings Form	64 women with prospectively confirmed premenstrual change or no premenstrual change	**Dysphoric mood** e.g.: - irritability - avoidance of social life	**Physical discomfort** e.g.: - breast pain - abdominal pain	**Low energy** e.g.: - sleep more - tired	**Consumption** e.g. - increased appetite	**Non-classified** e.g. - headaches - restlessness
D.C. Cumming, C.E. Cumming, Krausher & Fox (1991)[a]	Retrospective responses to the Premenstrual Assessment Form	109 women seeking treatment for premenstrual complaint	**Physiological depression** e.g.: - depression - physical discomfort - fatigue	**Anxiety-volatility** e.g.: - hostility - implusivity	**Increased well-being** e.g.: - increased well-being		

[a] these factors were comparable to those found in a similar study of non-complaining women (Yuk et al., 1990).

common with progesterone dominated- compared to oestrogen dominated- OCs in women without a history of premenstrual irritability. Richter, Haltvick and Shapiro (1984) found significant differences in symptom cyclicity and effect of progesterone in women who reported deriving more relief from progesterone relative to placebo, compared to those who reported gaining the greatest relief from placebo. Women who reported greater relief from progesterone showed cyclicity in more symptoms during placebo cycles (irritability, abdominal bloating, breast engorgement, depression, fatigue, increased appetite) than women who reported the placebo cycles to be more effective. Women who reported placebo cycles to be more effective, demonstrated cyclicity in irritability, abdominal bloating and breast engorgement only. When actual pre and post treatment scores were compared, an improvement in symptoms with progesterone was observed in the women who had ranked the progesterone cycles as best. Only appetite and irritability, however, reached statistical significance. Those who had ranked the placebo cycles as best showed that they actually had a worsening of symptoms during the days that they received progesterone. This was significant for abdominal bloating, depression and fatigue. These findings indicate that women who experience certain symptoms (or more symptoms) gain relief from progesterone treatment, while those who experience only irritability and swelling experience a worsening of symptoms with progesterone.

The fact that PMC may consist of distinct sub-groups of symptoms, possibly with different aetiological factors, has implications for the most appropriate manner in which to measure PMC. While some researchers view PMC as a unitary concept and combine premenstrual scores regardless of symptom type, others argue that differentiation of symptom groups is necessary to elucidate correlates of specific types of symptom change (Abplanalp, Haskett & Rose, 1980). Halbreich and Endicott (1982) further point out that combining symptom groups may actually obscure important differences. Most studies of premenstrual symptoms report significant correlations between symptom factors. Siegel et al. (1987) for instance reported correlations ranging from 0.39 (tense mood and physical discomfort) to 0.67 (tense mood and withdrawn mood), Schechter et al. (1989) reported correlations ranging

from 0.20 (appetite and sociability) to 0.52 (energy level and mood/cognition) and Endicott et al. (1986) reported correlations of 0.56 and 0.69 for low energy with physical discomfort and dysphoric mood respectively. While these high correlations suggest a general factor of premenstrual distress, they also indicate that some symptom groups do not relate strongly to others. Furthermore, high correlations do not necessarily suggest a common aetiology. Given that symptoms of PMC are diverse, falling into both emotional and physical categories, and given that there is some evidence for different pathophysiological processes underlying certain symptoms, it may be preferable at this stage to focus on specific symptom sub-types. In fact, given the number and variety of premenstrual symptoms, the search for the aetiology and treatment of PMC based on a combination of symptom types may not be realistic. Conversely, emphasis on distinct symptom types and differential relationships with these symptom groups may aid in ascertaining the aetiologies of PMC.

1.2.4 Retrospective and Prospective Methods of Data Collection and Participant Knowledge of Study Aims

One of the most significant issues with regard to assessment of menstrual cycle symptoms is the frequent use of retrospective data collection. A number of researchers have demonstrated that retrospective ratings are not confirmed by daily monitoring of symptoms but rather overestimate symptoms (e.g. McCance, Luff & Widdowson, 1937; Abplanalp et al., 1979; Endicott & Halbreich, 1982; N.F. Woods, Most & Dery, 1982a; Youdale & Freeman, 1987; McFarlane, Martin & Williams, 1988; Rapkin et al., 1988; Boyle & Grant, 1992; Christensen & Oei, 1992; van den Akker, Sharifian et al., 1995). In a small study of women attending a gynaecologic clinic, Rapkin et al. found greater symptom report on a retrospective compared to a prospective version of the PAF. Mean premenstrual ratings for 12 of 19 symptoms were significantly higher on the retrospective report than the daily ratings form; this finding was apparent for both somatic and psychological symptoms. The above cited studies have employed as participants women of various ages and backgrounds, and

while the finding does not appear to be specific to a certain group of women, it may be of greater concern in women with mild compared to severe changes. Endicott and Halbreich found retrospectively rated depressive symptoms to be confirmed by daily ratings in the majority of women who reported severe changes, but less than half of the women who reported mild or moderate changes.

Prospective data collection is more accurate than retrospective reports but must be done on a longitudinal basis since infrequent recording ignores day to day fluctuations and may be misleading (Endicott & Halbreich, 1982). Similarly, assessment for several days during the premenstrual phase without a comparison from other phases of the cycle is not sufficient. Month to month fluctuations also need to be taken into account. Studies of intercycle variability have demonstrated that data from one cycle may not be representative of a woman's usual experience (Hart et al., 1987; Walker, 1994; Sveinsdóttir & Bäckström, 2000b). Thus longitudinal prospective reporting is the only satisfactory manner in which to assess and confirm changes across the menstrual cycle. Although the importance of this method of data collection is well established, it is labour intensive and many researchers still opt for retrospective reports or infrequent prospective measures. A few prospective studies have been conducted but many are limited by small and unrepresentative samples. Large-scale prospective assessment of the pattern, incidence and risk factors of PMC is still lacking (this issue will be discussed further in chapter two).

Prospective daily ratings may also be subject to bias simply by virtue of the fact that they are based on self-report (this issue will discussed further in section 3.2). AuBuchon and Calhoun (1985) observed results to be influenced by social expectancy and experimental demand characteristics, with more psychological and somatic symptoms being reported during both the premenstrual and menstrual phases when the menstrual aspect of the study was made salient. Participants in this study, however, were young volunteers (mean age was not provided but most were in their early 20's), over half of whom were students. A study of older (mean age 32 years) and primarily non-student participants found no difference between women who were

aware of the study focus and those who were not, on any measure during the premenstrual or menstrual phases (Gallant, Hamilton, Popiel, Morokoff & Chakraborty, 1991).

In a subsequent study, Gallant et al. (1992a) found that awareness of the menstrual cycle focus of the study did not increase ratings of women with LLPDD. Awareness of the study focus did increase cyclicity in the ratings of asymptomatic women compared with those that were unaware, but the differences were small and most were not significant. The authors argued that the lack of increase in symptom reporting in women with LLPDD was due to the a priori salience of the menstrual cycle to such women. It was suggested that women with severe problems would ordinarily pay a lot of attention to the menstrual cycle in order to understand their moods, and thus a ceiling effect would be evident.

It thus appears that there is the potential for knowledge of study aims to increase reporting of premenstrual symptoms, at least in women who ordinarily experience no or mild cyclical changes. This finding highlights the importance of minimising women's awareness of the research focus, particularly when collecting menstrual cycle data from non-clinical samples.

1.2.5 Establishing Symptom Cyclicity

The methods by which daily prospective ratings are assessed, and cyclicity established, are varied. The most commonly used method of assessment is to consider PMC to be present if a luteal phase symptom score exceeds the symptom score of the follicular phase by a predetermined value (O'Brien, Craven, Selby & Symonds, 1979; Muse, Cetel, Futterman & Yen, 1984; Rubinow et al., 1984; Metcalf & Hudson, 1985; Eckerd, Hurt & Severino, 1989). The magnitude of this predetermined value, however, has been set somewhat arbitrarily by previous researchers and has thus differed from one study to another. For instance Muse et al. used a criterion of 100%, Eckerd et al., a criterion of 75% and Rubinow et al., a criterion of 30%. Schnurr

(1988) employed a different method, using effect size to measure premenstrual symptom change relative to day to day variability. This method required the late luteal phase score to exceed the follicular phase score by one standard deviation of the scores for that symptom. Reasons for selection of these particular thresholds are usually not provided. One exception to this is the criterion of 30% which was proposed at a conference of the National Institute of Mental Health in 1983 to be commensurate with a clinically meaningful increase in symptomatology (Rubinow et al., 1984). This criterion, however, has subsequently been suggested to be liberal (Gallant, Popiel, Hoffman, Chakraborty & Hamilton, 1992b; Christensen & Oei, 1995a).

Other researchers have opted for approaches based on trend analysis. Sampson and Jenner (1977) attempted to analyse their data by means of a least square method of fitting sine waves. Livesey, Wells, Metcalf, Hudson and Bates (1989) however, argued that a sine wave is not consistent with the pattern of symptom change across the menstrual cycle and developed a modified version of this approach, using a five-term fourier series approximation technique which allows for the fitting of two sine waves to daily mood scores. An approach by Magos and Studd (1986) was to use time series analysis and define PMS in terms of significant positive trends (i.e. symptoms worsening) at some stage during the premenstrual phase only, followed by significant negative trends (i.e. symptoms improving) at some time after the onset of menstruation. Although techniques based on time series analysis allow an evaluation of the statistical significance of premenstrual change, in terms of diagnosing PMC, these methods appear to yield similar results to the simpler methods.

Metcalf, Livesey and Wells (1989) compared four simple methods of pre- post-menstrual comparisons of scores (O'Brien et al., 1979; Muse et al., 1984; Rubinow et al., 1984; Metcalf & Hudson, 1985), trend analysis (Magos & Studd, 1986), sine wave model (Sampson & Jenner, 1977) and five-term fourier series approximation (Livesey et al., 1989) and found that, with one exception, they all gave comparable results. The exception was a method advocated by Muse et al. that compared

premenstrual symptoms to symptoms occurring during the first 10 days of the menstrual cycle. Given that these 10 days include the menstrual period during which the symptoms of some women remain high (e.g. Herrera et al., 1990; van der Ploeg & Lodder, 1993), it is not surprising that this result was discrepant from those based on a baseline of mid-follicular scores.

More recently, in a comparison of the following three methods: percentage change from post to premenstrual phases (30% increase) (Rubinow et al., 1984); the effect size method (Schnurr, 1988); and analysis of trend by time series analysis (Magos & Studd, 1986), Schnurr (1989) also found good agreement. She noted a particularly high agreement (kappa = 0.97) between the effect size and percent change methods, and suggested that an effect size of one closely approximates a 30% premenstrual increase. It thus appears that the comparability between methods of diagnosing PMC is remarkably high, and that adequacy is dependent on sensible definition of phases rather than the level of sophistication of the analytic technique used.

1.2.6 Conclusion

Reliable and valid measurement, and clear definitions of the phenomena to be studied, are basic requirements of good research. Unfortunately the interpretation of some research into PMC is encumbered by a failure to adhere to these standards. In the absence of a specific definition of the phenomena and a homogenous group of sufferers, care must be taken to provide clear descriptions of participant selection, and the methods used to diagnose PMC. There is still a great need for studies based on representative samples of women who provide data on a prospective, naïve, and preferably longitudinal basis. Care must be taken not to generalise from studies which do not meet these criteria but rather are based on limited groups of women and/or retrospective reports. Well-designed studies are critical to obtaining accurate information about menstrual cycle related changes and must be conducted if the aetiology/ies of PMC are to be determined.

CHAPTER 2

PATTERN AND INCIDENCE OF PREMENSTRUAL CHANGES

2.1 Pattern of Symptom Change Across the Menstrual Cycle

Despite the attribution of a diverse array of symptoms to the premenstrual period, there is still some uncertainty as to which symptoms fluctuate reliably across the menstrual cycle. The temporal pattern of symptom change is also unclear, with some reports of symptoms peaking premenstrually, and others of symptoms increasing over the premenstrual period, peaking during the early menstrual phase.

Sanders et al. (1983) collected data prospectively over one cycle in 55 women and found significant cycle phase differences in well-being, physical symptoms and sexual feelings. Positive symptoms peaked in the mid-late follicular phase and most negative feelings were apparent in the late luteal phase. They also noted that women who were attending a PMS clinic showed a similar pattern to those with self-reported PMS but had more severe symptoms which also began earlier (early luteal). Fatigue, aggression and a reduction in relaxation and sexual feelings all showed cyclicity in the former but not the latter group.

Results from other prospective studies, however, have indicated that while symptoms increase during the late luteal phase they do not remit with the onset of menses but continue to increase, peaking during menstruation. Moos, Kopell, Melges, Yalom, Lunde, Clayton and Hamburg (1969) collected data prospectively on nine occasions over each of two menstrual cycles and reported water retention, pain, anxiety, and aggression to be higher in the premenstrual compared to the follicular phase, but to reach a peak during the menstrual phase. Pleasantness, activation and sexual arousal were found to decrease in the luteal and menstrual phases relative to the follicular phase. Similar results were obtained by Herrera et al. (1990) who collected data prospectively during the menstrual, ovulatory and premenstrual phases of a single

menstrual cycle. Significant fluctuations in pain, water retention and negative affect but not behaviour change were noted, with symptoms peaking during the menstrual phase. Beumont, Abraham, Argall and Simson (1978) collected data daily over one menstrual cycle and found both menstrual and premenstrual symptoms to be significantly higher than follicular symptoms. Physical symptoms were observed to peak on day 1 of the menstrual cycle and mood symptoms on day 2.

All of the above-cited studies were based on data from a small to medium number of young women but results have been corroborated in samples of older women. In a study of 51 women with a median age of 35 years who completed a Dutch adaptation of the MDQ every other day for at least two cycles, daily symptoms scores were observed to begin increasing about day 22, peak on day 2 and rapidly disappear during the next four days. Symptoms were lowest between days 6 and 22. Variability of symptoms as measured by the standard deviations was low during this period and highest during the premenstrual and menstrual periods. Mood scores were lower than physical scores throughout the cycle (van der Ploeg & Lodder, 1993).

A number of researchers have indicated that the timing of symptom peaks across the menstrual cycle may not be uniform, with results of variable symptom fluctuation depending on symptom type. In a large retrospective study, N.F. Woods et al. (1982b) found significant cycle phase differences for only 16 of the 47 symptoms assessed by the MDQ (weight gain, crying, lowered school or work performance, taking naps, headache, skin disorders, cramps, anxiety, backache, fatigue, painful or tender breasts, swelling, irritability, mood swings, depression, tension). Severity of most of these symptoms differed from the premenstrual to the menstrual phase, with taking naps/staying in bed, cramps and fatigue peaking in the menstrual phase and weight gain, crying, skin disorders, anxiety, painful or tender breasts, swelling, irritability and mood swings peaking in the premenstrual phase. While these results are interesting, the retrospective nature of the study needs to be considered. As previously indicated (refer section 1.2.4), this method of data collection may elicit stereotyped beliefs about menstrual cycle symptoms (Englander-Golden et al., 1978). The

findings in this study of a premenstrual symptom peak for the majority of symptoms, with peak severity of naps, cramps and fatigue menstrually, appears commensurate with a stereotypic conception of PMS.

Van den Akker and Steptoe (1985) collected data prospectively from a large sample of young women who were unaware of the study purpose and who completed the MMDQ daily over one cycle. Significant symptom cyclicity was noted in 16 of the 34 symptoms, with most symptoms peaking during the menstrual phase. The exceptions were weight gain, cold sweats, depression and painful breasts which peaked premenstrually. Thirty-six of the 100 women showed greater menstrual than premenstrual increases, while 62 showed higher changes menstrually. Most women showed little difference between increases menstrually and premenstrually. Those that did show a particular increase menstrually suffered predominantly from symptoms such as stomach pains, tiredness and feeling sick while those experiencing predominantly premenstrual increases were characterised by symptoms such as difficulty concentrating, depression and crying spells. Thirty-one women showed premenstrual increases of 10% or more, while 29 reported similar increases menstrually. Ten women reported premenstrual reductions of more than 10% and 37 women showed negligible changes (less than 5%). A lot of variability in symptom experience between participants was apparent and the authors noted that this may reduce the likelihood of finding significant symptom cyclicity in studies with small samples.

Boyle and Grant (1992) collected prospective data from over 100 young women and found symptoms to be significantly higher menstrually than premenstrually for the MDQ sub-scales of pain, fluid retention, autonomic reactions and behaviour change. Negative affect was significantly higher premenstrually than menstrually.

Thus while it seems clear that a diverse array of symptoms increase over the late luteal phase, findings regarding the timing of symptom remission appear to be more discrepant. Despite the commonly held view that symptoms remit with the onset of

menses (e.g. Haskett, 1987; Blumenthal & Nadelson, 1988), there appears to be a substantial amount of evidence for symptoms continuing to remain high during the early menstrual phase. However, given that symptoms predominate during the late luteal phase, and begin to remit within a few days following menses onset, the conceptualisation of *premenstrual* changes seems justified. Further, in view of the fact that the late luteal and menstrual phases are markedly different in terms of both physiological events and associated psychological states, studying the premenstrual period as a separate entity is preferable to employing a concept such as Dalton's (1964; 1977; 1984) paramenstruum.

A further question of interest with regard to the pattern of symptom change across the menstrual cycle is whether psychological symptoms occur as a reaction to physical problems and thus subsequent to them. Coleman, Hart and Russell (1988) collected data prospectively using a modified MDQ over several cycles and employed spectral analysis to examine the temporal sequence of symptoms in women complaining of PMS. The results indicated that peaks in physical and tension symptoms preceded peaks in depression by one to two days. Results from another prospective study, however, indicated no consistent pattern in the temporal sequence of symptom peaks, with psychological symptoms sometimes following and sometimes preceding physical symptom peaks (Metcalf, Livesey, Wells & Braiden, 1990).

A finding noted by both Coleman et al. (1988) and Metcalf et al. (1990) was that cyclicity in physical symptoms was more common than cyclicity in psychological symptoms. Coleman et al. reported that while most women showed 28-day peaks in physical symptoms, only half showed such peaks in depression, behaviour change, tension and cognitive symptoms. Metcalf et al. (1989; 1990) reported an increase premenstrually in both affective and somatic symptoms in a self-reported PMS group but an increase in only somatic symptoms in the non-PMS group. Sanders et al. (1983) reported similar results with women reporting an absence of PMS showing a significant premenstrual increase in physical symptoms but not well-being. These results may indicate that while affective symptom cyclicity is specific to certain

women only, somatic symptom cyclicity is a ubiquitous part of the normal menstrual cycle, occurring to some degree in most women. However, as diagnosis of PMS/no-PMS was based on self-report in these studies, an alternative explanation is that women who experience primarily premenstrual somatic symptoms do not consider themselves to have PMS.

2.2 Incidence of Premenstrual Symptoms and Premenstrual Changes

The establishment of incidence rates of premenstrual symptoms and premenstrual change is problematic due to the lack of consensus as to what constitutes these phenomena. Furthermore, the majority of the research in this area has been conducted using retrospective data and thus incidence rates may have been overestimated. Many studies have assessed the incidence of premenstrual symptoms, not premenstrual change, and some have failed to distinguish between mild and more severe symptoms. The reported percentage of women who experience premenstrual symptoms differs widely, ranging from 20 to 90% depending on symptom type and method of measurement. The incidence of premenstrual change in the general population has not been clearly established.

From the sample of 839 women on which the MDQ was based, pain and negative affect were found to be the most common retrospectively reported problems associated with menstruation, and negative affect and water retention to be the most common symptoms of the premenstrual phase. The incidence of these more common symptoms was about 25-40% for mild to moderate symptoms and about 5-10% for severe symptoms (Moos, 1968). Moos (1986) later compiled data from 1542 women who had completed the MDQ under the instruction of other investigators and obtained results consistent with his original incidence rates. Further corroboration has come from studies utilising modified (Clare & Wiggins, 1979) or shortened versions of the MDQ (N.F. Woods et al., 1982b). Clare and Wiggins found slightly lower incidence rates for the majority of symptoms than Moos (1968; 1986), possibly because women with mild symptoms were not included (Clare & Wiggins, 1979). In a

large study N.F. Woods et al. found incidence rates of about 30% for most symptoms, with 2-8% of women rating them as severe.

Comparable results were obtained by Sheldrake and Cormack (1976) who collected data from over 3000 women and found irritability to be the most common premenstrual symptom (32.5%), followed by depression (31%), headaches (24%) and stomach-ache (21%). Stomach-ache (44%), backache (26%), lethargy (25%) and irritability (22%) were the most common symptoms during the menstrual phase. Symptom severity was not assessed. Kessel and Coppen (1963) reported similar findings in a study of 500 women randomly selected from those attending specific general practitioners. Moderate symptoms were reported by 33% of women for pain, 21% for depression, anxiety, nervousness or tension and 11% for irritation. Severe symptoms were reported by 11-12% of women, depending on symptom type. Reports from a 10-year epidemiologic cohort study of 299 women indicated that 47% of women reported some physical or emotional symptoms to be associated with either the premenstrual or early menstrual phase. The most common premenstrual symptoms were irritability (30.7%), depressed mood (18.8%), tension (18.3%) and nervousness (17.9%). The frequency of these emotional symptoms decreased by nearly 50% within one to three days of menses (Merikangas et al., 1993). High and Marellino (1995) obtained higher incidence rates, finding that women reported irritability (85%), bloating (78%), mood changes (74%), depression (69%), weight gain (64%), headaches (56%) and anger (50%) to be the most common premenstrual symptoms. These overall symptom reports were based on a simple "check" of symptoms experienced during the premenstrual phase which may account for the higher figures.

A number of researchers have used retrospective methods in an attempt to estimate the incidence of premenstrual *change*. Using the PAF, Halbreich et al. (1982) found breast pain (36% slight or mild, 48% moderate, severe or extreme) and weight gain (44% slight or mild, 39% moderate, severe or extreme) to be the most commonly reported premenstrual changes. Changes in psychological symptoms were reported

less frequently but still affected in excess of 70% of women. Feeling sad or blue was the most frequently reported psychological change (40% slight to mild, 36% moderate, severe or extreme) followed by feeling tearful (36% slight to mild, 37% moderate, severe or extreme), tendency to nag (42% slight or mild, 31% moderate, severe or extreme) and intolerance/impatience (46% slight to mild, 27% moderate, severe or extreme). Most women who rated their changes to be of greater than mild severity, endorsed moderate as the appropriate descriptor; only 3% rated symptom change to be severe or extreme (Halbreich et al., 1982). Yuk et al. (1990) administered the PAF to 133 women not complaining of PMS and found that only 20.3% did not meet the criteria for at least one sub-group. The most common sub-groups were minor and major depressive syndromes (65%) (with atypical and hostile sub-groups most common), general physical discomfort syndrome (61.7%) and fluid retention syndrome (53.4%).

Hargrove and Abraham (1982) asked 1,395 women to complete a menstrual symptom questionnaire during routine visits to a gynaecologic clinic. The 19 symptoms studied were divided into four sub-groups of PMS - PMT-A (anxiety/irritability), PMT-H (symptoms of water retention), PMT-C (appetite and general pain), and PMT-D (depression and cognitive change). Using strict criteria for premenstrual change, they found about 50% to score positive for at least one sub-group, the most common sub-groups being PMT-A and PMT-H. Moderate symptom change ranged in incidence from just in excess of 20% for sub-groups C and D to slightly more than 55% for sub-groups A and H. Incidence of severe symptom change ranged from less than 2% to 8-9% for sub-groups C and D, and A and H, respectively.

In a study of 1083 Swedish women, Andersch (1980, cited in Sanders et al., 1983) found 2-3% reported severe premenstrual change, while 70% reported mild or moderate changes. In a large study of 15 year-old adolescents, over 50% reported at least one symptom before and during menstruation. Fourteen percent were identified as suffering PMS; this however was diagnosed if symptom scores exceeded the mean

by more than 1.5 standard deviations in either the premenstrual or menstrual phase (Nada Raja, Feehan, Stanton & McGee, 1992).

All of the above-cited studies were based on retrospective symptom reports and thus reported incidence rates may be inflated. At the time of this research, no studies examining the incidence of premenstrual symptoms or PMC in the general population had been based on large-scale prospective reports. Magos et al. (1986) collected daily symptom records based on the MMDQ from 150 women but participants in this study had a history of PMS. Using trend analysis, it was determined that the majority of the women were PMS sufferers. The most common symptom sub-scale was fluid retention (experienced by approximately 85% of women) followed by negative affect (approximately 79%), concentration, pain, behavioural change and autonomic reactions (all experienced by between 60 and 70% of women). Recently, Sveinsdóttir and Bäckström (2000a) collected prospective data (daily for 1-7 menstrual cycles) from a random community sample of 83 Icelandic women. A significant premenstrual increase in at least one symptom was experienced by 80.7% of the participants. Almost half the sample (43%) experienced an increase in a somatic symptom group, while psychoemotional (14.5%) symptoms were less prevalent.

Overall, it appears that the majority of women retrospectively report some premenstrual symptoms (estimates generally range from about 50 to 80%). The most common symptoms are generally reported to be those of fluid retention and negative affect (specifically irritability, tension and depression) as well as headache. The percentage of women found to report each of the common symptoms/symptom groups ranges widely from about 10 to 100%, but is frequently cited as between 20 and 30% for mild to moderate symptoms. Severe symptoms are much less frequent, affecting only some 2-10% of women.

The percentage of women who experience premenstrual *change* is still unclear. Much of the work in this area has used the PAF or similar questionnaires in which women self-report the severity of premenstrual change. The PAF in particular is known to

yield high incidence rates (e.g. Youdale & Freeman, 1987). Other researchers have adopted criteria based on comparisons with other women and, with the exception of Magos et al. (1986) and Sveinsdóttir and Bäckström (2000a), all have assessed change retrospectively. Given the problems with retrospective data collection and the likelihood of recall in accord with stereotypic conceptions of the menstrual cycle, establishment of the prevalence of PMC can only be validly achieved through prospective studies. There is thus still a great need for prospective assessments of a representative sample of the population so that the "baseline" level of premenstrual symptoms and premenstrual change in the community can be determined. It is essential to develop an understanding of this "control group" in order that the significance and prevalence of PMC can be determined.

2.3 Factors Affecting the Pattern and Incidence of Premenstrual Symptoms

There is some evidence that the pattern and prevalence of premenstrual symptoms and premenstrual change varies with a number of demographic and menstrual cycle characteristics. This is important both in terms of considering these variables as potential confounds, and because information gained from these studies may provide insight into the aetiology of PMC. Extensive work has been conducted on the relationship between race and premenstrual symptoms; these studies will be discussed in the following section. Results regarding other demographics variables such as age and parity will also be outlined, as will studies of menstrual cycle characteristics such as length and regularity. Studies of oral contraceptive use and PMC will be discussed in the final section of this chapter.

The impact of these demographic and menstrual cycle variables on premenstrual symptoms has implications for both biological and psychological/social hypotheses of PMC. Changes associated with age and parity for instance may relate to biological changes or may result from psychosocial stressors. Variables such as cycle and menses length are mediated by neuroendocrine determinants but may also influence

expectancy factors and menstrual cycle salience. Although OCs are often studied with a view to elucidating the biological aetiology of PMC, there is considerable evidence that their effect/s may be partly attributable to psychological and social factors. The purpose of this section is to discuss evidence indicating that these variables are important mediators of menstrual cycle symptom severity, prevalence and timing. Implications for aetiology will be outlined where relevant, but to the extent that these variables are relevant to the major theories of PMC will be discussed in chapter three.

2.3.1 Race and Culture

In 1981, the World Health Organisation conducted a cross cultural study of menstruation on more than 5000 women from 14 cultural groups in Egypt, India (Hindu High Caste, Hindu Low Caste), Indonesia (Javanese, Sundanese), Jamaica, Korea, Mexico, Pakistan (Punjab, Sind), Philippines, United Kingdom and Yugoslavia (Muslim, non-Muslim). Data were collected retrospectively and severity was not noted but mood changes prior to or during menstruation were reported by each cultural group with an incidence ranging from 23% (Indonesia-Sundanese) to 73% (Yugoslavia-Muslim). Irritability, lethargy and depression were common symptoms.

Janiger, Riffenburgh and Kersh (1972) conducted a large retrospective cross-cultural study and found premenstrual symptoms in American, Japanese, Nigerian, Apache, Turkish and Greek women. Wide variation in the frequency of certain symptoms was noted; Japanese women in particular showed very low levels of breast complaints and Nigerian women very high frequencies of headaches. The highest overall incidence of symptoms was found in the Turkish and Nigerian women, followed by the Americans, Apache and Greek, with the Japanese women having fewer symptoms than the other groups. Of the psychological symptoms, the most frequent across the entire sample of women were irritability (29% among Japanese women to 70% among American women), depression (36% in Nigerian women to 66% in Turkish women) and tension (22% among Greek women to 88% among Turkish women).

Lower abdominal pain was the most frequent physical symptom (54% of Japanese women to 83% of Nigerian women) followed by fullness and bloating of the abdomen (14% of Nigerian women to 66% of Greek women).

Janiger et al. (1972) concluded that the symptoms most commonly reported in Western countries are present in a diverse number of cultural groups, although the frequency of individual symptoms varies quite considerably. Subsequent studies in the United States (N.F. Woods, Most & Dery, 1982c), Australia (Hasin, Dennerstein & Gotts, 1988) and in various European, Middle Eastern, African and Asian countries have supported this finding (e.g. Awaritefe, Awaritefe, Diejomoah, Ebie, 1980; Chandra & Chaturvedi, 1989; Chang, Holroyd & Chau, 1995; van den Akker, Eves, Service & Lennon, 1995; Sveinsdóttir, 1998). While the majority of cross-cultural studies have been retrospective in nature and thus potentially a reflection of sociocultural stereotypes, the studies by Sveinsdóttir and van den Akker, Eves et al. are notable exceptions. Sveinsdóttir collected prospective data in 83 Icelandic women finding the majority of women to display a low symptom pattern. Van den Akker, Eves et al. conducted a prospective study of symptoms in three British ethnic groups (48 Afro-Caribbean, 73 Caucasian, 32 Oriental). Although this study was conducted in Britain, the authors relied on the assumption that cultural factors would still influence the women's beliefs about reproduction, as has been observed in Westernised, Asian women. The results were consistent with Janiger et al. in showing premenstrual symptomatology in all groups and the least distress among Oriental women. However, unlike in the Janiger study, van den Akker et al. found Caucasian women to report greater premenstrual symptomatology both retrospectively and prospectively than the other two ethnic groups. In terms of specific symptom groups, Caucasian women reported significantly more premenstrual symptoms for both affective and physical symptoms, but comparable levels of cognitive and behavioural premenstrual symptoms. Follicular symptoms and negative affectivity were similar in all ethnic groups indicating the results are unlikely to be attributable to an underlying trait.

These prospective studies thus support the notion that premenstrual symptoms are experienced in a variety of cultural groups but that the frequency may differ markedly. In none of these studies, however, is there an indication of any consistent pattern of cross-cultural changes (Janiger et al., 1972; van den Akker, Eves et al., 1995). A variety of explanations for cross-cultural differences have been postulated, most centered around the influence of learned and culturally determined responses to menstruation. Although these hypotheses are worthy of attention, further discussion is not within the scope of this thesis (the interested reader can refer to van den Akker, Eves et al. for a critique of these hypotheses). The influence of culturally determined expectations on PMC in Western societies, will however, be discussed in section 3.2.

2.3.2 Other Demographic Characteristics

Several investigators have observed premenstrual symptoms to be more prevalent and more severe in older women compared to younger women (Dalton, 1964; Moos, 1968; Rouse, 1978; Hargrove & Abraham, 1982). Others, however, have observed no systematic change in the incidence or severity of premenstrual symptoms with age (Clare, 1983; Graham & Sherwin, 1987; Siegel et al., 1987; Hammarbäck & Bäckström, 1989; Ainscough, 1990; Chang et al., 1995). Furthermore, in a large retrospective study, N.F. Woods et al. (1982c) observed age to be negatively associated with premenstrual and menstrual symptoms. Older women experienced less menstrual headache, cramps and crying, and less premenstrual cramps, irritability, crying and napping than younger women. Lee and Rittenhouse (1991) obtained comparable results. In another large retrospective study, Futterman, Jones, Miccio-Fonseca and Quigley (1988) found age to correlate negatively with somatic symptoms but observed the relationship between age and affective symptoms to be non-linear. Women in the 40-50 year age range experienced fewer premenstrual symptoms than the other age groups but the 30-39 year age group experienced the highest level of emotional and cognitive symptoms.

Few large-scale cohort or prospective studies have been conducted. Results of the 10-year epidemiological cohort study of Merikangas et al. (1993) indicated that the incidence of physical and emotional problems during the premenstrual and menstrual phases increases with age. Van den Akker and Steptoe (1985) conducted a large prospective study of young women and also indicated that age was moderately correlated with total MDQ scores in the premenstrual phase. Age did not correlate with menstrual or follicular scores. Menstrual but not premenstrual change scores were significantly correlated with age. Schnurr (1988) however, in a study of older women (average age early 30's) found PMC to be more likely in younger women. Similarly, Freeman, Rickels, Schweizer and Ting (1995) reported severity of premenstrual symptoms to be inversely related to age in a large sample of women seeking treatment for PMS. The late twenties through early thirties was identified as the most vulnerable period for PMS.

Metcalf, Braiden and Livesey (1992) adopted a longitudinal approach to the study of age changes, studying nine women in 1982 and then again eight years later in 1990. Participants completed daily ratings of both physical and emotional symptoms for three menstrual cycles on both occasions. No significant changes were observed in either the incidence or severity of PMS. The symptoms of two individual women, however, were worse in 1990 than in 1982. It was not clear whether this was due to age related changes or other health problems experienced by the participants at that time.

Anecdotal evidence indicates that women report worsening of premenstrual symptoms following the birth of a child. Moos (1968) observed parity to correlate positively with the majority of premenstrual symptoms but negatively with menstrual autonomic reactions and fluid retention. N.F. Woods et al. (1982c) and Lee and Rittenhouse (1991), however, concluded that women who had been pregnant differed from nulliparous women only in that they were less likely to experience menstrual cramps. Other researchers have also noted parity to be unrelated to premenstrual symptoms (Clare, 1983; Siegel et al., 1987; Ainscough, 1990). There is thus no

consistent evidence supporting a relationship between parity and premenstrual symptoms.

Results from studies of marital and employment status have presented an unclear picture. N.F. Woods et al. (1982c) observed few effects of marital status but did note that married women were less likely than single women to take naps or stay in bed during the premenstrual or menstrual periods. Lee and Rittenhouse (1991) reported single women to experience more depressive symptoms that partnered women. Clare (1983) and Hammarbäck and Bäckström (1989), however, noted marital status to be unrelated to premenstrual symptoms while Sanders et al. (1983) observed partnered women to report increased symptomatology. N.F. Wood et al. reported that women who were employed experienced less impairment of work performance and more anxiety than women who were not employed. Sanders et al. found women with PMS to be more likely to be working at home, caring for small children. Hammarbäck and Bäckström noted no relationship between PMS and employment status.

Socioeconomic status (SES) has also received attention in relation to premenstrual symptoms but results are limited and widely discrepant, possibly due to varying definitions of SES. As noted by Logue & Moos (1986) the interpretation of any relevant findings is also problematic given other influences on SES (e.g. personality, nutrition). These studies will not be discussed here; the interested reader can refer to Logue and Moos for a review.

In short, results from studies of demographic factors have been contradictory. Despite some consistency in early reports suggesting that PMC increases with age and parity (e.g. Dalton, 1964; Moos, 1968), there is now considerable evidence that this may not be the case (e.g. Graham & Sherwin, 1987; Siegel et al., 1987). Furthermore, some researchers have found that the relationship between age and premenstrual symptoms is highly symptom specific (Futterman et al., 1988), while others have suggested that the relationship is not a linear one. Marital and employment status have also been studied with a view to understanding the role of psychosocial factors in PMC, but

results have been widely discrepant (N.F. Woods et al., 1982c; Clare, 1983; Sanders et al., 1983).

2.3.3 Menstrual Cycle Characteristics

A number of researchers have reported that longer menstrual cycle durations may increase the likelihood of experiencing premenstrual and menstrual symptoms. N.F Woods et al. (1982c) found that women with long cycles reported more premenstrual mood swings, depression and crying than women with shorter cycles. Sheldrake and Cormack (1976) did not conduct significance tests but noted that the percentage of women experiencing premenstrual and menstrual symptoms was generally higher in women with cycle lengths between 31 and 40 days compared to women with cycle lengths of 30 days or less. The exception to this was headaches which were higher premenstrually in women with shorter cycles. Other researchers have found no relationship between menstrual cycle length and menstrual or premenstrual symptoms (Moos, 1968; Graham & Sherwin, 1987; Schnurr, 1988; Hammarbäck & Bäckström, 1989; Ainscough, 1990; Lee & Rittenhouse, 1991).

Regularity of menstrual cycle length has also been postulated to relate to premenstrual and menstrual symptomatology. Sheldrake and Cormack (1976) found that, in general, women who had irregular menstrual cycles were more likely to experience menstrual symptoms. The influence of cycle regularity on incidence of premenstrual symptoms, however, was less clear cut with irregularity being associated with an increased incidence of some symptoms, but a decreased incidence of others. Moos (1968) also noted a relationship between cycle irregularity and perimenstrual symptoms. Women with irregular cycles were more likely to experience premenstrual and menstrual pain, fluid retention and negative affect. N.F. Woods et al. (1982c), however, while not studying menstrual cycle regularity per se, found that women who were able to predict their next menses were more likely to experience premenstrual weight gain and backache than women who were less able to

predict their next menstrual period. This suggests that women with more regular cycles experience greater premenstrual problems.

Results relating to length of menstrual flow have also been inconsistent. N.F. Woods et al. (1982c) reported that women with longer menstrual flows had more cramps, depression and mood swings during the premenstrual phase, and more irritability and mood swings during the menstrual phase, than women with shorter menstrual flows. Moos (1968) obtained similar results, reporting positive correlations between length of menstrual flow and premenstrual and menstrual pain, concentration, fluid retention and negative affect. Length of menstrual flow correlated with menstrual but not premenstrual behaviour change. Lee and Rittenhouse (1991) reported a relationship between menses duration and physical but not affective symptoms. Graham and Sherwin (1987) however, reported that duration of menstrual flow did not predict overall severity of premenstrual symptoms.

The relationship between age of menarche and premenstrual symptomatology has also been investigated by a number of researchers. Results have been discrepant with some researchers reporting symptoms to be greater in women with an earlier age of menarche (Nada Raja et al., 1992) and others reporting no association (N.F. Woods et al., 1982c; Hammarbäck & Bäckström, 1989). Examination of the relationship between severity of menstrual pain and severity of premenstrual symptoms has yielded more consistent results. Several researchers have reported findings indicating that women who report moderate or severe menstrual pain are significantly more likely to also report premenstrual symptoms (Clare, 1983; Steege, Stout & Rupp, 1985; Graham & Sherwin, 1987; Yankauskas, 1990; Bancroft & Rennie, 1995). Others, however, have reported no relationship between menstrual pain and premenstrual symptoms (Hammarbäck & Bäckström, 1989).

In conclusion, investigations of menstrual cycle characteristics have yielded inconsistent results. While some researchers have found variables such as menstrual cycle length and regularity, menses duration, and age of menarche to be important

mediators of premenstrual symptoms (e.g. Sheldrake & Cormack, 1976) others have reported no association (e.g. Graham & Sherwin, 1987). Examination of the relationship between menstrual pain and premenstrual symptoms has yielded more consistent results, with several suggestions of a significant association (e.g. Clare, 1983; Steege et al., 1985; Graham & Sherwin, 1987).

2.3.4 OC Use

Results of a number of retrospective studies have indicated an amelioration of at least some premenstrual symptoms with OC use (Herzberg & Coppen, 1970; Kutner & Brown, 1972; Rouse, 1977; Andersch & Hahn, 1981; Graham & Sherwin, 1987), although there are findings to the contrary (Dalton, 1977; Sheldrake & Cormack, 1976; N.F. Woods et al., 1982c). These results, however, may be misleading given the problems associated with retrospective data, and the fact that differences between OC users and non-users may be more pronounced when based on retrospective data (Boyle & Grant, 1992).

Results of prospective studies of OC use have yielded inconsistent results. Paige (1971) measured negative affect on five occasions during the menstrual cycle by content-analysing the verbal speech of 102 women. She found that women in the non-oral contraceptive (NOC) group showed an increase in negative affect premenstrually, but that this was not observed in OC users. Boyle and Grant (1992) found OC users to experience fewer premenstrual symptoms than non-users, particularly negative mood states. Results of other studies, however, have yielded few differences between the groups in psychological symptoms, but clear differences in some physical symptoms. Walker and Bancroft (1990) found controls and triphasic OC users but not monophasic OC users to show a premenstrual increase in breast tenderness, while van den Boogaard and Bijleveld (1988) reported OC users to experience less fluid retention but more abdominal pain than non-users. A number of researchers have reported no difference between OC users and non-users in either somatic or affective

symptoms (Harding, Vail & Brown, 1985; Marriott & Faragher, 1986; Sveinsdóttir & Bäckström, 2000a).

OC users appear to differ from non-users in a variety a ways. For instance OC users have been reported to be younger than non-users (Harding et al., 1985) and to have a greater belief in the efficacy of OCs for ameliorating premenstrual symptoms (Graham & Sherwin, 1987; Boyle & Grant, 1992). OC users also tend to tolerate the drug comparatively well, with those who experience side effects or an exacerbation of premenstrual symptoms more likely to discontinue usage (Cullberg, 1972; Dalton, 1977, Graham & Sherwin, 1992). Side effects may include depression secondary to altered metabolism of brain amines (Wynn, Adams, Folkard & Seed, 1975; Andersch, 1982) and may depend on the type of hormonal composition of the OCs (Andersch, 1982). There is also a question as to whether women with PMC are more likely to experience adverse reactions to OCs. Dalton (1977) reported that, based on her clinical experience, the majority of women with PMS readily develop side effects to OCs and discontinue usage.

These factors highlight the need for placebo-controlled trials of OC use. Due to the inherent difficulties with this type of research, few double-blind placebo-controlled trials have been conducted. Silbergeld, Brast and Noble (1971) studied a small group of primarily young women daily over four cycles in a placebo-controlled trial. They found a combined OC to worsen symptoms of fluid retention and anxiety but to lessen feelings of irritability and aggression. Coppen, Milne, Outram and Weber (1972) assessed 27 women before and after a one-month placebo-controlled trial, and found that norethisterone did not significantly reduce psychological or physiological symptoms relative to placebo. Morris and Udry (1972) reported that while some women reported greater feelings of subjective well-being with OC use, some also reported feeling worse and most reported feeling the same as usual. In a more recent and well controlled study, Graham and Sherwin (1992) analysed the responses of 45 women with prospectively confirmed PMC and found triphasic OCs to be superior to placebo for premenstrual breast pain and bloating but not mood symptoms.

Overall, the studies of oral contraceptives have yielded inconsistent findings and are indicative of a situation that is more complicated than was initially thought. The disparate results may be due in part to differential effects of OCs depending on their composition. Combined oral contraceptives are currently the only type of OC on the market. These contain both an oestrogen and a progestin (refer to section 3.1 for a discussion of the role of oestrogen and progesterone on premenstrual symptoms). Sequential preparations were available prior to the late 1970's. Women using sequential OCs took a pill containing an oestrogen for 14 to 16 days, then a pill containing a combination of an oestrogen and a progestin for 5 or 6 days. However, because of reports suggesting an increased incidence of endometrial tumours, a low efficacy, and greater premenstrual affective symptoms, these types of OCs were removed from the market (Asbell, 1995). Combined OCs typically contain between 20 and 50 micrograms of ethinyl estradiol and various amounts of a progestin. The types of progestins include levonorgestrel, norethindrone acetate, ethynodial diacetate, norgestrel, norgestimate and desogestrel, with dosages ranging from 0.05 to 1 milligrams. There is no evidence that these different types of progestins at these doses differentially affect premenstrual symptoms (Asbell, 1995). The primary difference between the OCs that are currently on the market is thus the difference between monophasic, biphasic and triphasic OCs. Much of the early work on OCs was conducting using high-dose monophasic's. Biphasic OCs were introduced in 1982 and triphasic OCs in 1986 (Asbell, 1995). Like monophasic OCs, biphasic and triphasic OCs contain both oestrogen and progesterone, but unlike the monophasic OCs, the ratio of progesterone to oestrogen changes once or twice during the 21 days the OC is taken (Asbell, 1995). For instance, a monophasic preparation may contain a constant dose of 35 micrograms of ethinyl estradiol and 1 milligram of norethindrone. A triphasic OC on the other hand contains dosages that alter three times across the cycle (e.g. ethinyl estradiol 30/40/30 micrograms; levonorgestrel 0.05/0.075/0.125 milligrams). The impetus for biphasic and triphasic OCs was the provision of a lower dose OC and the attempt to provide a "more physiological" endometrium (Diczfalusy, 1997, p. 124). By 1986 the use of high-dose oestrogen OCs had been reduced to only 3.4% of the market and in 1988 the three drug companies still manufacturing high

dose OCs voluntarily withdrew from the market all products containing over 50 micrograms of oestrogen. Over the years the amount of oestrogen has been reduced to one third or less of that in the first OCs, and progestogens have been decreased to one-tenth or less. Some of the above-cited studies thus reflect results based on higher dose OCs. The effect of the higher hormonal doses on premenstrual symptoms is unclear, but earlier OCs produced more severe physical side effects than the OCs currently on the market (Diczfalusy, 1997).

The situation is also complicated by reports that OCs may alter the timing of symptom fluctuation across the menstrual cycle. This may go unnoticed in studies examining limited days of the menstrual cycle only. In a retrospective study, Graham and Sherwin (1987) reported an OC group to experience a shorter duration of symptoms, with changes beginning closer to the onset of menstruation. Warner and Bancroft (1988) studied 4112 women who completed a retrospective questionnaire indicating when during their most recent menstrual cycle they felt their well-being and sexual interest to be at its highest and lowest. The results indicated well-being to be lowest premenstrually and highest postmenstrually, and sexual interest to be strongly associated with well-being. These findings were comparable in both OC and non-OC users, although the former were less likely to show variations across the menstrual cycle. This was particularly true of monophasic compared to triphasic OC users. OC, particularly monophasic, users were also more likely to report troughs during the menstrual period which may reflect a withdrawal effect during the OC-free week. In a small but prospective study of young women, 11 OC users reported peak negative affect during the menstrual phase, whereas the NOC group showed a premenstrual peak in negative affect and an abatement of symptoms during the menstrual phase. All women reported increased somatic symptoms (fluid retention and pain) during both the premenstrual and menstrual phases. The OC group had smaller variances on measures of somatic symptoms but increased variances for negative affect relative to the NOC group. The authors suggested that the former finding is consistent with the stabilising physiological effects of OCs, but that the finding for negative affect was unlikely to be due to a hormonal influence. They

argued that while differential biological responses to the cessation of OC use could account for increased variability in negative affect, if this was the case a concomitant increase in the variance of somatic symptoms should also have occurred at this time. The authors proposed that a more likely explanation was a differential psychological response to the onset of the premenstrual phase, as a result of differing expectations of menstruation. The increase in variance of the OC compared to the NOC group can be explained by the greater awareness in OC users of their menstrual cycle phase and impending menstruation (Wilcoxon, Schrader & Sherif, 1976). The results of these studies are suggestive of peak symptomatology occurring during the menstrual period in OC users. This may be the result of the cessation of exogenous hormones during the OC-free week, particularly in monophasic users who have constant oestrogen and progesterone for 21 days followed by rapid withdrawal. Menstruation typically begins one to two days subsequent to cessation of active OC use so it is of interest to determine whether symptoms arise only during the OC-free week.

The above-cited studies thus indicate that the effect of OCs on premenstrual symptoms is still unclear. Several issues may have contributed to this. Reid and Yen (1981) argue that some early reports of the efficacy of OCs may have resulted from the failure to distinguish premenstrual symptoms from dysmenorrhoea, the latter being relieved with OC use (Cullberg, 1972). The marked change in the oestrogen and progesterone content of OCs since their introduction means care needs to be taken in comparing results of the 1970's and early 1980's to subsequent results. Other barriers to determining the effects of OCs have included the failure of some researchers to distinguish between types of premenstrual symptoms and types of OC. Results from methodologically sound studies (Warner & Bancroft, 1990; Graham & Sherwin, 1992) have indicated that these factors may be crucial in understanding the relationship between OCs and premenstrual symptoms. Research thus now needs to focus on further elucidating the differential relationships between specific types of OCs and premenstrual symptoms. It also needs to be noted that any effect of OCs may result from psychological as well as biological factors, and may mediate the timing as well as the severity of premenstrual symptoms.

CHAPTER 3

AETIOLOGY OF PREMENSTRUAL CHANGES

3.1 Biological Influences

Since Frank (1931) coined the term PMT, research has focused on determining the aetiology of premenstrual symptoms. Given that symptom change across the menstrual cycle is temporally linked with the rhythm of the hypothalamic-pituitary-gonadal system, the assumption is often made that fluctuations in biological substances give rise to premenstrual symptoms. The study of animals has also provided an impetus for the search for a biological substance, with reports of behavioural changes across the menstrual cycle in various species of monkeys and apes (Rowell, 1963; Saayman, 1971; Mallow, 1981; Hausfater & Skoblick, 1985; Garcia-Castells, Gonalez, Ervin & Guzman-Flores, 1989; Bassoff, 1995). Premenstrual changes in baboons for instance, include: less time spent feeding and in social interaction; increased distance to nearest adult male and female neighbours; reduced rate of initiation of social interaction with those neighbours; decreased overall responsiveness to the presence of adult males neighbours and decreased rate of participation in social interactions of all types both affiliative and agonistic (Hausfater & Skoblick, 1985). Patterson, Holts and Saphire (1991) also demonstrated evidence of endocrinological influences on the behaviour of a female lowland gorilla who displayed a lower frequency of sign language during the premenstrual phase of her reproductive cycle.

There have been numerous endocrinological and biochemical hypotheses proposed to explain the aetiology of symptom change across the menstrual cycle. It is outside the scope of this thesis to discuss biological theories in any detail, but a brief overview will be presented in this section. The major hormonal hypotheses of PMC include a postulated role for oestrogen, progesterone, prolactin, cortisol, aldosterone and testosterone. The neurotransmitters, acetylcholine, noradrenaline, dopamine and

serotonin have also received considerable attention, particularly in the 1990's and 2000's. Despite the number and variety of substances proposed to be implicated in PMC, however, empirical support (or lack of) for each hypothesis has been gained from similar lines of investigation. The most common lines of investigation include:

- whether the relevant substance fluctuates across the menstrual cycle with a change in its level at a time when premenstrual symptoms begin and/or remit

- comparison of levels of the substance in women with PMC and asymptomatic controls, and examination of the relationship between luteal concentrations of the substance and symptom severity in women with PMC

- results of treatment studies

A major difficulty in the search for the aetiology of PMC has been the contradictory findings that have accrued from these lines of investigation. For instance all the aforementioned hormones and neurotransmitters have been examined to determine whether they fluctuate across the menstrual cycle. Results, however, have generally been inconsistent, with some reports of premenstrual changes and other reports of no change (for reviews see Clare, 1985; Janowsky & Rausch, 1985; Walker, 1992; Cerin et al., 1993; Leibenluft, Fiero & Rubinow, 1994; Mortola, 1996; Epperson, Wisner & Yamamoto, 1999). Oestrogen, progesterone and arguably aldosterone are the only hormones that have been determined to vary predictably across the menstrual cycle, but fluctuations have not been consistently linked to symptom change (e.g. Andersch, Abrahamsson, Wendestam, Ohman & Hahn, 1979; J.W. Taylor, 1979a; Munday, Brush & Taylor, 1981; Bäckström, Sanders, Leask, Davidson, Warner & Bancroft, 1983; Rubinow, Hoban, Grover, Galloway, Roy-Byrne, Andersen & Merriam, 1988; Cerin et al., 1993). Numerous hormones and neurotransmitter levels have been examined in women with PMC, but no biological substance has been demonstrated to differ consistently in these women relative to controls, or to correlate with symptom severity (for reviews see Clare, 1985; Janowsky & Rausch, 1985; Walker, 1992;

Cerin et al., 1993; Leibenluft et al., 1994; Mortola, 1996). Many initial trials with treatments for PMC were open and yielded good results; progesterone in particular received wide acclaim (e.g. Dalton, 1964). Subsequent double-blind placebo-controlled trials, however, failed to confirm these earlier findings (e.g. Sampson, 1979; van der Meer, Benedek-Jaszmann & van Loenen, 1983; Richter et al., 1984; Andersch & Hahn, 1985; Maddocks, Hahn, Moller & Reid, 1986; Freeman et al., 1990), partly because of the high (up to 80%) response to placebo (Jordheim, 1972; Mattson & von Schoultz, 1974; Sampson, 1979; Steiner, Haskett, Osmun, Rubin & Carroll, 1979; Metcalf & Hudson, 1985). Numerous studies have demonstrated that various drug treatments ameliorate PMC, but that this effect is not greater than that of the placebo (for reviews see Clare, 1985; Janowsky & Rausch, 1985; Walker, 1992; Cerin et al., 1993; Leibenluft et al., 1994; Mortola, 1996).

Thus, despite over five decades of study, the biological aetiology of PMC is still obscure. To date, there is no one hypothesis that can adequately explain the constellation of symptoms, and no treatment has been consistently demonstrated to be more effective than placebo. While the physiological basis of PMC continues to be heavily researched, attention has also focused on psychosocial determinants of PMC.

3.2 Psychosocial Influences

As indicated in section 1.2.4 it is widely accepted that retrospective data collection and participant awareness of study aims produce inaccurate symptom reports (Endicott & Halbreich, 1982; AuBuchon & Calhoun, 1985). One of the commonly cited explanations for this finding is that these methodologies increase the salience of the menstrual cycle and thus elicit stereotypic beliefs (Parlee, 1974; Englander-Golden et al., 1978). The postulation that premenstrual change is influenced by stereotypic beliefs is also supported by the difference in PMC incidence across a number of ethnic groups (Janiger et al., 1972, see section 2.2.1) (Ruble, 1977). These issues have important methodological implications but also contribute to the theory that premenstrual changes are influenced by psychosocial factors. In this section,

research examining the relationship between menstrual cycle symptoms and psychosocial influences will be discussed.

Examination of popular media information suggests the existence of negative societal stereotypes about the menstrual cycle. For instance, in a content analysis of 78 magazine articles that appeared between 1980 and 1987, the typical description of the premenstrual syndrome was found to be strongly biased towards reporting negative menstrual cycle changes. Most articles were found to be negative in tone, and supportive of the stereotype of the maladjusted woman (Chrisler & Levy, 1990).

Stereotypic beliefs regarding the menstrual cycle have been demonstrated to be present in young girls even before the onset of menstruation (Clarke & Ruble, 1978). Pre- and post- menarcheal girls, and boys, when instructed to complete the MDQ according to expectations or actual experience of the menstrual and intermenstrual phases, have been found to report in much the same manner (Clarke & Ruble, 1978). This indicates the presence of common beliefs about the menstrual cycle, and raises the possibility that girls' expectations of the menstrual cycle are primed to become a self-fulfilling prophecy.

Women have also been found to report more negative symptoms when asked to complete the MDQ as if premenstrual as opposed to intermenstrual (Brooks et al., 1977). In a particularly elegant experiment, Ruble (1977) found that women who were led to believe that they were premenstrual reported significantly more water retention, pain and changes in eating habits than women led to believe they were intermenstrual. This effect occurred despite the fact that the actual cycle phase of both groups of women was exactly the same (late luteal). Ratings for the other variables (negative affect, concentration, behavioural change, autonomic reactions, arousal and control) were not significantly different between the groups. Two attitude factors, that menstruation was debilitating and predictable, were related to expectations of cyclical change. Although the women were all relatively young (18-24 years) and not selected on the basis of suffering PMC, these results are provocative and suggest that self-

report of at least some symptoms may be influenced by expectations associated with cycle phase. The results of Ruble (1977) were subsequently replicated by Klebanov and Jemmott (1992) who also found, however, that reported premenstrual symptoms could not be explained by expectations alone.

McFarland, Ross and DeCourville (1989) studied a group of young women and found that when intermenstrual (follicular and early luteal) women were asked to recall their experiences of menstruation, they did so in concordance with their beliefs about menstruation. The more negative a woman believed menstruation to be, the more menstrual symptoms she recalled herself to have experienced. This effect was independent of previously made prospective ratings. Conversely, recall by intermenstrual women of experiences during the follicular phase were found to be unrelated to beliefs about menstruation. A similar effect was observed in the recall of intermenstrual phase experience by both intermenstrual and menstrual women. Menstrual women recalled the intermenstrual phase as being more positive than intermenstrual women. McFarland and colleagues proposed these findings to be consistent with a theory of biased recall due to use of implicit theories of change and stability. The authors argued that women recalling a menstrual cycle phase different to the one they were presently in, recalled their past experiences by invoking an exaggerated theory of menstrual distress. Conversely, women recalling a previous experience of a menstrual cycle phase while in that phase, invoked a theory of stability and used information about their present status rather than a theory of menstrual experience.

Chrisler, Johnston, Champagne and Preston (1994) investigated the effects of completing a "menstrual joy questionnaire (MJQ)" (listing a number of positive items) on subsequent completion of the MDQ. Fifty young undergraduate students completed both the MDQ and the MJQ, one week apart, with order of presentation of the questionnaires counterbalanced. Results indicated that completion of the MJQ did not alter subsequent reporting of negative symptoms on the MDQ but did increase ratings on the MDQ arousal sub-scale (affectionate, orderliness, excitement, feelings

of well-being, bursts of energy or activity). Women who completed the MJQ first were also more likely than women who completed the MDQ first to subsequently report menstruation as a natural event. There were no differences between the groups with regard to other more negative attitudes (e.g. menstruation as debilitating or bothersome). The authors thus concluded that the MJQ primed participants to be more aware of positive changes but had no effect on negative changes. They also suggested that the MDQ primes participants to focus on negative changes and ignore positive ones.

Fradkin and Firestone (1986) used a journal article, a videotape and group discussion to tell a group of women that PMT was due not to biology but to negative societal myths. Subsequently, these women reported fewer premenstrual symptoms relative to controls. In a further study designed to manipulate social expectancies, Olasov and Jackson (1987) used videotaped lecturers to either increase (group 1) or decrease (group 2) expectancies of a negative mood-menstrual relationship. Results from a large sample of undergraduates indicated that expectancies were altered in the predicted direction both immediately after lecture presentation and at a 40-day follow up. Furthermore, daily mood scores indicated more negative moods among women in group 1 than women in group 2 or two control groups. This effect, however, was not specific to the premenstrual phase but was evident across the entire menstrual cycle. Marván and Escobedo (1999) administered the MDQ to 86 Mexican women during the follicular phase of two consecutive menstrual cycles, before and after showing them one of two videos. The experimental group viewed a video describing the negative consequences of PMS while a control group watched a video describing the menstrual cycle. There were no differences in symptom reporting before and after the video in the control group, but women in the experimental group reported more severe premenstrual symptoms after watching the videotape.

The above-cited studies indicate that stereotypes and expectancies about premenstrual changes are learned in childhood and may alter the manner in which women report menstrual cycle symptoms. Ruble and Brooks-Gunn (1979) argue in favour of a

social cognition model in which the association of negative symptoms with the menstrual cycle is the result of biases in information processing. Some support in favour of this hypothesis has accrued from studies requesting participants to make attributional judgements about the causes of positive and negative moods following the presentation of vignettes. Such studies have found that negative moods are attributed to the menstrual cycle when occurring premenstrually but to other origins when occurring intermenstrually. Positive moods are generally attributed to causes other than the menstrual cycle, irrespective of the phase at which they occur (Koeske & Koeske, 1975; Bains & Slade, 1988). It is important to note, however, that the above-cited studies have used as participants primarily undergraduate students. Lawlor and Choi (1998) used four different age groups, under 18, 18-34, 35-54 and over 55, years, and found results consistent with past research for the middle two age groups but not the teenagers and over 55's. Furthermore, the teenage group were significantly more likely to attribute premenstrual positive moods to the menstrual cycle than the other groups, suggesting more positive attitudes toward the menstrual cycle in at least that sample of young British women.

Further information about the role of attribution comes from the study of Campos and Thurow (1978) who obtained daily self-reports from 85 undergraduate students and found that OC users were more likely than non-users to attribute premenstrual moods and symptoms to the menstrual cycle. The non-OC users conversely, were more likely than the OC group to attribute menstrual moods and symptoms to the menstrual cycle. The authors argued that these differential attribution patterns were due to cues in cycle phases, with OC users more able to identify their premenstrual phase and non-OC users perhaps reliably perceiving only two phases, menstrual and non-menstrual.

In sum, there is evidence supporting a relationship between PMC and cultural stereotypes and expectations. Investigations of psychosocial influences suggest that these factors are important determinants of premenstrual symptom experience in at least some women. It should be noted, however, that many of the above-cited studies

employed as participants, young healthy women. The effect of psychosocial influences on older women and on women who suffer severe symptoms is unclear. It is conceivable that the increased salience of the menstrual cycle to women who experience pronounced cyclicity minimises the impact of stereotypic conceptions. Furthermore, although psychosocial influences are clearly significant, they cannot fully account for individual differences in PMC. While biological determinants are presumed to be important in this regard, personality factors have also received increasing attention.

3.3 Personality Factors

3.3.1 Introduction

Personality refers to the relatively stable patterns of thoughts and behaviour that characterise an individual and his or her reactions to the environment (Costa & McCrae, 1992b; P. Gray, 1994). Much of the research into personality factors and PMC has been based on psychometric evaluation of personality traits. Some researchers have focused on very specific traits, most commonly anxiety and depression, and have attempted to relate these to premenstrual symptomatology. Others have investigated traits which constitute dimensions of trait theories. Eysenck and Eysenck's (1964, 1975) neuroticism scale for instance, has been widely studied in relation to premenstrual symptoms.

The questionnaires utilised to measure personality have included those that are designed to assess dimensions of normal personality, as well as those that are interpreted in terms of diagnostic categories. While there is clearly some overlap between the study of normal personality differences, and anxiety, depressive and other disorders, the focus of this section will be the relationship between premenstrual symptoms and normal variation on personality traits. Trait anxiety, depression and other specific negative affects will be discussed in section 3.3.2 and neuroticism in

section 3.3.3 It is outside the scope of this thesis to discuss psychological illness in any detail, although, where relevant, some findings of personality dysfunction in women with PMC will be covered. The large body of literature on the relationship between PMC and affective disorder, however, is a topic in its own right and will not be discussed here. The interested reader can refer to Halbreich (1997), Pearlstein and Stone (1998) and Breaux, Hartlage and Gehlert (2000) for recent reviews.

3.3.2 The Relationship Between Trait Anxiety and Other Negative Affects and PMC

Picone and Kirkby (1990) found trait anxiety as measured by the Spielberger's State-Trait Anxiety Inventory to correlate with three sub-scales of a modified version of the MDQ; the greatest correlation was observed with psychological followed by behavioural and physical symptoms. These findings were based on the retrospective assessment of premenstrual experiences but have been supported by findings of higher levels of trait anxiety throughout the menstrual cycle in women with PMC compared to controls (Halbreich and Kas, 1977; Giannini, Price, Loisell & Giannini, 1985; Mira et al., 1985). In a carefully selected sample of women without current or past psychiatric or psychological disorders, C.E. Cumming, Fox and D.C. Cumming (1995) reported that women with PMS differed from women with affective disorders and women without PMS on a measure of trait anxiety. The level of anxiety in the PMS groups was found to be comparable to that of a sample of women thought to represent the community at large.

Christensen and Oei (1989) were able to differentiate women with prospectively confirmed (over one cycle) premenstrual dysphoria from others on the basis of levels of state and trait anxiety, frequency of automatic negative self-statements and levels of depression. These findings were subsequently corroborated and demonstrated to occur whether or not participants were aware of the study's premenstrual theme (Christensen & Oei, 1992). In later work, however, Christensen, Board and Oei (1992) found few differences between those with confirmed compared to

unconfirmed premenstrual dysphoria, but a number of differences between both the aforementioned groups and controls. When assessed premenstrually, women with confirmed and unconfirmed dysphoria had higher levels of state and trait anxiety compared to controls, and when assessed postmenstrually, were more likely than controls to have a history of affective disorder and an external locus of control. The authors suggested that the differences between the results of the studies may have reflected the sample used; the women in the earlier studies were primarily healthy undergraduate students while those in the later study were from the general community and seeking treatment for premenstrual changes.

A number of studies have focused on anxiety levels during the follicular phase of the menstrual cycle in an attempt to ascertain whether women with PMC experience high levels of baseline symptomatology. Hart and Russell (1986) reported that women who identified themselves as having PMS, had significantly higher follicular levels of depression, anxiety, tension and irritability compared to women who did not complain of PMS. Interestingly, the authors also found that while the PMS group showed greater premenstrual increases in depression, abdominal swelling and headaches, both groups of women had similar increases in symptom severity for anxiety, tension, irritability, breast tenderness and sleeplessness. The authors suggested that this increase from an already high baseline level in women with PMS may result in a premenstrual level of symptom severity with which they have trouble coping.

Morse and Dennerstein (1988b), in an examination of the factor structure of the MDQ, collected follicular and premenstrual responses from 75 women who were seeking treatment for, and had prospectively confirmed, PMS. Five factors emerged, the first of which accounted for 22% of the total variance and was indicative of stress, depression, negative affect and anxiety in the follicular phase.

These studies indicate that women with PMC suffer from continuous psychological distress which interacts with changes occurring premenstrually. However it should be

noted that the Hart and Russell (1986) study was based on women with self-reported PMS, while Morse and Dennerstein (1988b) used as participants women who were seeking treatment for PMS. It may be the case that these women demonstrate more psychological distress than those who do not complain of PMS or actively seek treatment.

A number of researchers have examined PMC in relation to personality dysfunction, using specific diagnostic questionnaires. In a prospective study of women seeking an evaluation of PMS, Eckerd et al. (1989) found follicular phase personality dysfunction as measured by the Personality Diagnostic Questionnaire to correlate with severity of premenstrual symptoms. Personality dysfunction, however, was not related to diagnosis of PMS or LLPDD.

In a study of a small sample of women seeking evaluation of menstrual cycle problems, Chuong, Colligan, Coulam and Bergstralh (1988) noted that those with confirmed PMS had higher levels of personality dysfunction as indicated by the Minnesota Multiphasic Personality Inventory during both the follicular and late luteal phases. These problems included more feelings of worry, tension, anxiety and oversensitivity. It appeared that some women with PMS had dysfunction throughout the menstrual cycle which was exacerbated premenstrually, while others demonstrated normal follicular levels but dysfunction premenstrually.

C.E. Cumming et al. (1994) obtained similar results in a carefully selected group of healthy women recruited from a PMS clinic with prospectively confirmed premenstrual symptoms but not mid to late follicular symptoms. Results of a hierarchical cluster analysis revealed two groups, one in which women had personality profiles (assessed during the follicular and premenstrual phases using the Millon Clinical Multiaxial Inventory) indistinguishable from an asymptomatic group and the other containing women with greater, but not pathological, psychological difficulties.

Taken as a whole, the above-cited studies indicate that many women with PMC demonstrate high levels of psychological distress throughout the menstrual cycle and that these symptoms are exacerbated premenstrually. The findings also suggest however, that this relationship is not all encompassing but points to the existence of another group of women who have normal personality profiles and follicular scores, but experience dysfunction specific to the premenstrual phase. This view is consistent with Rees (1953) who, based on a large, prospective study over four decades ago, concluded that "when [premenstrual tension and neurosis] coexist they are positively correlated" (p. 67) but that "premenstrual tension can exist in women with little or no evidence of instability in personality, maladjustment or of neurosis.... Conversely, many women with severe neurosis do not suffer from premenstrual tension .... Thus neurosis or emotional instability in itself is not sufficient to account for the premenstrual tension syndrome" (p. 63).

3.3.3 The Relationship Between Neuroticism and PMC

Like anxiety and depression, neuroticism has been examined in a number of studies in relation to PMC. Neuroticism refers to a predisposition toward experiencing negative affects (e.g. irritability, depression, anger, anxiety) and associated cognitive and behavioural characteristics (Costa & McCrae, 1992a). It is thus a broader construct than anxiety or depression and is often considered to subsume these characteristics. Neuroticism is the most well-established personality trait (e.g. Costa & McCrae, 1992a; Eysenck, 1994) and forms a major dimension of the most widely studied trait theories of personality (Cattell, Eber & Tatsuoka, 1970; Costa & McCrae, 1992a; Eysenck, 1994).

In an early study, Coppen and Kessel (1963) noted correlations between neuroticism and the premenstrual psychological symptoms of irritability, depression and tension. Neuroticism also correlated to a lesser extent with headaches and swelling but not with pain. This finding was based on the retrospective assessment of premenstrual experiences but has been supported by data collected prospectively during the late

luteal phase (J.W. Taylor, 1979b; Harding et al., 1985). Taylor noted a correlation between neuroticism and affective but not somatic symptoms, while Harding et al. found relationships with all of the MDQ sub-scales (except arousal). However, while these results suggest an association between neuroticism and premenstrual symptomatology, it cannot be determined that the relationship is not simply a reflection of an underlying influence of neuroticism on symptoms such as anxiety and irritability, regardless of menstrual cycle phase.

In order to overcome this limitation, neuroticism needs to be examined in relation to premenstrual *change* rather than premenstrual symptoms. Few researchers have applied this methodology to the study of neuroticism, but Mohan and Chopra (1987) reported that women with PMS had higher levels of neuroticism than women with few symptoms. Interpretation of the finding, however, is problematic given that diagnosis of PMS was based on retrospective report. Results from prospective studies have been inconsistent, with some researchers finding higher levels of neuroticism in women with PMC relative to controls (Hallman, Oreland, Edman & Schalling, 1987; R.J. Taylor, Fordyce & Alexander, 1991), but others reporting no significant differences (Sanders et al., 1983; Ekholm, Ekholm & Bäckström, 1988).

Thus while there is evidence for a relationship between neuroticism and premenstrual symptoms, their is little evidence that this relationship persists in conditions where the generalised influence of neuroticism on psychosomatic symptomatology has been controlled. This is important since neuroticism has been demonstrated to have a pervasive effect on health related variables, relating to a diverse array of symptom reports including: somatization in patients with diabetes mellitus (Deary, Clyde & Frier, 1997); feelings of distress/discomfort in the absence of overt stress (Watson & Clark, 1984); somatic complaints but not actual health status (Costa & McCrae, 1987; Watson & Pennebaker, 1989); reporting of side effects to a placebo (Davis, Ralevski, Kennedy & Neitzert, 1995); perceived university stress (Lu, 1994) and a predisposition in Alzheimer's patients to experiencing non-cognitive symptoms (Meins, Frey & Thiesemann, 1998). These findings indicate that people scoring high

on neuroticism are more inclined to experience symptoms in a variety of circumstances. This appears to hold for individuals not suffering any overt health problems as well as people in certain illness groups who report an increased occurrence of non-diagnostic symptoms.

These findings highlight the importance of designing studies that minimise the impact of neuroticism as a potential confound. Of particular relevance to the study of PMC is the selection of research participants. Mira et al. (1985) demonstrated that women who self-report PMS and/or seek treatment for PMS have higher levels of neuroticism than other women. In one study of 658 women seeking treatment for PMS, over 60% of the participants were identified as suffering some degree of psychological distress as indicated by their General Health Questionnaire (GHQ) scores (Corney & Stanton, 1991). It thus needs to be ensured that differences in neuroticism levels between women with PMC and controls, is not confounded with differences between the groups in self-diagnosis/treatment seeking behaviour. To achieve this, samples of women who are seeking treatment for PMS must be avoided given the likelihood of inflated neuroticism levels.

Also worthy of attention is a possible influence of neuroticism on factors such the retrospective diagnosis of PMC and the influence of participant awareness of study aims. As previously indicated, it is widely accepted that these methodologies produce inaccurate symptom reports (Endicott & Halbreich, 1982), possibly because they increase the salience of the menstrual cycle and thus elicit stereotypic beliefs (Parlee, 1974; Englander-Golden et al., 1978). It is also conceivable that the psychological processes that lead to inaccurate symptom reports, interact with neuroticism. In other words, it is possible that women most affected by experimental demand characteristics are those who are most prone to neuroticism. Van den Akker, Sharifian et al. (1995) found women whose retrospective reports were not substantiated by daily ratings to have higher levels of generalised negative affect than women who retrospectively reported few symptoms. R.J. Taylor et al. (1991) obtained comparable results with women classified by the Eysenck Personality Inventory (EPI) neuroticism

scale as neurotic, demonstrating greater discrepancies between retrospective and prospective reports relative to the non-neurotic group.

Thus there appears to be some association between neuroticism and PMC but the nature of this association is not clear. The finding of correlations between neuroticism and premenstrual symptoms in itself is not unexpected, nor is it particularly informative given that there are a number of items on the MDQ such as anxiety, irritability, depression and tension that are common to many neuroticism scales. It is likely that these common symptoms are a substantial factor in the correlation between neuroticism and premenstrual symptoms; there is certainly no evidence from these studies to suggest that high levels of neuroticism cause premenstrual symptoms or vice versa. Studies of prospective premenstrual *change* are more useful but results have been inconsistent. The findings of no differences in neuroticism between women with PMC and controls (Sanders et al., 1983; Ekholm et al., 1988) raises the possibility that the relationship between neuroticism and premenstrual symptoms is a non-specific one than occurs regardless of menstrual cycle phase. If this is the case, then holding constant the generalised influence of neuroticism by calculating change scores would eliminate any relationship. Given the lack of consistency in previous research, however, this remains to be determined.

3.3.4 The Five-Factor Model of Personality

While many personality traits have been examined in relation to PMC, few studies have examined PMC in relation to a comprehensive theory of personality. Previously examined personality constructs include needs for comfort, achievement and approval, self-downing, other-downing, demands for fairness (Lindner & Kirkby, 1992) and self-preoccupation (Heilbrun & Frank, 1989), to name just a few. Results from these studies, however, have been discrepant and are difficult to integrate given the lack of reference to a unified paradigm of personality. This creates difficulties in determining whether significant predictors of premenstrual symptoms account for unique or shared variance, or overlap with other personality variables. The absence of

systematic study within a well-defined framework also increases the likelihood of overlooking potentially relevant personality constructs. Clearly there are numerous valid measures of personality constructs and a variety of levels at which personality can be conceptualised. Discussion of results, however, can be difficult when similarly named scales measure different constructs, and differently named scales measure much the same trait. The usefulness of a common language and widely accepted model of personality is clear, and many personality theorists have expended much effort striving to achieve this. While consensus is still a long way off, and indeed may never be achieved, a number of researchers now argue that progress has been made in identifying the trait structure of personality (R. Hogan, 1987; Digman, 1990; John, 1990; Briggs, 1992; McCrae & John, 1992; Wiggins & Trapnell, 1997).

One of the most widely accepted and well-researched models of personality is the five-factor model or "big-five" (Digman, 1990). The five-factor model which was originally developed by Tupes and Christal in 1961, posits the existence of five orthogonal factors which represent the fundamental dimensions underlying personality (Digman, 1990). The five factors are neuroticism, extraversion, openness to experience, agreeableness and concsienciousness. Eysenck argues that only his three-factor theory (psychoticism, extraversion, neuroticism) and the "big-five" have survived the "psychometric holocaust" (Eysenck, 1994, p. 38) given that questionnaires such as the Minnesota Multiphasic Personality Inventory, Californian Psychological Inventory and Myers-Briggs Temperament Inventory are not based on factor analysis, and Cattells' 16 Factors have received little support in replication studies. Eysenck's theory too, however, lacks support when compared to the large number of factor analytic studies which have drawn conclusions favouring a description of human personality based on five independent factors. Support for the five-factor model has accrued over the past four decades from studies of natural language adjectives, Californian Q-Set (Q-sort items) items and personality questionnaires (for reviews of the five-factor model see R. Hogan, 1987; Digman, 1990; John, 1990; Wiggins & Trapnell, 1997).

The most commonly used operational measure of the big-five is the NEO Personality Inventory Revised (NEO PI-R) (Costa & McCrae, 1992a). A rational approach was taken by the authors in constructing the NEO PI-R, with item development guided by both personality theory and factor analytic findings (Kaplan & Saccuzzo, 1997). The NEO PI-R has been used extensively for research in health psychology (see Costa & McCrae, 1992a) but to the authors knowledge no previous studies have examined premenstrual symptoms in relation to this model.

Given the recent advances in personality theory, now may thus be a propitious time to examine premenstrual symptomatology in relation to the five-factor model of personality. In addition to examining premenstrual symptoms in relation to a comprehensive set of personality factors, this would provide an opportunity to measure neuroticism using a scale that represents current thinking in personality theory. The vast majority of previous research on neuroticism and PMC has been based on Eysenck and Eysenck's (1964, 1975) concept of personality and has been measured using the Maudsley Medical Questionnaire/Personality Inventory or, more recently, the Eysenck Personality Inventory/Questionnaire. One of the differences between these questionnaires and the NEO PI-R is that factors of the EPI are assessed as a unitary dimensions, whereas each factor assessed by the NEO PI-R is comprised of six more specific facets. Each of the facets of the NEO PI-R neuroticism scale correlate with the neuroticism scale of the EPI, although the pattern of correlations reveals that the EPI neuroticism scale reflects anxiety and depression to a greater extent than the other facets, particularly hostility and impulsiveness (Costa & McCrae, 1986). The study of facets is beneficial since it allows an examination of the relative importance of more specific traits in predicting behaviour and a comparison of these with the broader factors. In the study of PMC, for instance, the comparative success of neuroticism compared to the facets of anxiety and/or depression in predicting different types of premenstrual symptomatology may be worthy of attention.

A description of the domain and facet scales based on the NEO PI-R is outlined below. Because no major personality dimensions other than neuroticism have been widely studied in relation to PMC, the significance of the five factors to health related variables is briefly discussed with a view to establishing their potential relevance to premenstrual symptomatology.

3.3.4.1 Neuroticism

As previously indicated, neuroticism can be defined as a predisposition toward experiencing negative affects and associated cognitive and behavioural characteristics. The six facets comprise (adapted from Costa & McCrae, 1992a):

Anxiety:	tendency to feel worried, apprehensive, fearful and tense
Angry Hostility:	readiness to experience anger, frustration and bitterness
Depression:	tendency to feel guilt, sadness, loneliness and hopelessness
Self-consci[illegible]ness:	sensitivity to ridicule and feelings of inferiority, shame and embarrassment
Impulsiveness:	inability to control cravings and urges
Vulnerability:	feelings of hopelessness or panic when faced with stressful situations

As indicated in section 3.3.3, neuroticism has been widely studied in relation to premenstrual symptomatology. The relationship between neuroticism and other health related variables will thus not be discussed here. One point worthy of attention, however, is the finding that negative affectivity, a component of neuroticism, is more strongly related to diffuse (e.g. fatigue) than to specific (e.g. muscolo-skeletal complaints) symptoms (Vassend, 1989), and to subjective experiences (e.g. feelings) rather than objective indices (e.g. behaviour changes, coping mechanisms) (Watson & Clark, 1984). This finding may have implications for the type of premenstrual symptoms expected to relate to neuroticism.

3.3.4.2 Extraversion

Extraversion is principally a description of interpersonal behaviour and relates primarily to the "preferred quantity of social stimulation" (Costa, McCrae & Dye, 1991, p. 888). Extraverts tend to be outgoing, sociable, assertive, active, energetic and optimistic while introverts are best described as showing a relative absence of these characteristics rather than the opposite. Extraversion comprises the following facets (adapted from Costa & McCrae, 1992a):

Warmth:	feeling and expression of genuine affection and friendliness toward others
Gregariousness:	preference for the company of others
Assertiveness:	tendency to be dominant, forceful, and socially ascendant
Activity:	desire for rapid tempo, vigorous movement and the need to keep busy
Excitement seeking:	desire for excitement and stimulation
Positive Emotions:	tendency to experience positive emotions such as joy, happiness and love

A number of studies have examined extraversion in relation to premenstrual symptoms and premenstrual change. Results, however, have presented an unclear picture with some researchers reporting that extraversion is associated with less premenstrual symptomatology (Mohan & Chopra, 1987), but most reporting no association (Coppen & Kessel, 1963; J.W. Taylor, 1979b; Awaritefe et al., 1980; R.J. Taylor et al., 1991).

Research in other areas of health psychology has demonstrated extraversion to negatively correlate with psychological symptoms (depression/anxiety) (Lu & Argyle, 1991) and perceived university stress (Lu, 1994). Extraversion has also been reported to relate to high levels of subjective well-being; subjective well-being in turn is negatively related to the experience of adverse symptoms (Costa & McCrae, 1980; Argyle & Lu, 1990; Lu & Argyle, 1991). Velting and Liebert (1997) found

extraversion as measured by the NEO PI-R, and in particular the facet "positive emotions", to predict average mood in a sample of eighty-one women. Interestingly, extraversion was also positively related to across day mood variability (Velting & Liebert, 1997).

The above-cited results suggest that extraversion predisposes individuals to experience positive affective states, and decreases the likelihood of experiencing negative affective and psychosomatic symptoms. While a relationship between extraversion and positive affects is widely accepted (e.g. McCrae & Costa, 1991; Watson & Clark, 1992), the postulation that extraversion acts as a protective factor against the experience of negative symptoms is more controversial. V.J. Sutherland and Cooper (1990) reported that at high levels of neuroticism, extraversion is related to somatic, and introversion to psychological, symptoms. This suggests that any negative relationship between extraversion and symptom experience may be mediated by neuroticism level. Other researchers, however, have found that extraversion is not related in any way to negative affects, and that individuals who are both neurotic and extraverted would experience high levels of negative and positive affects but as a result of the independent influences of these two personality characteristics respectively. For instance McCrae and Costa found extraversion to correlate positively with measures of positive affect, but to be unrelated to measures of negative affect.

3.3.4.3 Agreeableness

Agreeableness, like extraversion, is principally a description of interpersonal behaviour and refers to the typical manner of social interaction "along a continuum from compassion to antagonism" (Costa & McCrae, 1985, p. 2). Agreeableness comprises the following facets (adapted from Costa & McCrae, 1992a):

Trust:	belief that others are honest and well intentioned
Straightforwardness:	disposition toward frankness and sincerity in dealing with others
Altruism:	concern for, and willingness to assist, others
Compliance:	tendency to defer to others rather than fighting in situations of conflict
Modesty:	tendency to be humble and unassuming
Tender-Mindedness:	tendency to consider the needs of others when making judgements

Little work has been conducted examining the relationship between agreeableness and affective or psychosomatic symptoms. McCrae and Costa (1991) found agreeableness to be a significant predictor of psychological well-being, and suggested that this may be due to a greater likelihood of "social" success in individuals scoring more highly on the agreeableness scale (McCrae & Costa, 1991, p. 231). Velting and Liebert (1997), however, reported that agreeableness is not related to average mood or mood variability.

3.3.4.4 Openness

Openness refers to an openness to experience; the six facets of openness characterise different aspects of experience and comprise (adapted from Costa & McCrae, 1992a):

Fantasy:	vivid imagination and active fantasy life
Aesthetics:	appreciation for art and beauty
Feelings:	attentiveness to inner feelings and the evaluation of emotion as an important part of life
Actions:	preference for variety
Ideas:	intellectual curiosity and a willingness to consider new ideas
Values:	readiness to re-examine social, political and religious values and independence of judgement

Openness has been demonstrated to relate to both positive and negative emotions (McCrae & Costa, 1991), as well as within and between day mood variability, but not to average mood (Velting & Liebert, 1997). McCrae and Costa argue that open individuals experience emotions more acutely than closed individuals but because the positive and negative affects tend to cancel each other out, do not differ on overall feelings of subjective well-being.

In terms of the contribution of specific facets, Velting and Liebert (1997) found "fantasy" in particular to predict within day mood variability, while according to the definitions provided by Costa and McCrae (1992a) in the NEO PI-R manual, "feelings" is related to experiencing "deeper and more differentiated emotional states" (p. 17).

3.3.4.5 Conscientiousness

Conscientiousness refers to the control of impulses as well as the ability to plan, organise and carry out tasks. The six facets comprise (adapted from Costa & McCrae, 1992a):

Competence:	tendency to behave in a sensible, capable and accomplished manner
Order:	tendency to keep things tidy and well organised
Dutifulness:	adherence to ethical principles and moral obligation
Achievement:	desire for excellence and preparedness to work hard to achieve goals
Self-discipline:	ability to complete tasks despite boredom or other distractions
Deliberation:	tendency to be cautious and think carefully before acting

Unlike neuroticism, extraversion and openness, conscientiousness has not been found to relate to average mood or mood variability (Velting & Liebert, 1997). The relevance of conscientiousness to health psychology appears to be in its relationship

to wellness behaviours such as exercise and good diet (Booth-Kewley & Vickers, 1994). Presumably as a result of these factors, conscientiousness is positively related to good health indices. For instance, childhood conscientiousness was demonstrated in a large seven decade longitudinal study to predict longevity (H.S. Friedman, Tucker, Tomlinson-Keasey, Schwartz, Wingard & Criqui, 1993), and adult conscientious has been demonstrated to relate to physical fitness in a sample of men (J. Hogan, 1989). More generally, McCrae and Costa (1991) reported conscientiousness to predict psychological well-being and suggested that this relationship may be mediated by an increased likelihood of achievement in conscientious individuals.

CHAPTER 4

SUMMARY OF THE LITERATURE AND AIMS OF THE RESEARCH

4.1 The Pattern and Incidence of Premenstrual Change

Despite much research, the pattern and incidence of premenstrual changes remain poorly understood. There is still disagreement with regard to fundamental factors such as which symptoms, if any, fluctuate significantly across the menstrual cycle. While negative affect, somatic symptoms and fluid retention appear to show marked cyclicity (e.g. Herrera et al., 1990; Boyle & Grant, 1992), evidence for fluctuations in behaviour change, cognitive symptoms and autonomic reactions is less consistent (N.F. Woods et al., 1982b; Herrera et al., 1990). The temporal pattern of symptom change is also unclear, with some reports of symptoms remitting with the onset of menstruation (e.g. Sanders et al., 1983), and others of symptoms increasing over the premenstrual period and peaking during the early menstrual phase (e.g. van der Ploeg & Lodder, 1993). Of particular note is the absence of any clear data on the incidence of premenstrual changes. The majority of research in this area has been conducted using retrospective data and thus incidence rates may have been overestimated. Many studies have also assessed the incidence of premenstrual symptoms, not premenstrual *change*, and have failed to distinguish between mild and more severe symptoms.

Oral contraceptive use is an important potential mediator of the pattern and incidence of menstrual cycle symptoms but research in this area has yielded inconsistent results. Some of this confusion may reflect the failure to distinguish between types of OCs. There has been little research comparing the effects of monophasic and triphasic OCs, the most commonly used oral contraceptives in Australia. To the author's knowledge, no previous research has adequately examined any effect of OC use/type of the incidence of premenstrual change.

It is thus apparent that there is still a great need for prospective assessments of a representative sample of the population so that the "baseline" level of premenstrual symptoms and premenstrual change in the community can be determined. It is essential to develop an understanding of this "control group" in order that the significance and prevalence of PMC can be determined. An adequate description of basic phenomena such as the prevalence of PMC and role of OCs is essential if the aetiology/ies of these symptoms are to be identified and treatment approaches devised.

4.2 Risk Factors of Premenstrual Change

Numerous risk factors have been linked with PMC but few have been consistently supported. Psychological factors such as personality have received much attention with neuroticism, in particular, being widely researched. While there is evidence for a relationship between neuroticism and premenstrual symptoms (Coppen & Kessel, 1963; J.W. Taylor, 1979b; Harding et al., 1985; Hallman et al., 1987; Mohan & Chopra, 1987; R.J. Taylor et al., 1991), it is not clear whether this relationship is a generalised one, or whether it occurs specific to the premenstrual period. While methodological limitations plague menstrual cycle research, they are particularly problematic in the study of neuroticism. Specifically, it appears that biases resulting from methodological problems are more likely in women scoring highly on neuroticism scales. For instance neuroticism relates to general psychosomatic symptom reporting (e.g. Watson & Pennebaker, 1989), self-reporting of, and seeking treatment for, PMS (Mira et al., 1985) and the discrepancy between retrospective and prospective menstrual cycle symptom reports (R.J. Taylor et al., 1991). These findings highlight the importance of designing studies that reduce the impact of neuroticism as a confounding variable. In particular, the effect of neuroticism on baseline symptomatology needs to be established and statistically controlled, samples with potentially elevated levels of neuroticism must be avoided, and experimental demand characteristics must be minimised.

Although neuroticism has received much attention, a relatively neglected area of research has been the study of premenstrual change in relation to a comprehensive model of personality. Numerous personality constructs have been examined in relation to PMC but results are difficult to integrate given the lack of reference to a unified paradigm of personality. It is important to study PMC in the context of a theoretical model of personality in order that relevant personality constructs are not overlooked, and to develop a framework for understanding the relationship between personality and PMC. One of the most widely accepted and well-researched models of personality is the five-factor model. The most commonly used operational measure of this model is the NEO PI-R. To the author's knowledge, no previous studies have focused on these personality factors in relation to premenstrual symptoms, but previous research in other areas of health psychology provides a prima facie case for their examination. Use of the five-factor model is thus beneficial from the point of view of developing a comprehensive picture of the relationship between personality and PMC. It also provides an opportunity to measure neuroticism using a scale that represents current thinking in personality theory, and to investigate the relative importance of particular facets of neuroticism in predicting symptomatology.

In addition to personality factors, investigations have also focused on other potential risk factors for PMC. Results from studies of demographic factors and menstrual cycle characteristics, however, have been contradictory. Despite some consistency in early reports suggesting that PMC increases with age and parity (e.g. Dalton, 1964; Moos, 1968), there is now considerable evidence that this may not be the case (e.g. Graham & Sherwin, 1987; Siegel et al., 1987). Furthermore, some researchers have found that the relationship between age and premenstrual symptoms is highly symptom specific (Futterman et al., 1988), while others have suggested that the relationship is not a linear one. Marital and employment status have also been studied with a view to understanding the role of psychosocial factors in PMC, but results have been widely discrepant (N.F. Woods et al., 1982c; Clare, 1983; Sanders et al., 1983).

Investigation of menstrual cycle characteristics has focused on menstrual cycle length and regularity, menses duration and age of menarche. Again, results have been inconsistent with some researchers finding these characteristics to be important mediators of premenstrual symptoms (e.g. Sheldrake & Cormack, 1976) but others reporting no association (e.g. Graham & Sherwin, 1987). Examination of the relationship between menstrual pain and premenstrual symptoms has yielded more consistent results, with several suggestions of a significant association (e.g. Clare, 1983; Steege et al., 1985; Graham & Sherwin, 1987; Yankauskas, 1990; Bancroft & Rennie, 1995).

In short, the determinants of PMC remain to be clearly established. An understanding of the role of these variables has implications for both the aetiology and treatment of PMC.

4.3 Aims of the Research

Research suggests that the majority of women report the experience of premenstrual symptoms. For many women these symptoms are not debilitating yet impact on their lives and are frequently cited as distressing. A small proportion of women experience premenstrual symptoms to such a degree as to be incapacitating. Research in this area has considerable social relevance, yet many studies in the area are conceptually and methodologically flawed. A number of researchers have suggested that the progression of an understanding of PMC is reliant on upgrading the quality of research in the area (e.g. Rubinow & Roy-Byrne, 1984; Halbreich & Endicott, 1985).

Two particularly notable areas of concern are methodological limitations and the conceptualisation of PMC as a single disorder. These issues have been discussed in various sections of this literature review and will not be reiterated in detail here. Briefly, however, they key issues are as follows:

1. data should be collected prospectively, and preferably over more than one cycle
2. participants should not be made aware of the aims of the study
3. data should be analysed in terms of each woman's own baseline
4. a diverse, non-patient population should be used (except where clinical populations are the primary interest)
5. clear exclusion criteria should be implemented
6. affective symptoms should be distinguished from other types of symptoms (e.g. behavioural, somatic symptoms)

Although the necessity of such criteria has long been recognised (e.g. Rubinow & Roy-Byrne, 1984; Halbreich & Endicott, 1985), conducting studies in this manner is labour intensive and many researchers still opt for retrospective measures, unrepresentative samples, and single symptom scores. To avoid these shortcomings, the current research has been designed in light of the above issues. Broadly, the purpose of this research was to examine the pattern, incidence and risk factors of premenstrual change in a reliable manner by addressing key methodological limitations.

A longitudinal study was conducted in which a large number of women from the general community provided information about their symptom experience across the menstrual cycle. Detailed demographic, menstrual cycle and personality data were also collected. To ensure accurate diagnoses of premenstrual symptomatology, symptoms were assessed across the entire menstrual cycle daily and prospectively over a 70-day period in a study with disguised experimental aims. In an attempt to identify concomitants of PMC, premenstrual symptoms scores were subjected to factor analysis in order to derive an empirical summary of the data. Discrete groups of premenstrual symptoms were studied separately so that differential relationships could be examined. Strict exclusion criteria were applied and OC users were treated as a separate group. Detailed information about participants was gathered to allow an evaluation of the generalisability of the research and the comparability to other studies. In addition to basic demographic information this included, for instance, country of

birth, use of any medications, and psychiatric and menstrual history. Such information has been suggested by Dennerstein, Spencer-Gardner and Burrows (1984) to be routinely collected in menstrual cycle studies.

This research was conducted in two parts. Part I of the study centered around the pattern and incidence of premenstrual change, while part II centered around risk factors of premenstrual change. The aims of part I of the study were to:

- determine whether Moos' factors could be replicated based on daily and prospective completion of the MMDQ in women who were unaware of the study aims

- examine the pattern and incidence of premenstrual symptoms and premenstrual symptom change

- establish any effect of OC use/type on the pattern and incidence of menstrual cycle symptoms

In line with these aims, symptoms were compared across three phases of the menstrual cycle in non-users of OCs, triphasic OC users and monophasic OC users. The percentage of women experiencing premenstrual increases of various magnitudes was also calculated for these three OC groups. Based on previous research, it was expected that symptoms would vary by menstrual cycle phase, being higher in the premenstrual and menstrual phases relative to the follicular phase. A marked premenstrual increase of 30% from the follicular phase was expected to occur in at least one third to one half of the sample. More severe increases in symptomatology were expected to be less common. Incidence of premenstrual change was expected to be the greatest for symptoms of fluid retention and negative affect. Based on recent and prospective (van den Boogaard & Bijleveld, 1988; Walker & Bancroft, 1990) or double-blind (Graham & Sherwin, 1992) studies, oral contraceptive use was hypothesised to effect the severity of physical but not psychological symptom

severity. Premenstrual increases in symptoms were expected to occur later (closer to menstruation) in OC users relative to non-users.

The aim of part II of the study was to examine the risk factors of premenstrual symptoms and premenstrual change. To this end, the relationships between premenstrual symptoms and several demographic, menstrual cycle and personality variables were examined in a series of multiple regression analyses. It should be noted that no attempt was made to diagnose PMS in these analyses. Rather the extent to which the independent variables (IVs) predicted premenstrual symptoms was examined. In order to distinguish between the prediction of premenstrual symptoms and premenstrual change, predictors were examined in the context of premenstrual symptom scores both before and after controlling for baseline (follicular) scores.

It was expected that several IVs would differentially predict premenstrual symptoms. The primary interest in this study was personality factors, in particular, neuroticism. Based on previous findings of correlations between neuroticism and premenstrual symptoms, it was hypothesised that neuroticism would predict premenstrual symptoms. Given that some previous studies have found neuroticism to correlate with a variety of premenstrual symptoms, while others have found correlations with psychological but not somatic symptoms, neuroticism was expected to be more strongly related to negative affect than other types of symptoms. In view, however, of the lack of consistent evidence supporting an influence of neuroticism that is specific to the premenstrual phase, it was further hypothesised that neuroticism would not predict premenstrual negative affect scores if variation due to differences in baseline (follicular) negative affect was removed. In terms of the particular facets of neuroticism, anxiety and depression were expected to be particularly relevant predictors of symptomatology.

In line with research in other areas of health psychology (see sections 3.3.4.2-3.3.4.5), it was expected that factors of the NEO PI-R other than neuroticism would also predict premenstrual symptomatology. However, given that little past research has focused on

these personality characteristics in relation to PMC, this aspect of the study was deemed exploratory and specific hypotheses were not generated.

Although personality characteristics were the primary focus of this study, demographic and menstrual cycle variables were also of interest. Given their postulated role in mediating premenstrual symptoms, age, parity, marital and employment status were investigated in addition to menstrual cycle length and regularity, menses duration, age of menarche and degree of menstrual pain. Given the lack of consistent findings relating to the majority of these variables, few relationships were expected. The exception to this was menstrual pain which was hypothesised to predict premenstrual symptomatology.

PART TWO

EMPIRICAL RESEARCH

CHAPTER 5

PROSPECTIVE ASSESSMENT OF THE PATTERN AND INCIDENCE OF SYMPTOM CHANGE ACROSS THE MENSTRUAL CYCLE IN USERS AND NON-USERS OF ORAL CONTRACEPTIVES

5.1 Aims

The aim of this study was to examine the pattern and incidence of symptoms across the menstrual cycle by OC use/type. A further purpose of the study was to determine whether Moos' factors could be replicated based on daily and prospective completion of the MMDQ in women who were unaware of the study aims.

In line with these aims, symptom scores at three menstrual cycle phases were subjected to factor analyses. Following the derivation of symptom sub-scales, scores were compared across menstrual cycle phases in non-users of OCs, triphasic OC users and monophasic OC users. The percentage of women experiencing premenstrual increases of various magnitudes was also calculated for these three OC groups.

It was expected that symptoms would vary by menstrual cycle phase, being higher in the premenstrual and menstrual phases relative to the follicular phase. A marked premenstrual increase of 30% from the follicular phase was expected to occur in at least one third to one half of the sample. More severe increases in symptomatology were expected to be less common (see section 2.2). Incidence of premenstrual change was expected to be the greatest for symptoms of fluid retention and negative affect (see section 2.2). Based on recent and prospective (van den Boogaard & Bijleveld, 1988; Walker & Bancroft, 1990) or double-blind (Graham & Sherwin, 1992) studies, oral contraceptive use was hypothesised to effect the severity of physical but not psychological symptom severity. Premenstrual increases in symptoms were expected to occur later (closer to menstruation) in OC users relative to non-users (see section 2.3.4).

5.2 Method

5.2.1 Participants

Participants were 187 women who ranged in age from 18 to 45 years with a mean age of 29.9 (*SD* = 8.6) years. All age groups studied were well represented with 27% between the ages 18 and 21, 26% between the ages of 22 and 29, 29% between the ages of 30 and 39 and 18% 40 years of age or over. Approximately one third (32%) of the participants had at least one child and 45% were either married or living in a defacto relationship. The majority of participants (81.7%) were born in Australia and 78% of women stated that they did not strongly identify with another culture. Eighty-three percent (83%) of participants were employed at the time of study. Thirty-four percent (34%) of the women were current users of oral contraceptives (18.4% were using monophasic preparations, 2.2% biphasic preparations and 13.0% triphasic preparations).

Most women (90%) had no history of psychiatric illness; those that did had previously experienced depressive (8%), anxiety (2%) or eating (0.5%) disorders. The vast majority (89%) of women were not currently using any prescription medications. Medications that were used included: bronchodilator and preventative aerosls and inhalations; non-steroidal anti-inflamatory agents; acne, keratolytics and cleansers; antihypertensive agents; tetracyclines; hyperacidity, reflux and ulcers; topical nasopharangeal medication; antihistamine; and urinary antiseptics, alkalinisers and acidifiers. Each medication group was represented by less than 4% of the sample. Non-prescription drug/vitamin use was applicable to almost half the sample and included primarily vitamins/minerals, analgesics/antipyretics and naturopathic/herbal remedies.

5.2.1.1 Participant Recruitment

Given the well-established loss of participants in demanding studies of this type, participants were recruited in light of the recommendations of Halbreich, Bakhai,

Bacon, Goldstein, Endicott and Lesser (1989). The authors reported that the following strategies should be utilised to improve participant retention:

- continued contact throughout the study including calling participants after mailing any material in order to explain it and answer questions
- responding to the initial call and all enquiries promptly
- encouragement of participants to make further contact with the same staff member if they have any questions or need additional information
- design of questionnaires so that they are self-explanatory with succinct instructions and simple language
- use of self-addressed stamped envelopes
- provision of an explanation to participants that the experimenter has been through the process herself
- provision of incentives (Halbreich et al. discussed this in terms of medical check-ups and treatment. This was not appropriate in the current study but rather detailed feedback was provided to participants)
- encouragement of participants to become involved in the study with friends or family

Each of these recommendations was implemented in the current study. Further details are given in the following sections where relevant. All participant contact was maintained personally by the experimenter in order to ensure a consistent approach to participant recruitment and management, and to aid in the development of rapport.

5.2.1.2 Advertising the Study

Women were initially recruited via an extensive 18-month campaign in which written advertisements were posted in a variety of sources (e.g. women's groups/organisations, large workplaces such as hospitals and community health centers, newspapers, and various women's groups newsletters/magazines, local networks). Letters advertising the study were also provided for members of women's organisations attending

functions/meetings and information about the study was presented in a number of lectures and tutorials at La Trobe and Monash Universities.

In the majority of advertisements (Appendix A1) the study was promoted as examining "health and quality of life issues" rather than the menstrual cycle in order to minimise the women's awareness of the focus of the study. This was done in an attempt to avoid the amplification of cyclicity in self-reported symptoms that occurs when the menstrual aspect of a study is emphasised (AuBuchon & Calhoun, 1985). The advertisements in the major newspapers (Appendix A2) were re-worded from the original advertisement in an attempt to make the study appear more accessible and interesting, and to shorten the notice to meet cost constraints. The study was advertised as an investigation of "physical and psychological health and how it is affected by age, the menstrual cycle, marital status etc". All advertisements also stated that participants were required to indicate their daily experience of a number of moods, behaviours and physical states by completing a short questionnaire, that feedback would be provided at completion of the study, and that no travelling was required.

5.2.1.3 Phone Interview and Exclusion Criteria

Women who responded to the advertisement were given an initial phone interview. During this interview further information about the study was provided and respondents were asked a series of questions to determine whether they were suitable for inclusion in the study. Participants were screened out if they were under 18 or over 45 years of age, had a major psychiatric or physical disorder, were pregnant or breastfeeding, were taking any significant medications such as psychoactive preparations or hormones, had sought treatment in the past year for severe problems associated with menstruation, or did not have normal ovulatory menstrual cycles. Women taking oral contraceptives were not excluded, unless usage had begun only within the last three months. Women who had previously taken oral contraceptives and had stopped less than three months ago were also excluded. These exclusion criteria are typical of those used in menstrual cycle studies (e.g. Sanders et al., 1983; Gallant et al., 1992a) and were imposed in order

that extraneous influences on hormone levels, menstrual cycle function, health and premenstrual symptoms/change be reduced. The importance of completing a questionnaire every day over the 70-day period was also emphasised and a number of women who felt they could not meet the demands of the study elected not to participate.

Respondents were told that the degree to which women experienced a variety of "everyday" symptoms was to be investigated, in conjunction with a number of factors (such as stress, the menstrual cycle, age, marital status) that may influence the occurrence/severity of such symptoms. The menstrual cycle facet of the study was not highlighted, no reference was made to the premenstrual period, and the title of the MMDQ was eliminated from all questionnaires.

Three hundred women were accepted into the study, and menstrual cycle data were collected in two cohorts over an 18-month period. One hundred and eight-seven women completed the protocol without violating any exclusion criteria. Of those, 172 completed questionnaires for at least two menstrual cycles, and 15 completed questionnaires for at least one menstrual cycle.

A total of 113 of the initial 300 women did not complete the protocol. Seventy-eight women found it difficult to meet the demands of daily record keeping and either dropped out or were excluded due to insufficient data. Women were eliminated from the study if they failed to complete the questionnaire for more than two consecutive days at any time during the study, or if they failed to complete the questionnaire for more than five non-consecutive days in any one cycle. If women failed to complete the questionnaire on days constituting the same menstrual cycle phase in both menstrual cycles, they were also eliminated on the basis that this may be a systematic effect.

Sixteen women were eliminated during the study due to circumstance changes that made them ineligible (e.g. falling pregnant, beginning a course of antidepressants, beginning or stopping OC use) and 19 were excluded after completion of the study on

the basis of irregular/long/short menstrual cycles. The criteria employed for regular menstrual cycles were 21-35 days with no more than seven days variability between cycles. These parameters were imposed on the basis that menstrual cycle lengths falling outside of this range are more likely to be associated with various abnormalities. In 1979, on the basis of a study of 2,343 women, C. Wood, Larsen and Williams recommended that a range of 21-35 days be regarded as normal. These criteria are also reflected in the information provided by current gynaecology text-books (e.g. Gomel et al., 1990; Copeland, 2000), and are frequently used in PMC research (e.g. Metcalf, Livesey, Hudson & Wells, 1988; Walker, 1994). While the study of women with very long/short or irregular cycles may yield interesting information, this was not the focus of the current research and hence no analyses of this data are presented here.

5.2.2 Materials

5.2.2.1 MMDQ

The questionnaire used was a prospective version of the MMDQ developed by Clare and Wiggins (1979) (Appendix B). The MDQ was chosen for use because of its wide usage, good validity, and satisfactory test-retest and split-half reliability when used prospectively (Markum, 1976; Hart et al., 1987; see section 1.2.2). Furthermore, unlike some other questionnaires, the MDQ does not increase the salience of menstruation in relation to symptoms by allowing women to view their pattern of ratings over a whole month or by linking symptoms graphically to menstruation.

Due to the prospective and relatively long nature of this study, however, and the consequent importance of participant compliance, a shorter and easier to complete questionnaire than the standard MDQ was considered necessary. Like the standard MDQ, the modified version has good reliability and validity (Clare & Wiggins, 1979; Russell et al., 1988) and has been widely used (e.g. Hart et al., 1987; Bains & Slade, 1988; Picone & Kirkby, 1990; van den Akker, Sharifian, et al., 1995). The

questionnaire consists of 34 symptoms determined by Moos to represent menstrual cycle symptoms. These 34 items represent six of Moos' eight original sub-scales; the omitted sub-scales "control" and "arousal" contain items shown by Moos not to vary across the menstrual cycle (Moos, 1968). A further symptom, "distractibility", was omitted by Clare and Wiggins on the basis of its similarity to "difficulty concentrating". Unlike the original MDQ where participants are required to rate symptoms on a six-point scale, respondents completing the modified version are restricted to rating each symptom on a four-point scale from 0 (no experience of the symptom) to 3 (severe experience of the symptom). A number of symptoms in the MMDQ were renamed by Clare and Wiggins to make them appropriate for a British population (e.g. "tiredness" replaced "fatigue"). The wording of some symptoms was again changed in the current questionnaire to increase clarity (in general the more appropriate phrasing of the two versions for an Australian population was selected, while the meaning was left unchanged). A number of additional questions were added in the current questionnaire, requesting information about medication use, menstrual status and the occurrence of any stressful events or illness.

5.2.2.2 General Information Form

A general information form was devised to gather basic demographic, menstrual and medical information (Appendix C).

5.2.3 Procedure

Participants were either met with at their convenience (usually at the university or their home) or questionnaires and information sent to them in the mail (see Appendix D for a copy of the letter sent with materials). Most questionnaires were sent to participants in the mail, the exception being the majority of students who collected the questionnaires from the researcher at the university. All participants who wished to receive the

questionnaires in person either attended the university office or were visited in their homes, depending on their preference.

The questionnaire format of the study was explained and candidates informed that they would receive feedback at the completion of the study. The confidential and anonymous nature of the questionnaires was outlined.

Participants were given an explanatory statement (Appendix E) and completed a consent form (Appendix F) and the general information form. Participants were given 70 copies of the MMDQ (with title removed) and asked to complete one questionnaire every evening on a daily basis. Data were obtained over 70 days to ensure the inclusion of at least two menstrual cycles (McFarlane et al., 1988). To reduce bias due to difficulty remembering, participants completed ratings for the current day only. If a day was missed, that questionnaire was left blank and treated as missing data. To encourage daily completion of questionnaires, participants were asked to return the questionnaires in supplied pre-addressed, postage-paid envelopes every week. Furthermore, participants were contacted by phone shortly after initial receipt of the questionnaires and subsequently throughout the study approximately every three weeks in an attempt to motivate participants and maintain a good relationship between experimenter and participant. Participants were contacted between the hours of 6am and 11pm, Monday to Sunday, depending on their availability and preference.

At the conclusion of the study, participants were debriefed by letter (Appendix G). They were informed that the primary aim of the research was to "investigate changes in moods, behaviours and physical state across the menstrual cycle" and that "the study was advertised and conducted under the more general title of "health and quality of life issues" due to the fact that emphasis on the menstrual aspect of a study can change the way in which women report symptoms". Participants were not formally asked if they were aware of the study focus but did not appear to be so. Furthermore, a number of women spontaneously indicated their lack of awareness during follow-up calls with the experimenter.

In addition to debriefing information, participants were sent feedback from the study (Appendix G). This comprised individual and group means for each symptom overall, individual follicular and late luteal scores for each of the Moos factors', and an indication for each factor of whether a luteal increase (of at least 30%) was apparent.

5.3 Results

Data were analysed primarily using SPSS for Windows (SPSS Inc. Release 9.0.1). The exceptions to this were post-hoc tests on repeated measures variables, and simple main effects. These were calculated by the investigator using standard formulae.

5.3.1 Standardisation of Menstrual Cycle Length and Defining Menstrual Cycle Phases

The mean menstrual cycle duration for non-OC regulated cycles was 27.92 (*SD* = 3.13) days. Menstrual bleeding persisted for a mean of 5.12 (*SD* = 1.36) days. For OC controlled cycles, the mean duration was 27.94 (*SD* = 1.51) days. Menstrual bleeding persisted for a mean of 4.81 (*SD* = 1.05) days.

In order to compare varying menstrual cycle durations, data from each cycle were standardised into a 28-day record. A "day" was defined as the number of days in the cycle divided by 28 and data compressed or expanded using mathematical interpolation or extrapolation as required (see Hart et al., 1987). Follicular scores were then calculated for each symptom by averaging the scores obtained on days 7-11. These days were deemed suitable for a baseline measure since symptoms have been shown to be at their lowest point during this period (van der Ploeg & Lodder, 1993). The same technique was used in determining the luteal scores except that days 24-28 were used in the calculation. Symptom scores for the menstrual period were calculated using days 2-4; day 1 was omitted since, depending on time of menstruation, this may reflect both the premenstrual and menstrual periods. Because a single menstrual cycle may

not be representative of a woman's usual experience (Hart et al., 1987; Walker, 1994; Sveinsdóttir & Bäckström, 2000b), data were averaged across the two menstrual cycles to reduce the influence of cycle-specific exogenous or record keeping factors. The exception to this was the data from the 15 women who completed questionnaires for less than two cycles; only a single cycle of data was included for these participants.

5.3.2 Preliminary Data Screening

Data screening is described primarily in section 5.3.6 subsequent to the sections outlining how menstrual cycle symptom variables for the major analyses were derived. Only screening of the 34 symptoms of the MMDQ will be described here. These variables were evaluated for the entire sample of 187 in terms of the assumptions underlying principal components analysis. Variables were examined separately for each menstrual cycle phase and were screened for accuracy of data entry, and to identify missing values and univariate and multivariate outliers. Variables were examined to assess normality and linearity, and the matrix of correlations between variables was examined to assess factorability.

As discussed in section 5.2.1.3, women with insufficient data (missing more than two consecutive days, or five non-consecutive days per cycle) were eliminated from study. The vast majority of women who were not eliminated completed all 70 MMDQ's and thus few missing data were found. For those women who did have missing data, scores were allocated based on the linear interpolation method described in section 5.3.1 above.

Linearity among pairs of variables was established through inspection of bivariate scatterplots. Inference tests for skewness and kurtosis indicated that all variables were significantly skewed and about 85% of the variables had significant kurtosis. Normality of variables is not required for principal components analysis, but it was considered desirable that the deviation from normality not be sufficient to degrade the

solution. Since it is not unexpected to obtain significant skewness and kurtosis with only minor deviations from normality when sample sizes are large (Tabachnick & Fidell, 1986), all distributions were examined visually. The size of the skewness and kurtosis values was also examined. Consideration of these data indicated that the deviation from normality was not sufficient to make a substantive difference to the analyses. The shape of the distributions indicated that all variables displayed positive kurtosis and skewness because many women selected "0" to indicate the absence of symptomatology. Such a situation is less likely to degrade the solution than when some variables are positively skewed, and others negatively skewed. Furthermore, significant skewness is not often problematic in large samples, and the underestimation of variance associated with positive kurtosis disappears with samples of about 200 (Waternaux, 1976). The deviation from normality was thus not sufficient to degrade the solution, and accordingly variables were not transformed.

About one third of the variables contained between one and three univariate outliers as indicated by a standardised score in excess of 3.29 ($p < 0.001$, two-tailed test) (Tabachnick & Fidell, 1996). All outliers represented high scores. Each case containing an outlying value was examined in order to establish why the outlier/s occurred. Cases were examined across the 28 days of each cycle to examine consistency across menstrual cycle phase and consistency from one cycle to the next. The view of Hair, Anderson, Tatham and Black (1995) was adopted in that only truly aberrant scores should be eliminated, and that all other outliers should be retained without alteration in order to ensure generalisability. No outlier appeared due to an extraordinary event as evidenced by the pattern of raw data. All participants with an outlying score had consistently high scores on that variable across the two menstrual cycles and/or across menstrual cycle phase. All outliers thus appeared to be genuine, and appeared to merely reflect the propensity of some women to experience higher levels of certain symptoms. All outliers were thus deemed to represent valid observations in the population and were retained.

Seventeen multivariate outliers were identified through Mahalanobis distance with $p < 0.001$. Outlying cases were evaluated in a sample of multiple regressions where a dummy variable separating the outlying case from all others served as the dependent variable (DV). All multivariate outliers were found to be due to a high score on one or more variable. Outliers, however, could not be distinguished from other cases on the basis of any particular variable and thus all multivariate outliers were retained in the analyses.

The correlation matrices of variables at each menstrual cycle phase revealed numerous correlations in excess of 0.30 and several that were considerably higher. For each menstrual cycle phase, Bartlett's test of sphericity was significant and Kaiser's measure of sampling adequacy was in excess of 0.90. The majority of correlations between variables were significant, and values in the off-diagonal elements of the anti-image matrices were primarily small. The factorability of the data set was therefore indicated.

5.3.3 Factor Analysis of the MMDQ

In order to reduce the 34 items of the MMDQ to a smaller number of factors and to derive an empirical summary of the data set, principal components analyses with varimax rotation were conducted. The analyses were conducted separately on late luteal, menstrual and follicular scores to determine whether the MMDQ can be reduced to a set of reliable factors and to examine the consistency of any factors across menstrual cycle phases.

As is customary with factor analysis (Tabachnick & Fidell, 1986), prior to accepting a solution based on principal components analysis and varimax rotation, several additional analyses were also conducted using different extraction techniques, forcing different numbers of factors, and specifying both orthogonal and oblique rotations. Analyses based on the various extraction techniques yielded similar results which are thus not reported here. Examination of correlations between factors subsequent to oblique rotations indicated that the vast majority of correlations were less than 0.32. For

instance principal components analysis of symptoms during the premenstrual phase, selecting factors with eigenvalues of greater than one (seven factors), yielded only one correlation of 0.32 or above. Oblique rotation is recommended when factors correlate at or above 0.32 (Tabachnick & Fidell, 1986). Since all but one correlation failed to meet this criterion, and the overlap in variance among factors was frequently substantially less than 10%, orthogonal rotation was selected as the most appropriate method. Furthermore, orthogonal rotation was also considered desirable given the use of the factors as DVs in subsequent analyses (Tabachnick & Fidell, 1986; Hair et al., 1992), and for the purpose of comparability to previous research (see section 1.2.3).

Principal components analysis was thus retained as the most satisfactory extraction technique and variamax rotation as the most appropriate rotational method. Using the criterion of eigenvalues greater than one, principal components analysis of late luteal and menstrual scores yielded seven factors, while the analysis of follicular scores yielded eight factors. Solutions based on menstrual and follicular scores, however, both included one factor comprising a single symptom only (accident), and another comprising only two symptoms (sleep and headache; swollen and weight respectively). Given the difficulty in interpreting these factors, and the frequent unreliability of one to two item factors (Tabachnick & Fidell, 1986), a six-factor solution was examined. The six-factor solutions for each menstrual cycle phase are shown in Table 5.1. Due to space constraints all zero's preceding the decimal points have been omitted.

For the follicular and menstrual phases, a six-factor solution was more easily interpretable relative to the seven- or eight- factor solutions. The six factors differed from those proposed by Moos (1968) to constitute the MMDQ, although five of the factors could adequately be named according to Moos' labels of negative affect, cognition, behaviour change, somatic symptoms and fluid retention. The symptoms comprising Moos' autonomic factor were distributed amongst other factors. The final factor was difficult to interpret, with sleep and headache clustering together in the

menstrual phase analysis, and accident remaining on its own for the follicular phase analysis (see Table 5.1).

Both the six- and seven- factor solutions based on the late luteal phase were readily interpretable and similar to the original structure postulated by Moos (1968). Both the six- and seven- factor solutions produced factors centering around negative affect, cognition, fluid retention, behaviour change, autonomic reactions and somatic symptoms, with an additional factor comprising sleep, stomach and sick in the seven-factor solution. To facilitate comparison with the Moos factors, the current six-factor solution is shown in Table 5.2 in relation to the Moos factors. As can be seen in Table 5.2, the solution fits well into the structure provided by the Moos factors, although a number of differences are apparent. The major differences included the loading of :

- decreased "sociability" and "efficiency" with negative affect rather than behaviour change
- "skin disorder" with somatic symptoms rather than fluid retention
- "stomach pains" with autonomic reactions rather than somatic symptoms
- "sweats" with cognitive symptoms rather than autonomic reactions
- "headache" and "fatigue" with behaviour change rather than somatic symptoms

The six factors accounted for approximately 65% of the variance in each menstrual cycle phase. The variance accounted for by each factor ranged from about 4 to 18%. The factor accounting for the majority of variance differed according to menstrual cycle phase, with negative affect constituting the first factor in the late luteal and follicular phases, and cognitive symptoms constituting the first factor in the menstrual phase.

One of the most notable features in all the analyses was the high loading of a number of variables on two or more factors (Table 5.1). This was particularly evident in the follicular phase, making this solution less interpretable than the late luteal or menstrual solutions. It should also be noted that a number of variables failed to load

Table 5.1

Principal Components Analyses[a] of the MMDQ: Salient Factor Loadings[b] for Six-Factor Solutions at each Menstrual Cycle Phase

Symptom	Menstrual cycle phase																	
	Follicular						Late Luteal						Menstrual					
	Factors						Factors						Factors					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
Depression	**.73**						**.76**						**.77**			.40		
Mood swings	**.78**						**.70**						**.79**					
Crying spells	**.65**						**.70**						**.61**			.49		
↓Sociability		.42		.54			**.65**									.51		
Loneliness	**.52**			.48			**.65**						**.66**			.46		
Irritability	**.63**	.44					**.60**		.51				**.71**					
Restlessness	**.46**						**.51**	.43					**.52**					
Anxiety	**.62**						**.51**						**.56**	.48				
Tension	**.65**						**.50**						**.71**	.41				
↓Efficiency	.51	**.54**					**.45**	.43	.43					**.59**		.40		
↓Sleep						**.59**	**(.38)**										**.62**	
Confusion		**.70**						**.71**						**.73**				
↓Decision		**.66**						**.69**						**.74**				
Forgetfulness		**.73**						**.64**						**.75**				
↓Motor skills		**.68**						**.61**	.51		.40			**.69**				
Sweats				**.60**	-.43			**.60**						**.64**				
↓Concentrate	**.59**	.46					.44	**.56**						**.63**				
Accidents					**.73**			**(.36)**							**(.34)**			
Swollen			**.73**						**.78**						**.68**			
Weight gain			**.65**						**.76**						**.69**			
Breast pain			**.50**			.41			**.60**						**.62**			
Stay home				**.72**						**.71**						**.79**		
Take naps				**.62**						**.70**						**.68**		
↓Performance	**.57**	.51						.40		**.58**				.46		**.57**		
Headache						**.54**				**.56**							**.59**	
Fatigue	**.62**					.45				**.54**					**(.39)**			
Stomach ache			.41			**.55**					**.68**							**.68**
Feel sick						**.71**					**.62**					**.49**		.47
Flushes		**.55**		.47							**.60**			.46				**.66**
Dizziness		**.60**				.41					**.46**			.42				**.60**
Skin disorder	**.46**			.41								**.67**				**(.30)**		
Backache						**.63**						**.63**					.41	**.60**
Stiffness						**.65**						**.54**		.52				**.42**
Aches	.44					**.62**			.46			**.51**						**.49**

[a] factors were rotated using the varimax procedure.

[b] In general, only factor loadings ≥ 0.4 are reported. If the highest loading on any one variable is < 0.4, the value is reported in parentheses. The highest loading for each variable is given in bold.

Table 5.2

Principal Components Analysis[a] of the MMDQ Completed Premenstrually: Salient Factor Loadings[b] in Relation to the Moos Factors

Moos factor	Symptom	Factor					
		I	II	III	IV	V	VI
Negative Affect	Depression	**0.76**					
	Mood swings	**0.70**					
	Crying spells	**0.70**					
	Loneliness	**0.65**					
	Irritability	**0.60**		0.51			
	Restlessness	**0.51**	0.43				
	Anxiety	**0.51**					
	Tension	**0.50**					
Cognitive Symptoms	↓Concentrate	0.44	**0.56**				
	Accidents		**(0.36)**				
	↓Sleep	**(0.38)**					
	Confusion		**0.71**				
	↓Decision		**0.69**				
	Forgetfulness		**0.64**				
	↓Motor skills		**0.61**	0.51		0.40	
Fluid Retention	Swollen			**0.78**			
	Weight gain			**0.76**			
	Breast pain			**0.60**			
	Skin disorder						**0.67**
Behaviour Change	↓Efficiency	**0.45**	0.43	0.43			
	↓Sociability	**0.65**					
	Stay home				**0.71**		
	Take naps				**0.70**		
	↓Performance		0.40		**0.58**		
Somatic Symptoms	Backache						**0.63**
	Headache				**0.56**		
	Fatigue				**0.54**		
	Stomach ache					**0.68**	
	Stiffness						**0.54**
	Aches			0.46			**0.51**
Autonomic Reactions	Feel sick					**0.62**	
	Flushes					**0.60**	
	Dizziness					**0.46**	
	Sweats		**0.60**				

[a] factors were rotated using the varimax procedure.

[b] In general, only factor loadings ≥ 0.4 are reported. If the highest loading on any one variable is < 0.4, the value is reported in parentheses. The highest loading for each variable is given in bold.

on any factor in the late luteal and menstrual solutions. The consequence of these problems was some lack of stability of the solution across menstrual cycle phases and number of factors. It is worth noting, however, that if a more stringent factor-loading criterion of 0.5 is adopted, most multiple factor loadings are removed, and the factor solution replicates that of Moos quite closely.

5.3.4 Reliability Analysis

Because of the similarity of the six obtained factors to those of Moos (1968), and the usefulness of the Moos factors in terms of comparability with other research, the suitability of the Moos factors to summarise the data was examined using reliability analysis. Cronbach's alpha for each factor at each phase is shown in Table 5.3.

Table 5.3
Cronbach's Alpha Coefficients for the Moos Sub-scales by Menstrual Cycle Phase

Symptom sub-scale	Menstrual cycle phase		
	Follicular	Late Luteal	Menstrual
Negative Affect	0.92	0.91	0.91
Cognitive Symptoms	0.84	0.82	0.85
Behaviour change	0.84	0.82	0.85
Somatic Symptoms	0.83	0.80	0.81
Autonomic Reactions	0.70	0.70	0.74
Fluid Retention	0.35	0.61	0.64

As indicated in Table 5.3, Chronbach alpha coefficients were generally high, with values in excess of 0.9 for negative affect, equal to or in excess of 0.8 for cognition, behaviour change and somatic symptoms and equal to or in excess of 0.7 for autonomic reactions. Alpha for all of these sub-scales was consistent across menstrual cycle phase and relatively unaffected by deletion of any one item. The sub-scale of fluid retention was slightly less reliable, with alphas of 0.61 and 0.64 for the late luteal and menstrual phases respectively, but only 0.35 for the follicular phase. These lower figures were partly attributable to the inclusion of skin disorders in this sub-scale, with alpha increasing to 0.74, 0.71 and 0.55 for the late luteal, menstrual and

follicular phases respectively when this item was deleted. Given the high reliabilities obtained, the decision was made to use Moos' sub-scales in subsequent analyses.

5.3.5 Correlations Between Symptom Sub-scales

Summary scale scores were calculated for each woman on the six sub-scales by averaging constituent items (Moos, 1968). This was done separately for each menstrual cycle phase. For instance, to obtain a summary scale score to represent a woman's fluid retention premenstrually, her premenstrual score for each symptom constituting fluid retention (weight gain, skin disorder, breast pain, swollen) was summed and divided by the total number of items in that sub-scale (in this case, four). The sub-scales were then intercorrelated separately for each menstrual cycle phase and are presented in Tables 5.4a, 5.4b and 5.4c.

Table 5.4a
Inter-factor Correlations of the Six Sub-scales for the Follicular Phase

	Negative Affect	Cognitive Symptoms	Behaviour Change	Somatic Symptoms	Autonomic Reactions
Cognitive Symptoms	0.79***				
Behaviour Change	0.74***	0.79***			
Somatic Symptoms	0.75***	0.75***	0.67***		
Autonomic Reactions	0.62***	0.74***	0.70***	0.71***	
Fluid Retention	0.51***	0.50***	0.47***	0.48***	0.38***

***$p < 0.001$.

Table 5.4b
Inter-factor Correlations of the Six Sub-scales for the Late Luteal Phase

	Negative Affect	Cognitive Symptoms	Behaviour Change	Somatic Symptoms	Autonomic Reactions
Cognitive Symptoms	0.78***				
Behaviour Change	0.71***	0.77***			
Somatic Symptoms	0.68***	0.67***	0.66***		
Autonomic Reactions	0.53***	0.57***	0.58***	0.65***	
Fluid Retention	0.59***	0.53***	0.53***	0.63***	0.38***

***$p < 0.001$.

Table 5.4c
Inter-factor Correlations of the Six Sub-scales for the Menstrual Phase

	Negative Affect	Cognitive Symptoms	Behaviour Change	Somatic Symptoms	Autonomic Reactions
Cognitive Symptoms	0.72***				
Behaviour Change	0.72***	0.77***			
Somatic Symptoms	0.63***	0.63***	0.63***		
Autonomic Reactions	0.59***	0.67***	0.69***	0.66***	
Fluid Retention	0.45***	0.50***	0.44***	0.54***	0.42***

***$p < 0.001$.

As can be seen in Tables 5.4a, 5.4b and 5.4c, intercorrelations between sub-scales were all positive and highly significant. The highest correlations were generally between the psychological symptoms of behaviour change, cognitive symptoms, and negative affect. Psychological symptoms also correlated highly with somatic symptoms, autonomic reactions, and to a generally lesser extent, fluid retention. Among the physical symptom sub-scales, somatic symptoms correlated highly with autonomic reactions, and fluid retention. Correlations between fluid retention and autonomic reactions were lower.

The pattern of correlations was similar across all menstrual cycle phases. With the exception of correlations with fluid retention, follicular correlations were marginally but consistently higher than menstrual or late luteal correlations. With the exception of correlations based on autonomic reactions, late luteal correlations were generally higher than correlations based on the menstrual phase. It is also notable that correlations including fluid retention were consistently lower than intercorrelations between the other five sub-scales.

5.3.6 Data Screening

Having derived menstrual cycle symptom variables by defining symptom sub-scales, further data screening was conducted. The variables examined were all menstrual cycle symptom variables (six sub-scales by three menstrual cycle phases) and all demographic variables that formed part of the statistical analyses (age, number of children, marital status, employment/study status, OC use/type). Derived menstrual cycle symptom variables were screened for accuracy of computation, and all variables were screened to identify missing values and univariate and multivariate outliers. All variables were also examined to establish normality and linearity.

Linearity among pairs of variables was established through inspection of bivariate scatterplots. All demographic variables were normally distributed as indicated by visual examination of the distributions and skewness and kurtosis values. As with the

individual menstrual cycle symptoms, inference tests for skewness and kurtosis indicated that all menstrual cycle symptom variables were significantly skewed and about two thirds of the variables had significant kurtosis. The same process as that described in section 5.3.2 was used to evaluate whether the deviation from normality was sufficient to warrant variable transformation. This process will not be repeated in detail here but briefly, as was the case with the individual symptoms (section 5.3.2), all variables were skewed in the same direction, and the sample size was large. Visual examination of distributions, in addition to examination of skewness values, indicated that the deviation from normality was not sufficient to make a substantive difference to analyses (Tabachnick & Fidell, 1996). Accordingly, variables were not transformed.

Between one and three univariate outliers were noted for a number of the menstrual cycle symptom variables. All outliers represented high scores. The same process as that described in section 5.3.2 was used to ascertain why each outlier occurred. This process will thus not be repeated here. All scores were deemed to represent valid segments of the population and were hence retained. No outliers were noted for any of the demographic variables. Ten multivariate outliers were identified through Mahalanobis distance with $p < 0.001$. Outlying cases were evaluated in a sample of multiple regressions where a dummy variable separating the outlying case from all others served as the DV. All multivariate outliers were found to be due to high scores on menstrual cycle symptom variables. Outliers, however, could not be distinguished from other cases on the basis of any particular menstrual cycle symptom variable/s and thus all multivariate outliers were retained in the analyses.

5.3.7 Effect of OC Use/Type and Menstrual Cycle Phase on each Symptom Subscale

5.3.7.1 Overview of Analyses

Prior to conducting the main set of analyses, a series of one-way analyses of variance (ANOVAs) and chi-squared tests for independence/relatedness of categorical variables were conducted to determine whether there were any significant differences between the OC groups in key demographic variables (age, number of children, marital status, employment/study status). The OC groups were triphasic OC users, monophasic OC users and the NOC group. Because of the large number of women in the NOC (n = 123) relative to both OC groups (n = 24 and 34), 29 cases were randomly selected in an attempt to keep the sample sizes as similar as possible.

Although conducting five tests on the same DV has implications for the type 1 error rate, the maximum level of significance was set at 0.05 since it was deemed important to determine whether any subsequent main/interaction effects of OC use/type could be attributable to differences in demographic characteristics. Only one variable, age, differed significantly between the groups, $F(2,84) = 3.49$, $p < 0.05$. Post-hoc tests using the Newman-Keuls method revealed that women in the NOC group ($M = 32.08$, $SD = 9.45$) were significantly older than women in the monophasic OC group ($M = 26.90$, $SD = 5.62$), $p < 0.05$. The mean age of women in the triphasic OC group ($M = 29.87$, $SD = 8.12$) fell between the NOC and monophasic OC groups but did not differ significantly from either of them.

In order to determine the effect of OC use/type and phase on menstrual cycle symptomatology, a factorial ANOVA was conducted on each of the symptom subscales. A series of univariate ANOVAs was conducted in preference to multivariate analysis of variance (MANOVA) for primarily theoretical reasons. The theoretical rationale relates to the potential independence of different symptom groups in terms of aetiological factors. Although some premenstrual symptoms correlate highly,

numerous differential relationships have been noted between symptom groups and various demographic, biological and psychological variables (e.g. Bäckström & Mattson, 1975; J.W. Taylor, 1979b; N.F. Woods et al., 1982c; Graham & Sherwin, 1992). A number of researchers argue that obscuring these unique relationships by failing to consider symptom groups separately, has hindered the search for the aetiologies of PMC (e.g. Abplanalp et al., 1980; Halbreich & Endicott, 1982). Of particular relevance to this series of analyses is the fact that both menstrual cycle phase (e.g. N.F. Woods et al., 1982b; Boyle & Grant, 1992) and OC use and type (e.g. Warner & Bancroft, 1990; Graham & Sherwin, 1992) were expected to have differential effects on the various symptom sub-scales. These issues are discussed in detail in sections 2.1 and 2.3.4.

Statistical issues were also given consideration in selecting the most appropriate technique for data analysis. The major concern in this regard was the frequent loss of power associated with MANOVA relative to separate ANOVAs, particularly in complicated designs (Tabachnick & Fidell, 1986). Efforts to maximise power were consistent with the largely exploratory examination of OC effects, and it was considered important to increase the probability of detecting real effects that could lead to specific hypothesis testing in later research. Accordingly, alpha was maintained at 0.05 for each comparison. In order to avoid over-interpreting the results of significance testing however, estimates of the strength of association using partial eta squared (partial η^2) were provided for significant main and interaction effects. Eta squared provides an indication of the proportion of variance in the DV that can be attributed to levels of the IV.

All ANOVAs were 3x3 repeated measures models. IVs were OC use/type (none, monophasic, triphasic) and menstrual cycle phase (follicular, premenstrual, menstrual). OC use/type was a between subject variable and menstrual cycle phase a within subject variable. The 29 women randomly selected from the NOC group were used to constitute this group in all analyses and thus n equalled 24, 34 and 29 for the triphasic, monophasic and NOC groups respectively. ANOVAs were performed using

SPSS, weighting cells by their sample sizes to adjust for unequal n. Significant interaction effects were investigated with simple main effects involving *F* tests. Post-hoc tests were conducted using the Newman-Keuls method. Prior to each analysis, data were examined to ensure that the assumptions underlying repeated measures ANOVA were tenable. Results evaluating the assumptions of normality and homogeneity of variance and variance-covariance matrices were satisfactory. Significant sphericity as assessed using Mauchly's test was noted for fluid retention. However, application of the Huynh-Feldt correction did not result in an alteration of the appropriate degrees of freedom and thus unadjusted results are reported. Summary tables for all ANOVAs are presented in Appendices H1-H6. Results for each sub-scale are presented in sections 5.3.7.2 through 5.3.7.7. A summary of these results is presented in section 5.3.7.8

5.3.7.2 Negative Affect

Means and standard errors for negative affect by menstrual cycle phase and OC use/type are shown in Figure 5.1.

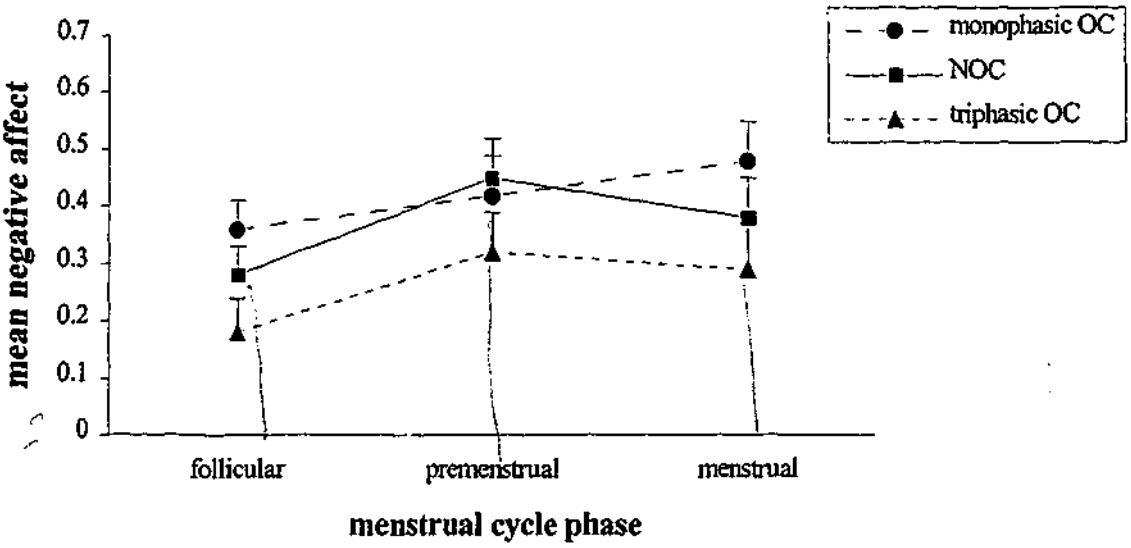


Figure 5.1. **Mean (+*SE*) Negative Affect by Menstrual Cycle Phase and OC Use/Type.**

ANOVA revealed a significant main effect of menstrual cycle phase, $F(2,168) = 10.08$, $p < 0.001$, $\eta^2 = 0.11$ (Figure 5.1). Post-hoc tests indicated that negative affect was significantly higher at both the premenstrual ($M = 0.40$, $SE = 0.04$) and menstrual ($M = 0.38$, $SE = 0.04$) phases relative to the follicular ($M = 0.28$, $SE = 0.03$) phase, p's < 0.01. Premenstrual and menstrual scores did not differ significantly from one another. No significant main effect of OC use/type was found, nor was there a significant interaction effect (Appendix H1).

5.3.7.3 Cognitive Symptoms

Means and standard errors for cognitive symptoms by menstrual cycle phase and OC use/type are shown in Figure 5.2.

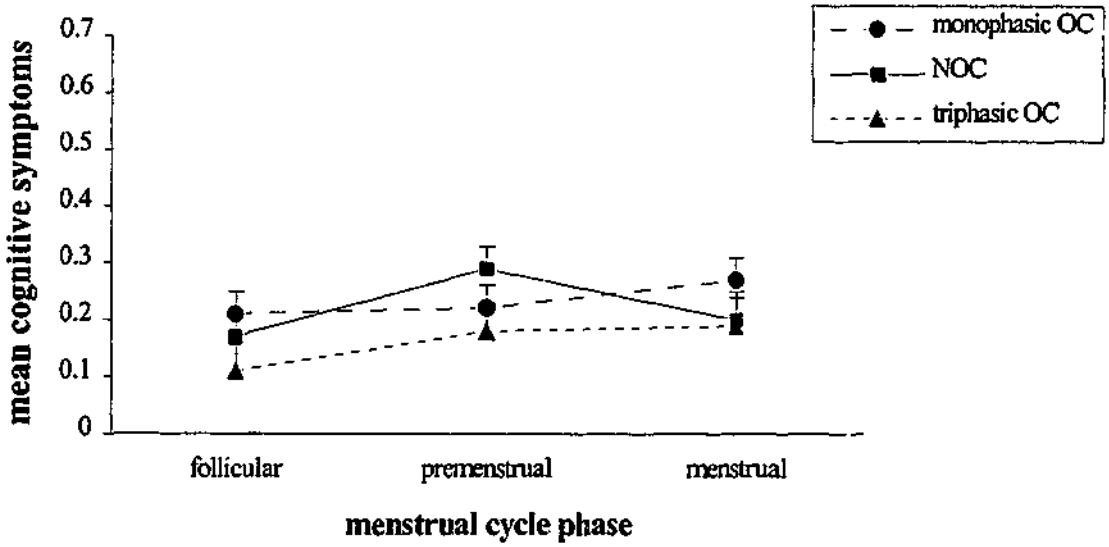


Figure 5.2. **Mean (+*SE*) Cognitive Symptoms by Menstrual Cycle Phase and OC Use/Type.**

ANOVA revealed a significant interaction between OC use/type and menstrual cycle phase, $F(4,168) = 2.68$, $p < 0.05$, $\eta^2 = 0.02$ (Figure 5.2). Simple main effects analysis indicated that cognitive symptoms fluctuated significantly across the menstrual cycle in the NOC group but not in either of the two OC groups. As can be seen in Figure 5.2, symptoms in the NOC group increased during the premenstrual phase ($M = 0.27$, $SE = 0.04$) relative to the follicular ($M = 0.17$, $SE = 0.04$) and menstrual ($M = 0.20$, $SE = 0.05$) phases. Main effects indicated that cognitive symptoms varied significantly according to phase, $F(2, 168) = 6.32$, $p < 0.01$, $\eta^2 = 0.07$. No statistically significant main effect of OC use/type was found (Appendix H2).

5.3.7.4 Behaviour Change

Means and standard errors for behaviour change by menstrual cycle phase and OC use/type are shown in Figure 5.3.

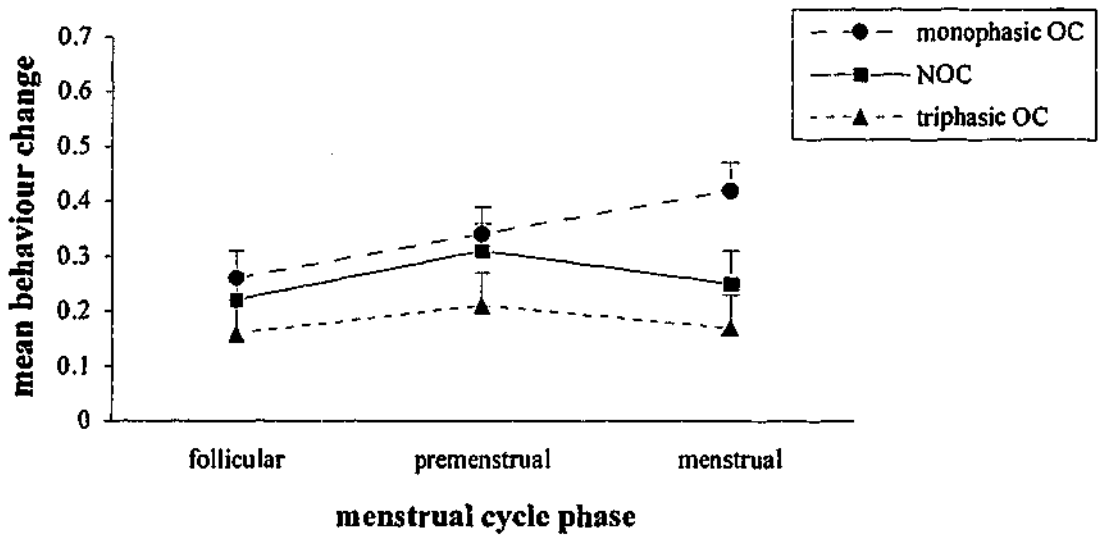


Figure 5.3. **Mean (+*SE*) Behaviour Change by Menstrual Cycle Phase and OC Use/Type.**

ANOVA revealed a significant main effect of menstrual cycle phase, $F(2,168) = 5.48$, $p < 0.01$, $\eta^2 = 0.06$ (Figure 5.3). Post-hoc tests indicated that behaviour change was significantly higher at both the premenstrual ($M = 0.29$, $SE = 0.03$) and menstrual ($M = 0.28$, $SE = 0.03$) phases relative to the follicular ($M = 0.21$, $SE = 0.03$) phase, p's < 0.01. Premenstrual and menstrual scores did not differ significantly from one another. No significant main effect of OC use/type was found, nor was there a significant interaction effect (Appendix H3).

5.3.7.5 Somatic Symptoms

Means and standard errors for somatic symptoms by menstrual cycle phase and OC use/type are shown in Figure 5.4.

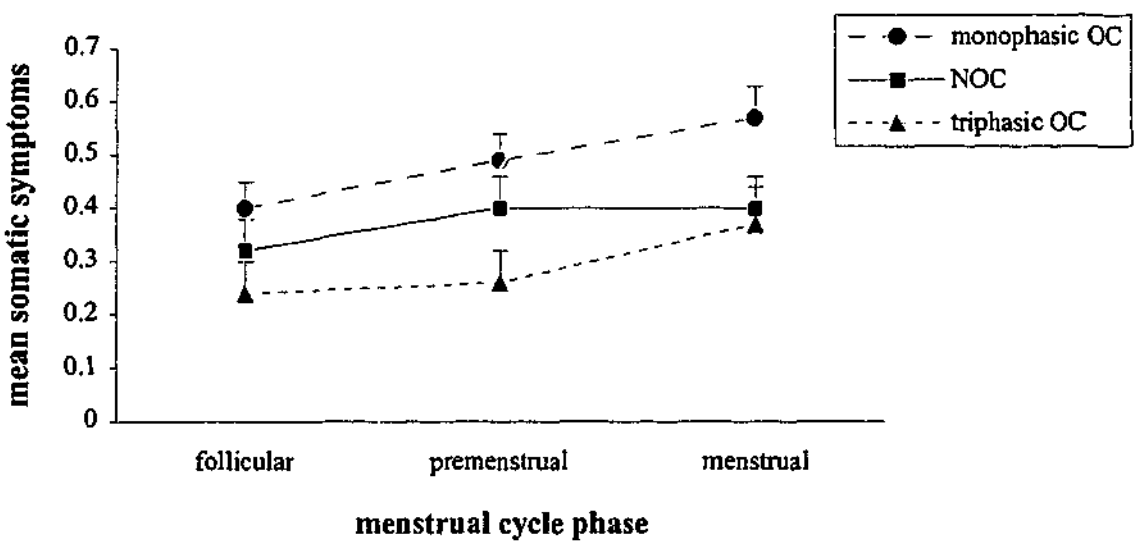


Figure 5.4. **Mean (+*SE*) Somatic Symptoms by Menstrual Cycle Phase and OC Use/Type.**

ANOVA revealed a significant main effect of menstrual cycle phase, $F(2,168) = 10.75$, $p < 0.001$, $\eta^2 = 0.11$ (Figure 5.4). Post-hoc tests indicated that somatic symptoms were significantly higher during the menstrual ($M = 0.45$, $SE = 0.04$) compared to the premenstrual ($M = 0.39$, $SE = 0.03$), $p < 0.05$, phase, and significantly higher during the premenstrual compared to the follicular ($M = 0.32$, $SE = 0.03$) phase. A statistically significant main effect of OC use/type was found, $F(2,84) = 3.83$, $p < 0.05$, $\eta^2 = 0.08$, with monophasic ($M = 0.49$, $SE = 0.05$) OC users experiencing significantly higher levels of somatic symptoms than triphasic ($M = 0.29$, $SE = 0.06$) OC users, $p < 0.05$. There were no significant differences between either of the OC groups and the NOC ($M = 0.37$, $SE = 0.05$) group. No significant interaction effect was found (Appendix H4).

5.3.7.6 Autonomic Reactions

Means and standard errors for autonomic reactions by menstrual cycle phase and OC use/type are shown in Figure 5.5.

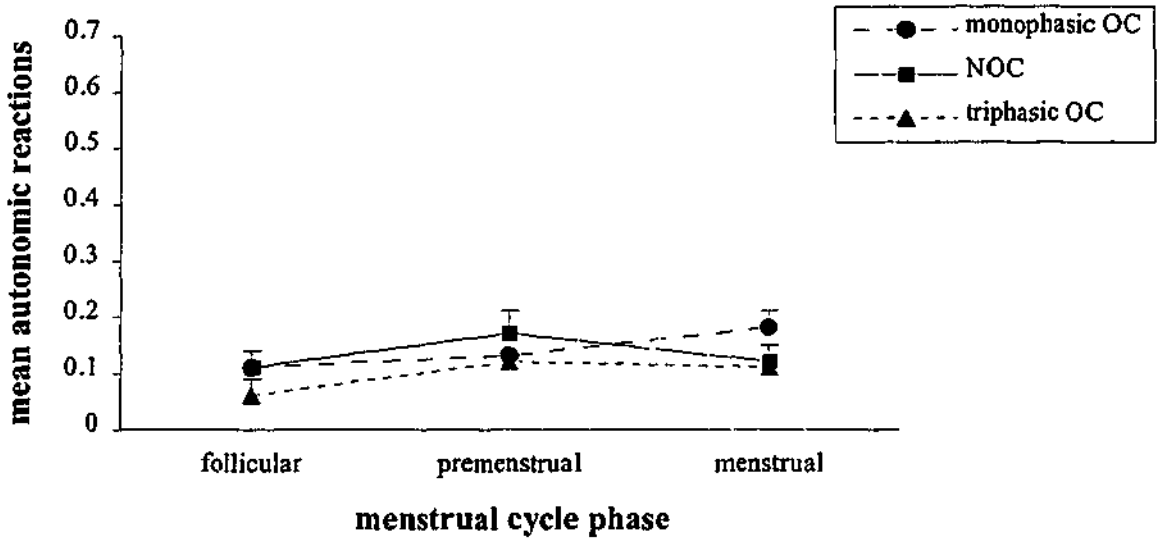


Figure 5.5. **Mean (+*SE*) Autonomic Reactions by Menstrual Cycle Phase and OC Use/Type.**

ANOVA revealed a significant main effect of menstrual cycle phase, $F(2,168) = 3.37$, $p < 0.05$, $\eta^2 = 0.04$ (Figure 5.5). Post-hoc tests indicated that autonomic reactions were significantly higher at both the premenstrual ($M = 0.14$, $SE = 0.02$) and menstrual ($M = 0.14$, $SE = 0.02$) phases relative to the follicular ($M = 0.09$, $SE = 0.02$) phase. Premenstrual and menstrual scores did not differ significantly from one another. No significant main effect of OC use/type was found, nor was there a significant interaction effect (Appendix H5).

5.3.7.7 Fluid Retention

Means and standard errors for fluid retention by menstrual cycle phase and OC use/type are shown in Figure 5.6.

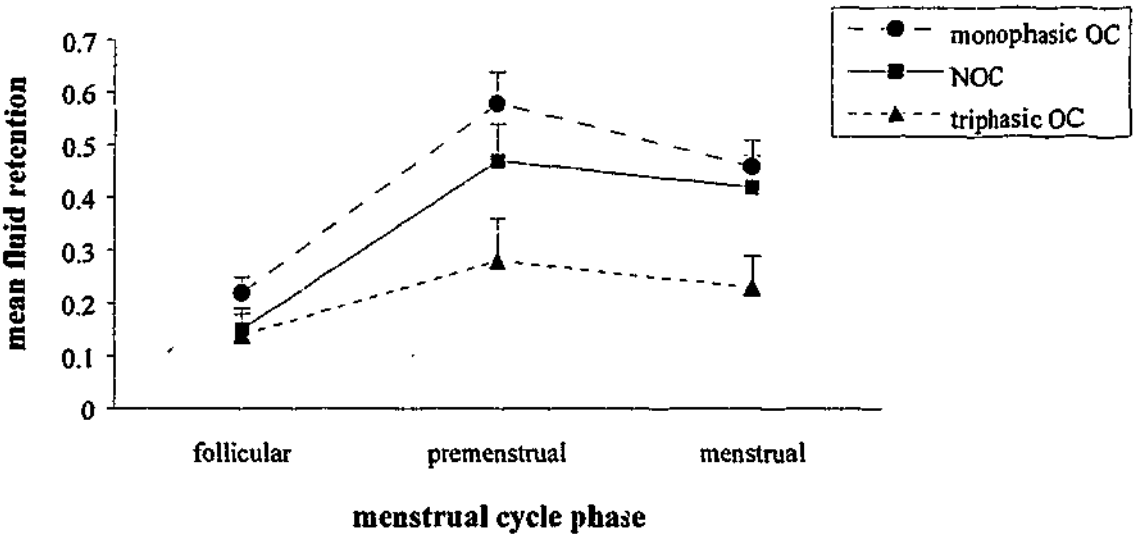


Figure 5.6. **Mean (+*SE*) Fluid Retention by Menstrual Cycle Phase and OC Use/Type.**

ANOVA revealed a significant main effect of menstrual cycle phase, $F(2,168) = 31.94$, $p < 0.001$, $\eta^2 = 0.28$ (Figure 5.6). Post-hoc tests indicated that fluid retention was significantly higher at both the premenstrual ($M = 0.44$, $SE = 0.04$) and menstrual ($M = 0.37$, $SE = 0.03$) phases relative to the follicular ($M = 0.17$, $SE = 0.02$) phase. Premenstrual scores were significantly higher than menstrual scores. A statistically significant main effect of OC use/type was found, $F(2,84) = 5.44$, $p < 0.01$, $\eta^2 = 0.12$, with monophasic ($M = 0.42$, $SE = 0.04$) OC users experiencing significantly higher levels of fluid retention than triphasic ($M = 0.22$, $SE = 0.05$) OC users, $p < 0.01$. There were no significant differences between either of the OC groups and the NOC ($M = 0.34$, $SE = 0.04$) group. No significant interaction effect was found (Appendix H6).

5.3.7.8 Integration of Results

To allow a comparison of the effect of OC use/type and menstrual cycle phase on the symptom sub-scales, a summary of the results is presented in Table 5.5. Table 5.5 lists the results of significant post-hoc/simple main effect tests for each sub-scale.

Table 5.5
The Effect of OC Use/Type and Menstrual Cycle Phase on Each Symptom Sub-scale: Direction of Significant Findings for Main and Interaction Effects

Symptom sub-scale	Type of effect		
	Main effect – Menstrual cycle phase	Main effect – OC use/type	Interaction effect
Negative Affect	Menstrual > Follicular Late Luteal > Follicular	NS[a]	NS
Cognitive Symptoms	Menstrual > Follicular Late Luteal > Follicular	NS	Significant cyclicity in the NOC group only
Behaviour Change	Menstrual > Follicular Late Luteal > Follicular	NS	NS
Somatic Symptoms	Menstrual > Follicular Late Luteal > Follicular Menstrual > Late Luteal	Monophasic > Triphasic	NS
Autonomic Reactions	Menstrual > Follicular Late Luteal > Follicular	NS	NS
Fluid Retention	Menstrual > Follicular Late Luteal > Follicular Late Luteal > Menstrual	Monophasic > Triphasic	NS

[a]NS = non-significant.

As can be seen in Table 5.5, all symptoms fluctuated significantly across the menstrual cycle. Symptoms were at there lowest during the follicular phase and increased premenstrually. In general, symptom severity changed little from the

premenstrual to the menstrual phase. The exceptions to this were somatic symptoms which were significantly higher during the menstrual compared to the premenstrual phase, and fluid retention which was significantly higher during the premenstrual compared to the menstrual phase. Eta squared values indicated that menstrual cycle phase accounted for a substantial amount of variance in fluid retention (28%), negative affect (11%) and somatic symptoms (11%). The amount of variance accounted for in the other sub-scales was less; 7, 6 and 4% for cognitive symptoms, behaviour change and autonomic reactions respectively.

There was a trend toward monophasic OC users experiencing the most severe menstrual cycle symptoms, followed by the NOC group and triphasic OC users. This was significant, however, for only somatic symptoms and fluid retention. For both of these symptom sub-scales, monophasic OC users reported more severe symptoms than the triphasic OC users. Mean symptom severity for the NOC group fell between that of the two OC groups but did not differ significantly from either. Eta squared values indicated that OC use/type accounted for 12 and 8% of the variance in fluid retention and somatic symptoms respectively.

Only one significant interaction effect was found. Significant cyclicity in cognitive symptoms was noted in the NOC group only. This effect however, accounted for only 2% of the variance in cognitive symptoms.

5.3.8 The Effect of OC Use/Type on the Timing of Peak Symptomatology

There is some indication in the above results that OC use/type may alter the timing of symptom fluctuation across the menstrual cycle. A general trend was apparent in that the NOC group consistently demonstrated a premenstrual increase in symptoms, and a decrease menstrually. This also occurred, although to a lesser extent, in triphasic OC users. Women in the monophasic OC group, however, generally demonstrated an increase premenstrually and a further increase menstrually. In order to further examine this, and to address the hypothesis that symptoms peak later in OC users, the

day of the menstrual cycle on which symptoms reached maximum severity was calculated. To ensure an accurate representation of the timing of peak symptomatology, the 28 days of menstrual cycle data were first smoothed using a moving average of three days. This was done separately for the three OC groups for each symptom sub-type. The day of peak symptomatology was then determined. These data are presented in Table 5.6.

Table 5.6
Menstrual Cycle Day of Peak Symptomatology by OC Use/Type

Symptom Sub-scale	OC group		
	NOC	Triphasic OC	Monophasic OC
Negative Affect	27	28	2
Cognitive Symptoms	1	28	2
Behaviour Change	1	27	3
Somatic Symptoms	1	2	2
Autonomic reactions	1	24	2
Fluid Retention	28	1	27

The majority of symptom sub-scales peaked on day 1 of the menstrual cycle in the NOC group. Symptoms in the triphasic OC group tended to peak about a day earlier (day 28), while symptoms in the monophasic OC group generally peaked about a day later (day 2). As illustrated in Table 5.6, somatic symptoms were generally among the last symptom group to reach their maximum. In both the NOC and monophasic OC groups, fluid retention peaked prior to the majority of other symptom sub-scales. With the exception of these findings, however, there is no indication that any symptom groups consistently peak prior to others.

5.3.9 Incidence of PMC

Incidence of premenstrual change in each sub-scale as well as overall was determined by calculating change scores from the follicular to the late luteal phase for each

woman. Results were calculated separately for the three OC groups and are presented in Table 5.7. Data from all participants with the exception of six women using OCs other than monophasic or triphasic preparations were included. The total N was 181. Sample size for the three OC groups was 123, 34 and 24 for the NOC, monophasic and triphasic groups respectively. Based on the recommendation of the National Institute of Mental Health, a 30% increase from the follicular to the late luteal phase was considered to be clinically meaningful and any change of a smaller magnitude, whether it be an increase or a decrease premenstrually, was classified as "no change". The percentage of women showing a decrease premenstrually was also calculated (note that the nature of this calculation prevents the magnitude of decrease from exceeding -100%). It should also be noted that follicular scores of 0 were replaced with 0.01 for the purposes of division of the change score.

As illustrated in Table 5.7, a substantial proportion of women exhibited premenstrual increases in each symptom sub-scale. The most common symptoms were those of fluid retention which increased premenstrually in over 70% of the sample. Premenstrual increases in autonomic, cognitive and somatic symptoms were generally experienced by between 40 and 50% of women. Negative affect was also experienced by between 40 and 50% of women in the NOC and monophasic groups but about 75% of women in the triphasic OC group. Behaviour change was experienced by 40% of women in the NOC group and about 60% of women the OC groups.

The percentage of women demonstrating no premenstrual change (with the exception of fluid retention) generally ranged from 25 to 35%. The percentage of women showing a premenstrual decrease was lower, typically ranging from 15 to 25%.

With the exception of the aforementioned differences between the groups in negative affect and behaviour change, OC use/type did not have an effect on the incidence of premenstrual change. In order to establish whether the differences for negative affect and behaviour change were significant, a three (NOC, monophasic and triphasic OC) by three (premenstrual increase, decrease and no change) chi-square test was

Table 5.7

Percentage of Women Showing a Premenstrual Symptom Increase, Decrease, and No Change, by Symptom Sub-scale and OC Use/Type

Symptom sub-scale	OC use/type	Premenstrual decrease	No premenstrual change	Premenstrual increase
Negative Affect	NOC	21.8%	25.0%	53.2%
	Monophasic OC	23.5%	29.4%	47.1%
	Triphasic OC	12.5%	12.5%	75.0%
	All women	20.9%	25.1%	54.0%
Cognitive Symptoms	NOC	17.7%	31.5%	50.8%
	Monophasic OC	20.6%	38.2%	41.2%
	Triphasic OC	16.7%	37.5%	45.8%
	All women	18.7%	33.2%	48.1%
Behaviour Change	NOC	28.2%	32.3%	39.5%
	Monophasic OC	11.8%	26.5%	61.7%
	Triphasic OC	16.7%	25.0%	58.3%
	All women	23.0%	31.0%	46.0%
Somatic Symptoms	NOC	18.5%	33.1%	48.4%
	Monophasic OC	08.8%	44.1%	47.1%
	Triphasic OC	29.2%	33.3%	37.5%
	All women	18.2%	34.8%	47.0%
Autonomic Reactions	NOC	21.8%	33.9%	44.3%
	Monophasic OC	38.2%	14.7%	47.1%
	Triphasic OC	20.8%	33.3%	45.9%
	All women	24.6%	29.9%	45.5%
Fluid Retention	NOC	07.3%	19.4%	73.3%
	Monophasic OC	11.8%	17.6%	70.6%
	Triphasic OC	08.3%	12.5%	79.2%
	All women	08.0%	18.2%	73.8%
Mean of all symptoms sub-scales	NOC	09.8%	35.0%	55.2%
	Monophasic OC	05.9%	35.3%	58.8%
	Triphasic OC	13.0%	34.8%	52.2%
	All women	09.2%	35.7%	55.1%

conducted on each of these sub-scales. The results indicated that the difference in incidence was not significant for either sub-scale, both $\chi^2 > 0.05$.

Because a 30% increase in premenstrual symptoms is considered by some researchers to be a liberal criterion (Gallant et al., 1992b; Christensen & Oei, 1995a), and some women experienced increases of a much greater magnitude, the percentage of women experiencing more marked changes was also calculated. With the exception of the 30% criterion, there is no consistent recommendation as to what constitutes a moderate or severe increase in symptoms. One hundred and three hundred percent were thus arbitrarily chosen to represent moderate and severe changes respectively. That is, women demonstrating premenstrual increases of between 30 and100% were considered to show relatively mild changes, women demonstrating increases of between 100 and 300%, moderate changes, and women demonstrating increases in excess of 300%, more severe changes. The percentage of women experiencing mild, moderate and severe premenstrual increases in each symptom sub-scale by OC use/type is presented in Table 5.8.

As demonstrated in Table 5.8, increases in fluid retention premenstrually tend to be severe, with 40% of women reporting increases in excess of 300%. The incidence of premenstrual changes in other symptom sub-scales was relatively evenly split with 10 to 20% of women experiencing mild, moderate and severe changes. The differences in severity between the OC groups were small and did not warrant statistical testing.

5.4 Discussion

5.4.1 Factor Analysis of the MMDQ

The results of the study suggest that factor analysis of prospectively collected MMDQ data yields results comparable to those obtained when data is collected retrospectively. Initial principal components analyses conducted on each menstrual cycle phase indicated that seven to eight factors had eigenvalues greater than unity. However, some factors contained only one or two symptoms and were thus deemed unreliable. A six-factor solution best summarised the data. This result is consistent

Table 5.8

Percentage of Women Showing Mild, Moderate and Severe Premenstrual Symptom Increases by Symptom Sub-scale and OC Use/Type

Symptom sub-scale	OC use/type	Mild premenstrual increase	Moderate premenstruai increase	Severe premenstrual increase
Negative Affect	NOC	16.9%	16.1%	20.2%
	Monophasic OC	17.6%	20.6%	08.8%
	Triphasic OC	37.5%	20.8%	16.7%
	All women	19.8%	17.1%	17.1%
Cognitive Symptoms	NOC	22.6%	13.7%	14.5%
	Monophasic OC	08.8%	26.5%	05.9%
	Triphasic OC	08.3%	20.8%	16.7%
	All women	17.6%	17.1%	13.4%
Behaviour Change	NOC	12.9%	12.9%	13.7%
	Monophasic OC	23.5%	17.6%	20.6%
	Triphasic OC	12.5%	12.5%	33.3%
	All women	14.4%	13.0%	17.6%
Somatic Symptoms	NOC	21.0%	15.3%	12.1%
	Monophasic OC	20.6%	20.6%	05.9%
	Triphasic OC	08.3%	20.8%	08.3%
	All women	19.3%	17.6%	10.2%
Autonomic Reactions	NOC	09.7%	16.9%	17.7%
	Monophasic OC	11.8%	17.6%	17.6%
	Triphasic OC	16.7%	12.5%	16.7%
	All women	10.7%	16.6%	18.2%
Fluid Retention	NOC	15.3%	16.9%	41.1%
	Monophasic OC	08.8%	26.5%	35.3%
	Triphasic OC	20.8%	25.0%	33.3%
	All women	14.4%	20.3%	39.0%
Mean of all symptom sub-scales	NOC	27.6%	15.4%	12.2%
	Monophasic OC	35.3%	17.6%	05.9%
	Triphasic OC	34.8%	13.0%	04.3%
	All women	29.2%	16.2%	09.7%

with both Moos (1968) and Clare (1983) who noted that symptoms of the MMDQ could be factored into six components. The content of the six obtained factors was also comparable to that of Moos and Clare but was not as consistent with the results

of van der Ploeg (1990) or Siegel et al. (1987). Both van der Ploeg and Siegel et al. found the symptoms of Moos' behaviour change and cognitive factors to form a single factor. This was not the case in the current study with two distinct grouping being apparent, particularly in the late luteal phase. Van der Ploeg and Siegel et al. also failed to find a factor constituting autonomic reactions. The current results indicated a clear factor of autonomic reactions during the late luteal but not the menstrual or follicular phases. During the menstrual phase, autonomic reactions and somatic symptoms combined to form a single factor, whereas during the follicular phase, symptoms of autonomic reactions were distributed among other factors. It is important to note, however, that the overall factor structure during the follicular phase was not as clear as either the premenstrual or menstrual solutions. This is not unexpected since symptoms assessed by the MMDQ do not predominate during the follicular phase.

The obtained factor structure thus differed from the previous work of van der Ploeg (1990) and Siegel et al. (1987), but was largely comparable to the solution derived by Moos (1968) and replicated by Clare (1983). A number of differences from the Moos structure were, however, apparent. The major differences during the late luteal phase in the current study included the loading of:

- decreased "sociability" and "efficiency" with negative affect rather than behaviour change
- "skin disorder" with somatic symptoms rather than fluid retention
- "stomach pains" with autonomic reactions rather than somatic symptoms
- "sweats" with cognitive symptoms rather than autonomic reactions
- "headache" and "fatigue" with behaviour change rather than somatic symptoms

It is also important to note that a number of symptoms loaded highly on more than one factor. The implication of this pattern was that different factor analytic models (e.g. different extraction techniques, specifying different number of factors) resulted in slightly different solutions. This may explain in part the discrepancies in previous

research since it suggests that a number of different solutions could adequately summarise the data.

Given this, it was somewhat surprising that the factors obtained, particularly those based on the late luteal phase, were so similar to those originally described by Moos (1968). Reliability analyses also indicated the strength of the Moos solution and lends support to the wide usage of the Moos factors. With the exception of the coefficient based on follicular fluid retention, all Cronbach alpha coefficients were high. The one lower value obtained may have resulted from the relative rarity of fluid retention during the follicular phase. Follicular presentation of these symptoms may occur in isolation as a result of specific antecedents (e.g. diet, overeating), rather than as a cluster of symptoms.

The results thus indicate that the Moos (1968) factors effectively represent the structure of menstrual cycle symptoms. Furthermore, these factors are replicable across different samples and across different methods of data collection. The current data were collected daily and prospectively in a large and diverse sample of women. Moos' sample was younger and the data collection retrospective. Given the differences in methodologies, the results of the factor analyses are remarkably similar.

5.4.2 Correlations Between the Symptom Sub-scales

In order to maintain comparability to previous research, data in the current study were summarised using the Moos (1968) sub-scales. Correlations between these symptom scales within each menstrual cycle phase were all positive and significant. Given that sub-scales were derived using an orthogonal rotation technique, these high correlations are a further reflection of the fact that a number of symptoms loaded highly on more than one factor. In other words, the high correlations reflect, in part, shared variance between the factors.

The highest correlations were between the psychological symptoms of negative affect, cognitive symptoms and behaviour change. This is consistent with past research (e.g. Moos, 1969; Siegel et al., 1987; Schechter et al., 1989) and suggests that experience of a particular symptom type increases the likelihood of experiencing other symptoms. The correlations were generally highest in the follicular relative to the late luteal and menstrual phases. These differences were small but may suggest that if symptoms are experienced during the follicular phase, they are diverse and perhaps indicative of generalised distress. This may be related to psychological factors such as neuroticism. The presence of a general factor of menstrual cycle related symptoms is also indicated to a certain extent during the late luteal and menstrual phases. The correlations, however, are not sufficiently high to warrant studying a single premenstrual or menstrual score. This is particularly reflected in the lower correlations between physical and psychological symptoms. It is also notable that correlations including fluid retention were consistently lower than intercorrelations between the other five sub-scales. This suggests that symptoms of fluid retention occur more independently of the other symptom groups, perhaps because they have a more discrete cause and/or are less affected by psychological factors. This contention is supported by findings that premenstrual fluid retention occurs almost ubiquitously, is present in women who do not report psychological symptoms (Sanders et al., 1983; Coleman et al., 1988; Metcalf et al., 1990) and has been reported to relate less strongly to neuroticism (J.W. Taylor, 1979b) relative to other symptoms.

5.4.3 Symptom Cyclicity Across the Menstrual Cycle

Results of repeated measures analyses of variance indicated that each symptom sub-scale fluctuated markedly across the menstrual cycle. As expected, symptoms were at there lowest during the follicular phase and increased significantly during the late luteal phase. In general, symptoms did not decrease menstrually but remained high with little difference in symptoms during the menstrual and premenstrual phases. One exception to this was somatic symptoms which were higher during the menstrual

compared to the premenstrual phase. This was not unexpected given that the constituent items include cramps, backache and general aches and pains. These symptoms, while present premenstrually, are typically associated with menstruation. This result is consistent with those of previous researchers (N.F. Woods et al., 1982b; van den Akker & Steptoe, 1985; Boyle & Grant, 1992) who have noted that symptoms such as cramps and fatigue peak early in the menstrual phase.

The only other symptom sub-scale to show a significant change from the premenstrual to the menstrual phase was fluid retention. Fluid retention peaked premenstrually, then decreased in the menstrual phase. This result is consistent with N.F. Woods et al. (1982b) but inconsistent with other researchers who have found fluid retention to peak during the early menstrual phase (Moos et al., 1969; Herrera et al., 1990; Boyle & Grant, 1992). The reason for this discrepancy is not entirely clear but may be related to different conceptualisations of the menstrual phase. In the current study, menstrual scores were derived by averaging symptoms across days 2 to 4 where day 1 was used to indicate the day of menses onset. Many researchers do not specify the days used to calculate phase scores, but at least some researchers (e.g. Walker & Bancroft, 1990; Gallant et al., 1992a; Graham & Sherwin, 1992) have used the day of menses onset in calculation of menstrual phase symptom scores. This is potentially misleading since, depending on the time of menstruation, this may reflect both the premenstrual and menstrual periods. In other words, women rating their symptoms on the day of menses onset may indicate that menstruation has begun, but in recalling symptom experience over the past 24 hours, make ratings based largely on how they felt prior to menstruation. This is particularly problematic since symptoms may be very high at this time. If this data were included in menstrual phase calculations it would thus erroneously inflate the symptom score.

With the exception of somatic symptoms and fluid retention, no significant differences were noted between the menstrual and premenstrual phases. This result is largely consistent with previous research (e.g. Beumont et al., 1978; N.F. Woods et al., 1982b; van den Akker & Steptoe, 1985), although some investigators have noted

symptoms to peak premenstrually (Sanders et al., 1983), while others have noted symptoms to peak menstrually (e.g. van der Ploeg & Lodder, 1993). The reasons for these differences are not clear, although, as mentioned above, different methods of deriving phase scores may account for some of the discrepancies. All in all, however, given the diverse range of methodologies used, results are reasonably consistent. Symptoms show a marked increase from the follicular to the premenstrual phase, change little between the premenstrual and menstrual phases, and do not revert to baseline levels during the early menstrual phase as is sometimes suggested (e.g. Haskett, 1987; Blumenthal & Nadelson, 1988). Symptom sub-scales peaked at about the same time; generally between day 28 and day 2 of the menstrual cycle. Consistent with the work of Metcalf et al. (1990), there was no evidence that psychological symptoms occur subsequent to physical ones.

It was also clear that cyclicity is not limited to physical symptoms but occurs in a diverse range of symptom groups. It does appear, however, that some symptom groups are more affected by menstrual cycle phase than others. Measures of effect size indicated that phase accounted for more variance in fluid retention (28%), negative affect (11%) and somatic symptoms (11%) than in cognitive symptoms, behaviour change and autonomic reactions (7, 6 and 4% respectively). This was not unexpected given that cognitive symptoms, (N.F. Woods et al., 1982b) behaviour change (Herrera et al., 1990) and autonomic reactions (N.F. Woods et al., 1982b) have all been cited as stable across the menstrual cycle. While the absence of cyclicity found in these studies may be attributable to the methodologies used (Herrera et al. used undergraduate students and Woods et al. a conservative criterion to establish cycle phase differences), it does appear that these symptom sub-scales show comparatively less fluctuation across the menstrual cycle. It should also be noted that a significant interaction effect for cognitive symptoms was found, with only the NOC group showing significant cyclicity across the menstrual cycle. This effect however, accounted for only 2% of the variance in cognitive symptoms.

Another notable finding was that the magnitude of symptom severity during the follicular and premenstrual phases was comparable for negative affect and somatic symptoms. This is contrary to the finding of van der Ploeg and Lodder (1993) who found mood scores to be lower than physical scores throughout the cycle. In the current study, negative affect and somatic symptoms were experienced to a greater degree than cognitive, behavioural and particularly autonomic reactions. Symptoms of fluid retention were low during the follicular phase but demonstrated a more dramatic increase than the other symptom sub-scales premenstrually.

5.4.4 Incidence of PMC

Results from the calculation of premenstrual change scores are further suggestive of marked cyclicity across the menstrual cycle in all symptom sub-scales. As expected, these results indicated that over 40% of women demonstrated a premenstrual increase in excess of 30% in each symptom sub-scale. Close to 50% of women experienced increases in negative affect, and over 70% increases in fluid retention. Less than 25% of the sample showed a premenstrual *decrease* in each symptom sub-scale. The fact that considerably fewer women experienced a premenstrual decrease in symptoms suggests that women experience premenstrual increases as a result of systematic rather than random fluctuations. Slade (1984) has argued that premenstrual affective changes occur no more than would be expected by chance. In the current study, comparison of the percentages of women whose symptoms increased and decreased premenstrually illustrates that this was not the case. This is further suggested by the figures based on the mean of all symptom sub-scales. Only 9% of women demonstrated an overall decrease in symptoms during the premenstrual phase. This suggests that while women may experience a premenstrual decrease in certain symptoms, they do not experience an overall amelioration of symptoms during the late luteal phase. Conversely, over 55% of the sample showed an overall premenstrual increase in symptoms. This suggests that the majority of women experience a marked premenstrual increase in a variety of symptoms.

These results are consistent with previous retrospective studies demonstrating the high incidence of premenstrual change. It is interesting to note that some of the most commonly cited incidence rates are based on large studies that assessed the incidence of premenstrual *symptoms* not premenstrual *change* (e.g. Kessel & Coppen, 1963; Moos, 1968, 1986; Sheldrake & Cormack, 1976; Clare & Wiggins, 1979; N.F. Woods et al., 1982b). These studies have indicated the most common symptoms to be experienced by between 20 and 40% of women. Studies assessing premenstrual *change*, however, have yielded higher figures which are more consistent with the current results. Halbreich et al. (1982) found over 80% of women to experience increases in symptoms of fluid retention and over 70% of women to experience increases in psychological symptoms. Yuk et al. (1990) found increases in fluid retention to affect about 55% of women, somatic symptoms to affect about 60% of women and negative affect to affect 65% of women. The generally lower figures obtained in the current study are not unexpected given that data were collected daily and prospectively in women unaware of the study aims. As previously indicated, these methods usually result in a lower reporting of premenstrual change. In addition, both Halbreich et al. and Yuk et al. used the PAF which is a retrospective questionnaire known to yield high incidence rates (e.g. Youdale & Freeman, 1987). At the time of this research, the only other large-scale prospective study assessing incidence rates was conducted by Magos et al. (1986). The 150 participants in this study had a history of PMS and thus incidence rates were higher than those obtained in the current study. Results, however, were similar to the current results in that behaviour change, cognitive symptoms, somatic symptoms and autonomic reactions were all common and approximately equally prevalent (60-70% in the Magos study compared to 40-50% in the current study). Magos et al. also noted fluid retention (85% compared to 74% in the current study) and negative affect (79% compared to 54% in the current study) to be the most common sub-scales. This high incidence of fluid retention and negative affect has also been documented by a number of other researchers (e.g. Moos, 1968; Halbreich et al., 1982; Hargrove & Abraham, 1982; High & Marcellino, 1995). The very high rate of premenstrual increases in fluid retention is consistent with the view that physical symptom cyclicity is more common

than psychological symptom cyclicity and may represent an almost ubiquitous aspect of the menstrual cycle (Sanders et al., 1983; Coleman et al., 1988; Metcalf et al., 1990).

Recently Sveinsdóttir and Bäckström (2000a) prospectively assessed the symptoms of a random sample of 83 Icelandic women. Reported incidence rates were lower than those found in the current study with 43.4% of women experiencing a premenstrual increase in a somatic symptom group and 14.4% experiencing an increase in a psychoemotional symptom group. There are several possible reasons for the lower incidence rates obtained by Sveinsdóttir and Bäckström. Both the follicular and the premenstrual phases were defined using nine days; a duration longer than the more typically imposed three to five days. The inclusion of a greater number of days in the phase score calculations, particularly during the premenstrual phase, may have "diluted" the difference between the phases. In addition, cyclicity was established using non-parametric statistics to establish significance of the difference between the phases. It is not clear how this compares to the more commonly used method of a 30% increase from the follicular to the premenstrual phase. The sample comprised close to 50% of a larger random sample which was drawn from the National Registry of Iceland. While the attrition rate may introduce some bias into this sample, it is possible that participants in this study were less likely to suffer from premenstrual changes relative to studies in which potential participants responded to advertisements (this issue is discussed further in section 7.5).

The other notable finding of the current study was the high percentage of women demonstrating premenstrual increases in excess of 100 and 300% from the follicular phase. This clearly indicates that the changes experienced by many women are not merely mild as suggested by some researchers (e.g. Haskett, 1987). Unexpectedly, in many symptom sub-scales, as many women experienced changes of these higher magnitudes as they did changes in excess of 30% (but less than 100%). This meant that about 15% of women experienced changes in excess of 300% in each symptom sub-scale. The one exception to this was somatic symptoms, possibly because these

symptoms are higher menstrually than premenstrually. Fluid retention was noted to increase dramatically from the follicular to the premenstrual phase, with 30-40% of women demonstrating an increase in excess of 300%. Again, these figures are higher than previous results based on assessment of premenstrual symptom *severity* (e.g. Kessel & Coppen, 1963; Moos, 1968; N.F. Woods et al., 1982b), but lower than those based on assessment of severity of premenstrual *change*. Halbreich et al. (1982) found moderate change to be reported by between 30 and 40% of women for the most common psychological symptoms, and by between 40 and 50% of women for the most common symptoms of fluid retention. Hargrove and Abraham (1982) found moderate change to be experienced by about 20% of women for depressive and pain sub-scales and by about 50% of women for anxiety and fluid retention sub-scales. The differences between the results of these studies are again probably due to method of data collection and differing definitions of "moderate". In the Halbreich et al. study, women self-reported severity of change while in the study of Hargrove and Abraham women had to report moderate symptomatology during the late luteal phase and no or mild symptomatology during the follicular phase.

It should be noted that while premenstrual changes were experienced to a marked degree by many women, the absolute level of symptom severity was low. As illustrated in Figures 5.1 through 5.6, the mean symptom level was less than one, indicating only mild severity. However, it needs to be kept in mind that mean symptom scores were derived by averaging scores across three to five days for four to eight symptoms, and that women report individual symptoms, and symptom groups on certain days, as considerably more severe. Furthermore, it appears that despite the low absolute level of symptoms, women find premenstrual change distressing. Eighty-six percent of the sample reported that they regularly experience changes across the menstrual cycle, indicating that they are aware of cyclicity in their symptoms. More importantly, 56% of the sample had sought treatment for premenstrual changes, with 32% seeking help from a general practitioner. This suggests that symptom change is experienced by the majority of women to be of a sufficient magnitude to prompt them to seek help.

5.4.5 The Relationship Between OC Use/Type and Premenstrual Symptoms

OC use did not alter the incidence or severity of premenstrual change in any symptom sub-scale. The percentage of women experiencing premenstrual decreases, no change, and premenstrual increases of 30, 100 and 300%, did not differ by OC use or OC type. To the author's knowledge, no previous studies have prospectively examined incidence rates by OC use/type so replication of this result would be pertinent. The results, however, are consistent with a large number of studies demonstrating a lack of effect of OCs on symptom change across the menstrual cycle (Coppen et al., 1972; Harding et al., 1985; Marriott & Faragher, 1986; Sveinsdóttir & Bäckström, 2000a).

An interesting and unexpected result of the current study was the finding of overall differences in symptom severity between the OC groups. Monophasic OC users generally reported the highest level of symptoms followed by the NOC group then the triphasic OC group. Analyses of variance revealed that this main effect of OC use/type was significant for fluid retention and somatic symptoms. In both cases, post-hoc tests revealed that monophasic OC users had a higher level of symptomatology compared to triphasic OC users. This result is consistent with the hypothesis, and with studies demonstrating minimal effects of OC use on psychological symptoms but more impact on physical symptoms (van den Boogaard & Bijleveld, 1988; Walker & Bancroft, 1990; Graham & Sherwin, 1992). What is surprising, however, is that monophasic and triphasic OCs had *opposite* effects on physical symptomatology relative to the NOC group. To the author's knowledge, this has not previously been reported and thus replication is warranted. In light of the confusion, however, as to the effect of OCs on menstrual cycle symptoms, the concept that the major types of OCs have opposite effects may have explanatory value. Such differential effects, for instance, may explain previous findings of no differences between users and non-users of OCs in physical symptomatology (Harding et al., 1985; Marriott & Faragher, 1986). These studies included more than one type of OC but did not separately consider their impact. Any effects of particular OCs may therefore have been obscured.

Commensurate with the current results, a number of researchers have noted that fluid retention, in particular, appears to be affected by OCs. The direction of effect, however, has not been consistent. Graham and Sherwin (1992) and Silbergeld et al. (1971) obtained results comparable to those obtained here. Silbergeld et al. observed a high dose monophasic OC to worsen symptoms of fluid retention relative to a placebo, and Graham and Sherwin found triphasic OCs to reduce breast tenderness and bloating relative to a placebo. Contrary to the current results, however, Walker and Bancroft (1990) noted a marked premenstrual increase in breast tenderness in controls and triphasic OC users but not monophasic OC users.

There are a number of possible explanations for a differential effect of OCs on physical symptoms. Monophasic OC use, for instance, may result in generalised physical symptoms that occur independent of menstrual cycle phase. An alternative but less likely explanation is that triphasic OCs may result in an amelioration of physical symptoms. Differences between the OC groups in demographic characteristics may also account for the differences in symptomatology, although only age was found to discriminate between the groups. The NOC group was significantly older than monophasic OC users. Triphasic OC users fell between the other two groups but did not differ significantly from either of them. The finding that women who were using OCs were younger than women in the NOC group is probably a reflection of the fact that OC usage is less frequently recommended for women over 35 years of age (Melbourne Sexual Health Centre, personal communication, November 13, 2000).

It is also conceivable that monophasic and/or triphasic OC users differ from the other groups on a psychological or biological characteristic that leads to an altered level of symptomatology. This is perhaps less likely given that differences between the OC groups are specific to physical symptoms. However, the possible impact of psychological and menstrual cycle variables on this relationship will be further explored in the next chapter following examination of the relationships between these variables and premenstrual symptoms.

As hypothesised, there was some indication that OC use alters the timing of symptom fluctuation across the menstrual cycle. The majority of symptom sub-scales peaked on day 1 of the menstrual cycle in the NOC group, while symptoms in the triphasic OC group tended to peak about a day earlier (day 28). Monophasic OC users exhibited peak symptomatology on primarily day 2 of the menstrual cycle. This result for monophasic OC users relative to the NOC group is consistent with other results demonstrating that the symptoms of OC users peak later in the menstrual cycle relative to non-users (Wilcoxon et al., 1976; Graham & Sherwin, 1987; Warner & Bancroft, 1988). However, symptoms of triphasic OC users did not follow this pattern, often peaking earlier in the menstrual cycle. In terms of the timing of symptoms in relation to hormone intake by OC use, these results indicate that symptoms peak in the middle of the OC-free week in monophasic users and at the beginning of the OC-free week in triphasic users. In other words, symptoms in OC users appear to peak subsequent to cessation of active OC use (possibly due to the withdrawal of exogenous hormones), but to peak more rapidly following cessation of active OCs in triphasic relative to monophasic users. An explanation for such a result is not readily available.

CHAPTER 6

THE PREDICTION OF PREMENSTRUAL SYMPTOMATOLOGY FROM PERSONALITY, DEMOGRAPHIC AND MENSTRUAL CYCLE VARIABLES

6.1 Aims

In light of the high incidence of PMC found in the first part of the study, the aim of this research was to examine several potential risk factors of premenstrual symptoms and premenstrual change. A further aim of the study was to determine whether the OC groups could be significantly differentiated on variables which may mediate the OC effect observed in the previous chapter. The IVs included demographic characteristics (age, marital status, employment status, number of children), menstrual cycle variables (menstrual cycle length, menstrual cycle regularity, duration of menstruation, age of menarche, degree of menstrual pain) and personality factors (neuroticism, extraversion, openness, agreeableness, conscientiousness). Each of the symptom sub-scales derived in chapter five (sections 5.3.3. & 5.3.4) was treated separately as a DV. The relationships between the IVs and DVs were examined in a series of multiple regression analyses. In order to distinguish between the prediction of premenstrual symptoms and premenstrual change, predictors were examined in the context of premenstrual symptom scores both before and after controlling for baseline (follicular) scores.

It was expected that several IVs would differentially predict premenstrual symptoms. The primary interest in this study was personality factors, in particular, neuroticism. Based on previous findings of correlations between neuroticism and premenstrual symptoms, it was hypothesised that neuroticism would predict premenstrual symptoms. Given that some previous studies have found neuroticism to correlate with a variety of premenstrual symptoms, while others have found correlations with psychological but not somatic symptoms, neuroticism was expected to be more strongly related to

negative affect than other types of symptoms. In view, however, of the lack of consistent evidence supporting a relationship between neuroticism and symptoms that is specific to the premenstrual phase, it was further hypothesised that neuroticism would not predict premenstrual negative affect scores if variation due to differences in baseline (follicular) negative affect was removed. In terms of the particular facets of neuroticism, anxiety and depression were expected to be particularly relevant predictors of symptomatology (see sections 3.3.2 & 3.3.3).

In line with research in other areas of health psychology, it was expected that factors of the NEO PI-R other than neuroticism would also predict premenstrual symptomatology. However, given that little past research has focused on these personality characteristics in relation to PMC, this aspect of the study was deemed exploratory and specific hypotheses were not generated (see section 3.3.4).

Although personality characteristics were the primary focus of this study, demographic and menstrual cycle variables were also of interest. Given their postulated role in mediating premenstrual symptoms, age, parity, marital status and employment status were all investigated, in addition to menstrual cycle length and regularity, menses duration, age of menarche and degree of menstrual pain. Given the lack of consistent findings relating to the majority of these variables, few relationships were expected. The exception to this was menstrual pain which was hypothesised to predict premenstrual symptomatology (see sections 2.3.2 & 2.3.3).

6.2 Method

6.2.1 Participants

Participants who had successfully completed part I of the study were invited to participate in part II. One hundred and nine of the original 187 women participated in this part of the study. This reduction in participant numbers was largely due to a loss of contact with some participants over the 18-month period of menstrual cycle data

collection. A number of women also elected not to complete part II of the study. The results of this chapter are thus based on the 109 women who completed both parts I and II of the study. Collection of the menstrual cycle data for these women was described in the previous chapter. Collection of the remaining data is described in the following sections.

Participants ranged in age from 18 to 45 years with a mean age of 31.8 (SD = 8.5) years. Approximately one third (35%) of the participants had at least one child and 50% were either married or living in a defacto relationship. Thirty-nine percent (39%) of the women were current users of oral contraceptives. The majority of participants (70%) were working part-time or casually, with 30% working full-time.

As was the case for the whole sample of 187 women, the majority of the 109 women who participated in part II of the study were born in Australia. Most had no history of psychiatric illness and were not currently using any prescription medications. Again, non-prescription drug/vitamin use was applicable to almost half the sample and included primarily vitamins/minerals, analgesics/antipyretics and naturopathic/herbal remedies. This information was almost identical to that reported for part I of the study and thus the details will not be repeated here.

Prior to standardising personality scores, a series of independent t-tests were conducted to determine whether the characteristics of the sample differed from that expected based on the normative data of the NEO PI-R. The t-tests were conducted using gender and age appropriate norms (Costa & McCrae, 1992a). Accordingly, the tests were conducted separately for women falling into the adult group and those falling into the "college" age group (only women aged 18-20 in the current sample). It should be noted, however, that since only 10 women fell into the college age group, results of these t-tests should be treated with caution. The college age sample differed from the norms only in that they scored significantly more highly on the openness scale than was expected, $t(1,249) = 5.39$, $p < 0.001$. Participants over 20 years of age, however, differed on several personality characteristics relative to the NEO PI-R norms. Women in the current

sample scored significantly higher on neuroticism ($t(1,597) = 6.17$, $p < 0.001$) and openness ($t(1,597) = 7.72$, $p < 0.001$) and significantly lower on agreeableness ($t(1,597) = 2.85$, $p < 0.01$) relative to the norms.

The mean menstrual cycle duration for non-OC regulated cycles was 27.73 ($SD = 3.12$) days with an average cycle to cycle variability of 3.62 ($SD = 4.94$) days. Menstrual bleeding persisted for a mean of 4.92 ($SD = 1.33$) days. For OC controlled cycles, the mean duration was 27.98 ($SD = 1.47$) days with an average variability of 0.95 ($SD = 1.23$) days. Menstrual bleeding persisted for a mean of 4.80 ($SD = 1.05$) days. The mean age of menarche was 12.80 ($SD = 1.68$). The majority of women reported experiencing either no (35.8%) or mild (37.6%) pain associated with menstruation. Moderate and severe menstrual pain was reported by 21.1% and 5.5% of women, respectively. These results are comparable to those previously reported (Busch, Costa, Whitehead & Heller, 1988).

N = ?

6.2.2 Materials

6.2.2.1 The Menstrual History Form

A Menstrual History form was developed to obtain detailed information about the participants' menstrual history, as well as to gather additional demographic data (Appendix I). The questionnaire comprised three sections, the first requesting demographic information (e.g. the number of hours worked per week), the second requesting menstrual history information (e.g. age of menarche, degree of menstrual pain) and the final section requesting information about symptom change across the menstrual cycle (e.g. whether treatment had been sought for PMC).

6.2.2.2 The NEO Personality Inventory Revised

The NEO PI-R was developed through rational and factor analytic techniques to operationalise the five-factor model of personality (Costa & McCrae, 1992a). The questionnaire consists of 240 items each rated on a five-point scale from strongly disagree to strongly agree. A self-report version (form S) was used in the current study, although peer and spouse observer rating versions are available. The questionnaire yields five factor scores: neuroticism, extraversion, openness to experience, agreeableness and conscientiousness. Each of these domain scales is comprised of six sub-scales or "facets" that measure more specific traits.

The questionnaire does not contain any validity or social desirability responding scales, the authors arguing that the use of such scales has little support and may in fact be counterproductive (McCrae, Costa, Dahlstrom, Barefoot, Siegler & Williams, 1989). Three validity items, however, are listed at the end of the questionnaire, asking respondents if they have answered honestly and accurately, responded to all the items, and marked their responses in the correct spaces on the answer sheet. Item scoring is balanced to control for acquiescence and nay-saying, and socially desirable responding does not appear to bias scores (McCrae & Costa, 1983b; Costa & McCrae, 1988a). Given that the women in this study had already satisfactorily completed part I of the study, and were aware that they were to receive feedback about their personality based on the NEO PI-R, they were assumed to be motivated and honest respondents.

Internal consistency coefficients for the NEO PI-R range from 0.86 to 0.95 for domain scales and 0.56 to 0.90 for facet scales (Costa, McCrae & Dye, 1991). Six-month retest reliabilities of 0.87, 0.91 and 0.86 have been demonstrated for the domain scales of neuroticism, extraversion and openness, while scores for the facet scales range from 0.66 to 0.92 (McCrae & Costa, 1983a). A six-year longitudinal study showed stability coefficients above 0.8 for the neuroticism, extraversion and openness scales for form S and a range from 0.68 to 0.79 for the facet scales (Costa & McCrae, 1988b). The retest reliabilities for the agreeableness and conscientiousness scales after a three year period were found to be 0.63 and 0.79 respectively (Costa & McCrae, 1988b).

The questionnaire was validated on a large sample of adults, and correlations with other personality inventories, as well as projective techniques, show good discriminant and convergent validity. Consensual validity is demonstrated by the significant correspondence between self-report and spouse and peer ratings. Correlations for the domain scales of neuroticism, extraversion, openness, agreeableness and conscientiousness respectively are 0.36, 0.44, 0.53, 0.41 and 0.40 for self-report/peer ratings, and 0.60, 0.73, 0.65, 0.62 and 0.34 for self-report/spouse ratings. Median correlations between self-report and peer ratings for the facet scales in each domain are 0.30, 0.40, 0.38, 0.31 and 0.34. (McCrae, 1991; Costa & McCrae, 1992a).

6.2.3 Procedure

Participants were given a copy of the NEO PI-R and the menstrual history questionnaire. Approximately two thirds of the participants attended an information and general "get together" session at Monash University after the completion of part I of the study. Participants who attended one of these sessions completed the questionnaires during that time. For the remaining participants, questionnaires were sent in the mail and completed by participants at home. All participants were given detailed instructions as to how to complete the questionnaires and were informed that they would receive feedback at the completion of the study (see Appendix J for a copy of the letter sent with the NEO PI-R). The confidential and anonymous nature of the questionnaires was outlined.

All raw scores derived from the NEO PI-R were converted to standardised T scores by comparison to age and gender appropriate normative samples. At the conclusion of the study participants were sent the standard NEO PI-R summary form. The form is designed to provide understandable feedback to participants with regard to their scores on each of the five dimensions of personality (Costa & McCrae, 1992a).

6.3 Results

All data were analysed using SPSS for Windows (SPSS Inc. Release 9.0.1).

6.3.1 Data Screening

Prior to analyses, data were screened for accuracy of data entry, and to identify missing values and univariate and multivariate outliers. Variables were examined to establish normality and linearity. Variables examined were all personality domain and facets scores and all demographic (age, number of children, marital status, employment status) and menstrual cycle (OC use/type, menstrual cycle length, length of menstruation, variation in menstrual cycle length, age of menarche, degree of menstrual pain) variables that formed part of the statistical analyses. Section 5.3.6 outlines how these issues relate to the menstrual cycle symptom variables. Data screening of the menstrual cycle symptom variables for the 109 women who participated in this part of the study yielded essentially identical information to that presented in section 5.3.6 for the entire sample of 187 women. This information will thus not be repeated here.

Linearity among pairs of variables was established through inspection of bivariate scatterplots. Visual examination of the distributions and inference tests for skewness and kurtosis indicated that all variables were normally distributed. Two variables were omitted from the analyses on the basis of missing/inaccurate data. The first of these, educational level, was omitted on the basis that some participants answered this question with regard to the highest level of education *completed*, as specified by the relevant question, but others answered the question in terms of *current* educational undertaking (i.e. highest level reached as degree if currently an undergraduate student). The question requesting the age at which participants first experienced symptom change across the menstrual cycle also proved problematic since a number of participants failed to answer this question. This appeared to be due to the placing

of the question on the questionnaire, with some participants overlooking it. Due to the extent of the missing data, this variable was omitted from analyses.

One univariate outlier was noted for both self-reported menstrual cycle length and variation in menstrual cycle length. These values were extremely discrepant. Furthermore, the scores were not consistent with the participant's actual menstrual cycle length or variation as measured in part I of the study. Given these factors, the outlying scores were presumed to be errors and each was replaced with the mean for that variable. Missing data were also noted for the variables "age of menarche" (two missing cases) and "menstrual cycle variation" (one missing case). All these cases were replaced with the relevant mean for either monophasic or triphasic OC users or the NOC group.

6.3.2 Prediction of Premenstrual Symptoms from Personality, Demographic and Menstrual Cycle Variables

6.3.2.1 Overview of Analyses

The relationships between premenstrual symptoms and various predictors were examined using multiple regression techniques. This approach to the statistical analyses was adopted in light of the aims of the investigation, the number of measures, and the nature of the variables. Multiple regression allows the assessment of the relationship between a DV and several IVs. It is appropriate when IVs are correlated with each other and with the DV, and enables a determination of the importance of IVs to the relationship. Multiple regression can accommodate discrete or continuous variables. Some researchers select ANOVA as the appropriate method of statistical analysis for menstrual cycle research because premenstrual symptoms and premenstrual change are conceptualised as discrete IVs (i.e. high, low premenstrual symptoms; PMS or no PMS). This was not considered desirable in the current study since there is no evidence that menstrual cycle symptoms are anything but continuous (section 1.1.5). The selection of thresholds for levels of the IV in an

ANOVA is thus relatively arbitrary. The 30% premenstrual change criterion has been frequently used, and while this is useful for descriptive purposes, it does not represent a "real" level above which women can be classified as having PMS. In other words, there is no evidence that women who demonstrate a 30% premenstrual increase have a qualitatively different experience to those women who show a 20% increase or a 50% increase. Menstrual cycle symptom variables in the current study were thus viewed as *dependent continuous* variables. The majority of the IVs (e.g. age, personality, menstrual cycle length) were also best measured as continuous variables. Rendering either the IVs or the DV discrete for the purposes of ANOVA or discriminant analysis respectively, would thus have resulted in a loss of information. From a purely statistical viewpoint, rendering the variables discrete would also have resulted in markedly discrepant sample sizes.

A series of multiple regressions was conducted in preference to a multivariate technique such as canonical correlation for the theoretical reasons discussed in the previous chapter (section 5.3.7.1) and outlined in more detail in section 1.2.3. Briefly, numerous differential relationships have been noted between symptom sub-scales and various demographic and psychological variables (e.g. Bäckström & Mattson, 1975; J.W. Taylor, 1979b; N.F. Woods et al., 1982c; Graham & Sherwin, 1992). Obscuring these unique relationships by failing to consider symptom groups separately, hinders the search for the aetiologies of PMC (e.g. Abplanalp et al., 1980; Halbreich & Endicott, 1982). Furthermore, although aspects of this study were exploratory, specific hypotheses such as the relationship between neuroticism and negative affect were of interest. These hypotheses are more clearly examined via a univariate design.

In addition, it is considered statistically defensible to perform several analyses when the outcomes of the analyses are measured by separate DVs (Statistical Consulting Service, personal communication, August, 2000). Such a series of multiple analyses does not have the same implications for the Type 1 error rate as does performing multiple analyses on the same DV. It is also common with multiple regression to run several analyses, either eliminating, adding, comparing or changing IVs, or

examining contingencies among IVs (Tabachnick & Fidell, 1986). Because of the relatively exploratory nature of some of the analyses, and the consequent importance of detecting effects that could lead to specific hypothesis testing in later research, alpha was maintained at 0.05 for each comparison. To avoid over-interpreting the results of significance testing however, the importance of an IV to a relationship was considered in light of the proportion of the variance accounted for. Where relevant, the results were also considered in terms of clinical as well as statistical significance.

The following paragraphs provide an outline of the analyses presented in this section. More detailed information is given in the sections to follow. The broad sequence of analyses involved three steps, determining:

1. which variables predicted premenstrual scores
2. which variables predicted follicular scores
3. which variables predicted premenstrual scores when holding follicular scores constant.

This procedure was conducted separately for the various symptom sub-scales. Each step is outlined in more detail below.

1. In the initial multiple regression for each sub-scale, premenstrual symptom scores (for that sub-scale) served as the DV and all IVs were entered into the equation. The purpose of this was to determine which IVs predicted that particular DV. In conducting these analyses, however, an important caveat needed to be considered. Specifically, it was anticipated that some predictor variables would not significantly contribute to the prediction of the DV. These non-contributors can potentially undermine an analysis. In particular these variables raise the probability of type II errors (Cohen & Cohen, 1983). Accordingly, non-contributors need to be excluded from the analysis. Statistical (stepwise) regression is often utilised for this purpose but was not appropriate in this situation. Specifically, this procedure is particularly susceptible to sampling error.

That is, two samples may provide similar data but yield different conclusions (Cohen & Cohen, 1983). The problems that can occur as a result of capitalising on chance and overfitting the data are particularly relevant given the sample size here of 109. Further, because statistical regression can yield different results depending on the sample used, cross validation with a second sample is considered desirable (Tabachnick & Fidell, 1996). This was not feasible for the current project. The issue was hence circumvented by adopting an alternative approach to the problem. Specifically, the method of successive elimination of non-contributors was utilised. Following the initial regression, any non-significant predictors were eliminated and the regression re-run. If any of the remaining IVs failed to remain as significant predictors, the process was repeated until a set of IVs that significantly predicted the DV was obtained (Tabachnick & Fidell, 1996). Only the results of the regressions containing the significant predictors are presented in this chapter. Results from the preliminary regressions are presented in Appendix K.

2. Having established which variables predict the premenstrual symptom scores, a regression was conducted for each sub-scale to determine whether these relationships were specific to the premenstrual phase, or whether they occurred regardless of menstrual cycle phase. In order to determine this, the relevant IVs were entered into an equation with *follicular* scores as the DV.

3. The purpose of the final set of analyses was to determine whether the variables predicting premenstrual scores would continue to act as significant predictors if variance due to follicular scores was statistically removed. Accordingly, follicular scores were entered as an IV in a sequential model, prior to entry of other IVs. Premenstrual scores served as the DV. Results of these analyses thus provided an indication of whether the IVs predicted premenstrual *change*. Results also indicated the extent to which premenstrual scores were predictable from follicular scores.

This sequence of analyses was selected in preference to using a measure of premenstrual change as a DV because of the comprehensiveness of the results obtained. In addition to addressing the primary issue of predictors of premenstrual change, these analyses allowed a comparison of the influence of IVs during the follicular and premenstrual phases. This is of particular interest for variables such as neuroticism since previous results reporting a relationship between neuroticism and premenstrual symptoms may have been attributable to an influence of neuroticism on chronic symptomatology rather than premenstrual symptomatology per se (see section 3.3.3). It was thus considered useful to attempt to "disentangle" the potentially complicated relationships between neuroticism and menstrual cycle symptomatology.

The IVs for these analyses included demographic variables, menstrual cycle variables, and personality variables. These variables and how they were measured is described in Table 6.1. Because correlations between the IVs can influence the interpretation of multiple regression analyses, these are presented in Table 6.2. Due to space constraints all zero's preceding the decimal points have been omitted. Note that although the direction of the relationship is not typically indicated for point-biserial correlations or phi coefficients, it is provided here for ease of interpretation. The meaning of relationships including a dichotomous variable can thus be interpreted by reference to Table 6.1 which indicates how each variable was measured and coded. For instance marital status was coded by representing single women with a "0" and partnered women with a "1". A positive correlation between marital status and age for instance, thus indicates that coupled women were more likely to be older than single women.

Table 6.1
Independent Variables and their Measurement

Independent Variable	Measurement of Independent Variable
OC use/type	3 conditions (NOC, monophasic OC and triphasic OC) coded as dummy variables until all degrees of freedom had been used. - *Monophasic OC:* monophasic OC users = 0 triphasic OC users and the NOC group = 1 - *Triphasic OC:* triphasic OC users = 0 monophasic OC users and the NOC group = 1 - *NOC:* NOC group = 0 monophasic and triphasic OC users = 1
Age	Years
Number of children	Number of children
Marital status	2 conditions: single = 0 married/defacto = 1
Employment status	2 conditions: employed full-time = 0 not employed full time = 1
Menstrual cycle length[a]	Days
Variation in cycle length[a]	Days
Length of menstruation[a]	Days
Age of menarche	Years
Menstrual pain	4 categories of increasing pain from no pain to severe pain
Neuroticism	NEO PI-R standardised scores
Extraversion	NEO PI-R standardised scores
Openness	NEO PI-R standardised scores
Agreeableness	NEO PI-R standardised scores
Conscientiousness	NEO PI-R standardised scores

[a] self-reported values.

Table 6.2
Correlations between Independent Variables

	Monoph-asic OC	Triphasic OC	NOC	Age	Number children	Marital status	Employ. status	MC length	MC variation	Length menses	Age menarche	Menstrual pain	Neuroti-cism	Extraver-sion	Open-ness	Agreeabl-eness
Triphasic OC	-.22*															
NOC	-.62***	-.55***														
Age	.20*	.07	-.24*													
Number of children	.14	-.01	.11	.55***												
Marital status	-.05	-.00	.06	.52***	.50***											
Employment status	.07	.25*	-.20*	-.25**	.07	-.15										
MC[a] length	.04	.04	-.06	-.13	-.06	-.10	.03									
MC variation	.18	.20*	-.32**	.01	-.04	-.04	.15	.45***								
Length menses	.06	-.11	.03	-.14	.07	-.08	.03	-.01	.04							
Age menarche	.05	-.02	-.05	.02	.22*	.05	-.20*	-.16	-.08	-.14						
Menstrual pain	.16	.12	-.18	-.02	-.03	-.08	.02	-.04	.04	.07	-.15					
Neuroticism	.32**	-.03	.31**	-.11	-.04	-.07	-.05	.01	-.07	.15	-.22*	.05				
Extraversion	.18	-.05	-.70	-.10	.00	.00	.12	.04	.10	-.17	.18	-.02	-.42***			
Openness	.00	.06	-.05	-.25*	-.28**	-.17	.21*	.12	.18	-.13	-.00	.02	.04	.23*		
Agreeableness	.18	.16	-.22*	.10	.08	.09	.01	-.08	.10	-.00	.04	.04	-.24*	.12	.03	
Conscientiousness	-.02	-.03	.03	.22*	.04	.16	-.08	-.07	-.06	-.10	-.02	-.12	-.17	.08	-.12	.01

[a] MC = menstrual cycle.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

It should be noted that all multiple regressions were conducted as sequential models, with OC use/type entered in the first step. OC use/type was held constant given that it appears to affect the baseline symptomatology of some symptom sub-scales (see sections 5.3.7.5, 5.3.7.7, 5.3.7.8 & 5.4.5), and could potentially mediate the relationship between some IVs and the DVs. OC use also correlates with IVs such as variation in menstrual cycle length (Table 6.2), and the interest in these analyses was determining the effect of these variables on menstrual cycle symptoms after controlling for OC use/type. All IVs at each step of the analyses were entered simultaneously, using the SPSS enter method. Data from all participants were included in these analyses and thus N equalled 109. Full output in table format is presented for key analyses only. This is generally limited to the models in which the prediction of premenstrual scores from IVs is evaluated after controlling for follicular scores. Full output from all other regressions are presented in Appendix K. Results for each sub-scale are presented in sections 6.3.2.2 through 6.3.2.7. A summary of these results is presented in section 6.3.2.8

6.3.2.2 Predictors of Negative Affect Across the Menstrual Cycle

Preliminary analysis indicated that all the IVs together accounted for 36% of the variance in premenstrual negative affect (R^2 = 0.36, $F(17,91) = 3.06$, $p < 0.001$; Appendix K1). Only neuroticism, however, contributed significantly to the model. Accordingly, a sequential multiple regression was conducted with OC use/type entered in the first step and neuroticism in the second. The results indicated that neuroticism accounted for 17% of the variance in premenstrual negative affect (R^2change = 0.17, Fchange$(1,104) = 21.38$, $p < 0.001$; Appendix K2). When this regression was repeated with follicular scores serving as the DV, neuroticism was found to significantly predict follicular negative affect, accounting for 9% of the variance (R^2change = 0.09, Fchange$(1,104) = 10.41$, $p < 0.01$; Appendix K3). Women with higher neuroticism scores thus had more severe symptoms of premenstrual and follicular negative affect.

Having established that neuroticism predicted negative affect during both the follicular and the late luteal phases, the aim of this analysis was to determine whether the relationship between neuroticism and premenstrual negative affect would persist after adjustment for differences in baseline (follicular) scores. A sequential multiple regression model was used with OC use/type entered in the first step, follicular negative affect scores in the second, and neuroticism in the third. Premenstrual negative affect served as the DV. Table 6.3 shows standardised (β) regression coefficients for all variables, and R^2 and R^2 change (sr^2 incremental), at each step.

Table 6.3
Sequential Regression of OC Use/Type, Follicular Negative Affect and Neuroticism on Premenstrual Negative Affect

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.21		
	Monophasic OC	-0.15		
	Triphasic OC	-0.03	0.02	0.02
2	NOC	-0.15		
	Monophasic OC	0.02		
	Triphasic OC	-0.07		
	Follicular negative affect	0.70***	0.46***	0.48***
3	NOC	-0.23		
	Monophasic OC	0.03		
	Triphasic OC	-0.10		
	Follicular negative affect	0.63***		
	Neuroticism	0.24**	0.05**	0.53***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

As illustrated in Table 6.3, follicular negative affect significantly predicted premenstrual negative affect, accounting for 46% of the variance (R^2change = 0.46, Fchange(1,104) = 93.52, $p < 0.001$). When neuroticism was added to the multiple regression model it was found to account for an additional 5% of the variance in premenstrual negative affect (R^2change = 0.05, Fchange(1,103) = 9.95, $p < 0.01$). Women with higher neuroticism scores had more severe premenstrual negative affect even after variation due to differences in baseline negative affect was removed.

In order to further examine the relationship between neuroticism and premenstrual negative affect, a multiple regression analysis was conducted with the six facets of neuroticism serving as IVs. This allowed the determination of whether a substantial proportion of variance could be attributed to one or more specific facet of neuroticism. OC use/type was entered in the first step of the regression model, follicular negative affect in the second, and the neuroticism facets in the third. Premenstrual negative affect served as the DV. The facets of neuroticism did not significantly add to the prediction of premenstrual negative affect. They did, however, significantly predict premenstrual negative affect when follicular negative affect was omitted from the model. The facets in this analysis accounted for 19% of the variance (R^2change = 0.19, Fchange(6,99) = 3.95, $p < 0.01$; Appendix K4). No individual predictor, however, contributed significantly to the multiple regression model.

6.3.2.3 Predictors of Cognitive Symptoms Across the Menstrual Cycle

Preliminary analysis indicated that all IVs together accounted for 38% of the variance in premenstrual cognitive symptoms ($R^2 = 0.38$, $F(17,91) = 3.33$, $p < 0.001$; Appendix K5). Only marital status and menstrual pain, however, contributed significantly to the model. Accordingly, a sequential multiple regression was conducted with OC use/type entered in the first step and marital status and menstrual pain in the second. The results indicated that together marital status and menstrual pain accounted for 20% of the variance in premenstrual cognitive symptoms (R^2change = 0.20, Fchange(2,103) = 13.41, $p < 0.001$; Appendix K6). Single women and women who reported more severe menstrual pain had more severe premenstrual cognitive symptoms. When this regression was repeated with follicular scores serving as the DV, marital status and menstrual pain together accounted for 14% of the variance (R^2change = 0.14, Fchange(2,103) = 8.50, $p < 0.001$; Appendix K7). Examination of the regression coefficients, however, indicated that only marital status contributed significantly to the DV. Single women had more severe follicular cognitive symptoms than women who were either married/in a defacto relationship.

Having established that marital status predicted cognitive symptoms durin_g both the follicular and the late luteal phases, the aim of this analysis was to determine whether the relationship between marital status and premenstrual cognitive symptoms would persist after adjustment for differences in follicular scores. Although not predictive of follicular cognitive symptoms, menstrual pain remained in the equation in order that the proportion of variance in cognitive symptoms accounted for by predictors could be directly compared across analyses. A sequential multiple regression model was used with OC use/type entered in the first step, follicular cognitive symptoms scores in the second, and marital status and menstrual pain in the third. Premenstrual cognitive symptoms served as the DV. Table 6.4 shows standardised (β) regression coefficients for all variables, and R^2 and R^2 change (sr^2 incremental), at each step.

Table 6.4
Sequential Regression of OC Use/Type, Follicular Cognitive Symptoms, and Marital Status and Menstrual Pain, on Premenstrual Cognitive Symptoms

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.18		
	Monophasic OC	-0.09		
	Triphasic OC	-0.00	0.02	0.02
2	NOC	-0.15		
	Monophasic OC	-0.04		
	Triphasic OC	-0.07		
	Follicular cognitive symptoms	0.69***	0.46***	0.48***
3	NOC	-0.20		
	Monophasic OC	-0.13		
	Triphasic OC	-0.13		
	Follicular cognitive symptoms	0.62***		
	Marital status	-0.14		
	Menstrual pain	0.23*	0.07**	0.55***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

As can be seen in Table 6.4, follicular cognitive symptoms significantly predicted premenstrual cognitive symptoms, accounting for 46% of the variance (R^2change =

0.46, Fchange(1,104) = 91.05, $p < 0.001$). When marital status and menstrual pain were added to the multiple regression model they were found to account for a further 7% of the variance in premenstrual cognitive symptoms (R^2change = 0.07, Fchange (2,102) = 7.91, $p < 0.01$). Examination of the regression coefficients indicated that only menstrual pain contributed significantly to the prediction of the DV.

6.3.2.4 Predictors of Behaviour Change Across the Menstrual Cycle

Preliminary analysis indicated that all IVs together accounted for 43% of the variance in premenstrual behaviour change ($R^2 = 0.43$, $F(17,91) = 3.98$, $p < 0.001$; Appendix K8). Age, marital status and menstrual pain contributed significantly to the model. When the multiple regression was repeated with non-significant predictors eliminated, only marital status and menstrual pain remained as significant predictors (Appendix K9). Accordingly, a sequential multiple regression was conducted with OC use/type entered in the first step, and marital status and menstrual pain in the second. The results indicated that together marital status and menstrual pain accounted for 27% of the variance in premenstrual behaviour change (R^2change = 0.27, Fchange(2,103) = 19.86, $p < 0.001$; Appendix K10). As was the case for cognitive symptoms, single women and women who reported more severe menstrual pain had more severe premenstrual behaviour change. When this regression was repeated with follicular scores serving as the DV, marital status and menstrual pain accounted for 13% of the variance (R^2change = 0.13, Fchange(2,103) = 7.71, $p <$ 0.01; Appendix K11). Examination of the regression coefficients, however, indicated that only marital status significantly predicted the DV. Single women had more severe premenstrual behaviour change than women who were married/in a defacto relationship.

Having established that marital status predicted behaviour change during both the follicular and the late luteal phases, the aim of this analysis was to determine whether the relationship between marital status and premenstrual behaviour change would persist after adjustment for differences in follicular scores. Although not predictive of

follicular behaviour change, menstrual pain remained in the equation in order that the proportion of variance in behaviour change accounted for by predictors could be directly compared across analyses. A sequential multiple regression model was used with OC use/type entered in the first step, follicular behaviour change in the second, and marital status and menstrual pain in the third. Premenstrual behaviour change served as the DV. Table 6.5 shows standardised (β) regression coefficients for all variables, and R^2 and R^2 change (sr^2 incremental), at each step.

Table 6.5
Sequential Regression of OC Use/Type, Follicular Behaviour Change, and Marital Status and Menstrual Pain, on Premenstrual Behaviour Change

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.20		
	Monophasic OC	-0.28		
	Triphasic OC	-0.05	0.03	0.03
2	NOC	-0.04		
	Monophasic OC	-0.11		
	Triphasic OC	0.03		
	Follicular behaviour change	0.71***	0.49***	0.53***
3	NOC	-0.07		
	Monophasic OC	-0.19		
	Triphasic OC	-0.03		
	Follicular behaviour change	0.61***		
	Marital status	-0.25***		
	Menstrual pain	0.19**	0.09***	0.62***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

As illustrated in Table 6.5, follicular behaviour change significantly predicted premenstrual behaviour change, accounting for 49% of the variance (R^2change = 0.49, Fchange(1,104) = 107.62, $p < 0.001$). When marital status and menstrual pain were added to the multiple regression model they were found to account for an additional 9% of the variance in premenstrual behaviour change (R^2change = 0.09, Fchange(2,102) = 12.30, $p < 0.001$). Examination of regression coefficients indicated

that both marital status and menstrual pain contributed significantly to the prediction of the DV.

6.3.2.5 Predictors of Somatic Symptoms Across the Menstrual Cycle

Preliminary analysis indicated that all the IVs together accounted for 44% of the variance in premenstrual somatic symptoms ($R^2 = 0.44$, $F(17,91) = 4.15$, $p < 0.001$; Appendix K12). Only marital status, neuroticism and menstrual pain contributed significantly to the model. Accordingly, a sequential multiple regression was conducted with OC use/type entered in the first step, and marital status, neuroticism and menstrual pain in the second. The results indicated that together, marital status, neuroticism and menstrual pain accounted for 28% of the variance in premenstrual somatic symptoms (R^2change = 0.28, Fchange$(3,102) = 14.28$, $p < 0.001$; Appendix K13). Single women, women who scored more highly on the neuroticism scale, and women who reported more severe menstrual pain had more severe premenstrual somatic symptoms. When this regression was repeated with follicular scores serving as the DV, marital status, neuroticism and menstrual pain accounted for 21% of the variance (R^2change = 0.21, Fchange$(3,102) = 9.31$, $p < 0.001$; Appendix K14). Examination of the regression coefficients, however, indicated that only marital status and neuroticism contributed significantly to the DV. Single women and women who scored more highly on the neuroticism scale had more severe follicular somatic symptoms.

Having established that marital status and neuroticism predicted somatic symptoms during both the follicular and the late luteal phases, the aim of this analysis was to determine whether the relationship between marital status, neuroticism and premenstrual somatic symptoms would persist after adjustment for differences in follicular scores. Although not predictive of follicular somatic symptoms, menstrual pain remained in the equation in order that the proportion of variance in somatic symptoms accounted for by predictors could be directly compared across analyses. A sequential multiple regression model was used with OC use/type entered in the first step, follicular somatic symptoms in the second, and marital status, neuroticism and

menstrual pain in the third. Premenstrual somatic symptoms served as the DV. Table 6.6 shows standardised (β) regression coefficients for all variables, and R^2 and R^2 change (sr^2 incremental), at each step.

Table 6.6
Sequential Regression of OC Use/Type, Follicular Somatic Symptoms, and Marital Status, Neuroticism and Menstrual Pain, on Premenstrual Somatic Symptoms

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.07		
	Monophasic OC	-0.14		
	Triphasic OC	0.12	0.04	0.04
2	NOC	0.08		
	Monophasic OC	0.05		
	Triphasic OC	0.14		
	Follicular somatic symptoms	0.73***	0.51***	0.55***
3	NOC	-0.05		
	Monophasic OC	-0.09		
	Triphasic OC	0.02		
	Follicular somatic symptoms	0.64***		
	Marital status	-0.03		
	Neuroticism	0.08		
	Menstrual pain	0.29***	0.08***	0.63***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

As illustrated in Table 6.6, follicular somatic symptoms predicted premenstrual somatic symptoms, accounting for 51% of the variance (R^2change = 0.51, Fchange(1,104) = 116.68, $p < 0.001$). When marital status, neuroticism and menstrual pain were added to the multiple regression model they were found to account for a further 8% of the variance in premenstrual somatic symptoms (R^2change = 0.08, Fchange(3,101) = 7.74, $p < 0.001$). Examination of regression coefficients, however, indicated that only menstrual pain contributed significantly to the prediction of the DV.

6.3.2.6 Predictors of Autonomic Reactions Across the Menstrual Cycle

Preliminary analysis indicated that all the IVs together accounted for 42% of the variance in premenstrual autonomic reactions ($R^2 = 0.42$, $F(17,91) = 3.94$, $p < 0.001$; Appendix K15). Marital status, age, number of children, extraversion and menstrual pain contributed significantly to the model. Accordingly, a sequential multiple regression was conducted with OC use/type entered in the first step and marital status, age, number of children, extraversion and menstrual pain in the second. The results indicated that together the IVs (excluding OC use/type) accounted for 35% of the variance in premenstrual autonomic reactions (R^2change = 0.35, Fchange(5,100) = 10.78, $p < 0.001$; Appendix K16). Increased premenstrual autonomic reactions were positively associated with parity and menstrual pain, and negatively associated with age and extraversion. Women who were single were also more likely to experience greater premenstrual autonomic reactions that women who were married or in a defacto relationship. When this regression was repeated with follicular scores serving as the DV, the IVs (excluding OC use/type) accounted for 23% of the variance (R^2change = 0.23, Fchange(5,100) = 6.08, $p < 0.001$; Appendix K17). Examination of the regression coefficients, however, indicated that only marital status, extraversion and age significantly predicted the DV. Single women, younger women, and women who scored more highly on the extraversion scale had more severe premenstrual autonomic reactions.

Having established that marital status, age and extraversion predicted autonomic reactions during both the follicular and the late luteal phases, the aim of this analysis was to determine whether the relationship between these IVs and premenstrual autonomic reactions would persist after adjustment for differences in follicular scores. Although not predictive of follicular autonomic reactions, number of children and menstrual pain remained in the equation in order that the proportion of variance in cognitive symptoms accounted for by predictors could be directly compared across analyses. A sequential multiple regression model was used with OC use/type entered in the first step, follicular autonomic reactions in the second, and marital status, age, number of children, extraversion and menstrual pain in the third. Premenstrual

autonomic reactions served as the DV. Table 6.7 shows standardised (β) regression coefficients for all variables, and R^2 and R^2 change (sr^2 incremental), at each step.

Table 6.7
Sequential Regression of OC Use/Type, Follicular Autonomic Reactions, and Marital Status, Age, Number of Children, Extraversion and Menstrual Pain, on Premenstrual Autonomic Reactions

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.11		
	Monophasic OC	-0.00		
	Triphasic OC	-0.01	0.01	0.01
2	NOC	0.08		
	Monophasic OC	0.15		
	Triphasic OC	0.08		
	Follicular autonomic reactions	0.65***	0.42***	0.43***
3	NOC	0.04		
	Monophasic OC	0.10		
	Triphasic OC	0.04		
	Follicular autonomic reactions	0.51***		
	Marital status	-0.19*		
	Age	-0.19*		
	Extraversion	-0.17*		
	Number of children	0.27**		
	Menstrual pain	0.20**	0.12***	0.55***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

As can be seen in Table 6.7, follicular autonomic reactions accounted for 42% of the variance in premenstrual autonomic reactions (R^2change = 0.42, Fchange(1,104) = 76.96, $p < 0.001$). When marital status, age, extraversion, number of children and menstrual pain were added to the multiple regression model they were found to account for a further 12% of the variance in premenstrual autonomic reactions (R^2change = 0.12, Fchange(5,99) = 5.39, $p < 0.001$). Examination of regression coefficients indicated that all IVs contributed significantly to the prediction of the DV.

Examination of the bivariate correlations between the IVs and the DV in comparison to the standardised regression coefficients for each IV however, revealed the presence of a suppressor variable. Number of children predicted (β = 0.27), but did not correlate with, premenstrual autonomic reactions (r = 0.02). Successive elimination of each IV and examination of any impact on the regression coefficient for number of children, indicated that either marital status or age (or both) was acting as a suppressor variable. The prediction of premenstrual autonomic reactions from number of children thus appeared due to the influence of age/marital status rather than any real relationship between these variables (Cohen & Cohen, 1983).

In order to further examine the relationship between extraversion and premenstrual autonomic reactions, a multiple regression analysis was conducted with the six facets of extraversion serving as IVs. This allowed the determination of whether a substantial proportion of variance could be attributed to one or more specific facet of extraversion. OC use/type was entered in the first step of the regression model, follicular autonomic reactions in the second, and the extraversion facets in the third. Premenstrual autonomic reactions served as the DV. The facets of extraversion together significantly added to the prediction of premenstrual autonomic reactions, accounting for 7% of the variance (R^2 change = 0.07, Fchange(6,98) = 2.27, $p < 0.05$; Appendix K18). Furthermore the individual facet, "activity", contributed significantly to the multiple regression model.

Table 6.8 shows the effect of holding constant "activity" prior to entry of the other facets of extraversion. OC use/type was entered in the first step of the multiple regression model, follicular autonomic reactions in the second, activity in the third, and the remaining facets of extraversion in the fourth. Premenstrual autonomic reactions served as the DV. Table 6.8 shows standardised (β) regression coefficients for all variables, and R^2 and R^2 change (sr^2 incremental), at each step.

Table 6.8
Sequential Regression of OC Use/Type, Follicular Autonomic Reactions, Activity, and the other Extraversion Facets on Premenstrual Autonomic Reactions

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.11		
	Monophasic OC	-0.00		
	Triphasic OC	-0.01	0.01	0.01
2	NOC	0.08		
	Monophasic OC	0.15		
	Triphasic OC	0.08		
	Follicular autonomic reactions	0.65***	0.42***	0.43***
3	NOC	0.13		
	Monophasic OC	0.20		
	Triphasic OC	0.12		
	Follicular autonomic reactions	0.62***		
	Activity	-0.18*	0.03*	0.46***
4	NOC	0.16		
	Monophasic OC	0.21		
	Triphasic OC	0.13		
	Follicular autonomic reactions	0.60***		
	Activity	-0.17*		
	Warmth	0.16		
	Gregariousness	-0.13		
	Assertiveness	-0.06		
	Excitement seeking	-0.11		
	Positive emotions	-0.02	0.04	0.50***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

As illustrated in Table 6.8, and as previously indicated, follicular autonomic reactions predicted premenstrual autonomic reactions, accounting for 42% of the variance. When activity was added to the multiple regression model it was found to account for a further 3% of the variance in premenstrual autonomic reactions (R^2change = 0.03, Fchange(1,103) = 5.79, $p < 0.05$). Higher scores on the activity scale were associated with less severe premenstrual autonomic reactions. The addition of the remaining facets of extraversion did not significantly improve R square.

6.3.2.7 Predictors of Fluid Retention Across the Menstrual Cycle

Preliminary analysis indicated that all the IVs together accounted for 34% of the variance in premenstrual fluid retention (R^2 = 0.34, $F(17,91) = 2.71$, $p < 0.01$; Appendix K19). Only menstrual cycle length and menstrual pain contributed significantly to the model. When the multiple regression was repeated with non-significant predictors eliminated, only menstrual pain remained a significant predictor (Appendix K20). Accordingly, a sequential multiple regression was conducted with OC use/type entered in the first step and menstrual pain in the second. The results indicated that menstrual pain accounted for 11% of the variance in premenstrual fluid retention (R^2change = 0.11, Fchange$(1,104) = 13.81$, $p < 0.001$; Appendix K21). Women who reported more severe menstrual pain had more severe premenstrual fluid retention. When this regression was repeated with follicular scores serving as the DV, menstrual pain was not found to significantly predict follicular fluid retention (R^2change = 0.01, Fchange$(1,104) = 0.61$, $p > 0.05$; Appendix K22).

Since menstrual pain did not predict follicular fluid retention, an analysis holding constant follicular scores and examining any remaining effect of menstrual pain on premenstrual scores was not necessary for this DV. However, this analysis was still necessary from the point of view of determining the extent to which follicular fluid retention predicts premenstrual fluid retention. Menstrual pain was added in a third step of the model in order that the amount of variance accounted for after holding constant follicular scores could be determined. A sequential multiple regression model was used with OC use/type entered in the first step, follicular fluid retention scores in the second, and menstrual pain in the third. Premenstrual fluid retention served as the DV. Table 6.9 shows standardised (β) regression coefficients for all variables, and R^2 and R^2 change (sr^2 incremental), at each step.

Table 6.9
Sequential Regression of OC Use/Type, Follicular Fluid Retention and Menstrual Pain on Premenstrual Fluid Retention

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.11		
	Monophasic OC	-0.20		
	Triphasic OC	0.13	0.07	0.07
2	NOC	-0.04		
	Monophasic OC	-0.11		
	Triphasic OC	0.15		
	Follicular fluid retention	0.36***	0.12***	0.20***
3	NOC	-0.14		
	Monophasic OC	-0.26		
	Triphasic OC	0.02		
	Follicular fluid retention	0.33***		
	Menstrual pain	0.32***	0.09***	0.29***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

As can be seen in Table 6.9, follicular fluid retention significantly predicted premenstrual fluid retention, accounting for 12% of the variance (R^2change = 0.12, Fchange(1,104) = 16.07, $p < 0.001$). When menstrual pain was added to the multiple regression model it was found to account for a further 9% of the variance in premenstrual fluid retention (R^2change = 0.09, Fchange(1,103) = 13.37, $p < 0.001$).

6.3.2.8 Integration of Results

To allow a comparison of predictors of menstrual cycle symptomatology across symptom sub-scales and menstrual cycle phase, a representation of results is presented in Table 6.10. Table 6.10 indicates which individual predictors were significant in the final step of each multiple regression, with the exception of the facet analyses for neuroticism and extraversion.

Table 6.10

Significance of Independent Variables in Predicting Menstrual Cycle Symptomatology by Menstrual Cycle Phase and Symptom Sub-scale

	Premenstrual Phase						Follicular Phase						Premenstrual Phase after holding constant follicular scores[c]					
Independent variable	Negative Affect	Cognitive Symptoms	Behaviour Change	Autonomic Reactions	Fluid Retention	Somatic Symptoms	Negative Affect	Cognitive Symptoms	Behaviour Change	Autonomic Reactions	Fluid Retention	Somatic Symptoms	Negative Affect	Cognitive Symptoms	Behaviour Change	Autonomic Reactions	Fluid Retention	Somatic Symptoms
NOC[a]																		
Monophasic OC[a]																		
Triphasic OC[a]																		
Marital status		***	***	**		**		***	***	*		***			***	*		
Age				**						**						*		
Number of children				***												**		
Employment Status																		
Menstrual Pain		*	*	*	***	***								**	**	**	***	***
Age menarche																		
MC[b] length																		
MC variation																		
Length menstruation																		
Neuroticism	***					*	**					*	**					
Extraversion				**						*						*		
Openness																		
Agreeableness																		
Conscientiousness																		

[a] Variables entered in the first step of each analysis. Significant results thus refer to the prediction of the DV after variance due to these variables had been removed.

[b] MC = menstrual cycle.

[c] Significant results in this section refer to the prediction of the DV after variance due to follicular scores had been removed.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

As illustrated in Table 6.10, degree of menstrual pain and marital status were the most consistent predictors of premenstrual symptoms. Menstrual pain was related to premenstrual symptoms in all sub-scales with the exception of negative affect, and was particularly predictive of fluid retention and somatic symptoms. Menstrual pain did not predict any follicular symptomatology and consequently continued to predict premenstrual symptoms even when follicular scores were held constant. Marital status, on the other hand, was related to autonomic reactions, behaviour change, cognitive symptoms and somatic symptoms during both the premenstrual and the follicular phases. When variance attributable to baseline scores was held constant, marital status continued to predict premenstrual behaviour change and autonomic reactions, but not cognitive or somatic symptoms. It should be noted that given the importance of marital status as a predictor variable, relationship status was examined in more detail in a series of subsequent analyses which are not reported here. Consideration of relationship history, differences between marriage and defacto relationships, and interrelationships with age and parity, did not contribute to the variance in the models, or hence to the understanding of the results. Age predicted follicular autonomic reactions in addition to premenstrual autonomic reactions both before and after controlling for follicular scores. Recall from section 6.3.2.6 above, that although number of children predicted premenstrual autonomic reactions, this was the result of the influence of suppressor variables rather than a real relationship between the two variables. Personality variables predicted few premenstrual symptoms. Extraversion predicted autonomic reactions during the premenstrual phase, the follicular phase, and the premenstrual phase after controlling for follicular scores. Much of this relationship was attributable to the extraversion facet, "activity". When variance due to this facet was removed, the other extraversion facets did not account for a significant amount of variance in premenstrual scores. Neuroticism predicted somatic symptoms and negative affect during both menstrual cycle phases, but only the relationship between neuroticism and negative affect persisted when follicular scores were controlled. The relationship between neuroticism and negative affect could not be linked to any particular facet of neuroticism.

6.3.3 Differences Between the OC Groups in Personality and Menstrual Cycle Variables

As noted in sections 5.3.7.5 and 5.3.7.7, repeated measures ANOVA's indicated a main effect of OC use/type for somatic symptoms and fluid retention. When collapsed across menstrual cycle phase, monophasic OC users had significantly higher symptoms than triphasic users. The mean for the NOC group fell between the two other groups but did not differ significantly from either of them. The possibility that this result could be attributable to differences between the groups in demographic characteristics was discussed in section 5.4.5. In the current section, the groups were also examined to ascertain whether they differed on personality or menstrual cycle variables that may account for the result. Examination of the correlations between the OC variables and personality and menstrual cycle variables (Table 6.2) revealed few relationships that warranted further exploration. Only three variables correlated with OC use/type. These were neuroticism, agreeableness, and variability in menstrual cycle duration. These data were subjected to one-way ANOVAs. Because of the large number of women in the NOC (n = 66) relative to both OC groups (n = 22 and 18), 20 women from this group were randomly selected in order to keep the sample sizes as similar as possible. Results indicated that neuroticism significantly discriminated between the groups, $F(2, 52) = 4.13$, $p < 0.05$. Post-hoc tests using the Newman-Keuls method revealed that monophasic OC users scored significantly higher on neuroticism ($M = 64.58$, $SD = 10.05$) compared to the NOC group ($M = 54.04$, $SD = 12.04$). The triphasic group ($M = 57.62$, $SD = 14.30$) fell between the other two groups but did not differ significantly from either of them. Menstrual cycle variability also differed between the groups, $F(2,57) = 4.97$, $p < 0.05$, with both monophasic ($M = 1.09$, $SD = 1.48$) and triphasic ($M = 0.72$, $SD = 0.96$) OC users reporting significantly less variability than the NOC group ($M = 5.15$, $SD = 8.31$). Agreeableness did not differ between the groups.

6.4 Discussion

6.4.1 The Relationship Between Neuroticism and Premenstrual Negative Affect

The prediction of premenstrual negative affect from neuroticism is consistent with the results of a number of studies demonstrating a correlation between neuroticism and premenstrual affective symptoms (Coppen & Kessel, 1963; J.W. Taylor, 1979b; Harding et al., 1985). This result is not unexpected given that neuroticism includes components (e.g. anxiety, depression) that are common to the negative affect scale. The finding that neuroticism also predicted follicular scores, supports a view of neuroticism exerting a generalised influence on symptom experience across the menstrual cycle. The more interesting and unexpected finding is the fact that a relationship between neuroticism and premenstrual negative affect appears to occur over and above that which can be attributable to this generalised effect of neuroticism on symptom experience. The current results indicate that even when initial differences in baseline affective symptomatology are held constant, neuroticism predicts premenstrual negative affect. This indicates that neuroticism has an effect on symptom experience that is specific to the premenstrual phase, and suggests that women scoring more highly on the neuroticism scale are more likely to experience a premenstrual increase in affective symptoms. One possible mechanism for such an effect is an interaction between neuroticism and physiological changes across the menstrual cycle. For instance, women scoring more highly on neuroticism may be more reactive to, or less able to cope with, biological changes occurring premenstrually. An alternative explanation is that neuroticism interacts with expectations about the premenstrual period. In other words, high scorers may be more prone to selectively attend to information congruent with their stereotypes of premenstrual changes. This explanation is less likely given the limited experimental demand characteristics of the study, but is worthy of further research.

When the individual facets of neuroticism were entered into a multiple regression model in place of the domain score, they were found to predict premenstrual negative

affect. They did not, however, continue to predict premenstrual symptoms if variance due to follicular scores was first removed. This was unexpected given that neuroticism as a whole predicted premenstrual symptoms both before and after controlling for baseline symptomatology. The failure of the neuroticism facets to add significantly to R squared following entry of follicular scores was presumably the result of the increased degrees of freedom in this model. After controlling for OC use/type and follicular scores, entry of the facets increased the total number of predictor variables to 10. It is well established that the inclusion of a large number of IVs attenuates statistical power and increases the probability of making a type II error (e.g. Cohen & Cohen, 1983). Neuroticism accounted for five percent of the variability in the DV both when entered as a domain score and when entered as constituent facet scores. While this was statistically significant in the former analysis, it was offset in the facet analysis by increased degrees of freedom. With the concomitant reduction in power, statistical significance was not obtained.

Nonetheless, the analyses of the neuroticism facets did provide insight into the relationship between neuroticism and premenstrual negative affect. As indicated above, the facets *did* predict premenstrual symptoms *when follicular scores were omitted from the model.* In this analysis, the facets together accounted for 19% of the variance in premenstrual negative affect. No individual predictor, however, contributed significantly to the multiple correlation squared. This finding was interesting. Given that premenstrual symptoms have been linked specifically to anxiety and depression, relationships based on these facets were expected to be stronger than those involving other components of neuroticism (e.g. vulnerability, impulsiveness). This was not observed; rather these results suggest that it is neuroticism as a whole that is an important concomitant of premenstrual affective symptoms. To the authors' knowledge, this issue has not previously been addressed, and thus there is no relevant literature with which to draw comparisons. It is worth noting, however, that research relating to constructs such as life satisfaction, happiness, and positive and negative affect, has involved comparison of neuroticism as a domain with its constituent facets. Findings from these studies have suggested

neuroticism to have a "temperamental basis" (Watson & Clark, 1992, p. 468) with the facets as a whole exerting broad and general rather than differential effects (Costa & McCrae, 1984; Watson & Clark, 1992). This work supports this hypothesis and suggests that in terms of menstrual cycle affective changes, assessment of neuroticism as a domain is more informative than assessment of any individual facet subsumed by it.

6.4.2 The Relationship Between Neuroticism and Other Premenstrual Symptoms

Neuroticism was also found to predict somatic symptoms during both menstrual cycle phases. The prediction of premenstrual scores, however, did not persist after controlling for follicular scores. The finding that somatic symptoms were higher in women with higher neuroticism scores was not unexpected. A number of other researchers have noted neuroticism to correlate with premenstrual non-affective symptoms (Coppen & Kessel, 1963; Harding et al., 1985). What is somewhat surprising, however, is that neuroticism correlated with somatic symptoms but not the other symptom sub-scales. Researchers who have noted neuroticism to predict premenstrual symptomatology have generally reported correlations with a greater variety of symptoms. Coppen and Kessel noted correlations between neuroticism and affective symptoms, headache and swelling, while Harding et al. found relationships with all of the MDQ sub-scales. A possible explanation for the discrepant results is the use of different data collection methods. The Coppen and Kessel study was based on retrospective data and the Harding et al. study on prospective reports on a single day of the late luteal phase only. Retrospective recall produces inflated symptom reports, particularly in women scoring highly on neuroticism scales (R.J. Taylor et al., 1991; van den Akker, Sharifian et al., 1995). Given that the participants in the Harding et al. study were aware of the study aims, and knew their current menstrual cycle phase, it is probable that symptom reports in this situation were also influenced by experimental demand characteristics. Women with higher neuroticism scores may have been particularly influenced by stereotypic conceptions of PMS (R.J. Taylor et

al., 1991; van den Akker, Sharifian et al., 1995). Use of these methodologies may thus have resulted in a less discriminant pattern of correlations with symptom sub-scales relative to the current results.

Also relevant to the current study is the finding of Watson and Clark (1984) that trait negative affectivity is more strongly related to subjective experiences (feelings) than to objective ones. This may help explain why neuroticism did not predict all symptom sub-scales, although in the case of some MMDQ symptoms, the distinction between objective and subjective may be somewhat ambiguous. Nonetheless, relative to the affective symptoms, symptoms of fluid retention (e.g. weight gain, swelling), autonomic reactions (e.g. cold sweats, nausea/vomiting) and behaviour change (e.g. take naps, avoid social activities) are comparatively objective. The cognitive symptom sub-scale too, comprises some symptoms which are objective (e.g. accidents, insomnia), although others could be construed as falling into either category (e.g. forgetfulness, difficulty concentrating).

The somatic symptom sub-scale is more difficult to conceptualise in this context. Many of the symptoms are arguably relatively objective, yet were strongly related to neuroticism. This may be explained by considering the role of somatization in symptom reporting. Neuroticism has been consistently reported to relate to somatization (e.g. Pennebaker & Watson, 1991; Dickson, Hays, Kaplan, Scherl Abbott & Schmidtt, 1992; Hull, Tedlie & Lehn, 1995), with individuals scoring high in neuroticism being more likely to perceive, attend to, and report minor physical problems (Vassend, 1989; Watson & Pennebaker, 1989). Diffuse psychosomatic symptoms such as fatigue may be particularly common. Kuczmierczyk, Labrum and Johnson (1995) reported that somatization in women with premenstrual symptoms was influenced by depression. Women with PMS who reported depressed mood exhibited higher levels of somatization and alexithymia relative to women with PMS but non-depressed mood. The current results suggest the utility of investigating the relationships between premenstrual symptoms, somatization and neuroticism.

6.4.3 The Relationship Between Extraversion and Autonomic Reactions

An interesting finding of the current study was that autonomic reactions were strongly related to extraversion. Women with lower extraversion scores reported more autonomic reactions during both the premenstrual and follicular phases. Even after follicular scores were held constant, extraversion predicted premenstrual autonomic reactions. This suggests that less extraverted women report greater premenstrual increases in these symptoms. Much of this relationship was attributable to the extraversion facet "activity". When variance due to this facet was removed, the other extraversion facets did not account for a significant amount of variance in premenstrual scores.

Little previous research has focused on the relationship between extraversion and PMC. The majority of studies in the area to date have utilised Eysenck's (1964, 1975, 1994) three-factor model of personality and have indicated that extraversion is not related to premenstrual symptoms (Coppen & Kessel, 1963; Awaritefe et al., 1980; R.J. Taylor et al., 1991). Mohan and Chopra (1987) did, however, report a high PMT group to have significantly lower extraversion scores premenstrually compared to a low PMT group. This relationship was observed in unmarried but not married women. None of the above-cited studies examined premenstrual autonomic reactions so it is not possible to compare the current result specifically to past research. No work to date has focused on the constituent facets of extraversion.

It is interesting to note at this point, the findings of Lu and colleagues (Lu & Argyle, 1991; Lu, 1994) who reported low levels of extraversion to relate to adverse symptoms. In contrast, McCrae and Costa (1991) and Watson and Clark (1992) argue that while extraversion is related to positive affects, it does not protect against adverse symptoms. While the former tenet of these authors was not addressed in the current study, the results indicate that extraversion can protect against at least the specific symptoms of autonomic reactions.

The manner in which extraversion, and specifically "activity", relates to autonomic reactions is not clear. To reiterate relevant definitions, extraversion is principally a description of interpersonal behaviour and relates primarily to the "preferred quantity of social stimulation" (Costa, McCrae & Dye, 1991, p. 888). "Activity" refers to the desire for rapid tempo, vigorous movement and the need to keep busy. The autonomic symptom sub-scale comprises dizziness/faintness, cold sweats, nausea/vomiting and hot flushes. Although causality can not be inferred from correlational data, personality characteristics are theoretically more likely to influence symptomatology than vice versa. This premise is based on the fact that personality has biological underpinnings and is relatively enduring. Following this logically then, low "activity" would be expected to result in autonomic symptoms. In this case, however, the opposite could conceivably be true with autonomic symptomatology contributing to a pervasive lack of desire for "activity". An additional alternative is that the same mechanism may underlie both autonomic symptomatology and "activity".

According to Eysenck (1967), extraversion is underpinned physiologically by activity in the corticoreticular loop. Introverts are postulated to have higher levels of activity than extraverts and hence experience greater cortical arousal. The consequence of this is thought to be greater physiological responsiveness to stimulation in introverts relative to extraverts. The most consistent findings have been obtained from studies utlilising electrothermal measures. Introverts show greater orienting reactions to novel stimuli including increased skin conductance, digital vasoconstriction, cephalic vasodilation, heart rate deceleration and electroencephalogram desynchronisation.

Similar measures of physiological responsiveness have also been postulated to vary across the menstrual cycle. For instance, Asso and Beech (1975) used a galvanic skin response and observed a greater susceptibility to acquiring a conditioned response premenstrually compared to intermenstrually (according to Eysenck's theory, introversion should be associated with increased conditionability (J.A. Gray, 1981)). Ussher and Wilding (1992) argue that there is now substantial evidence indicating that physiological activation or sensitivity varies during the menstrual cycle, with

increased physiological and self-reported arousal increasing premenstrually. They further suggest that these increases are more pronounced in women with self-reported PMS relative to controls.

Based on these postulates, it could be hypothesised that higher arousal in introverts may contribute to the experience of autonomic reactions, particularly in the premenstrual phase. It is widely accepted that arousal leads to symptoms such as sweating, trembling, flushing and nausea; symptoms akin to those constituting autonomic reactions (Costa & McCrae, 1987). In the absence of further empirical research, however, this is purely speculative.

6.4.4 The Relationship Between Personality Characteristics and Premenstrual Symptoms - Comment

With the exception of neuroticism and extraversion, personality characteristics did not predict premenstrual symptoms. While previous research in health psychology provided a prima facie case for their examination, no evidence was found to suggest a role for openness, agreeableness or conscientiousness in menstrual cycle symptomatology.

The current results are of interest, however, since few other studies have examined premenstrual symptoms in relation to a comprehensive theory of personality. The vast majority of previous research using major personality paradigms has focused on Eysenck's (1964, 1975, 1994) model. As indicated by T.W. Smith and Williams (1992), however, research and theory in personality and health have not taken full advantage of the recent advances in general personality theory. Current personality research suggests that personality can be assessed using five dimensions; anything less than five dimensions fails to give an adequate picture of the individual. The current findings suggest that of these five factors, neuroticism and extraversion are the most significant concomitants of premenstrual symptoms. If the other personality factors play a role, their influence is obscured by more important correlates or by

more complicated relationships. Subsequent research into personality and PMC will thus be most fruitful if the roles of neuroticism and extraversion are further explored.

6.4.5 The Relationship Between Menstrual Pain and Premenstrual Symptoms

Menstrual pain was the most consistent concomitant of premenstrual symptoms, predicting all symptoms groups except negative affect. Women who reported more severe menstrual pain also reported more severe premenstrual symptoms. This relationship was particularly strong for the physical symptom sub-scales of fluid retention and somatic symptoms. Menstrual pain did not predict any follicular symptomatology, suggesting that the effect of menstrual pain is not generalised but occurs specific to the premenstrual phase. This conclusion is further supported by the fact that menstrual pain predicted premenstrual symptoms even when follicular scores were held constant. This suggests that women with more severe menstrual pain, experience a greater *increase* in premenstrual symptoms.

These results are consistent with those of a number of researchers who have noted dysmenorrhoea to correlate with a variety of premenstrual symptoms and/or premenstrual change (Clare, 1983; Steege et al., 1985; Graham & Sherwin, 1987). The mechanism for this relationship is not clear but several explanations merit consideration. A common underlying biological mechanism may contribute to both menstrual pain and premenstrual symptoms. It is also possible, however, that the relationship may be an effect of a personality variable such as neuroticism, with some women prone to "complaining" about premenstrual *and* menstrual symptoms (Coppen, 1965; Harding et al., 1985). The anticipation of dysmenorrhoea may also cause premenstrual symptoms. That is, the menstrual cycle may become more salient among women who experience greater menstrual pain and hence symptoms may be attributed to the perimenstrual period.

The current results suggest the former explanation to be the most likely. If the anticipation of menstrual pain contributes to premenstrual problems, symptoms of negative affect would be expected to predominate. In this study, negative affect was the only sub-scale that was *not* predicted by menstrual pain. There is little basis on which to suggest that other symptoms, particularly those such as fluid retention, would occur in response to the anticipation of pain. The "complaining personality" hypothesis is also not supported by these results since menstrual pain did not correlate with neuroticism.

It is not clear what sort of mechanism could contribute to both menstrual pain and premenstrual symptoms. As discussed in section 3.1, numerous endocrinological and biochemical hypotheses have been proposed to explain the aetiology of premenstrual symptoms. Despite this, no hypothesis has been empirically supported. There is evidence, however, that prostaglandins contribute to dysmenorrhoea (Budoff, 1979; Friederich, 1983; Yankauskas, 1990). Prostaglandins affect various bodily tissues and systems including the breasts, reproductive tract and central nervous system (Bancroft & Bäckström, 1985; see Budoff, 1987 for review). Prostaglandins may increase in the late luteal phase in response to decreasing progesterone levels. Endometrial prostaglandins are thought to stimulate uterine blood vessels resulting in cramping and subsequent menstrual pain. Certain prostaglandins have been documented to be higher in women with dysmenorrhoea (Pulkkinen & Kaihola, 1977). Several double-blind studies have also suggested that prostaglandins inhibitors ameliorate various physical and psychological premenstrual symptoms (C. Wood & Jakubowicz, 1980; Mira, McNeil, Fraser, Vizzard & Abraham, 1986; Budoff 1987). Future research may thus benefit from exploration of the relationships between premenstrual change, prostaglandins, and other factors associated with menstrual pain.

6.4.6 The Relationship Between Other Menstrual Cycle Variables and Premenstrual Symptoms

With the exception of menstrual pain, no other menstrual cycle variables predicted premenstrual symptomatology. Other researchers have noted menstrual cycle length, menstrual cycle variability, age of menarche, and duration of menstrual flow, to relate to premenstrual symptoms. Research in this area, however, has yielded widely discrepant results with some researchers reporting associations (e.g. Moos, 1968; Sheldrake & Cormack, 1976) and others finding no significant effects (e.g. Graham & Sherwin, 1987; Hammarbäck & Bäckström, 1989). Again, methodological concerns may account for some of the variability in findings. The tendency to "complain" may be particularly relevant here. Clare (1983) noted that women who report moderate to severe premenstrual symptoms were more likely to have lengthy menstrual periods, lengthy menstrual cycles and an irregular onset of periods. However controlling for GHQ status eliminated these relationships. This suggests that women who complain of premenstrual symptoms may also complain of undesirable cycle characteristics. This may be exaggerated by retrospective recall and hence not apparent in the current study.

6.4.7 The Relationship Between Marital Status and Premenstrual Symptoms

Along with menstrual pain, marital status was the other consistent predictor of premenstrual symptoms. In all cases, single women experienced greater symptomatology than women who were married or in a defacto relationship. However, unlike menstrual pain, marital status had a more generalised effect on menstrual cycle symptoms. More specifically, many of the relationships between marital status and menstrual cycle symptoms were not specific to the premenstrual phase. Marital status was related to autonomic reactions, behaviour change, cognitive symptoms and somatic symptoms. These relationships occurred during both the follicular and the premenstrual phases. When variance attributable to baseline scores

was held constant, marital status continued to predict premenstrual behaviour change and autonomic reactions only.

It should also be noted that marital status correlated with a number of demographic variables, notably age and number of children. As expected, single women were more likely to be younger and to be nulliparous. With the exception of autonomic reactions, however, these demographic characteristics did not predict symptomatology.

The prediction of premenstrual symptoms from marital status was not expected since previous research in the area has yielded inconsistent results. There are a number of reasons, however, why single women may report more symptomatology relative to women who are living with a partner. Broadly, these results suggest a role for social support as a protector against the experience of adverse symptoms. A number of researchers have reported that the social support provided by significant others decreases the likelihood of developing illness (Miller & Ingham, 1976; Connell, Davis, Gallant & Sharpe, 1994). Miller and Ingham further suggest that psychological symptom levels probably vary with social support even when there is no serious life event present. The key factor appears not to be the number of people in the social support network but rather satisfaction with social support (Connell et al., 1994). This contention is supported by the work of Fontana and Pontari (1994) who found all women to perceive a lesser number of significant others as being present in their social support network premenstrually, but only women with PMS to be less satisfied with their social support premenstrually compared to postmenstrually. This suggests that it is dissatisfaction with support, rather than perceived number of people in the support network that contributes to premenstrual change. The Fontana and Pontari study, however, offers little insight into the particular role of support offered by a marriage/defacto relationship. No information regarding age or relationship status was provided, but all participants were undergraduate students so presumably young and primarily unmarried.

Satisfaction with social support is thought to act as a psychological buffer that protects against the detrimental effects of stress. In contrast, the absence of perceived support is associated with negative affect (Rook, 1984). Similarly, there is evidence that disrupted social supports (e.g. marital problems) can increase premenstrual problems (Clare, 1983). Nonetheless, the finding of a relationship between marital status and premenstrual symptoms was somewhat surprising given that some single women presumably get satisfactory social support from friends/family, and given that marriage does not necessarily reflect a supportive environment. However, a number of researchers have observed that married women *do* report higher levels of perceived social support than unmarried women (Connell, Fisher & Houston, 1992; Wineberger, Hiner & Tierney, 1987; Connell et al., 1994). Furthermore, the relationship between life stress and psychological symptoms has been reported to be greater in women living alone relative to those who are married or not living alone (Eaton, 1978). Living alone/not having a partner has also been found to be a risk factor for negative affect at menopause (Collins & Landgren, 1995; Dennerstein, Lehert, Burger & Dudley, 1999). These findings suggest that women who live alone may be more prone to developing symptoms in response to a stressful situation (e.g. the premenstrual period), possibly due to lower levels of perceived support.

The current finding may also be somewhat specific to the sample. The majority of participants were in their 20's and 30's, and most had a high level of education. Furthermore, factors which are sometimes associated with marriage (e.g. staying home, looking after small children) were not prevalent in this sample. Rather, all the women were working outside the home in some capacity. These factors may have contributed to a large number of partnered women being satisfied in their relationships. Sanders et al. (1983) suggested that the inescapable commitments of working in the home may make premenstrual symptoms harder to tolerate. This may account for the finding of Sanders et al. that marriage can act as a *risk* factor for PMC, and help explain why a similar result was not obtained in the current study.

Living with a partner may reduce premenstrual changes in a variety of ways. Having someone with whom to discuss problems and to turn to for help may enhance well-being directly. The social support and resources offered by a partner may increase a woman's perception of her ability to cope with premenstrual changes and thus the evaluation of a stress response may be attenuated. Support may also lead to a reduction in the perceived importance of premenstrual changes, or may provide a distraction from the problem. A partner may also facilitate general health behaviours such as exercise and good nutrition which appear to ameliorate premenstrual symptoms.

The relationships between marital status and behaviour change and autonomic reactions are of particular interest since they occur over and above that which can be attributable to a generalised effect of marital status on symptom reporting. The result for behaviour change is consistent with the finding of N.F. Woods et al. (1982c) who reported that married women were less likely than single women to take naps or stay in bed during the premenstrual or menstrual periods. As indicated above, this is possibly a result of increased social support, although it is conceivable that being in a couple confers additional responsibilities that decrease the likelihood of behaviour change. Married women appear to experience the same degree of negative affect as single women for instance but, due to greater demands placed upon them, may be less able to make behavioural changes to accommodate these affective states. In other words, partnered women may be equally likely to feel like taking a nap or avoiding social activities but may be more reluctant to act on these feelings.

All the above suggestions require further research. In general, the extent to which social supports play a role in alleviating premenstrual symptoms is still unclear, being a relatively neglected area of study. In the absence of more detailed studies of the particular role of marital status on premenstrual symptoms, such explanations must remain speculative. It should also be noted that the correlational nature of this design makes it impossible to rule out the possibility that the greater experience of

premenstrual symptoms and/or premenstrual change, increases the likelihood of being single. Such an explanation, however, is less likely.

6.4.8 The Relationship Between Other Demographic Characteristics and Premenstrual Symptoms

In general, no demographic characteristics other than marital status predicted premenstrual symptomatology. Age predicted autonomic reactions only, and parity and employment status did not act as significant predictors of any symptom type. Previous results with regard to age have been widely discrepant. Few studies have investigated autonomic reactions as a separate group, with some researchers combining them with somatic symptoms (e.g. Siegel et al., 1987) and others investigating demographic variables in relation to overall symptom scores (e.g. Graham & Sherwin, 1987). Only Moos investigated autonomic reactions specifically, finding age to be unrelated to premenstrual symptoms and negatively related to menstrual symptoms. The relationship between age and autonomic reactions in the current study is complicated by the comparatively large number of predictors of autonomic symptoms. The results indicate that women reporting autonomic reactions are more likely to be single, young and introverted. This is an unusual combination of risk factors and an explanation is not readily available.

The finding that employment status and parity were unrelated to premenstrual symptoms is consistent with previous studies (N.F. Woods et al., 1982c; Hammarbäck & Bäckström, 1989; Ainscough, 1990; Lee & Rittenhouse, 1992). It should be noted, however, that some researchers have noted that working outside the home protects against premenstrual symptoms (D. Friedman & Jaffe, 1985). In the current study participants were all employed and thus full-time work was contrasted to part-time/casual work. It was thus not possible here to compare the effects on premenstrual symptoms of employment outside the home with home duties.

6.4.9 Differences Between The OC Groups In Personality and Menstrual Cycle Variables

As indicated in chapter five, a main effect of OC use/type on somatic symptoms and fluid retention was noted. Monophasic OC users had a significantly higher level of symptoms than triphasic users. The mean for the NOC group fell between that of the two OC groups but did not differ significantly from either. The possibility that this result could be attributable to differences between the groups in demographic characteristics was discussed in section 5.4.5. Age was found to differ significantly between the groups, but results from part II of the study indicate that age does not predict premenstrual fluid retention or somatic symptoms. In this chapter, the groups were also examined to ascertain whether they differed on personality or menstrual cycle variables. Although these analyses were conducted on a sub-sample of women relative to part I of the study, the results can be used to help explain the relationship between OC type and physical symptoms. As expected, menstrual cycle variability was greater in the NOC relative to both OC groups. This result thus cannot explain the difference found in symptomatology between the monophasic and triphasic OC groups. Neuroticism level was also found to significantly differ between the groups. Monophasic OC users had slightly higher neuroticism levels than triphasic users and significantly higher levels than the NOC group. This needs to be considered when interpreting the higher levels of symptomatology in monophasic compared to triphasic OC users. However, there are a number of reasons that render involvement of neuroticism in the relationship between OC type and level of fluid retention/somatic symptoms unlikely. Firstly, if neuroticism did contribute to higher reporting of somatic and fluid retention symptoms, this should be evident in a linear relationship between symptom level and the neuroticism level of each OC group. (Recall from section 6.3.1 that there is no evidence for a non-linear relationship between neuroticism and menstrual cycle symptoms). Triphasic OC users, because of their higher neuroticism level, would thus be expected to report *increased* symptomatology relative to the NOC group. This was not the case. In other words, the pattern of results across OC group with regard to symptomatology is not the same as

the pattern of results with regard to neuroticism level. Monophasic OC users differed significantly from only triphasic OC users in symptomatology, but differed significantly from only the NOC group in neuroticism level. This suggests that if neuroticism did mediate the relationship between OC type and level of symptomatology, it was not the only contributing factor.

The second and perhaps more important argument against attributing higher physical symptomatology in monophasic users to neuroticism, is that if this was the case, monophasic users would also be expected to report high levels of negative affect relative to the other groups. Recall that in the multiple regression analyses, neuroticism did not predict fluid retention but was predictive of somatic symptoms and particularly negative affect. Negative affect, however, was not found to differ between the OC groups.

The finding of higher levels of neuroticism in the OC groups is, however, interesting in itself, and worthy of consideration. This finding is unlikely to be attributable to the age difference between the groups since neuroticism was standardised according to age relevant norms and would be expected to be lower, not higher, in the younger groups (i.e. in the two OC groups) (Costa & McCrae, 1992a). A possible explanation is that higher levels of neuroticism result in greater attention to, and/or reduced ability to deal with, premenstrual symptoms. Consequently, more neurotic women may adopt OC use due to a perceived efficacy of their role in reducing premenstrual symptoms. To the authors knowledge there have been no previous reports of higher levels of neuroticism in OC users; replication of this result would thus be pertinent.

PART THREE

SUMMARY AND INTEGRATION

CHAPTER 7

SUMMARY AND IMPLICATIONS OF MAIN FINDINGS

7.1 Summary of Main Findings

The results of this study demonstrated a very high incidence of premenstrual change. In excess of 40% of women demonstrated a 30% increase from the follicular to the late luteal phase in each symptom sub-scale. Close to 50% of women experienced increases in negative affect, and over 70% increases in fluid retention. Over 55% of the sample showed an overall premenstrual increase in symptoms. This suggests that the majority of women experience a marked premenstrual increase in a variety of symptoms. The results also indicate, however, that the 30% criterion may be too liberal when used to diagnose PMS.

A high percentage of women also demonstrated premenstrual increases in excess of 100 and 300% from the follicular phase. This clearly indicates that the changes experienced by many women are not merely mild as suggested by some researchers (e.g. Haskett, 1987). In many symptom sub-scales, as many women experienced changes of these higher magnitudes as they did changes in excess of 30% (but less than 100%). This meant that about 15% of women experienced changes in excess of 300% in each symptom sub-scale.

Symptom cyclicity was not limited to certain symptom types but rather all symptom sub-scales fluctuated markedly across the menstrual cycle. Symptoms were at there lowest during the follicular phase and increased significantly during the late luteal phase. Somatic symptoms were higher during the menstrual compared to the premenstrual phase, and fluid retention was higher premenstrually than menstrually. In general, however, the results indicate that symptom severity changes little between the premenstrual and menstrual phases. The current results further suggest that significant cyclicity occurs in a normal population of women, and is not the result of retrospective reporting or knowledge of study aims.

OC use did not alter the incidence or severity of premenstrual change in any symptom sub-scale. Overall differences in symptom severity between the OC groups, however, were noted with monophasic OC users reporting higher levels of fluid retention and somatic symptoms than the triphasic group. The most likely explanation for this result is that monophasic OCs result in generalised physical symptoms that occur independent of menstrual cycle phase.

The current results suggest that only a few key variables strongly predict premenstrual symptomatology. As expected, a specific relationship was observed between neuroticism and negative affect. Neuroticism exerted a generalised influence on affective symptoms but also an effect that was specific to the premenstrual phase. Women with higher neuroticism scores were more likely to experience greater premenstrual increases in affective symptoms. The relationship between neuroticism and negative affect could not be linked to any particular facet of neuroticism. Rather, these results were supportive of the hypothesis that neuroticism has a "temperamental basis" (Watson & Clark, 1992, p. 468) with the facets as a whole exerting broad and general rather than differential effects (Costa & McCrae, 1984; Watson & Clark, 1992).

Neuroticism did not predict any other symptom sub-scales once follicular scores had been held constant. Neuroticism did, however, exert a generalised effect on somatic symptoms, predicting symptoms during both the follicular and premenstrual phases. This is likely attributable to the role of neuroticism in somatization (e.g. Pennebaker & Watson, 1991; Dickson et al., 1992; Hull et al., 1995), with individuals scoring high in neuroticism being more likely to perceive, attend to, and report minor physical problems (Vassend, 1989; Watson & Pennebaker, 1989).

The only other personality factor to predict premenstrual symptomatology was extraversion. Women with lower extraversion scores reported more autonomic reactions throughout the menstrual cycle. They also reported greater premenstrual increases in symptomatology. Much of this relationship was attributable to the

extraversion facet "activity". The manner in which extraversion, and specifically "activity", relates to autonomic reactions is not clear but was discussed in the context of Eysenck's theory of increased arousal in introverts (Eysenck, 1967).

The cognitive, behavioural, somatic and fluid retention symptom sub-scales were predicted almost exclusively by menstrual pain and marital status. Menstrual pain showed a very clear pattern of predicting premenstrual but not follicular symptoms. As a result of this, degree of pain was strongly related to the extent of premenstrual change. Menstrual pain was particularly predictive of somatic symptoms and fluid retention. The very robust finding for menstrual pain is consistent with that of Graham and Sherwin (1987) who used multiple regression analyses to determine which variables predicted overall severity of premenstrual symptoms. The results indicated that dysmenorrhoea was the only significant predictor. Steege et al. (1985), however, cautions that while dysmenorrhoea may correlate with premenstrual symptoms, psychological factors are likely to be more influential. With the notable exception of negative affect, this was not the case in the current study. In addition, menstrual pain did not correlate with neuroticism. This indicates that the relationship between menstrual pain and premenstrual symptomatology is not an artefact of elevated symptom reporting. These results are suggestive of a common biological mechanism that contributes to both menstrual pain and premenstrual symptoms.

The relationship between marital status and premenstrual symptoms was also observed across symptom sub-scales but was more complicated. The effect occurred regardless of menstrual cycle phase, with single women reporting more cognitive, behavioural, autonomic and somatic symptoms during both the premenstrual and follicular phases. When variance attributable to baseline scores was held constant, marital status continued to predict premenstrual behaviour change and autonomic reactions only. Marriage/partnership was postulated to act as a protective factor against premenstrual symptoms due to increased social support.

With the exception of the aforementioned variables, no other menstrual cycle, demographic or personality variables predicted premenstrual symptomatology. The fewer significant predictors noted here relative to other large studies (e.g. Moos, 1968; N.F. Woods et al., 1982c) may be the result of the methods used. Relationships may be more likely to be observed in retrospective studies where participants may report symptoms in accord with stereotypic conceptions of PMS. It is assumed in the current study that since women reported symptoms daily, and were not aware of the study aims, that they were not influenced to any great extent by experimental demand characteristics or stereotypes of PMC. This supposition is supported by the results of premenstrual change across the menstrual cycle. The commonly held conception that symptoms decrease shortly following menstruation was not noted here, rather women reported similar levels of symptomatology across the premenstrual and menstrual phases. Furthermore, the significant predictors of premenstrual symptomatology could not be linked to neuroticism. This suggests that the observed relationships were not inflated by the general tendency to complain.

7.2 Implications for the Study of Premenstrual Changes

The results of the current study support previous recommendations (Halbreich & Endicott, 1982) that symptom sub-scales of PMC should be studied separately. While the high correlations between the sub-scales suggest some commonality in premenstrual symptoms, the differential relationships with predictor variables, and the variable impact of OC use/type, indicates some independence in terms of risk factors. This appears sufficient to warrant the additional effort of individual examination of symptom groups. This is particularly the case given that some key relationships (e.g. negative affect and neuroticism; extraversion and autonomic reactions, monophasic OC use and physical symptoms) would have been obscured by studying premenstrual symptoms as a single score.

The findings also indicate that the Moos (1968) factors effectively represent menstrual cycle symptoms. When factor analysed, a number of symptoms of the

MMDQ were found to load highly on more than one factor, suggesting that a number of slightly different solutions could adequately summarise the data. However, given the differences in methodology, the results were remarkably similar to those derived by Moos and replicated by Clare (1983). This suggests that the Moos factors are replicable across different samples and different methods of data collection. Hence, these results demonstrate the importance of conceptualising of PMC as consisting of different symptom groups, and lend support to the wide usage of the Moos factors.

The use of sequential multiple regression techniques proved valuable in elucidating predictors of menstrual cycle symptoms. This was particularly the case for assessing the role of neuroticism in premenstrual symptomatology. The current results suggest that neuroticism has a broad effect, predicting both baseline symptoms in addition to premenstrual change. Given the reliance of menstrual cycle research on self-report, this suggests that measurement of neuroticism is important for methodological purposes. Many symptoms of premenstrual negative affect are similar to the type of questions common to neuroticism scales, and thus contamination between the measures may occur. Unless the influence of neuroticism on generalised symptom reporting is controlled, correlations may be inflated. Menstrual cycle research provides a good opportunity to utilise within subject designs and hence control for neuroticism. Caution should be used in interpreting results demonstrating correlations between premenstrual symptoms and any measures that include a subjective distress component (e.g. neuroticism and related constructs, perceived stress, self-reported general health) in the absence of this type of methodology.

7.3 Implications for the Aetiology of Premenstrual Changes

The results of this study have implications for the aetiology of PMC. As indicated above, both common and differential risk factors for various premenstrual symptoms were identified. The role of personality was exemplified in the relationships between neuroticism and negative affect, and extraversion and autonomic reactions. Across different symptom sub-scales, menstrual pain and marital status were identified as

key predictors. Women who are single and who report more menstrual pain are at risk of a variety of premenstrual symptoms. These factors suggest that premenstrual changes are not the result of a simple biological or psychological factor. Rather, these results are supportive of a bio-psycho-social model of PMC.

The increase in symptomatology observed in the premenstrual phase in the majority of women indicates that this is a time of increased vulnerability. The finding that menstrual pain predicts premenstrual change is suggestive of an underlying physiological mechanism that contributes to both phenomena. The exact nature of this mechanism, however, is yet to be identified. While some women may suffer from a hormonal/neurotransmitter imbalance and/or increased sensitivity to biological changes, cyclicity in certain symptoms appears almost ubiquitous suggesting that PMC occurs largely in response to a non-pathological process. This is further suggested by the bulk of research demonstrating the absence of physiological differences between women with and without PMC (see section 3.1). The lack of any effect of OCs on PMC or menstrual pain indicates that these problems are not dependent on the sequelae to ovulation. This suggests that ovarian hormones do not directly effect psychological and physical symptoms. There was some indication, however, that OC use alters the timing of symptom cyclicity. This indicates that premenstrual and menstrual symptom experience may result from an interaction between hormonal changes and psychological/social factors.

While the biological basis of PMC remains to be determined, it is clear that psychological and demographic factors also play a role in menstrual cycle symptomatology. These risk factors relate to enduring traits as well as social situational characteristics, but all can be conceptualised in terms of personal resources. In particular, neuroticism and being single appear to sensitise women to noticing changes that are linked to the menstrual cycle. These vulnerability factors render women more likely to experiencing fairly non-specific psychological and physical symptoms. The results of this study indicate that neuroticism and marital status predict both baseline symptomatology, in addition to premenstrual increases in

symptoms. These results suggest that women with poorer personal resources are more *reactive* to menstrual cycle changes. In order words, women who score highly on neuroticism, or are single, may be at greater risk of interpreting premenstrual changes as significant or pathological.

In summary, the results of this study suggest that women respond to the occurrence of normal physiological events associated with the menstrual cycle. Certain factors may increase vulnerability to these changes. In particular, personality characteristics (e.g. high neuroticism, low extraversion) in addition to social situational variables (e.g. being single) render women more reactive to premenstrual changes. Such a model accounts for the finding that women report varying levels of PMC from cycle to cycle, with increased symptomatology during stressful periods, and less symptomatology during periods of distraction (e.g. holidays) (Hart et al., 1987; Walker, 1994). It is important to note, however, that women are likely to be affected differently by different risk factors. Some women may have more "pure" PMC while others may be more affected by vulnerability factors. It is also worth reiterating that while the women in this study reported high levels of premenstrual change, they did not constitute a clinical sample, and no attempt made to diagnose PMS. The risk factors identified in this study may exert less influence in such samples. It is also important to point out that PMC is undoubtedly multifactorial in origin. While this research has identified some key risk factors, other potential influences were not measured. It is necessary to avoid a simplistic view of PMC and preferable to conceptualise of a variety of personal resources which may make women more or less vulnerable to premenstrual changes. Working within this type of framework should lead to an increased understanding of the social and personality factors that contribute to premenstrual change.

7.4 Implications for the Treatment of Premenstrual Changes

On the basis of these results, several recommendations with regard to the treatment of PMC can be made. As indicated above, cyclicity of the hypothalamic-pituitary-

gonadal axis creates in the premenstrual phase a time when women are prone to a variety of adverse symptoms. The specific neuroendocrine events that cause this are yet to be determined. Undoubtedly however, personal resources, cultural attitudes, and psychosocial experiences impact on the expression of symptoms. The majority of women report premenstrual changes, but most do not find them debilitating. Accordingly, it is appropriate that initial therapeutic measures be conservative and focus on increasing social support and enhancement of coping mechanisms.

Particularly relevant is neuroticism. While the current results indicated neuroticism to predict change in negative affect only, this sub-scale constitutes the most distressing premenstrual symptoms and should be targeted to improve overall well-being. Neuroticism predicted five percent of the variance in premenstrual negative affect when follicular scores were held constant. This is not a large percentage but is more consequential when considered in light of the fact that neuroticism also predicted nine percent of the variance in follicular negative affect. Given that follicular negative affect is a very strong predictor of premenstrual negative affect, this suggests that neuroticism contributes substantially to premenstrual symptomatology.

These results indicate that women with premenstrual negative affect may benefit from psychological treatment approaches. For women who experience premenstrual negative affect and high levels of neuroticism, cognitive-behaviour therapy may prove a useful and non-intrusive first step in a treatment plan. Although neuroticism is considered to be a relatively stable trait, possibly underpinned by neuroanatomical substrates, results of a meta-analysis revealed that neuroticism could be reduced by up to 1.25 standard deviations by psychotherapy, particularly rational emotive therapies (Jorm, 1989). High neuroticism has also been associated with maladaptive defense mechanisms (Costa, Zonderman & McCrae, 1991) and hence psychotherapy may aid women in developing better methods of coping with premenstrual changes. This is likely to be the case even if neuroticism level per se is not substantially altered through therapy.

Findings of amelioration of premenstrual symptoms have also been reported subsequent to cognitive-behavioural therapy (Morse & Dennerstein, 1988a; Morse, Bernard & Dennerstein, 1989; Morse, Dennerstein, Farrell & Varnavides, 1991; Christensen & Oei, 1995; Blake, Salkovskis, Gath, Day & Garrod, 1998). Much of this research has been conducted by Morse and colleagues who have done extensive work on the usefulness of various treatment approaches in women who seek treatment for *severe* PMS. The current finding of a relationship between premenstrual change and neuroticism in women from the *general population*, suggests that cognitive-behavioural therapy may also be worth trialling in women with less debilitating symptoms.

While neuroticism has received some attention in relation to PMC, the impact of social relationships has received relatively little study. This is surprising in view of the fact that supportive relationships are widely accepted as protecting against the negative impact of a diverse range of stressful events and illnesses (e.g. Miller & Ingham, 1976; Connell et al., 1994). The exact protection against PMC that is conferred by marriage/partnership needs further exploration; however increased social support is a likely factor. In the context of PMC, the premenstrual period is viewed as a time of increased stress and hence social support is expected to mediate the response to this stressor. The little work that has been conducted in this area has focused primarily on the impact of poor social supports (e.g. marital distress) rather than the positive effects of good social support. Some research suggests that good and poor social support may represent independent domains (Rook, 1984). For instance, Weiss, Hops and Patterson (1973) reported that positive and negative spouse interactions are independent of each other. While understanding the role of both good and poor social support is essential, elucidating the impact of positive interactions in particular, has implications for treatment approaches.

The current results suggest that social support may be particularly relevant for single women. Support groups may be helpful, especially for validation, the opportunity for discussion of issues, and to aid in other behavioural, cognitive or lifestyle approaches

to PMC. Single women may also benefit from encouragement to actively seek social support from other sources. At this stage, in the absence of a clear understanding of the role of marital status in PMC, only general treatment approaches can be suggested. More research, however, should provide information which will aid the design of interventions to improve social support.

7.5 Generalisability of the Results

Several factors increase the generalisability of the results reported here. The sample included a wide range of participants recruited from the community. The figures for age, parity, marital status and contraceptive use reflect the characteristics of the population at large (Australian Bureau of Statistics, 1997a, 1997b). In terms of generalisability, the current sample is more representative of the general community than those used in many other studies (see section 1.2.1). Menstrual cycle characteristics were also within the expected range, with average cycle length and menses duration comparable to those found by other researchers (e.g. N.F. Woods et al., 1982c; van der Ploeg & Lodder, 1993). It should be noted, however, that the sample was derived from volunteers who responded to public advertisements. In this sense, the participants of this study are not necessarily representative of women at large, many of whom may not choose to participate in such a study. Accordingly, it should be kept in mind that care must be taken in generalising the results of this study to women as a whole.

A number of further potential limitations of the study should be noted. While every attempt was made to study a representative sample of women, participants aged over 20 years of age had significantly higher levels of neuroticism and openness, and significantly lower levels of agreeableness, than would be expected based on normative data from the United States. To the authors' knowledge, there are no Australian norms for the NEO PI-R, and it is thus unclear whether these findings represent genuine cultural differences. The results may also be a reflection of the personality characteristics that typify women who volunteer for health-related studies.

This makes sense given that women with higher levels of neuroticism and lower levels of agreeableness are more inclined to be self focused. Openness may relate to the willingness to engage in research projects.

It thus needs to be kept in mind that women who participate in health-related research are likely to report higher levels of any psychosomatic symptoms, including menstrual cycle related symptomatology. Given the relatively demanding nature of this study, women who completed the process may also have been more committed because they suffered from health problems, and were thus particularly interested in relevant research. These difficulties, however, are inherent in all studies based on volunteer participants. Furthermore, differential diagnosis was possible since women with psychiatric illness were excluded. It can thus be concluded that while participants may have been health focused, their symptoms were not an exacerbation of an existing affective or anxiety disorder.

Other factors limiting the generalisability of the results include the fact that a large proportion of the sample were studying, although many were not full-time students but rather completing courses part-time. This is also reflected in the fact that many women were working in a casual or part-time capacity. It should also be noted that menstrual pain was assessed by asking women to report whether or not they experienced menstrual pain, and how severe this was. It would be desirable in future studies to report menstrual pain on a daily and prospective basis.

The methodological procedures and statistical techniques employed in this study were designed in light of the goals of sound research. However the nature of the variables studied precludes experimental manipulation. It thus needs to be kept in mind that the results derived from the multiple regression analyses are correlational in nature, and that definitive statements regarding causality are not appropriate.

7.6 Conclusion

In conclusion, this study was designed to examine the pattern, incidence and risk factors of premenstrual change in a reliable manner by addressing key methodological limitations. A longitudinal study was conducted in which a large number of women provided menstrual cycle data prospectively over 70 days. Personality was measured using a widely accepted and contemporary assessment tool. Each of Moos' symptom sub-scales were demonstrated to fluctuate significantly across the menstrual cycle. A very high incidence of PMC was noted, suggesting that women respond to non-pathological physiological cyclicity. Oral contraceptives were found to have little impact on the pattern or incidence of menstrual cycle symptoms. Oral contraceptives, however, were found to relate to higher levels of baseline physical symptoms, and to neuroticism. These relationships are worthy of further investigation.

Several risk factors of PMC were identified. These included neuroticism, extraversion, menstrual pain and marital status. These variables were demonstrated to predict premenstrual symptom scores, and more importantly, to predict premenstrual scores over and above that which was attributable to a generalised effect of risk factors on level of reported symptoms. The results suggest that the premenstrual period is a time of increased vulnerability, and that certain personality and demographic characteristics sensitise women to noticing physiological and psychological changes that occur during this time. These findings support a bio-psycho-social model of PMC and suggest the utility of cognitive-behavioural treatment approaches.

REFERENCES

Abplanalp, J.M. (1983). Premenstrual syndrome: A selective review. *Women and Health, 8,* 107-123.

Abplanalp, J.M., Donnelly, A.F. & Rose, R.M. (1979). Psychoendocrinology of the menstrual cycle: I. Enjoyment of daily activities and moods. *Psychosomatic Medicine, 41,* 587-603.

Abplanalp, J.M., Haskett, R.F. & Rose, R.M. (1980). The premenstrual syndrome. *Psychiatric Clinics of North America, 3,* 327-347.

Ainscough, C.E. (1990). Premenstrual emotional changes a prospective study of symptomatology in normal women. *Journal of Psychosomatic Research, 34,* 35-45.

Alvir, J.M.J. & Thys-Jacobs, S. (1991). Premenstrual and menstrual symptom clusters and response to calcium treatment. *Psychopharmacology Bulletin, 27,* 145-148.

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders (*3rd ed., Rev.). Washington DC: Author.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders (*4th ed.). Washington DC: Author.

Andersch, B. (1982). The effect of various oral contraceptive combinations on premenstrual symptoms. *International Journal of Gynaecology and Obstetrics, 20,* 463-469.

Andersch, B., Abrahamsson, L., Wendestam, C., Ohman, R. & Hahn, L. (1979). Hormonal profile in premenstrual tension: Effects of bromocriptine and diuretics. *Clinical Endocrinology, 11,* 657-664.

Andersch, B. & Hahn, L. (1981). Premenstrual complaints. II. Influence of oral contraceptives. *Acta Obstetricia et Gynecologica Scandinavica, 60,* 579-583.

Andersch, B. & Hahn, L. (1985). Progesterone treatment of premenstrual tension - A double blind study. *Journal of Psychosomatic Research, 29,* 489-493.

Andersch, B., Hahn, L., Wendestam, C., Ohman, R. & Abrahamson, L. (1978). Treatment of the premenstrual syndrome with bromocriptine. *Acta Endocrinologica, 216* (suppl.), 165-174.

Argyle, M. & Lu, L. (1990). The happiness of extraverts. *Personality and Individual Differences, 11,* 1011-1017.

Asbell, B. (1995). *The Pill. A biography of the drug that changed the world.* New York: Random House.

Asso, D. & Beech, H.R. (1975). Susceptibility to the acquisition of a conditioned response in relation to the menstrual cycle. *Journal of Psychosomatic Research, 19,* 337-344.

AuBuchon, P.G. & Calhoun, K.S. (1985). Menstrual cycle symptomatology: The role of social expectancy and experimental demand characteristics. *Psychosomatic Medicine, 47,* 35-45.

Australian Bureau of Statistics. (1997a). *Australian women's yearbook* (Cat. No. 4124.0). Canberra, Australian Capital Territory: Author.

Australian Bureau of Statistics. (1997b). *Family characteristics* (Cat. No. 4442.0). Canberra, Australian Capital Territory: Author.

Awaritefe, A., Awaritefe, M., Diejomoah, F.M.E. & Ebie, J.C. (1980). Personality and menstruation. *Psychosomatic Medicine, 42,* 237-251.

Bäckström, T. & Cartensen, H. (1974). Estrogen and progesterone in plasma in relation to premenstrual tension. *Journal of Steroid Biochemistry, 5,* 257-260.

Bäckström, T. & Mattson, B. (1975). Correlation of symptoms in pre-menstrual tension to oestrogen and progesterone concentrations in blood plasma. *Neuropsychobiology, 1,* 80-86.

Bäckström, T., Sanders, D., Leask, R., Davidson, D., Warner, P. & Bancroft, J. (1983). Mood, sexuality, hormones and the menstrual cycle. II. Hormone levels and their relationship to the premenstrual syndrome. *Psychosomatic Medicine, 45,* 503-507.

Bains, G.K. & Slade, P. (1988). Attributional patterns, moods, and the menstrual cycle. *Psychosomatic Medicine, 50,* 469-476.

Bancroft, J. (1993). The premenstrual syndrome: A reappraisal of the concept and evidence [Monograph]. *Psychological Medicine, 24* (Suppl), 1-47.

Bancroft, J. & Bäckström, T. (1985). Premenstrual syndrome. *Clinical Endocrinology, 22,* 313-336.

Bancroft, J. & Rennie, D. (1995). Perimenstrual depression: Its relationship to pain, bleeding, and previous history of depression. *Psychosomatic Medicine, 57,* 445-452.

Bassoff, T.B. (1995). Behavioral changes across the menstrual cycle in isosexual groups of bonnet macaques (*Macaca radiata*). *Primates, 36,* 549-562.

Benedek, T. & Rubenstein, B.B. (1939). The correlations between ovarian activity and psychodynamic processes: II. The menstrual phase. *Psychosomatic Medicine, 1,* 461-485.

Beumont, P.J.V., Abraham, S.F., Argall, W.J. & Simson, K.G. (1978). A prospective study of premenstrual tension symptoms in healthy young Australians. *Australian and New Zealand Journal of Psychiatry, 12,* 241-244.

Blake, F., Salkovskis, P., Gath, D., Day, A. & Garrod, A. (1998). Cogntitive therapy for premenstrual syndrome: A controlled trial. *Journal of Psychosomatic Research, 45,* 307-318.

Blumenthal, S.J. & Nadelson, C.C. (1988). Late luteal phase dysphoric disorder (premenstrual syndromes): Clinical implications. *Journal of Clinical Psychiatry, 49,* 469-474.

Booth-Kewley, S. & Vickers, R.R. (1994). Association between major domains of personality and health behaviour. *Journal of Personality, 62,* 281-298.

Boyle, G.J. & Grant, A.F. (1992). Prospective versus retrospective assessment of menstrual cycle symptoms and mood: Role of attitudes and beliefs. *Journal of Psychopathology and Behavioral Assessment, 14,* 307-321.

Breaux, C., Hartlage, S. & Gehlert, S. (2000). Relationships of premenstrual dysphoric disorder to major depression and anxiety disorders: a re-examination. *Journal of Psychosomatic Obstetrics and Gynecology, 21,* 17-24.

Briggs, S. (1992). Assessing the five-factor model of personality. *Journal of Personality, 60,* 253-293.

Brockway, J.A. (1976). Prediction of premenstrual symptomatology using the Moos Menstrual Distress Questionnaire (Doctoral Dissertation, University of Iowa, 1975). *Dissertation Abstracts International, 36* (12-B, Pt 1), 6371.

Brooks, J., Ruble, D. & Clarke, A. (1977). College women's attitudes and expectations concerning menstrually-related changes. *Psychosomatic Medicine, 39,* 288-298.

Budoff, P.W. (1979). Use of mefenamic acid in the treatment of primary dysmenhorrea. *JAMA, 241,* 2713-2716.

Budoff, P.W. (1987). Use of prostoglandin inhibitors in the treatment of PMS. *Clinical Obstetrics and Gynecology, 30,* 453-464.

Busch, C.M., Costa, P.T., Jr., Whitehead, W.E. & Heller, B.R. (1988). Severe perimenstrual symptoms: Prevalence and effects on absenteeism and health care seeking in a non-clinical sample. *Women and Health, 14,* 59-74.

Campos, F. & Thurow, C. (1978). Attributions of moods and symptoms to the menstrual cycle. *Personality and Social Psychology Bulletin, 4,* 272-276.

Cattell, R.B., Eber, H.W. & Tatsuoka, M.M. (1970). *Handbook for the Sixteen Personality Factor Questionnaire (16 PF).* Champaign, IL: Institute for Personality and Ability Testing.

Cerin, A., Collins, A., Landgren, B.-M. & Eneroth, P. (1993). Hormonal and biochemical profiles of premenstrual syndrome. *Acta Obstetricia et Gynecologica Scandinavica, 72,* 337-343.

Chandra, P.S. & Chaturvedi, S.K. (1989). Cultural variations of premenstrual experience. *The International Journal of Social Psychiatry, 35,* 343-349.

Chang, A.M., Holroyd, E. & Chau, J.P.C. (1995). Premenstrual syndrome in employed Chinese women in Hong Kong. *Health Care for Women International, 16,* 551-561.

Choi, P.Y.L. (1995). The menstrual cycle and premenstrual syndrome. What is this news on the menstrual cycle and premenstrual syndrome? *Social Science and Medicine, 41,* 759-760.

Chrisler, J.C., Johnston, I.K., Champagne, N.M. & Preston, K.E. (1994). Menstrual joy. The construct and its consequences. *Psychology of Women Quarterly, 18,* 375-387.

Chrisler, J.C. & Levy, K.B. (1990). The media construct a menstrual monster: A content analysis of PMS articles in the popular press. *Women and Health, 16,* 89-104.

Christensen, A.P., Board, B.J. & Oei, T.P.S. (1992). A psychosocial profile of women with premenstrual dysphoria. *Journal of Affective Disorders, 25,* 251-260.

Christensen, A.P. & Oei, T.P.S. (1989). Correlates of confirmed premenstrual dysphoria. *Journal of Psychosomatic Research, 33,* 307-313.

Christensen, A.P. & Oei, T.P.S. (1992). The relationship between confirmed premenstrual dysphoria and behaviour and mood changes. *Psychologia, 35,* 186-192.

Christensen, A.P. & Oei, T.P.S. (1995a). Correlates of premenstrual dysphoria in help-seeking women. *Journal of Affective Disorders, 33,* 47-55.

Christensen, A.P. & Oei, T.P.S. (1995b). The efficacy of cognitive behavior therapy in treating premenstrual dysphoric changes. *Journal of Affective Disorders, 33,* 57-63.

Chuong, C.J., Colligan, R.C., Coulam, C.B. & Bergstralh, E.J. (1988). The MMPI as an aid in evaluating patients with premenstrual syndrome. *Psychosomatics, 29,* 197-202.

Clare, A.W. (1983). Psychiatric and social aspects of premenstrual complaint. *Psychological Medicine, 4* (suppl.), 1-58.

Clare, A.W. (1985). Premenstrual syndrome: Single or multiple causes. *Canadian Journal of Psychiatry, 30,* 474-482.

Clare, A.W. & Wiggins, R.D. (1979). The construction of a modified version of the Menstrual Distress Questionnaire for use in general practice populations. In L. Carenza & L. Zichella (Eds.), *Emotions and Reproduction*, vol 20A (pp. 177-184). London: Academic Press.

Clarke, A.E. & Ruble, D.N. (1978). Young adolescents' beliefs concerning menstruation. *Child Development, 49*, 231-234.

Cohen, J. & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale: Erlbaum.

Coleman, G.J., Hart, W.G. & Russell, J.W. (1988). Temporal sequence of symptoms in women complaining of PMS. *Journal of Psychosomatic Obstetrics and Gynaecology, 8*, 105-112.

Collins, A. & Landgren, B.-M. (1995). Reproductive health, use of estrogen and experience of symptoms in perimenopausal women: A population-based study. *Maturitas, 20*, 101-111.

Connell, C.M., Davis, W.K., Gallant, M.P. & Sharpe, P.A. (1994). Impact of social support, social cognitive variables, and perceived threat on depression among adults with diabetes. *Health Psychology, 13*, 263-273.

Connell, C.M., Fisher, E.B., Jr. & Houston, C.A. (1992). Relationships among social support, diabetes outcomes, and morale for older men and women. *Journal of Aging and Health, 4*, 77-100.

Copeland, L.J. (2000). *Textbook of gynecology*. Philadelphia: W.B. Saunders.

Coppen, A. (1965). The prevalence of menstrual disorders in psychiatric patients. *British Journal of Psychiatry, 11*, 155-167.

Coppen, A. & Kessel, N. (1963). Menstruation and personality. *British Journal of Psychiatry, 109*, 711-721.

Coppen, A.J., Milne, H.B., Outram, D.H. & Weber, J.C.P. (1972). Dytide, norethisterone and a placebo in the premenstrual syndrome - A double-blind comparison. *Clinical Trials Journal, 6*, 33-36.

Corney, R.H. & Stanton, R. (1991). A survey of 658 women who report symptoms of premenstrual syndrome. *Journal of Psychosomatic Research, 35*, 471-482.

Costa, P.T., Jr. & McCrae, R.R. (1980). Influence of extraversion and neuroticism on subjective well-being: Happy and unhappy people. *Journal of Personality and Social Psychology, 38*, 668-678.

Costa, P.T., Jr. & McCrae, R.R. (1984). Personality as a lifelong determinant of wellbeing. In C. Malatesta & C. Izard (Eds.) *Emotion in adult development* (pp. 141-157). Beverly Hills, CA: Sage.

Costa, P.T., Jr. & McCrae, R.R. (1985). The NEO Personality Inventory manual. Odessa, FL: Psychological Assessment Resources.

Costa, P.T., Jr. & McCrae, R.R. (1986). Major contributions to personality psychology. In S. Modgil & C.Modgil (Eds.) *Hans Eysenck: Consensus and controversy* (pp. 63-72). Philadelphia: Falmer.

Costa, P.T., Jr. & McCrae, R.R. (1987). Neuroticism, somatic complaints, and disease: Is the bark worse than the bite? *Journal of Personality, 55,* 299-316.

Costa, P.T., Jr. & McCrae, R.R. (1988a). From catalog to classification: Murray's needs and the five-factor model. *Journal of Personality and Social Psychology, 55,* 258-265.

Costa, P.T., Jr. & McCrae, R.R. (1988b). Personality in adulthood: A six-year longitudinal study of self-reports and spouse ratings on the NEO Personality Inventory. *Journal of Personality and Social Psychology, 54,* 853-863.

Costa, P.T., Jr. & McCrae, R.R. (1992a). *NEO PI-R professional manual.* Odessa, FL: Psychological Assessment Resources.

Costa, P.T. Jr. & McCrae, R.R. (1992b). Trait psychology comes of age. In T.B. Sonderegger (Ed.), *Nebraska Symposium on Motivation 1991: Psychology and aging. Current theory and research in motivation* (Vol. 39) (pp. 169-204). Lincoln, NE: University of Nebraska Press.

Costa, P.T. Jr., McCrae, R.R. & Dye, D.A. (1991). Facet scales for Agreeableness and Conscientiousness: A revision of the NEO Personality Inventory. *Personality and Individual Differences, 12,* 887-898.

Costa, P.T., Jr., Zonderman, A.B. & McCrae, R.R. (1991). Personality, defense, coping, and adaptation in older adulthood. In E.M. Cummings, A.L. Greene & K.H. Karraker (Eds.), *Life-span developmental psychology: Perspectives on stress and coping* (pp. 277-293). Hillsdale, NJ: Erlbaum.

Cullberg, G. (1972). Mood changes and menstrual symptoms with different gestagen/estrogen combinations. *Acta Psychiatrica Scandinavica, 236* (suppl.), 1-86.

Cumming, C.E., Fox, E.E. & Cumming, D.C. (1995). Intermenstrual affect in women with symptomatic premenstrual change. *Journal of Psychosomatic Research, 39,* 261-269.

Cumming, C.E., Krausher, R.J.R., Jugdutt, A.V., Grover, D.W., Fox, E.E. & Cumming, D.C. (1994). Millon Clinical Multiaxial Inventory (MCMI) profiles of women with and without symptomatic premenstrual change. *European Journal of Psychological Assessment, 10,* 214-219.

Cumming, D.C., Cumming, C.E., Krausher, R.J.R. & Fox, E.E. (1991). Towards a definition of PMS II: A factor analytic evaluation of premenstrual change in women with symptomatic premenstrual change. *Journal of Psychosomatic Research, 35,* 713-720.

Dalton, K. (1964). *The premenstrual syndrome*. London: Heinemann.

Dalton, K. (1977). *The premenstrual syndrome and progesterone therapy.* London: Heinemann.

Dalton, K. (1984). *The premenstrual syndrome and progesterone therapy.* London: Heinemann.

Davis, C., Ralevski, E., Kennedy, S.H. & Neitzert, C. (1995). The role of personality factors in the reporting of side effect complaints to moclobemide and placebo: A study of healthy male and female volunteers. *Journal of Clinical Psychopharmacology, 15,* 347-352.

Deary, I.J., Clyde, Z. & Frier, B.M. (1997). Constructs and models in health psychology: The case of personality and illness reporting in diabetes mellitus. *British Journal of Health Psychology, 2,* 35-54.

Dennerstein, L., Lehert, P., Burger, H. & Dudley, E. (1999). Mood and the menopausal transition. *The Journal of Nervous and Mental Disease, 187,* 685-691.

Dennerstein, L., Spencer-Gardner, C. & Burrows, G.D. (1984). Psychiatric progress. Mood and the menstrual cycle. *Journal of Psychiatric Research, 18,* 1-12.

Dickson, L.R., Hays, L.R., Kaplan, C., Scherl, E., Abbott, S. & Schmitt, F. (1992). Psychological profile of somatizing patients attending the integrative clinic. *International Journal of Psychiatry in Medicine, 22,* 141-153.

Diczfalusy, E. (1997). *The contraceptive revolution. An era of scientific and social development.* New York: Pathenon.

Digman, J.M. (1990). Personality structure: Emergence of the five-factor model. *Annual Review of Psychology, 41,* 417-440.

Eaton, W.W. (1978). Life events, social supports, and psychiatric symptoms: A reanalysis of the New Haven data. *Journal of Health and Social Behavior, 19,* 230-234.

Eckerd, M.B., Hurt, S.W. & Severino, S.K. (1989). Late luteal phase dysphoric disorder: Relationship to personality disorders. *Journal of Personality Disorder, 3,* 338-344.

Ekholm, U., Ekholm, N. & Bäckström, T. (1988). Premenstrual syndrome: Comparison between different methods to diagnose cyclicity using daily symptom ratings. *Acta Obstetricia et Gynecologica Scandinavica, 77,* 551-557.

Endicott, J. & Halbreich, U. (1982). Psychobiology of premenstrual change. *Psychopharmacology Bulletin, 18,* 109-112.

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

Englander-Golden, P., Whitmore, M.R. & Dienstbier, R.A. (1978). Menstrual cycle as a focus of study and self-reports of moods and behavior. *Motivation and Emotion, 2,* 75-87.

Epperson, C.N., Wisner, K.L. & Yamamoto, B. (1999). Gondal steroids in the treatment of mood disorders. *Psychosomatic Medicine, 61,* 676-697.

Eysenck, H.J. (1967). *The biological basis of personality.* Springfield, MA: Thomas.

Eysenck, H.J. (1994). The Big Five or the Giant Three: Criteria for a paradigm. In C.F. Halverson, G.A. Kohnatmm & R.P. Martin (Eds.), *The developing structure of temperament and personality from infancy to adulthood* (pp. 37-51). Hillsdale, NJ: Erlbaum.

Eysenck, H.J. & Eysenck, S.B.G. (1964). *Manual of the Eysenck Personality Inventory.* London: University Press.

Eysenck, H.J. & Eysenck, S.B.G. (1975). *Manual of the Eysenck Personality Questionnaire.* San Diego, CA: EdITS.

Facchinetti, F., Genazzani, A.D., Martignoni, E., Fioroni, L., Nappi, G. & Genazzani, A.R. (1993). Neuroendocrine changes in luteal function in patients with premenstrual syndrome. *Journal of Clinical Endocrinology and Metabolism, 76,* 1123-1127.

Fontana, A. & Pontari, B. (1994). Menstrual-related perceptual changes in women with premenstrual syndrome: Factors to consider in treatment. *Counselling Psychology Quarterly, 7,* 399-406.

Fradkin, B. & Firestone, P. (1986). Premenstrual tension, expectancy, and mother-child relations. *Journal of Behavioral Medicine, 9,* 245-259.

Frank, R.T. (1931). The hormonal causes of premenstrual tension. *Archives of Neurology and Psychiatry, 26,* 1053-1057.

Freeman, E.W., Rickels, K., Schweizer, E. & Ting, T. (1995). Relationships between age and symptom severity among women seeking medical treatment for premenstrual symptoms. *Psychological Medicine, 25,* 309-315.

Freeman, E., Rickels, K., Sondheimer, S.J. & Polansky, M. (1990). Ineffectiveness of progesterone suppository treatment for premenstrual syndrome. *JAMA, 264,* 349-353.

Friederich, M.A. (1983). Dysmenorrhea. *Women and Health, 8,* 91-106.

Friedman, D. & Jaffe, A. (1985). Influence of life-style on the premenstrual syndrome. *Journal of Reproductive Medicine, 30,* 715-719.

Friedman, H.S., Tucker, J.S., Tomlinson-Keasey, C., Schwartz, J.E., Wingard, D.L. & Criqui, M.H. (1993). Does childhood personality predict longevity? *Journal of Personality and Social Psychology, 65,* 176-185.

Futterman, L.A., Jones, J.E., Miccio-Fonseca, L.C. & Quigley, M.E.T. (1988). Assessing premenstrual syndrome using the premenstrual experience assessment. *Psychological Reports, 63,* 19-34.

Gallant, S.J., Hamilton, J.A., Popiel, D.A., Morokoff, P.J. & Chakraborty, P.K. (1991). Daily moods and symptoms: Effects of awareness of study focus, gender, menstrual-cycle phase, and day of the week. *Health Psychology, 10,* 180-189.

Gallant, S.J., Popiel, D.A., Hoffman, D.M., Chakraborty, P.K. & Hamilton, J.A. (1992a). Using daily ratings to confirm premenstrual syndrome/late luteal phase dysphoric disorder. Part I. Effects of demand characteristics and expectations. *Psychosomatic Medicine, 54,* 149-166.

Gallant, S.J., Popiel, D.A., Hoffman, D.M., Chakraborty, P.K. & Hamilton, J.A. (1992b). Using daily ratings to confirm premenstrual syndrome/late luteal phase dysphoric disorder. Part II. What makes a 'real' difference? *Psychosomatic Medicine, 54,* 167-181.

Garcia-Castells, E., Gonzalez, J.J., Ervin, F.R. & Guzman-Flores, C. (1989). Changes in social dynamics associated to the menstrual cycle in the vervet monkey (*Cercopithecus aethiops*). *Boletin de Estudios Medicos y Biologicos, 37,* 11-16.

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

Golub, S. & Harrington, D.M. (1981). Premenstrual and menstrual mood changes in adolescent women. *Journal of Personality and Social Psychology, 41,* 961-965.

Gomel, V., Munro, M.G. & Rowe, T.C. (1990). *Gynecology. A practical approach.* Baltimore: Williams & Wilkins.

Gottschalk, L.A., Kaplan, S.M., Gleser, G.C. & Winget, C.M. (1962). Variations in magnitude of emotion: A method applied to anxiety and hostility during phases of the menstrual cycle. *Psychosomatic Medicine, 24,* 300-311.

Graham, C.A. & Sherwin, B.B. (1987). The relationship between retrospective premenstrual symptom reporting and present oral contraceptive use. *Journal of Psychosomatic Research, 31,* 45-53.

Graham, C.A. & Sherwin, B.B. (1992). A prospective treatment study of premenstrual symptoms using a triphasic oral contraceptive. *Journal of Psychosomatic Research, 36,* 257-266.

Gray, J.A. (1981). A critique of Eysenck's theory of personality. In H.J. Eysenck (Ed.), *A model of personality* (pp. 246-276). New York: Springer-Verlag.

Gray, P. (1994). *Psychology* (2nd ed.). New York: Worth.

Hair, J.F., Anderson, R.E., Tatham, R.L. & Black, W.C. (1995). *Multivariate data analysis* (4th ed). Englewood Cliffs, NJ: Prentice Hall.

Halbreich, U. (1997). Premenstrual dysphoric disorders: A diversified cluster of vulnerability traits to depression. *Acta Psychiatrica Scandinavica, 95,* 169-176.

Halbreich, U., Bakhai, Y., Bacon, K.B., Goldstein, S., Endicott, J. & Lesser, J. (1989). Screening and selection process for studies of menstrually-related changes. *Journal of Psychiatric Research, 23,* 65-72.

Halbreich, U. & Endicott, J. (1982). Classification of premenstrual syndromes. In R.C. Friedman (Ed.), *Behavior and the menstrual cycle* (pp. 243-265). New York: Marcel Dekker.

Halbreich, U. & Endicott, J. (1985). Methodological issues in studies of premenstrual changes. *Psychoneuroendocrinology, 10,* 15-32.

Halbreich, U., Endicott, J., Schacht, S. & Nee, J. (1982). The diversity of premenstrual changes as reflected in the Premenstrual Assessment Form. *Acta Psychiatrica Scandinavica, 65,* 46-65.

Halbreich, U. & Kas, D. (1977). Variations in the Taylor MAS of women with premenstrual syndrome. *Journal of Psychosomatic Research, 21,* 391-393.

Hallman, J., Oreland, L., Edman, G. & Schalling, D. (1987). Thrombocyte monoamine oxidase activity and personality traits in women with severe premenstrual syndrome. *Acta Psychiatrica Scandinavica, 76,* 225-234.

Hamilton, J.A., Parry, B., Alagna, S., Blumenthal, S. & Herz, E. (1984). Premenstrual mood changes: A guide to evaluation and treatment. *Psychiatric Annals, 14,* 426-435.

Hammarbäck, S. & Bäckström, T. (1989). A demographic study in subgoups of women seeking help for premenstrual syndrome. *Acta Obstetricia et Gynecologica Scandinavica, 68,* 247-253.

Harding, C.M., Vail, C. & Brown, R. (1985). Effect of oral contraceptives and some psychological factors on the menstrual experience. *Journal of Biosocial Science, 17,* 291-304.

Hargrove, J.T. & Abraham, G.E. (1982). The incidence of premenstrual tension in a gynecologic clinic. *Journal of Reproductive Medicine, 27,* 721-724.

Hart, W.G., Coleman, G.J. & Russell, J.W. (1987). Assessment of premenstrual symptomatology: A re-evaluation of the predictive validity of self-report. *Journal of Psychosomatic Research, 31,* 185-190.

Hart, W.G. & Russell, J.W. (1986). A prospective comparison study of premenstrual symptoms. *The Medical Journal of Australia, 144,* 466-468.

Hasin, M., Dennerstein, L. & Gotts, G. (1988). Menstrual cycle related complaints: A cross-cultural study. *Journal of Psychosomatic Obstetrics and Gynaecology, 9,* 35-42.

Haskett, R.F. (1987). Premenstrual Dysphoric Disorder: Evaluation, pathophysiology and treatment. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 11,* 129-135.

Haskett, R.F. & Abplanalp, J.M. (1983). Premenstrual tension syndrome: Diagnostic criteria and selection of research subjects. *Psychiatry Research, 9,* 125-138.

Hausfater, G. & Skoblick, B. (1985). Perimenstrual behavior changes among female yellow baboons: Some similarities to premenstrual syndrome (PMS) in women. *American Journal of Primatology, 9,* 165-172.

Heilbrun, A.B. & Frank, M.E. (1989). Self-preoccupation and general stress level as sensitizing factors in premenstrual and menstrual distress. *Journal of Psychosomatic Research, 33,* 571-577.

Herrera, E., Gómez-Amor, J., Martínez-Selva, J.M. & Ato, M. (1990). Relationship between personality, psychological and somatic symptoms, and the menstrual cycle. *Personality and Individual Differences, 11,* 457-461.

Herzberg, B. & Coppen, A. (1970). Changes in psychological symptoms in women taking oral contraceptives. *British Journal of Psychiatry, 116,* 161-164.

High, R.V. & Marcellino, P.A. (1995). Premenstrual symptoms and the female employee. *Social Behaviour and Personality, 23,* 265-272.

Hogan, J. (1989). Personality correlates of physical fitness. *Journal of Personality and Social Psychology, 56,* 284-288.

Hogan, R. (1987). Personality psychology: Back to basics. In J. Aronoff, A.I. Rabin & R.A. Zucker (Eds.), *The emergence of personality* (pp. 79-104). New York: Springer.

Hull, J.G., Tedlie, J.C. & Lehn, D.A. (1995). Modeling the relation of personality variables to symptom complaints. The unique role of negative affectivity. In R.H. Hoyle (Ed.), *Structural equation modelling: Concepts, issues and applications* (pp. 217-235). Thousand Oaks, CA: Sage.

Hurt, S.W., Schnurr, P.P., Severino, S.K., Freeman, E.W., Gise, L.H., Rivera-Tovar, A. & Steege, J.F. (1992). Late luteal phase dysphoric disorder in 670 women evaluated for premenstrual complaints. *American Journal of Psychiatry, 149,* 525-530.

Janiger, O., Riffenburgh, R. & Kersh, R. (1972). Cross cultural study of premenstrual symptoms. *Psychosomatics, 13,* 226-235.

Jarowsky, D.S. & Rausch, J. (1985). Editorial. Biochemical hypotheses of premenstrual tension syndrome. *Psychological Medicine, 15,* 3-8.

John, O.P. (1990). The "Big Five" factor taxonomy: Dimensions of personality in the natural language and in questionnaires. In L. Pervin (Ed.), *Handbook of personality theory and research* (pp. 66-100). New York: Guilford.

Jordheim, O. (1972). The premenstrual syndrome: Clinical trials of treatment with a progesterone combined with a diuretic compared with both a progestogen alone and with a placebo. *Acta Obstetricia et Gynecologica Scandinavica, 51,* 77-80.

Jorgensen, J., Rossignol, A. & Bonnlander, H. (1993). Evidence against multiple premenstrual syndromes: Results of a multivariate profile analysis of premenstrual symptomatology. *Journal of Psychosomatic Research, 37,* 257-263.

Jorm, A.F. (1989). Modifiability of trait anxiety and neuroticism: A meta-analysis of the literature. *Australian and New Zealand Journal of Psychiatry, 23,* 21-29.

Kaplan, R.M. & Saccuzzo, D.P. (1997). *Psychological testing: Principles, applications, and issues* (4th ed.). Pacific Grove, CA: Brooks/Cole.

Kessel, N. & Coppen, A. (1963). The prevalence of common menstrual symptoms. *Lancet, 2,* 61-64.

Klebanov, P.K. & Jemmott, J.B. (1992). Effects of experiences and bodily sensations on self-reports of premenstrual symptoms. *Psychology of Women Quarterly, 16,* 289-310.

Koeske, R.K. & Koeske, G.F. (1975). An attributional approach to moods and the menstrual cycle. *Journal of Personality and Social Psychology, 31,* 473-478.

Kuczmierczyk, A.R., Labrum, A.H. & Johnson, C.C. (1995). The relationship between mood, somatization, and alexithymia in premenstrual syndrome. *Psychosomatics, 36,* 26-32.

Kutner, S.J. & Brown, W.L. (1972). Types of oral contraceptives, depression and premenstrual symptoms. *Journal of Nervous and Mental Disease, 155,* 153-162.

Lahmeyer, H.W., Miller, M. & DeLeon-Jones, F. (1982). Anxiety and mood fluctuation during the normal menstrual cycle. *Psychosomatic Medicine, 44,* 183-194.

Lawlor, S. & Choi, P.Y.L. (1998). The generation gap in menstrual cycle attributions. *British Journal of Health Psychology, 3,* 257-263.

Lee, K.A. & Rittenhouse, C.A. (1991). Prevalence of perimenstrual symptoms in employed women. *Women and Health, 17,* 17-32.

Lee, K.A. & Rittenhouse, C.A. (1992). Health and perimenstrual symptoms: Health outcomes for employed women who experience perimenstrual symptoms. *Women and Health, 19,* 65-78.

Leibenluft, E., Fiero, P.L. & Rubinow, D.R. (1994). Effect of the menstrual cycle on dependent variables in mood disorder research. *Archives of General Psychiatry, 51,* 761-781.

Lindner, H. & Kirkby, R.J. (1992). Premenstrual symptoms: The role of irrational thinking. *Psychological Reports, 71,* 247-252.

Livesey, J.H., Wells, J.E., Metcalf, M.G., Hudson, S.M. & Bates, R.H.T. (1989). Assessment of the significance and severity of premenstrual tension - I. A new model. *Journal of Psychosomatic Research, 33,* 269-279.

Logue, C.M. & Moos, R.H. (1986). Perimenstrual symptoms: Prevalence and risk factors. *Psychosomatic Medicine, 48,* 388-414.

Lu, L. (1994). University transition: Major and minor life stressors, personality characteristics and mental health. *Psychological Medicine, 24,* 81-87.

Lu, L. & Argyle, M. (1991). Happiness and cooperation. *Personality and Individual Differences, 12,* 1019-1030.

Maddocks, S., Hahn, P., Moller, F. & Reid, R.L. (1986). A double-blind placebo controlled trial of progesterone vaginal suppositories in the treatment of premenstrual syndrome. *American Journal of Obstetrics and Gynecology, 154,* 573-581.

Magos, A.L., Brincat, M. & Studd, J.W.W. (1986). Treatment of the premenstrual syndrome by subcutaneous oestradiol implants and cyclical oral norethisterone: Placebo controlled study. *British Medical Journal, 292,* 1629-1633.

Magos, A.L. & Studd, J.W.W. (1986). Assessment of menstrual cycle symptoms by trend analysis. *American Journal of Obstetrics and Gynecology, 155,* 271-277.

Mallow, G.K. (1981). The relationship between aggressive behavior and menstrual cycle stage in female rhesus monkeys (*Macaca mulatta*). *Hormones and Behavior, 15,* 259-269.

Markum, R.S. (1976). Assessment of the reliability of and the effect of neutral instructions on the symptom ratings on the Moos Menstrual Distress Questionnaire. *Psychosomatic Medicine, 38,* 163-172.

Marriott, A. & Faragher, E.B. (1986). An assessment of psychological state associated with the menstrual cycle in users of oral contraception. *Journal of Psychosomatic Research, 30,* 41-47.

Marván, L. & Escobedo, C. (1999). Premenstrual symptomatology: Role of prior knowledge about premenstrual syndrome. *Psychosomatic Medicine, 61,* 163-167.

Mattson, B. & von Schoultz, B.V. (1974). A comparison between lithium, placebo and a diuretic in premenstrual tension. *Acta Psychiatrica Scandinavica, 255* (suppl.), 75-84.

McCance, R.A., Luff, M.C. & Widdowson, E.E. (1937). Physical and emotional periodicity in women. *Journal of Hygiene, 37,* 571-611.

McCrae, R.R. (1991, August). *The counterpoint of personality assessment: Self-reports and ratings.* Invited address presented at the meeting of the American Psychological Association, San Francisco.

McCrae, R.R. & Costa, P.T., Jr. (1983a). Joint factors in self-reports and ratings: Neuroticism, extraversion and openness to experience. *Personality and Individual Differences, 4,* 245-255.

McCrae, R.R. & Costa, P.T., Jr. (1983b). Social desirability scales: More substance than style. *Journal of Consulting and Clinical Psychology, 51,* 882-888.

McCrae, R.R. & Costa, P.T., Jr. (1991). Adding liebe und arbeit: The full five factor model and well-being. *Personality and Social Psychology Bulletin, 17,* 227-232.

McCrae, R.R., Costa, P.T., Jr., Dahlstrom, W.G., Barefoot, J.C., Siegler, I.C. & Williams, R.B., Jr. (1989). A caution on the use of the MMPI K-correction in research on psychosomatic medicine. *Psychosomatic Bulletin, 51,* 58-65.

McCrae, R.R. & John, O. (1992). An introduction to the five-factor model and its applications. *Journal of Personality, 60,* 175-215.

McFarland, C., Ross, M. & DeCourville, N. (1989). Women's theories of menstruation and biases in recall of menstrual symptoms. *Journal of Personality and Social Psychology, 57,* 522-531.

McFarlane, J., Martin, C.L. & Williams, T.M. (1988). Mood fluctuations. Women versus men and menstrual versus other cycles. *Psychology of Women Quarterly, 12,* 201-223.

Meins, W., Frey, A. & Thiesmann, R. (1998). Premorbid personality traits in Alzheimer's Disease: Do they predispose to noncognitive behavioral symptoms? *International Psychogeriatrics, 10,* 369-378.

Merikangas, K.R., Foeldenyi, M. & Angst, J. (1993). The Zurich Study XIX. Patterns of menstrual disturbances in the community: Results of the Zurich Cohort Study. *European Archives of Psychiatry and Clinical Neuroscience, 243,* 23-32.

Metcalf, M.G., Braiden, V. & Livesey, J.H. (1992). Symptom cyclicity in women with the premenstrual syndrome: An 8-year follow-up study. *Journal of Psychosomatic Research, 36,* 237-241.

Metcalf, M.G. & Hudson, S.M. (1985). The premenstrual syndrome: Selection of women for treatment trials. *Journal of Psychosomatic Research, 29,* 631-638.

Metcalf, M.G., Livesey, J.H., Hudson, S.M. & Wells, E.J. (1988). The premenstrual syndrome: Moods, headaches and physical symptoms in 133 menstrual cycles. *Journal of Psychosomatic Obstetrics and Gynaecology, 8,* 31-43.

Metcalf, M.G., Livesey, J.H. & Wells, J.E. (1989). Assessment of the significance and severity of premenstrual tension - II. Comparison of methods. *Journal of Psychosomatic Research, 33,* 281-292.

Metcalf, M.G., Livesey, J.H., Wells, J.E. & Braiden, V. (1989). Mood cyclicity in women with and without the premenstrual syndrome. *Journal of Psychosomatic Research, 33,* 407-418.

Metcalf, M.G., Livesey, J.H., Wells, J.E. & Braiden, V. (1990). Physical symptom cyclicity in women with and without the premenstrual syndrome. *Journal of Psychosomatic Research, 34,* 203-213.

Miller, P. McC. & Ingham, J.G. (1976). Friends, confidants and symptoms. *Social Psychiatry, 11,* 51-58.

Mira, M., McNeil, D., Fraser, I.S., Vizzard, J. & Abraham, S. (1986). Mefenamic acid in the treatment of premenstrual syndrome. *Obstetrics and Gynecology, 68,* 395-398.

Mira, M., Vizzard, J. & Abraham, S. (1985). Personality characteristics in the menstrual cycle. *Journal of Psychosomatic Obstetrics and Gynaecology, 4,* 329-334.

Mohan, V. & Chopra, R. (1987). Personality variations as an effect of pre-menstrual tensions. *Personality and Individual Differences, 8,* 763-765.

Moos, R.H. (1968). The development of a menstrual distress questionnaire. *Psychosomatic Medicine, 30,* 853-867.

Moos, R.H. (1969). Typology of menstrual cycle symptoms. *American Journal of Obstetrics and Gynecology, 103,* 390-402.

Moos, R.H., Kopell, B.S., Melges, F.T., Yalom, I.D., Lunde, D.T., Clayton, R.B. & Hamburg, D.A. (1969). Fluctuations in symptoms and moods during the menstrual cycle. *Journal of Psychosomatic Research, 13,* 37-44.

Moos, R.H. (1986). *Menstrual Distress Questionnaire Manual.* Los Angeles: Western Psychological Services.

Morris, N.M. & Udry, J.R. (1972). Contraceptive pills and day-by-day feelings of well-being. *American Journal of Obstetrics and Gynecology, 113,* 763-765.

Morse, C.A., Bernard, M.E. & Dennerstein, L. (1989). The effects of rational-emotive therapy and relaxation training on premenstrual syndrome: A preliminary study. *Journal of Rational-Emotive and Cognitive Behavioural Therapy, 7,* 98-110.

Morse, C.A. & Dennerstein, L. (1988a). Cognitive therapy for premenstrual syndrome. In M.G. Brush & E.M. Goudsmit (Eds.), *Functional disorders of the menstrual cycle* (pp. 177-190). New York: John Wiley & Sons.

Morse, C.A. & Dennerstein, L. (1988b). The factor structure of symptom reports in premenstrual syndrome. *Journal of Psychosomatic Research, 32,* 93-98.

Morse, C.A., Dennerstein, L., Farrell, E. & Varnavides, K. (1991). A comparison of hormone therapy, coping skills training, and relaxation for the relief of premenstrual syndrome. *Journal of Behaviour Medicine, 14,* 469-489.

Mortola, J.F. (1996). Premenstrual syndrome. *Trends in Endocrinology and Metabolism, 7,* 184-189.

Munday, M.R., Brush, M.G. & Taylor, R.W. (1981). Correlations between progesterone, oestradiol and aldosterone levels in the premenstrual syndrome. *Clinical Endocrinology, 14,* 1-9.

Muse, K.N., Cetel, N.S., Futterman, L.A. & Yen, S.S.C. (1984). The premenstrual syndrome. Effects of "medical ovariectomy". *The New England Journal of Medicine, 311,* 1345-1349.

Nada Raja, S., Feehan, M., Stanton, K W. & McGee, R. (1992). Prevalence and correlates of the premenstrual syndrome in adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry, 31,* 783-789.

O'Brien, P.M., Craven, D., Selby, C. & Symonds, E.M. (1979). Treatment of premenstrual syndrome by spironolactone. *British Journal of Obstetrics and Gynaecology, 86,* 142-147.

Olasov, B. & Jackson, J. (1987). Effects of expectancies on women's reports of moods during the menstrual cycle. *Psychosomatic Medicine, 49,* 65-78.

Paige, K.E. (1971). Effects of oral contraceptives on affective-fluctuations associated with the menstrual cycle. *Psychosomatic Medicine, 33,* 515-536.

Parlee, M.B. (1973). The premenstrual syndrome. *Psychological Bulletin, 80,* 454-465.

Parlee, M.B. (1974). Stereotypic beliefs about menstruation: A methodological note on the Moos Menstrual Distress Questionnaire and some new data. *Psychosomatic Medicine, 36,* 229-240.

Patterson, F.G.P., Holts, C. & Saphire, L. (1991). Cyclic changes in hormonal, physical, behavioral, and linguistic measures in a female lowland gorilla. *American Journal of Primatology, 24,* 181-194.

Pearlstein, T. & Stone, A.B. (1998). Premenstrual syndrome. *The Psychiatric Clinics of North America, 21,* 577-590.

Pennebaker, J.W. & Watson, D. (1991). The psychology of somatic symptoms. In L.J. Kirmayer & J.M. Robbins (Eds.), *Current concepts of somatization: Research and clinical perspectives* (pp. 21-35). Washington DC: American Psychiatric Press.

Picone, L. & Kirkby, R.J. (1990). Relationship between anxiety and premenstrual syndrome. *Psychological Reports, 67,* 43-48.

Pulkkinen, M.O. & Kaihola, H.-L. (1977). Mefenamic acid in dysmenhorrea. *Acta Obstetricia et Gynecologica Scandinavica, 56,* 75-76.

Rapkin, A.J., Chang, L.I.C. & Reading, A.E. (1988). Comparison of retrospective and prospective assessment of premenstrual symptoms. *Psychological Reports, 62,* 55-60.

Rees, L. (1953). Psychosomatic aspects of the premenstrual tension syndrome. *British Journal of Psychiatry, 99,* 63-73.

Reid, R.L. & Yen, S.S.C. (1981). Premenstrual Syndrome. *American Journal of Obstetrics and Gynecology, 139,* 85-104.

Ricci, J.V. (1950). *The genealogy of gynaecology.* Philadelphia: Blakiston.

Richter, M.A., Haltvick, R. & Shapiro, S.S. (1984). Progesterone treatment of premenstrual syndrome. *Current Therapeutic Research, 36,* 840-850.

Rivera-Tovar, A.D. & Frank, E. (1990). Late luteal phase dysphoric disorder in young women. *American Journal of Psychiatry, 147,* 1634-1636.

Rook, K.S. (1984). The negative side of social interaction: Impact on psychological well-being. *Journal of Personality and Social Psychology, 46,* 1097-1108.

Rosen, L.N., Moghadam, L.Z. & Endicott, J. (1988). Psychosocial correlates of premenstrual dysphoric subtypes. *Acta Psychiatrica Scandinavica, 77,* 446-553.

Rosen, L.N., Moghadam, L.Z. & Endicott, J. (1990). Relationship between premenstrual symptoms and general well-being. *Psychosomatics, 31,* 47-54.

Rouse, P. (1978). Premenstrual tension: A study using the Moos Menstrual Questionnaire. *Journal of Psychosomatic Research, 22,* 215-222.

Rowell, T.E. (1963). Behaviour and reproductive cycles of female macaques. *Journal of Reproduction and Fertility, 6,* 193-203.

Rubinow, D.R., Hoban, M.C., Grover, G.N., Galloway, D.S., Roy-Byrne, P., Andersen, R. & Merriam, G.R. (1988). Changes in plasma hormones across the menstrual cycle in patients with menstrually related mood disorder and in control subjects. *American Journal of Obstetrics and Gynecology, 158,* 5-11.

Rubinow, D.R. & Roy-Byrne, P. (1984). Premenstrual syndromes: Overview from a methodologic perspective. *American Journal of Psychiatry, 141,* 163-172.

Rubinow, D.R., Roy-Byrne, P., Hoban, M.C., Gold, P.W. & Post, R.M. (1984). Prospective assessment of menstrually related mood disorders. *American Journal of Psychiatry, 141,* 684-686.

Rubinow, D.R. & Schmidt, P.J. (1989). Models for the development and expression of symptoms in premenstrual syndrome. *Psychiatric Clinics of North America, 12,* 53-68.

Ruble, D.N. (1977). Premenstrual symptoms: A reinterpretation. *Science, 197,* 291-292.

Ruble, D.N. & Brooks-Gunn, J. (1979). Menstrual symptoms: A social cognition analysis. *Journal of Behavioral Medicine, 2,* 171-194.

Russell, J.W., Coleman, G.J. & Hart, W.G. (1988). Validation of a modified version of the Menstrual Distress Questionnaire: A case for false attribution? *Journal of Psychosomatic Obstetrics and Gynaecology, 8,* 19-29.

Saayman, G.S. (1971). Aggressive behaviour in free-ranging chacma baboons (*Papio ursinus*). *Journal of Behavioral Science, 1,* 77-83.

Sampson, G.A. (1979). Premenstrual syndrome: A double-blind controlled trial of progesterone and placebo. *British Journal of Psychiatry, 135*, 209-215.

Sampson, G.A. & Jenner, F.A. (1977). Studies of daily recordings from the Moos Menstrual Distress Questionnaire. *British Journal of Psychiatry, 130*, 265-271.

Sanders, D., Warner, P., Bäckström, T. & Bancroft, J. (1983). Mood, sexuality, hormones and the menstrual cycle. I. Changes in mood and physical state: Description of subjects and method. *Psychosomatic Medicine, 45*, 487-501.

Schechter, D., Bachmann, G.A., Vaitukaitis, J., Phillips, D. & Saperstein, D. (1989). Perimenstrual symptoms: Time course of symptom intensity in relation to endocrinologically defined segments of the menstrual cycle. *Psychosomatic Medicine, 51*, 173-194.

Schnurr, P.P. (1988). Some correlates of prospectively defined premenstrual syndrome. *American Journal of Psychiatry, 145*, 491-494.

Schnurr, P.P. (1989). Measuring amount of symptom change in the diagnosis of premenstrual syndrome. *Psychological Assessment, 1*, 277-283.

Sheldrake, P. & Cormack, M. (1976). Variations in menstrual cycle symptom reporting. *Journal of Psychosomatic Research, 20*, 169-177.

Siegel, J.P. (1987, Fall). Premenstrual syndrome: Psychiatric, physiological, and psychosocial perspectives. *Health and Social Work*, 284-289.

Siegel, J.P., Myers, B.J. & Dineen, M.K. (1987). Premenstrual tension syndrome symptom clusters. Statistical evaluation of the subsyndromes. *Journal of Reproductive Medicine, 32*, 395-399.

Silbergeld, S., Brast, N. & Noble, E.P. (1971). The menstrual cycle: A double blind study of symptoms, mood and behavior, and biochemical variables using Enovid and placebo. *Psychosomatic Medicine, 33*, 411-428.

Slade, P. (1984). Premenstrual emotional changes in normal women: Fact or fiction. *Journal of Psychosomatic Research, 28,* 1-7.

Smith, S.L. (1975). Mood and the menstrual cycle. In E.J. Sachar (Ed.), *Topics in psychoneuroendocrinology* (pp. 19-58). New York: Grune and Stratton.

Smith, T.W. & Williams, P.G. (1992). Personality and health: Advantages and limitations of the five-factor model. *Journal of Personality, 60,* 395-423.

Steege, J.F., Stout, A.L. & Rupp, S.L. (1985). Relationships among premenstrual symptoms and menstrual cycle characteristcs. *Obstetrics and Gynecology, 65,* 398-402.

Steiner, M., Haskett, R.F. & Carroll, B.J. (1980). Premenstrual tension syndrome: The development of research diagnostic criteria and new rating scales. *Acta Psychiatrica Scandinavica, 62,* 177-190.

Steiner, M., Haskett, R., Osmun, J., Rubin, R. & Carroll, B.J. (1979). Premenstrual tension syndrome: Psychoendocrine evaluation and treatment outcome. *Psychosomatic Medicine, 41,* 73.

Sutherland, H. & Stewart, I. (1965). A critical analysis of the premenstrual syndrome. *Lancet, 1,* 1180-1183.

Sutherland, V.J. & Cooper, C.L. (1990). *Understanding stress: A psychological perspective for health professionals.* London: Chapman & Hall.

Sveinsdóttir, H. (1998). Prospective assessment of menstrual and premenstrual experiences of Icelandic women. *Health Care for Women International, 19,* 71-82.

Sveinsdóttir, H. & Bäckström, T. (2000a). Prevalence of menstrual cycle symptom cyclicity and premenstrual dysphoric disorder in a random sample of women using and not using oral contraceptives. *Acta Obstetricia et Gynecologica Scandinavica, 79,* 405-413.

Sveinsdóttir, H. & Bäckström, T. (2000b). Menstrual cycle symptom variation in a community sample of women using and not using oral contraceptives. *Acta Obstetricia et Gynecologica Scandinavica, 79,* 757-764.

Tabachnick, B.G. & Fidell, L.S. (1986). *Using multivariate statistics* (3rd ed.). New York: HarperCollins.

Taylor, J.W. (1979a). Plasma progesterone, oestradiol 17ß and premenstrual symptoms. *Acta Psychiatrica Scandinavica, 60,* 76-86.

Taylor, J.W. (1979b). Psychological factors in the aetiology of pre-menstrual symptoms. *Australian and New Zealand Journal of Psychiatry, 13,* 35-41.

Taylor, R.J., Fordyce, I.D. & Alexander, D.A. (1991). Relationship between personality and premenstrual symptoms: A study in five general practices. *British Journal of General Practice, 41,* 55-57.

Thys-Jacobs, S., Alvir, J.M.J. & Fratarcangelo, P. (1995). Comparative analysis of three PMS assessment instruments – The identification of premenstrual syndrome with core symptoms. *Psychopharmacology Bulletin, 31,* 389-396.

Thys-Jacobs, S., Ceccarelli, S., Bierman, A., Weisman, H., Cohen, M.A. & Alvir, J. (1989). Calcium supplementation in premenstrual syndrome. *Journal of General Internal Medicine, 4,* 183-189.

Tupes, E.C. & Christal, R.E. (1961). Recurrent personality factors based on trait ratings. *USAF ASD Technical Report* (No. 61-97).

Ussher, J.J. & Wilding, J.M. (1992). Interactions between stress and performance during the menstrual cycle in relation to the premenstrual syndrome. *Journal of Reproductive and Infant Psychology, 10,* 83-101.

van den Akker, O.B.A., Eves, F.F., Service, S. & Lennon, B. (1995). Menstrual cycle symptom reporting in three British ethnic groups. *Social Science and Medicine, 10,* 1417-1423.

van den Akker, O., Sharifan, N., Packer, A. & Eves, F. (1995). Contribution of generalized negative affect to elevated menstrual cycle symptom reporting. *Health Care for Women International, 16,* 263-272.

van den Akker, O. & Steptoe, A. (1985). The pattern and prevalence of symptoms during the menstrual cycle. *British Journal of Psychiatry, 147,* 164-169.

van den Boogaard, T.G.H.M. & Bijleveld, C.C.J.H. (1988). Daily menstrual symptom measures in women and men using an extended version of Moos's instrument. *Journal of Psychosomatic Obstetrics and Gynaecology, 9,* 103-110.

van der Meer, Y.G., Benedek-Jaszmann, L.J. & van Loenen, A.C. (1983). Effect of high-dose progesterone on the pre-menstrual syndrome; a double-blind cross-over trial. *Journal of Psychosomatic Obstetrics and Gynaecology, 2,* 220-222.

van der Ploeg, H.M. (1987). Emotional states and the premenstrual syndrome. *Personality and Individual Differences, 8,* 95-100.

van der Ploeg, H.M. (1990). The factor structure of the Menstrual Distress Questionnaire. *Psychological Reports, 66,* 707-714.

van der Ploeg, H.M. & Lodder, E.B. (1993). Longitudinal measurement in the diagnostics of the premenstrual syndrome. *Journal of Psychosomatic Research, 37,* 33-38.

Vassend, O. (1989). Dimensions of negative affectivity, self-reported somatic symptoms, and health-related behaviors. *Social Science and Medicine, 28,* 29-36.

Velting, D.M. & Liebert, R.M. (1997). Predicting three mood phenomena from factors and facets of the NEO-PI. *Journal of Personality Assessment, 68,* 165-172.

Vila, J. & Beech, H.R. (1980). Premenstrual symptomatology: An interaction hypothesis. *British Journal of Social and Clinical Psychology, 19,* 73-80.

Walker, A. (1992). Premenstrual symptoms and ovarian hormones: A review. *Journal of Reproductive and Infant Psychology, 10,* 67-82.

Walker, A. (1994). Mood and well-being in consecutive menstrual cycles. *Psychology of Women Quarterly, 18,* 271-290.

Walker, A. & Bancroft, J. (1990). Relationship between premenstrual symptoms and oral contraceptive use: A controlled study. *Psychosomatic Medicine, 52,* 86-96.

Warner, P. & Bancroft, J. (1988). Mood, sexuality, oral contraceptives and the menstrual cycle. *Journal of Psychosomatic Research, 32,* 417-427.

Waternaux, C.M. (1976). Asymptotic distribution of the sample roots for a nonnormal population. *Biometrika, 63,* 639-545.

Watson, D. & Clark, L.A. (1984). Negative affectivity: The disposition to experience aversive emotional states. *Psychological Bulletin, 96,* 465-490.

Watson, D. & Clark, L.A. (1992). On traits and temperament: General and specific factors of emotional experience and their relation to the five-factor model. *Journal of Personality, 60,* 441-476.

Watson, D. & Pennebaker, J.W. (1989). Health complaints, stress, and distress: Exploring the central role of negative affectivity. *Psychological Review, 96,* 234-254.

Weiss, R.L., Hops, H. & Patterson, G.R. (1973). A framework for conceptualizing marital conflict, a technology for altering it, some data for evaluating it. In L.A. Hammerlynch, L.C. Handy & E.J. Mash (Eds.), *Behaviour change, methodology, concepts, and practice* (pp. 309-342). Champaign, IL: Research Press.

Wiggins, J.S. & Trapnell, P.D. (1997). Personality structure: The return of the big five. In R. Hogan, J.A., Johnson & S. Briggs (Eds.), *Handbook of personality psychology* (pp. 737-765). San Diego, CA: Academic Press.

Wilcoxon, L.A., Schrader, S.L. & Sherif, C.W. (1976). Daily self-reports on activities, life events, moods and somatic changes during the menstrual cycle. *Psychosomatic Medicine, 38,* 399-417.

Wineberger, M., Hiner, S.L. & Tierney, W.M. (1987). Assessing social support in elderly adults. *Social Medicine, 25,* 1049-1055.

Wood, C. & Jakubowicz, D. (1980). The treatment of premenstrual symptoms with mefenamic acid. *British Journal of Obstetrics and Gynaecology, 87,* 627-630.

Wood, C., Larsen, L. & Williams, R. (1979). Menstrual characteristics of 2,343 women attending the Shepherd Foundation. *Australian and New Zealand Journal of Obstetrics and Gynaecology, 19,* 107-110.

Woods, N.F., Most, A. & Dery, G.K. (1982a). Estimating perimenstrual distress: A comparison of two methods. *Research in Nursing and Health, 5,* 81-91.

Woods, N.F., Most, A. & Dery, G.K. (1982b). Toward a construct of perimenstrual distress. *Research in Nursing and Health, 5,* 123-136.

Woods, N.F., Most, A. & Dery, G.K. (1982c). Prevalence of perimenstrual symptoms. *American Journal of Public Health, 72,* 1257-1264.

World Health Organisation. (1981). A cross-cultural study of menstruation: Implications for contraceptive development and use. *Studies in Family Planning, 12,* 3-16.

Wynn, V., Adams, P., Folkard, J. & Seed, M. (1975). Tryptophan, depression and steroidal contraception. *Journal of Steroid Biochemistry, 6,* 965-970.

Yankauskas, E. (1990). Primary female syndromes: An update. *New York State Journal of Medicine, 90,* 295-302.

Youdale, J.V.M. & Freeman, R.J. (1987). Premenstrual assessment form typological categories: Classification of self-defined premenstrually symptomatic and asymptomatic women. *Journal of Consulting and Clinical Psychology, 55,* 418-422.

Yuk, V.J., Jugdutt, A.V., Cumming, C.E., Fox, E.E. & Cumming, D.C. (1990). Toward a definition of PMS: A factor analytic evaluation of premenstrual change in non-complaining women. *Journal of Psychosomatic Research, 34,* 439-446.

Appendix A1

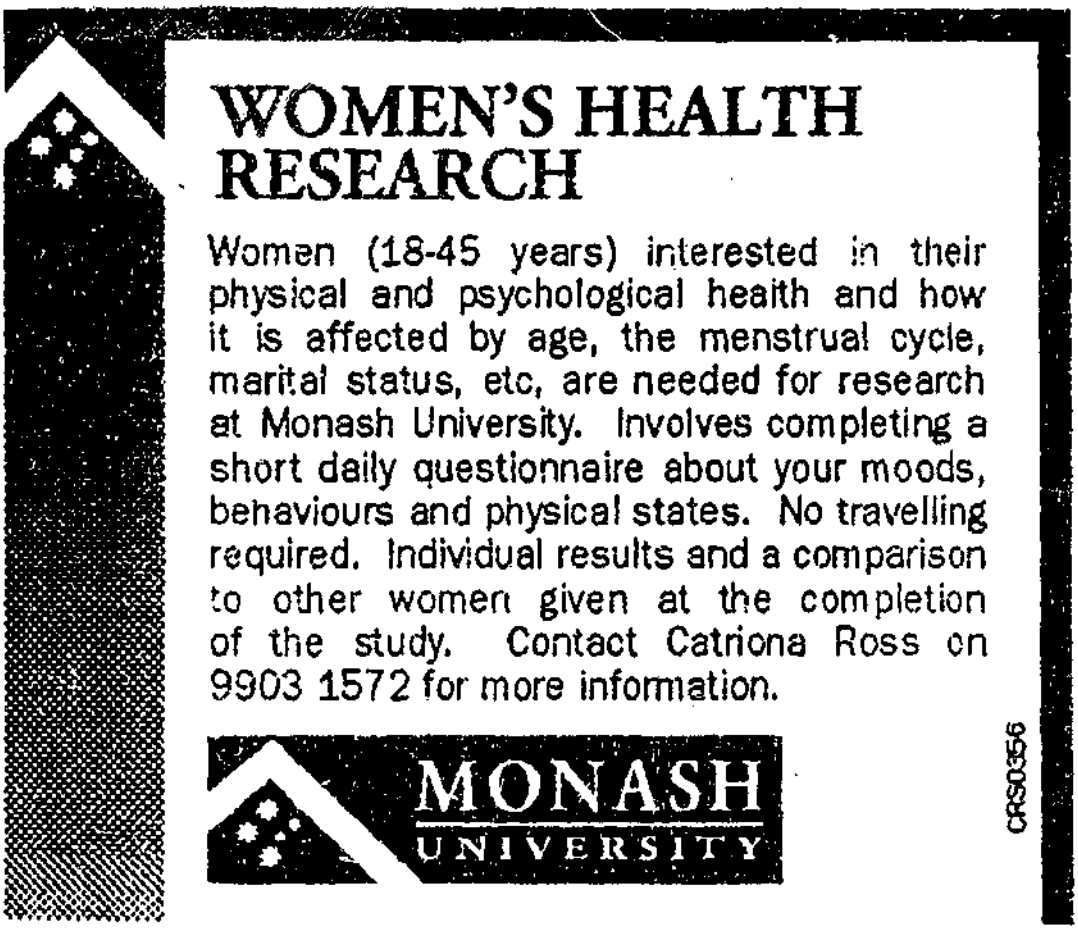
Recruitment Advertisement Posted on Bulletin Boards and in Local Newsletters/Magazines

WOMEN NEEDED FOR HEALTH STUDY

Women between the ages of 18 and 45 are needed to participate in a study examining health and quality of life issues. You will be asked to fill in a short questionnaire daily for 10 weeks, indicating your experience of a number of moods, behaviours and physical states. At the end of the study you will be given some feedback on how your daily experiences relate to your current situation and compare to those of other women. (Participants are not required to travel; questionnaires can be completed at your convenience and returned in postage paid envelopes). If you are interested contact Catriona on 9905-3971 (Monday-Wednesday) or 9479-2147 (Thursday-Friday).

Appendix A2

Recruitment Advertisement Used in Major Newspapers



Appendix B

Modified Moos Menstrual Distress Questionnaire

Code _____ Date _____

Below is a list of moods, behaviours, and physical states that people sometimes experience. Please indicate the category which best describes your experience of each item over the past 24 hours by circling the corresponding number.

	None	slight	moderate	severe
1. WEIGHT GAIN	0	1	2	3
2. DIFFICULTY SLEEPING	0	1	2	3
3. CRYING SPELLS	0	1	2	3
4. LOWERED WORK, SCHOOL PERFORMANCE	0	1	2	3
5. MUSCLE STIFFNESS	0	1	2	3
6. FORGETFULNESS	0	1	2	3
7. CONFUSION	0	1	2	3
8. TAKING NAPS, STAYING IN BED	0	1	2	3
9. HEADACHE	0	1	2	3
10. SKIN DISORDER	0	1	2	3
11. LONELINESS	0	1	2	3
12. STAYING HOME FROM WORK, SCHOOL	0	1	2	3
13. STOMACH PAINS	0	1	2	3
14. DIZZINESS OR FAINTNESS	0	1	2	3
15. AVOIDING SOCIAL ACTIVITIES	0	1	2	3
16. ANXIETY	0	1	2	3
17. BACKACHE	0	1	2	3
18. COLD SWEATS	0	1	2	3
19. DIFFICULTY MAKING DECISIONS	0	1	2	3
20. FATIGUE	0	1	2	3
21. FEELING SICK OR VOMITING	0	1	2	3
22. RESTLESSNESS	0	1	2	3
23. HOT FLUSHES	0	1	2	3
24. DIFFICULTY IN CONCENTRATION	0	1	2	3
25. PAINFUL OR TENDER BREASTS	0	1	2	3
26. ACCIDENTS	0	1	2	3
27. FEELING SWOLLEN OR BLOATED	0	1	2	3
28. IRRITABILITY	0	1	2	3
29. GENERAL ACHES AND PAINS	0	1	2	3
30. CHANGES OF MOOD	0	1	2	3
31. DEPRESSION	0	1	2	3
32. DECREASE IN EFFICIENCY	0	1	2	3
33. LOWERED MOTOR CO-ORDINATION	0	1	2	3
34. TENSION	0	1	2	3

Please turn over and answer the questions on the other side.

Please answer the following questions by circling yes or no and providing additional information if required.

1. Have you taken any prescription or nonprescription medication or vitamins today? yes/no
   If yes, please specify

   _____

   _____

2. Are you menstruating today? yes/no

3. Did you experience any unusually stressful event/s today? yes/no
   If yes, please specify

   _____

   _____

4. Have you been ill today? yes/no
   If yes, please specify

   _____

   _____

Thank-you very much for your co-operation.

Appendix C

General Information Form

Date _____ Code no _____

Please answer all of the following questions. Most questions require you to circle yes or no and to provide some additional information if you answered yes. All of the information will be kept strictly confidential.

1. Age: _____ years _____ months

2. Relationship status: single/defacto/married

3. If in a relationship, do you live with your partner? yes/no

4. Do you have any children? yes/no
   If yes, how many? _____

5. Were you born in Australia? yes/no
   If no, what country were you born in? _____

6. Is there a culture, other than the Australian culture, that you strongly identify with? yes/no
   If yes, what is it? _____

7. Do you take any prescribed medication (with the exception of oral contraceptives) on a regular basis? yes/no
   If yes, please specify the medication, the dosage, and how often you take the medication.

   _____

   _____

8. Are you currently working? yes/no If yes, part-time/full-time
   Are you currently studying? yes/no If yes, part-time/full-time

9. Have you ever used oral contraceptives? yes/no
   If yes, are you currently using them? yes/no
   If you are no longer using oral contraceptives, when did you stop? _____

10. Do you use any nonprescription drugs or vitamins on a regular basis (e.g. marijuana, heroin, aspirin, pain killers)? yes/no
    If yes, please specify the drug/vitamin, and how often you use it.

    _____

    _____

Please turn over and answer the questions on the other side.

11. Do you experience physical, behavioural or emotional changes during the premenstrual phase of your menstrual cycle? yes/no
If yes, please specify the nature of the problem.

_____

_____

_____

12. Are you suffering from any major physical or psychiatric illness? yes/no
If yes, please specify the nature of the illness.

_____

_____

_____

13. Have you ever suffered from a psychiatric illness? yes/no
If yes, please give a brief history of the problem.

_____

_____

_____

14. Have you had any major abnormalities in menstruation in the past year? (e.g. breakthrough bleeding, missed periods, extended bleeding, extremely painful periods, marked variation in cycle length, extremely long or short menstrual cycles). yes/no
If yes, please specify the nature and history of the problem.

_____

_____

_____

15. Are you currently pregnant or breast feeding? yes/no

16. On completion of this study would you be interested in being contacted regarding another study? yes/no

Thank-you very much for your co-operation.

Appendix D

Letter Providing Instructions to Participants Regarding Part I of The Study

Catriona Ross
Department of Psychology
Monash University

Dear

Thanks very much for your interest in this study. Enclosed are 70 **double-sided** questionnaires, enough to complete one per day for 10 weeks. Please complete one at approximately the same time at the end of each day; most women put them on the coffee table or beside the bed and complete them in the evenings. I would appreciate it if you would return the completed questionnaires to me every fortnight in the supplied pre-paid, addressed envelopes.

Also enclosed are a General Information Form, a Consent Form and an Explanatory Statement. Please complete these and return the General Information Form and the Consent form to me when you send the first lot of questionnaires. The Explanatory Statement should be retained for your records - it contains most of the important information about the study, the ethics details and my phone number.

I will call you in a few days to check that you are doing O.K with the questionnaires, but if you have any questions or problems in the meantime please don't hesitate to call me any time.

Thanks again,

Catriona Ross

Appendix E

Explanatory Statement

25/2/97

HEALTH AND QUALITY OF LIFE ISSUES IN WOMEN

My name is Catriona Ross and I am studying for my PhD at Monash University. A research project is an important component of the course and I am undertaking my research project under the supervision of Professor Grahame Coleman, a professor in the Department of Psychology.

The aim of this research project is to investigate health and quality of life issues in women. I am interested in what sort of "everyday" health problems (e.g.. depression, headache, difficulty concentrating) women experience, and how these symptoms relate to things such as age, marital status and the menstrual cycle. I hope that the findings of this research project will be useful in contributing to knowledge in these areas.

I am seeking healthy women between the ages of 18 and 45 who are prepared to fill in a short questionnaire every day for 10 weeks. If you are currently being treated for a major psychiatric or physical illness, or severe problems associated with menstruation, are pregnant or breast feeding, or taking any significant medications, you are unable to participate in this research project. The procedure will take approximately one to two minutes of your time every day, and will be undertaken at your convenience. Please complete the questionnaire at approximately the same time each day. You will also be asked to return the completed questionnaires to me every fortnight by posting them in the supplied pre-paid envelopes. Throughout the study you will be contacted by phone approximately every three weeks so that any questions or difficulties you have can be dealt with.

No findings which could identify any individual participant will be published. The anonymity of your participation is assured by our procedure, in which you are not asked to provide your name on the questionnaires. Access to data is restricted to my supervisor and me. Coded data are stored for five years, as prescribed by University regulations.

Participation in this research is entirely voluntary, and if you agree to participate, you may withdraw your consent at any time by contacting me either by phone or mail.

If you have any queries or would like to be informed of the aggregate research finding, please contact me by telephone on 9903-1572.

Should you have any complaint concerning the manner in which this research is conducted, please do not hesitate to contact The Standing Committee on Ethics in Research on Humans at the following address:

The Secretary
The Standing Committee on Ethics in Research on Humans
Monash University
Wellington Road
Clayton Victoria 3168
Telephone (03) 9905 2052 Fax (03) 9905 1420

Thank you.

Catriona Ross

9903 1572

Appendix F

Informed Consent Form

HEALTH AND QUALITY OF LIFE ISSUES IN WOMEN

I agree to take part in the above Monash University research project. I have had the project explained to me, and I have read and understood the Explanatory Statement, which I retain for my records.

I understand that any information I provide is confidential, and that no information that could lead to the identification of any individual will be disclosed in any reports on the project, or to any other party.

I also understand that my participation is voluntary, that I can choose not to participate, and that I can withdraw my participation at any stage of the project.

Name: ..... (please print) Code: .....

Signature: ..... Date: .....

Phone number: .....

Appendix G

Debriefing Letter and Feedback From Part I of Study

Catriona Ross
Department of Psychology
Monash University
Caulfield East 3145

Ph: 9903-1572
Fax: 9903-2501
email: catriona.ross@sci.monash.edu.au

Dear

Thank-you very much for your participation in, and commitment to, this research project. Your involvement was greatly appreciated and I hope you found the study interesting and relevant. Attached you will find your feedback from the study. This contains group feedback as well as individual data so that you can compare your experiences to the "average". Information about overall symptom experience as well as menstrual cycle data is included.

Also enclosed are a number of short questionnaires which ask you for information about yourself and your emotions. The purpose of these questionnaires is twofold. Firstly it will allow me to obtain some additional information about you which may be relevant to the symptoms you, and women in general, experience. Secondly, it provides some "follow-up" information, giving me some idea about how you were feeling during the study. I would appreciate your completing and returning these questionnaires in the supplied envelope.

Early this year some additional research will be conducted in which you are invited to participate. This research will involve examining the role of personality factors in menstrual cycle related symptoms. Personality refers to stable traits (e.g. introversion, extroversion) which influence the way we interact with our environment. In the absence of major life events or therapeutic intervention, our personality remains much the same throughout adulthood and affects all aspects of our lives. There has been some indication in past studies that personality may influence women's experiences of menstrually related changes. This issue, however, is still a contentious one and more research is required to understand how biological and psychological factors interact to produce premenstrual changes.

Because personality assessment involves the use of psychological tests, it is best carried out under appropriate circumstances in the presence of an examiner. Because of this issue, this research will be carried out at the Caulfield campus of Monash

University. I realise that due to distance and other constraints some women will not have the option of attending and I apologise for this. If you are interested in participating, however, but cannot attend a session at the university please let me know as special arrangements can be made. For those women who are interested in this project, day and evening sessions will be run and feedback from the testing session will be provided.

The questionnaire to be used is called the NEO personality inventory revised and is based on evidence that personality is comprised of five major factors. The feedback given will involve a brief description of your personality on each of the five factors.

The questionnaire takes 30- 45 minutes to complete but you will be asked to attend the university for up to 1 1/2 hours to allow for a more detailed explanation of the process, question time etc.

The sessions to be offered are outlined on the following page but are subject to the number of women wishing to attend (sessions will be run with between 15 and 20 women). If you are able to attend please indicate what times would be most suitable and return this information in the supplied envelope. If you are interested in attending you will be contacted by phone to confirm the day and time.

As mentioned previously the sessions will be held at the Caulfield campus of Monash University. The details are as follows:

Monash University
Caulfield campus
cnr Princess hwy and Sir John Monash drive (see Melway map reference 68 F1
(marked as Chisholm Institute of Technology on older Melways)
Building B, room 2.21 (2nd floor) (see attached campus map)

Note: free 2, 4 and 5 hour parking is usually available on the streets surrounding the university, but, if not, free all day parking is always available on Derby crescent, a short walk from the University (Melway map ref 68 F 2 and 3).

Please feel free to contact me as per the details at the top of the page if you wish to discuss anything further. Thanks again for your interest.

Best wishes,

Catriona Ross

SESSION TIMES

Please return this page if you are interested in attending. Circle one or more times that would be suitable.

Code number: _____

Name: _____

Phone numbers: _____

_____

Thurs Feb 19th - 10am
Thurs Feb 19th - 6pm

Tues Feb 24th - 10am
Tues Feb 24th - 6pm

FEEDBACK FROM WOMEN'S HEALTH STUDY

ID number _____

The primary aim of this research project was to investigate changes in moods, behaviours and physical state across the menstrual cycle. The study was advertised and conducted under the more general title of "health and quality of life issues" due to the fact that emphasis on the menstrual aspect of a study can change the way in which women report symptoms. Because you were not told the exact aim of the study you have the right to withdraw your data if you wish to do so. If you have any questions or wish to discuss this further please feel free to contact me.

As you probably recall you were asked to rate the extent to which you experienced a series of 34 symptoms every day for 70 days (0 represented no experience of the symptom, 1 represented slight experience of the symptom, 2 represented moderate experience of the symptom and 3 represented severe experience of the symptom). In the analysis presented below, the scores were averaged across the 70 days for: 1) all participants and 2) each individual participant. The first column of the table lists the 34 symptoms, the second column lists the overall score for that symptom (i.e. an average across the 70 days and across all subjects) and the third column lists your average score for that symptom across the 70 days.

symptom	**overall mean symptom score (all participants)**	**your mean symptom score**
accidents		
general aches and pains		
anxiety		
backache		
painful or tender breasts		
difficulty in concentrating		
confusion		
crying spells		
difficulty making decisions		
depression		
dizziness or faintness		
decrease in efficiency		

fatigue		
hot flushes		
forgetfulness		
headache		
staying home from work, school		
irritability		
loneliness		
changes of mood		
lowered motor co-ordination		
taking naps or staying in bed		
lowered work, school performance		
restlessness		
feeling sick or vomiting		
skin disorders		
difficulty sleeping		
avoiding social activities		
muscle stiffness		
stomach pains		
cold sweats		
feeling swollen or bloated		
tension		
weight gain		

As you can see from the above table, the most common symptoms overall were fatigue, taking naps or staying in bed, skin disorders, difficulty concentrating and irritability. By comparing your score to the overall score you can determine whether you experienced each symptom to a greater or lesser extent than average.

In the second analysis your symptom scores were calculated for a number of sub-scales as follows:

1. Negative Affect

* crying spells
* loneliness
* anxiety
* restlessness
* irritability
* changes of mood
* depression
* tension

2. Pain

* muscle stiffness
* stomach pains
* backache
* headache
* general aches and pains
* fatigue

3. Concentration

* difficulty sleeping
* forgetfulness
* confusion
* difficulty in concentrating
* accidents
* lowered motor co-ordination
* difficulty making decisions

4. Autonomic Reactions

* dizziness or faintness
* cold sweats
* feeling sick or vomiting
* hot flushes

5. Behavioural Change

* lowered work, school performance
* take naps, stay in bed
* staying home from work, school
* avoiding social activities
* decrease in efficiency

6. Water Retention

* weight gain
* skin disorder
* painful or tender breasts
* feeling swollen or bloated

Your average score for each of these sub-scales was determined both pre- and post-menstrually. An analysis was then conducted to establish whether you experienced a significant increase in symptomatology during the premenstrual period. This was calculated on the basis of a 30% increase from the post- to the pre- menstrual period; the diagnostic criteria recommended by the 1983 National Institute of Mental Health Conference. The first column in the table below lists the 6 sub-scales and the second and third columns your post- and pre- menstrual scores respectively. The fourth column indicates whether you experienced a significant increase in your premenstrual score when compared to your postmenstrual score. The final column indicates the percentage of women as a whole that experienced a significantly higher pre- than post- menstrual score. The final row in the table gives the above information for your overall pre- and post-menstrual scores.

sub-scale	post-menstrual score	pre-menstrual score	premenstrual increase?	% of women showing premenstrual increase
negative affect				
pain				
concentration				
autonomic reactions				
behavioural change				
water retention				
overall score				

Note: It must be made clear that the information provided here is not a clinical diagnosis of the presence or absence of the premenstrual syndrome. No advice will be given regarding treatment issues. If you have any queries of this nature please consult your physician.

Appendix H1

ANOVA Summary Table: The Effect of OC Use/Type and Menstrual Cycle Phase on Negative Affect

Source	*SS*	*df*	*MS*	*F*
OC use/type	1.07	2	0.54	1.96
Error between	23.26	84	0.28	
MC[a] phase	0.75	2	0.37	10.08***
Interaction	0.16	4	0.04	1.08
Error within	6.22	168	0.04	

[a]MC = menstrual cycle.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix H2

ANOVA Summary Table: The Effect of OC Use/Type and Menstrual Cycle Phase on Cognitive Symptoms

Source	*SS*	*df*	*MS*	*F*
OC use/type	0.25	2	0.13	0.92
Error between	11.48	84	0.14	
MC[a] phase	0.21	2	0.11	6.32**
Interaction	0.18	4	0.04	2.68*
Error within	2.80	168	0.02	

[a] MC = menstrual cycle.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix H3

ANOVA Summary Table: The Effect of OC Use/Type and Menstrual Cycle Phase on Behaviour Change

Source	*SS*	*df*	*MS*	*F*
OC use/type	1.17	2	0.59	2.97
Error between	16.59	84	0.20	
MC[a] phase	0.29	2	0.14	5.48**
Interaction	0.24	4	0.06	2.34
Error within	4.38	168	0.03	

[a]MC = menstrual cycle.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix H4

ANOVA Summary Table: The Effect of OC Use/Type and Menstrual Cycle Phase on Somatic Symptoms

Source	*SS*	*df*	*MS*	*F*
OC use/type	1.76	2	0.88	3.83*
Error between	19.28	84	0.23	
MC[a] phase	0.66	2	0.33	10.75***
Interaction	0.13	4	0.03	1.07
Error within	5.18	168	0.03	

[a]MC = menstrual cycle.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix H5

ANOVA Summary Table: The Effect of OC Use/Type and Menstrual Cycle Phase on Autonomic Reactions

Source	*SS*	*df*	*MS*	*F*
OC use/type	0.07	2	0.04	0.55
Error between	5.56	84	0.07	
MC[a] phase	0.11	2	0.05	3.37*
Interaction	0.08	4	0.02	1.22
Error within	2.64	168	0.02	

[a]MC = menstrual cycle.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix H6

ANOVA Summary Table: The Effect of OC Use/Type and Menstrual Cycle Phase on Fluid Retention

Source	*SS*	*df*	*MS*	*F*
OC use/type	1.77	2	0.87	5.44**
Error between	13.68	84	0.16	
MC[a] phase	3.40	2	1.70	31.94***
Interaction	0.43	4	0.11	2.03
Error within	8.95	168	0.05	

[a]MC = menstrual cycle.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix I

Menstrual History Form

Code _____

Please answer the following questions by circling the option that best describes your circumstances **during the time that you completed the women's health study.** If you are unsure as to the answer to any question and cannot make a reasonable guess, please make a note and leave the question blank. All of the information will be kept strictly confidential.

DEMOGRAPHIC INFORMATION

1) **current** relationship status:

not currently in a relationship
married
de facto
in a relationship but not married/de facto
other (please specify) _____

2) relationship **history**

a) previous marriage/s

if you have ever been in a marriage other than the one indicated in 1) above please indicate the number of times you have previously been married and the reason/s for the ending of the marriage/s

number of previous marriages _____

reason/s for ending of marriage/s:

decision by one/both partners led to separation
decision by one/both partners led to divorce
death of partner
other (please specify) _____

b) previous de facto relationship/s

if you have ever been in a de facto relationship other than the one indicated in 1) above please indicate the number of times you have previously been in a de facto relationship and the reason/s for the ending of the relationship/s:

number of previous de facto relationships _____

reason/s for the ending of the relationship/s:

decision by one/both partners
death of partner
other (please specify) _____

3) highest education level obtained:

less than year 10 high school
year 10 high school
year 12 high school
certificate or equivalent
diploma or equivalent
degree or equivalent
postgraduate studies

4) your income:

$0-$12, 000
$12, 001-$20,000
$20,001-$30,000
$30,001-$40,000
$40,001-$50,000
$50,001-$60,000
over $60,001

5) partner's income (if applicable):

$0-$12,000
$12,001-$20,000
$20,001-$30,000
$30,001-$40,000
$40,001-$50,000
$50,001-$60,000
over $60,001

6) if you are currently employed, please indicate how often you work by circling one or more of the options below and indicating the number of hours you work per week

full- time _____

part-time _____

casual _____

shift work _____

occasional _____

volunteer _____

other _____

7) if you are currently employed, please circle the category that best describes your primary occupation:

executive, administrative and managerial
administrative support, including clerical
professional
para-professional (e.g. nurse)
tradesperson
sales and personal service
plant and machine operator or driver
labourer or related worker
other (please specify) _____

8) if you are not currently employed, please indicate if you are: (circle more than one if applicable)

looking for work
performing household duties
caring for children
other (please specify) _____

9) if you are currently studying, please indicate the type of study you are doing:

TAFE
apprenticeship
undergraduate
postgraduate
other (please specify) _____

10) please indicate if you live in:

capital city/suburbs
country town
rural country
other (please specify) _____

MENSTRUAL CYCLE HISTORY

1. At what age did you begin to menstruate (e.g. 12yrs)?_____

2. What is the usual length of your menstrual cycle (e.g. 28 days)?_____

3. To what degree does the length of your menstrual cycle vary from cycle to cycle (e.g. by 1-2 days; 5 days) _____

4. What is the usual length of your period (e.g. 5 days)?_____

5. Do you experience pain associated with menstruation? Please circle:

no
yes - mild
yes - moderate
yes - severe

6. Please comment on any problems/concerns you have that are associated with your period (e.g. heavy blood loss)

7. Please comment on anything (e.g. diet, stress, medications, age) that you feel affects the timing/length/occurrence etc of your menstrual cycle.

HISTORY OF SYMPTOM CHANGE ACROSS THE MENSTRUAL CYCLE

1. Have you ever sought treatment for mood, behavioural or physical symptoms associated with the menstrual cycle. If yes, please indicate:

- who you sought help from (e.g. general practitioner, counsellor, gynaecologist, friend)
- what treatments you have tried (e.g. hormones, vitamin B6, exercise, counselling)
- the effectiveness of any treatments used

2. At what age did you first begin to experience symptoms associated with the menstrual cycle?

3. Have you noticed any changes in the type or severity of symptoms since they began (e.g. with age, the birth of children, marital problems, stress, diet etc)

4. Please comment on anything else that you feel affects the changes in your mood, physical state or behaviours across the menstrual cycle

5. Please comment on any major life events or stressors that have affected you over the past couple of years (e.g. relationship issues, financial difficulties, problems/issues at work). Please indicate the type of stressor, when it occurred, how long it lasted and whether it is still a problem for you

6. Please make any other comments that you feel are relevant

Thank you very much for your interest in this study

Appendix J

Letter Providing Instructions to Participants Regarding Completion of the NEO PI-R

Catriona Ross
Dept. Psychology
Monash University
Caulfield Campus
Ph: 9903-1572
email: catriona.ross@sci.monash.edu.au

Thank you for your interest in this personality assessment. Please complete the enclosed questionnaire by following the instructions on the item booklet. When you have completed the questionnaire, please return both the booklet and the answer sheet to me in the supplied envelope. I would appreciate your returning the materials to me as soon as possible, so that the booklet can be passed on to other women interested in the research. Please note that these materials are covered by copyright regulations and cannot be reproduced in any way.

Please ensure that you read all the instructions for the HAND-SCORING ANSWER SHEET on the front page of the item booklet before beginning the questionnaire. (Ignore the instructions for the machine-scoring answer sheet on page 2). If you are unsure about any of the instructions, contact me before beginning the questionnaire. It is particularly important to remember:

- not to write on the item booklet; record all answers on the answer sheet only
- not to erase any errors on the answer sheet as this may affect the scoring of the questionnaire. If you make a mistake place an "X" through the incorrect response.
- to answer the three questions at the bottom of the answer sheet

Please note also that the questionnaire uses the term "panhandler" which refers to a beggar/swindler/hustler etc.

Please complete this questionnaire under appropriate conditions. Try and sit at a table or desk with adequate lighting conditions, in an area free of distractions. Please complete the questionnaire honestly and do not ask the opinion of others.

Your feedback from the questionnaire will be sent to you in the mail as soon as possible.

Yours sincerely,

Catriona Ross

Appendix K1

Sequential Regression of Personality, Demographic and Menstrual Cycle Variables on Premenstrual Negative Affect

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.21		
	Monophasic OC	-0.15		
	Triphasic OC	-0.03	0.02	0.02
2	NOC	-0.38		
	Monophasic OC	-0.16		
	Triphasic OC	-0.11		
	Age	0.16		
	Marital status	-0.22		
	Number of children	0.12		
	Employment status	0.06		
	Age menarche	-0.14		
	MC[a] length	-0.12		
	MC variation	-0.04		
	Length menses	0.03		
	Menstrual pain	0.18		
	Neuroticism	0.34**		
	Extraversion	-0.03		
	Openness	0.07		
	Agreeableness	-0.07		
	Conscientiousness	0.09	0.34***	0.36***

[a] MC = menstrual cycle.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K2

Sequential Regression of OC Use/Type and Neuroticism on Premenstrual Negative Affect

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.21		
	Monophasic OC	-0.15		
	Triphasic OC	-0.03	0 .02	0 .02
2	NOC	-0.35		
	Monophasic OC	-0.12		
	Triphasic OC	-0.08		
	Neuroticism	0.44***	0.17***	0.19***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K3

Sequential Regression of OC Use/Type and Neuroticism on Follicular Negative Affect

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.09		
	Monophasic OC	-0.25		
	Triphasic OC	0.06	0.06	0.06
2	NOC	-0.19		
	Monophasic OC	-0.22		
	Triphasic OC	0.02		
	Neuroticism	0.31**	0.09**	0.15**

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K4

Sequential Regression of OC Use/Type and The Neuroticism Facets on Premenstrual Negative Affect

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.21		
	Monophasic OC	-0.15		
	Triphasic OC	-0.03	0.02	0.02
2	NOC	-0.34		
	Monophasic OC	-0.10		
	Triphasic OC	0.03		
	Anxiety	0.01		
	Angry hostility	0.18		
	Depression	0.10		
	Self-consciousness	0.21		
	Impulsiveness	0.03		
	Vulnerability	0.08	0.19**	0.21**

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K5

Sequential Regression of Personality, Demographic and Menstrual Cycle Variables on Premenstrual Cognitive Symptoms

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.17		
	Monophasic OC	-0.09		
	Triphasic OC	-0.00	0 .02	0 .02
2	NOC	-0.22		
	Monophasic OC	-0.06		
	Triphasic OC	0.02		
	Age	-0.17		
	Marital status	-0.37**		
	Number of children	0.23		
	Employment status	-0.02		
	Age menarche	-0.18		
	MC[a] length	0.01		
	MC variation	-0.09		
	Length menses	0.01		
	Menstrual pain	0.20*		
	Neuroticism	0.15		
	Extraversion	0.02		
	Openness	0.11		
	Agreeableness	-0.17		
	Conscientiousness	0.15	0.37***	0.38***

[a]MC = menstrual cycle.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K6

Sequential Regression of OC Use/Type, Marital Status and Menstrual Pain on Premenstrual Cognitive Symptoms

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.17		
	Monophasic OC	-0.09		
	Triphasic OC	-0.00	0 .02	0 .02
2	NOC	-0.17		
	Monophasic OC	-0.16		
	Triphasic OC	-0.05		
	Marital status	-0.38***		
	Menstrual pain	0.23*	0.20***	0.22***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K7

Sequential Regression of OC Use/Type, Marital Status and Menstrual Pain on Follicular Cognitive Symptoms

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.03		
	Monophasic OC	-0.08		
	Triphasic OC	0.09	0.02	0.02
2	NOC	0.04		
	Monophasic OC	-0.04		
	Triphasic OC	0.14		
	Marital status	-0.37***		
	Menstrual pain	0.00	0.14***	0.16**

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K8

Sequential Regression of Personality, Demographic and Menstrual Cycle Variables on Premenstrual Behaviour Change

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.20		
	Monophasic OC	-0.28		
	Triphasic OC	-0.05	0 .03	0 .03
2	NOC	-0.22		
	Monophasic OC	-0.26		
	Triphasic OC	-0.02		
	Age	-0.27*		
	Marital status	-0.43***		
	Number of children	0.22		
	Employment status	-0.01		
	Age menarche	-0.05		
	MC[a] length	-0.13		
	MC variation	-0.10		
	Length menses	0.10		
	Menstrual pain	0.18*		
	Neuroticism	0.03		
	Extraversion	-0.07		
	Openness	0.14		
	Agreeableness	-0.06		
	Conscientiousness	0.15	0.39***	0.43***

[a]MC = menstrual cycle.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K9

Sequential Regression of OC Use/Type, Age, Marital Status and Menstrual Pain on Premenstrual Behaviour Change

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.20		
	Monophasic OC	-0.28		
	Triphasic OC	-0.05	0 .03	0 .03
2	NOC	-0.23		
	Monophasic OC	-0.33		
	Triphasic OC	-0.09		
	Age	-0.16		
	Marital status	-0.38***		
	Menstrual pain	0.20**	0.29***	0.32***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K10

Sequential Regression of OC Use/Type, Marital Status and Menstrual Pain on Premenstrual Behaviour Change

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.19		
	Monophasic OC	-0.28		
	Triphasic OC	-0.05	0 .03	0 .03
2	NOC	-0.17		
	Monophasic OC	-0.33		
	Triphasic OC	-0.07		
	Marital status	-0.47***		
	Menstrual pain	0.20*	0.27***	0.30***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K11

Sequential Regression of OC Use/Type, Marital Status and Menstrual Pain on Follicular Behaviour Change

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.23		
	Monophasic OC	-0.24		
	Triphasic OC	-0.11	0.02	0.02
2	NOC	-0.17		
	Monophasic OC	-0.22		
	Triphasic OC	-0.07		
	Marital status	-0.36***		
	Menstrual pain	0.03	0.13**	0.14**

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K12

Sequential Regression of Personality, Demographic and Menstrual Cycle Variables on Premenstrual Somatic Symptoms

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.07		
	Monophasic OC	-0.14		
	Triphasic OC	0.12	0 .04	0 .04
2	NOC	-0.23		
	Monophasic OC	-0.29		
	Triphasic OC	-0.05		
	Age	-0.09		
	Marital status	-0.29**		
	Number of children	0.19		
	Employment status	0.11		
	Age menarche	-0.17		
	MC[a] length	-0.02		
	MC variation	0.02		
	Length menses	-0.01		
	Menstrual pain	0.38***		
	Neuroticism	0.20*		
	Extraversion	0.07		
	Openness	0.02		
	Agreeableness	-0.09		
	Conscientiousness	0.11	0.39***	0.44***

[a] MC = menstrual cycle.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K13

Sequential Regression of OC Use/Type, Marital Status, Neuroticism and Menstrual Pain on Premenstrual Somatic Symptoms

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.07		
	Monophasic OC	-0.14		
	Triphasic OC	0.12	0 .04	0 .04
2	NOC	-0.21		
	Monophasic OC	-0.27		
	Triphasic OC	-0.03		
	Marital status	-0.25**		
	Menstrual pain	0.38***		
	Neuroticism	0.21*	0.28***	0.33***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K14

Sequential Regression of OC Use/Type, Marital Status, Neuroticism and Menstrual Pain on Follicular Somatic Symptoms

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.20		
	Monophasic OC	-0.27		
	Triphasic OC	-0.03	0.04	0.04
2	NOC	-0.25		
	Monophasic OC	-0.29		
	Triphasic OC	-0.07		
	Marital status	-0.35***		
	Menstrual pain	0.15		
	Neuroticism	0.20*	0.21***	0.24***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K15

Sequential Regression of Personality, Demographic and Menstrual Cycle Variables on Premenstrual Autonomic Reactions

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.11		
	Monophasic OC	-0.00		
	Triphasic OC	-0.01	0 .01	0 .01
2	NOC	-0.09		
	Monophasic OC	0.08		
	Triphasic OC	0.03		
	Age	-0.41**		
	Marital status	-0.31**		
	Number of children	0.38**		
	Employment status	-0.02		
	Age menarche	-0.16		
	MC[a] length	-0.11		
	MC variation	-0.03		
	Length menses	-0.05		
	Menstrual pain	0.20*		
	Neuroticism	-0.02		
	Extraversion	-0.31**		
	Openness	0.14		
	Agreeableness	-0.05		
	Conscientiousness	0.14	0.41***	0.42***

[a] MC = menstrual cycle.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K16

Sequential Regression of OC Use/Type, Marital Status, Age, Number of Children, Extraversion and Menstrual Pain on Premenstrual Autonomic Reactions

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.11		
	Monophasic OC	-0.00		
	Triphasic OC	-0.01	0 .01	0 .01
2	NOC	-0.08		
	Monophasic OC	0.04		
	Triphasic OC	0.00		
	Marital status	-0.32**		
	Menstrual pain	0.21*		
	Age	-0.37**		
	Number of children	0.37***		
	Extraversion	-0.28**	0.35***	0.36***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K17

Sequential Regression of OC Use/Type, Marital Status, Age, Number of Children, Extraversion and Menstrual Pain on Follicular Autonomic Reactions

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.29		
	Monophasic OC	-0.23		
	Triphasic OC	-0.13	0.02	0.02
2	NOC	-0.25		
	Monophasic OC	-0.13		
	Triphasic OC	-0.07		
	Marital status	-0.27*		
	Menstrual pain	0.03		
	Age	-0.35**		
	Number of children	0.19		
	Extraversion	-0.21*	0.23***	0.25***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K18

Sequential Regression of OC Use/Type , Follicular Autonomic Reactions and The Extraversion Facets on Premenstrual Autonomic Reactions

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.11		
	Monophasic OC	-0.00		
	Triphasic OC	-0.01	0.01	0.01
2	NOC	0.08		
	Monophasic OC	0.15		
	Triphasic OC	0.08		
	Follicular Autonomic Reactions	0.65***	0.42***	0.43***
3	NOC	0.16		
	Monophasic OC	0.21		
	Triphasic OC	0.13		
	Follicular Autonomic Reactions	0.60***		
	Warmth	0.16		
	Gregariousness	-0.13		
	Assertiveness	-0.06		
	Activity	-0.16*		
	Excitement seeking	-0.11		
	Positive emotions	-0.02	0.07*	0.50***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K19

Sequential Regression of Personality, Demographic and Menstrual Cycle Variables on Premenstrual Fluid Retention

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.11		
	Monophasic OC	-0.20		
	Triphasic OC	0.13	0 .07	0 .07
2	NOC	-0.26		
	Monophasic OC	-0.31		
	Triphasic OC	-0.00		
	Age	-0.10		
	Marital status	-0.21		
	Number of children	0.09		
	Employment status	-0.05		
	Age menarche	-0.16		
	MC[a] length	-0.24*		
	MC variation	0.10		
	Length menses	-0.11		
	Menstrual pain	0.29**		
	Neuroticism	0.21		
	Extraversion	0.08		
	Openness	0.05		
	Agreeableness	-0.01		
	Conscientiousness	0.15	0.27**	0.34**

[a] MC = menstrual cycle.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K20

Sequential Regression of OC Use/Type, Menstrual Cycle Length and Menstrual Pain on Premenstrual Fluid Retention

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.11		
	Monophasic OC	-0.20		
	Triphasic OC	0.13	0 .07	0 .07
2	NOC	-0.22		
	Monophasic OC	-0.35		
	Triphasic OC	0.00		
	MC[a] length	-0.14		
	Menstrual pain	0.33***	0.13**	0.20**

[a] MC = menstrual cycle.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K21

Sequential Regression of OC Use/Type and Menstrual Pain on Premenstrual Fluid Retention

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.11		
	Monophasic OC	-0.20		
	Triphasic OC	0.13	0 .07	0 .07
2	NOC	-0.22		
	Monophasic OC	-0.36		
	Triphasic OC	-0.01		
	Menstrual pain	0.34***	0.11***	0.18***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Appendix K22

Sequential Regression of OC Use/Type and Menstrual Pain on Follicular Fluid Retention

Step entered	Independent variables	β	R^2 Change	R^2
1	NOC	-0.22		
	Monophasic OC	-0.26		
	Triphasic OC	-0.05	0.03	0.03
2	NOC	-0.24		
	Monophasic OC	-0.29		
	Triphasic OC	0.08		
	Menstrual pain	0.08	0.01	0.04

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.