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Relationships Among Premenstrual Symptom Reports, Menstrual Attitudes, and Mindfulness

M. Kathleen B. Lustyk · Winslow G. Gerrish · Haley Douglas · Sarah Bowen · G. Alan Marlatt

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Abstract The physical and affective symptoms of a broad range of conditions are improved following mindfulness-based practices. One set of symptoms that has yet to be explored through the lens of mindfulness, however, is that associated with the premenstruum. Also, given the relationships among negative attitudes towards menstruation and amplified symptom reporting, it is reasonable to expect that mindfulness qualities cultivated through practices aimed at dispelling negative anticipatory and judgmental thinking will moderate these relationships. Thus, in this study we examined interrelationships among premenstrual symptom severity reports (PMSR), menstrual attitudes, and mindfulness qualities in a sample of 127 women (age range 18-26 years). Results revealed several statistically significant positive relationships between menstrual attitudes and PMSR. Also, higher scores on measures of mindfulness were significantly associated with lower PMSR. Moderating effects revealed that mindfulness significantly buffered the relationships between menstrual attitudes and PMSR, specifically between: anticipation of menses onset and PMSR as well as anticipation of menses onset and premenstrual water retention. These results may offer the first empirical evidence of relationships among menstrual attitudes, PMSR, and mindfulness qualities. Results from this study align with the body of research showing that mindfulness is predictive of improved symptomatology and well-being across varied conditions. We conclude with discussion supporting the development of a mindfulness-based intervention aimed at reducing symptom severity in premenstrual symptom sufferers.

Keywords Premenstrual Symptomatology · Menstrual Attitudes · Mindfulness · Women · Menses

M. K. B. Lustyk (✉) · W. G. Gerrish · H. Douglas
School of Psychology, Family, and Community,
Seattle Pacific University,
3307 Third Ave. West, Suite 107,
Seattle, WA 98119, USA
e-mail: klustyk@spu.edu
URL: http://www.spu.edu/LustykLab

S. Bowen · G. A. Marlatt
Department of Psychology, University of Washington,
Seattle, WA, USA

Introduction

An increasing number of studies report improvements in the physical and affective symptoms of a broad range of conditions following mindfulness-based practices (Greeson 2009; Baer 2003). Moreover, recent research points to the development of mindfulness traits as predictive of improved symptomatology and well-being (Carmody and Baer 2008). One set of symptoms that has yet to be explored through the lens of mindfulness is that associated with the premenstruum. Given that premenstrual symptoms may be physical, affective, and impair quality of life and well-being, it is reasonable to expect improvements in such symptoms from mindfulness-based practices. Still, a mindfulness-based intervention has yet to be developed for premenstrual symptomatology. Given the costs associated with intervention research, there is a strong need to produce sound justification for intervention development.

Premenstrual symptoms, while varied, generally include negative changes in mood, behavior, and well-being (including body image) and increased food cravings (Michener et al. 1999; Mitchell et al. 1991; Trout et al. 2008). Up to 90% of women experience premenstrual symptoms (Campagne and Campagne 2007). The relation-

ships among premenstrual symptoms, psychosocial, and health-related variables are wide-ranging. For example, premenstrual symptoms are significantly related to perceived stress (Lustyk et al. 2004; Lustyk et al. 2006; Woods et al. 1985), menstrual attitudes (Aubeeluck and Maguire 2002; Brooks-Gunn and Ruble 1980; Woods et al. 1982), abuse history (Lustyk et al. 2007), and post-traumatic stress disorder (Wittchen et al. 2003). Additionally, premenstrual symptoms are significantly related to increased cravings among substance users (Carpenter et al. 2006; Epstein et al. 2006) and lower quit rates for female smokers (Allen et al. 2000; Carpenter et al. 2006).

While premenstrual symptoms can start with menarche, care-seeking women are typically in their late twenties and early thirties (Dell 2004). While there is no gold standard for diagnosis, premenstrual symptoms that noticeably affect the well-being of a woman are characterized as premenstrual syndrome (PMS). Premenstrual dysphoric disorder (PMDD) is a severe form of PMS with specific emphasis on affective symptoms (Kroll and Rapkin 2006; Lustyk and Gerrish 2008). Applying current prevalence rates to United States (US) census data, it is projected that up to 28 million women have PMS and 6 million have PMDD (Kroll and Rapkin 2006). Presently, no cure or definitive treatment for the constellation of symptoms that characterize either condition exists. Because women can have up to 500 menstrual cycles during their reproductive years with premenstrual symptoms amplified during days 4–7 premenses, there is a potential 4 to 10 years of suffering from symptom days alone (Stoddard et al. 2007). In fact, PMS and PMDD have similar disability-adjusted life years as other major dysphoric disorders (Halbreich et al. 2003). As such, PMS and PMDD are clinically relevant mental disorders in need of better treatment intervention.

Relevant to treatment intervention for premenstrual symptomatology is the impact of menstrual attitudes on symptoms. In self-report studies, negative attitudes towards menstruation are associated with exacerbated premenstrual symptom reports. For example, in what is now considered a classic study in this area of research, Woods et al. (1982) performed a community-based study of women 18–35 years of age. Women's responses on the Moos Menstrual Distress Questionnaire and the Menstrual Attitudes Questionnaire revealed several significant relationships. Specifically, there was a positive relationship between the attitude of seeing menstruation as a debilitating event and premenstrual reports of pain, negative affect, and impaired performance. There was also a significant positive relationship between being able to anticipate and predict the onset of menstruation and premenstrual pain, affect, performance, and water retention reports. Conversely, denial of any effects of menstruation was negatively related to premenstrual pain, negative affect, and impaired performance.

Relationships among attitudes and menstrual experiences pervade current research. For example, Rembeck et al. (2006) found that postmenarcheal girls 12 years of age reported more positive feelings towards menstruation if they also reported wanting to be an adult and liking their developing bodies. And while referring to menstruation as *the curse* has lost popularity in recent times, negative attitudes towards menstruation and menstruating women remain popular in Western societies (Kowalski and Chapple 2000). In a survey of college students, Forbes et al. (2003) found that both men and women negatively perceived menstruating women. In response to the query "Compared with the average woman, the woman during her period is…", both men and women rated the menstruating woman as more irritable, angry, sad, and less energized and sexy than the average woman.

As a symptom of the premenstruum, craving may also be affected by negative attitudes towards menstruation especially when the premenstruum serves as a craving cue. Craving is a powerful drive and psychological hunger for the craved objects (e.g., foods). Craving can be associated with people, places, rituals, and items related to the craved object (Sinha and Li 2007). Based on laboratory studies of craving in substance abusers, craving can be both the source and result of stress (e.g., Sinha 2008). Because stress is known to affect premenstrual symptoms, for those that suffer premenstrual cravings the premenstruum itself may become associated with the craved objects. For example, when food cravings were assessed prospectively over 5 weeks in a non-clinical sample of healthy women (n= 25, 20–57 years of age), women reported increases in their food cravings premenstrually (Hill and Heaton-Brown 1994). These cravings were unrelated to arousal or hunger reports. Thus it appears that a salient stimulus for this type of craving is the premenstruum itself. Still, there remains a dearth of research on premenstrual cravings as an outcome measure (Dye et al. 1995; Hill and Heaton-Brown 1994; Michener et al. 1999), and we were unable to find any published studies that assessed interrelationships with menstrual attitudes and mindfulness.

According to Kabat-Zinn (1990), mindfulness involves paying attention on purpose, in the present moment, on a moment-to-moment basis in an effort to cultivate an accepting or non-judgmental, non-reactive state of awareness. This awareness has been described as a detached metacognitive state in which one is aware of his or her thought processes without being caught up in them (Teasdale et al. 1995). Mindfulness is often cultivated through the practice of meditation. Mindfulness meditation (MM) is rooted in the traditional Buddhist practice of Vipassana, which literally translates as: *seeing things as they really are*. MM is a relatively safe meditation practice (Lustyk et al. 2009a) that begins with sustained observation

of the breath and expands to include awareness of physical sensations, thoughts, and emotional states. This naturalistic observation of affect, thought, and sensation cultivates attitudinal and cognitive capacities in practitioners with supporting changes in neurobiological substrates (Ivanoski and Malhi 2007). Studies investigating neurobiological concomitants of MM suggest that MM practice results in neurobiological (e.g., Davidson et al. 2003; Holzel et al. 2008; Lazar et al. 2005) and endocrine (Tang et al. 2007) changes. These changes are also associated with reductions in anxiety and negative affect suggesting a more adaptive stress response may result from MM (Shapiro et al. 2006; Rubia 2009).

As a therapeutic device, MM is a promising adjunct to a number of psychological treatments aimed at relieving symptoms that overlap with premenstrual symptoms. For example, mindfulness-based stress reduction is efficacious at treating chronic pain (Kabat-Zinn 1990) and anxiety (Kabat-Zinn et al. 1992; Orsillo et al. 2003), mindfulness-based cognitive therapy reduces the likelihood of depression relapse (Segal et al. 2002), mindfulness-based eating and awareness training helps those who suffer with compulsive overeating (Kristeller and Hallett 1999), and mindfulness-based relapse prevention (Bowen et al. 2009) reduces craving and use in substance abusers. As pain, anxiety, depression, and food cravings are all symptoms of the premenstruum, it is reasonable to expect benefits from mindfulness. However, as stated previously, preliminary investigation of the interrelationships among mindfulness traits and premenstrual symptoms is warranted before costly intervention research is performed.

To measure mindfulness via self-report, Baer et al. (2006) developed the Five Facets Mindfulness Questionnaire (FFMQ). Based on a large-scale psychometric analysis of several questionnaires aimed at assessing traits that define mindfulness, Baer et al. (2006) determined that mindfulness is a multifaceted construct. The five facets identified are: observing (noticing internal and external stimuli including sensations and percepts [e.g., sights, sounds, and smells], emotions, thoughts, and cognitions); describing (being able to label stimuli with words, either out loud or mentally); acting with awareness (paying attention to one's actions so as to not operate on automatic pilot in a mindless manner); nonjudging of inner experiences (allowing one's sensations and percepts, emotions, thoughts, and cognitions to occur without evaluation); and nonreacting to inner experience (allowing one's sensations and percepts, emotions, thoughts, and cognitions to occur without getting caught up in them).

One of the measures used to develop the FFMQ was the Mindful Attention Awareness Scale (MAAS; Brown and Ryan 2003), which is a one-dimensional measure of mindfulness. However, only five out of 15 total items from the MAAS contributed to the acting with awareness factor of the FFMQ and the remaining ten items failed to load at all (Baer et al. 2006). Thus, the MAAS is uniquely capturing some aspect of mindful awareness that the FFMQ does not measure. Moreover, Baer et al. (2006) found the MAAS to emphasize elements of mindfulness related to dissociation and absent-mindedness as demonstrated through highly significant inverse correlations with the Scale of Dissociative Activities (Mayer and Farmer 2003) and the Cognitive Failures Questionnaire (Broadbent et al. 1982), respectively. This is noteworthy given research demonstrating cognitive failures premenstrually in women with PMDD (Reed et al. 2008). Thus, for the purposes of exploring mindfulness in women with premenstrual symptoms, we chose to include both the FFMQ and MAAS in our measures.

As reported here, MM effects on the premenstruum are unknown. Yet, mindfulness-based practices positively affect symptoms that overlap with premenstrual symptoms. Also, cultivating mindfulness qualities through MM attenuates negative anticipatory and judgmental thinking. Given the wealth of research demonstrating that poor menstrual attitudes adversely affect premenstrual symptoms, our aims were to (1) explore the interrelationships among menstrual symptom reports, menstrual attitudes, and mindfulness; (2) assess the unique contribution of mindfulness on premenstrual symptom reporting over and above menstrual attitudes; and (3) assess whether mindfulness buffers the relationship between menstrual attitudes and premenstrual symptom reports.

Given that we were unable to find any published research that investigated relationships among menstrual symptoms, menstrual attitudes, and/or mindfulness, we performed this study as a first step in determining whether mindfulness training may be helpful to women suffering from premenstrual symptoms.

Method

Participants and Procedure

Following Institutional Review Board (IRB) approval of the protocol, a sample of 127 female students (age range 18–26 years) from a small liberal arts university in the Pacific Northwest completed the survey. Participants were mainly White (89%), single (93%), nulliparous (98%), and heterosexual (96%) women. Additional characteristics of the sample are reported in Table 1.

Women enrolled in introductory psychology (n=150) or psychobiology of women (n=25) courses during fall quarter 2008 were offered extra credit towards their course grade for completing the survey. None of the women were enrolled in both courses. Researchers distributed survey

Table 1 Health-related characteristics of study participants (n=127)

Characteristic	*n*	%[a]
Sexual Activity Status		
Yes—sexually active	15	12
No—not sexually active	112	88
Hormonal Contraception Usage		
Currently Using	28	22
Used in last 6-months	37	29
Parity Status		
Nulliparous	124	98
Mindfulness Meditation Experience		
Yes—has some experience	56	44
No—never tried MM	70	55
Currently Practicing	14	11
Positive PMS/PMDD Diagnosis	28	22
Non-smoker	127	100
Non-drinker	107	84
Free from major medical illness	113	93
	Mean	*SD*
Age of Menarche (n=123)	12.7	1.4
Cycle length in days (n=127)	30.3	14.5
BMI	22.9	3.4
Hours of Exercise/week (n=118)	3.1	2.2

PMS Premenstrual Syndrome, *PMDD* Premenstrual Dysphoric Disorder, *BMI* Body Mass Index

[a] Percentages rounded to nearest whole number

packets in class. To maintain anonymity, participants returned the completed survey packets in sealed envelopes within 48 h of distribution to a drop slot of a locked office. A consent form attached to the survey packet envelope stated that a participant's completion of the packet proffered consent to be included in the study and that the participant may retain the consent form which included researcher and IRB contact information. To ensure that participation was not forced, all students enrolled in the two courses were offered various opportunities to obtain extra credit including other research options or writing assignments. Of the 150 female students enrolled in introductory psychology, 131 chose to participate in our study. Of the 25 female students enrolled in psychobiology of women, 23 chose to participate. Of the 154 packets distributed, 139 were returned. Four packets were omitted because greater than 90% of the data were missing from these packets. This left a final sample size of 127 women with complete survey packets included in these analyses.

Measures

Demographic and Health History Questionnaire Participants completed a 23-item health history and demographic form. Demographic information included participant's age, ethnicity, religious affiliation, and partnered and socio-economic status. Health assessments included menstrual and parity history, sexual activity status, contraception practices, and health behavior indicators such as smoking and exercise habits. Participants also indicated their experience with meditation by answering yes or no to the question: "Have you ever practiced any form of meditation/yoga?" Those that responded affirmatively were subsequently asked: "If yes, do you currently practice meditation/yoga", and then "If yes, how many times do you meditate/practice yoga in a week?" These inquires were separate from the questions addressing exercise. Our purpose for including yoga with meditation is twofold: (a) as this was a survey, we wanted to be sure to give participants who practice traditional non-western forms of yoga that are more akin to meditation (e.g., Tibetan Yoga) the opportunity to report that and (b) we wanted to be able to include yoga as a meditative form along with meditation as a covariate (but separate from exercise) if needed in our analyses. Henceforward, we refer to this variable as meditation/yoga.

Shortened Premenstrual Assessment Form (SPAF; Allen et al. 1991) Participants completed the 10-item SPAF, which assessed premenstrual symptom severity using a 6-point scale ranging from 1 = not present at all or no change from the usual level to 6 = extreme change from usual level, perhaps noticeable even to casual acquaintances. The SPAF provides an overall symptom summary score (i.e., sum of all items) and three subscales summarizing the symptom clusters of pain, water retention, and negative affect calculated from the sum endorsements for items supporting these factors. SPAF symptom summary scores range from 10 to 60. Subscale scores range from 3 to 18 for pain and water retention and 4 to 24 for affect. Allen et al. (1991) report high internal consistency for the SPAF (α=.95) and a test–retest coefficient range of .6 to .7. Cronbach's alphas in the present study were .85 for the overall symptom summary score, .83 for the affect subscale, .81 for the pain subscale, and .81 for the water retention subscale.

Penn Alcohol Craving Scale (PACS; Flannery et al. 1999) To gather retrospective reports of premenstrual cravings, we modified the PACS to specifically assess participants' self-reports of cravings the week before and during the first few days of menses. Specifically, participants were asked "Considering your typical cycle, do you find that you crave a particular food (e.g., chocolate), substance (e.g., alcohol) or behavior (e.g., exercise/sleeping) the week before and/or during the first few days of your period?" Next, participants responded to an open-ended item in which

they listed the things they crave. In response to the remaining five items, participants provided the frequency, intensity, and duration of their premenstrual cravings, yielding an overall rating of premenstrual craving ranging from 0 to 30. Other researchers have modified the PACS for study-specific assessments and found the internal consistency and predictability with outcome measures to be high (Bowen et al. 2009). Cronbach's alpha for the PACS in the current sample was .92.

Menstrual Attitudes Questionnaire (MAQ; Brooks-Gunn and Ruble 1980) Participants completed the 33-item MAQ, which assessed five attitudes towards menstruation: debilitating (seeing menstruation as a debilitating event), bothersome (seeing menstruation as a bothersome event), natural (seeing menstruation as a natural event), anticipate (being able to anticipate or predict the onset of menstruation), and denial (denying any effect of menstruation). Using a 7-point scale ranging from 1 = disagree strongly to 7 = strongly agree, women indicated their congruence with statements such as "Menstruation can adversely affect my performance in sports" and "Menstruation allows women to be more aware of their bodies." Subscale scores from the MAQ represent rating totals from relevant items following reverse scoring for negatively worded items. Subscale score ranges are: 12 to 84 for debilitating, 5 to 35 for bothersome, 3 to 21 for natural, 4 to 28 for anticipate, and 7 to 49 for denial. Cronbach's alphas for the subscales in the present study were .91 for debilitating, .82 for bothersome, .88 for natural, .92 for anticipate, and .82 for denial.

The FFMQ (Baer et al. 2006) To assess mindfulness, participants completed the 39-item FFMQ. As outlined in our "Introduction" section, Baer et al. (2006) identified five facets with good internal consistency: (a) observing, α=.83; (b) describing, α=.91; (c) acting with awareness, α=.87; (d) nonjudging, α=.87; and (e) nonreactivity, α=.75. These facets are correlated in the expected directions with predicted variables of mindfulness such as experiential avoidance and thought suppression (Baer et al. 2006). Participants rated items using a 5-point scale ranging from 1 = never or very rarely true to 5 = very often or always true. Subscale score ranges are: 8 to 40 for observing, describing, acting with awareness, and nonjudging and 7–35 for nonreactivity. Cronbach's alphas for the subscales in the present study were .71 for observing, .82 for describing, .88 for acting with awareness, .90 for nonjudging, and .77 for nonreactivity.

MAAS (Brown and Ryan 2003) Participants completed the 15-item MAAS. Brown and Ryan (2003) coined the phrase dispositional mindfulness to describe this one-dimensional measure of mindfulness or one's general tendency to be attentive to and aware of present-moment experiences in daily life. The 15 items are rated on a 6-point scale (from almost always to almost never) to generate a single total score (score range, 15 to 90). The MAAS allows respondents to indicate how often they experience different mindfulness related phenomena such as acting on automatic pilot. In the present study, Cronbach's alpha for the MAAS was .85.

Statistical Analyses

We calculated descriptive statistics for all subject variables assessed via the demographic questionnaire. Mean differences in premenstrual symptom severity reports and craving reports for those with and without a history of either meditation or yoga were assessed prior to regression analyses. Because of the similarities between non-western forms of yoga and meditation, we assessed our query of meditation/yoga as a potential covariate separate from exercise history. Bivariate correlations were run between predictors (menstrual attitudes and mindfulness) and premenstrual symptoms. In an effort to determine if mindfulness disposition or traits could buffer the statistically significant relationships among menstrual attitudes and premenstrual symptom reports, multiple regressions with interaction probing were performed in accordance with the methods of Aiken and West (1991). To reduce the possibility of multicollinearity among the interaction terms and their component predictors, all predictors were mean centered prior to regression analyses.

Results

Demographics

A summary of participant characteristics is presented in Table 1. Fifty-six women affirmed trying meditation/yoga in the past with only 14 indicating they currently practiced meditation/yoga at the time of the survey. Groups dichotomized on this variable were compared on each of the premenstrual symptoms and all mean differences were non-significant. We further examined all data for outliers and finding none, meditation/yoga experience was not treated as a covariate in subsequent analyses.

Zero-Order Correlations: Symptoms and Attitudes

All participants reported some level of premenstrual symptomatology as indicated by the overall symptom summary score from the SPAF: M=29, SD=9, range= 13–48. Of the 127 women surveyed, 111 reported

experiencing some form of premenstrual craving. The majority of women (n=83) indicated that they craved carbohydrates either alone (n=73) or with exercise or sleep (n=10). Of the carbohydrates, women listed in the open-ended write-in portion of the PACS, the most frequently reported form was "chocolate" or "sweets" (60% of the carbohydrate items written in were chocolate). Few women reported craving only behaviors (n=9), and the only behavior cravings reported were sleep (n=8) and exercise (n=1).

Zero-order intercorrelations among premenstrual symptom severity reports and menstrual attitudes are presented in Table 2. Several statistically significant interrelationships were found between premenstrual symptom severity reports and menstrual attitudes. Statistically significant positive relationships were observed between the attitudes debilitating and anticipate and each premenstrual symptom assessed. Specifically, women who indicated that menstruation is a debilitating event (debilitating) or that they anticipate menses onset (anticipate) reported more severe changes in symptomatology premenstrually. A similar positive relationship was observed with bothersome and premenstrual pain such that women who endorsed the attitude that menses is a bothersome event also reported more premenstrual pain.

Zero-Order Correlations: Symptoms and Mindfulness

Zero-order intercorrelations among premenstrual symptom severity reports and mindfulness are also presented in Table 2. Several statistically significant inverse relationships existed. First, the MAAS summary score was inversely related to each premenstrual symptom assessed. Second, the mindfulness facets (from the FFMQ) observing, describing, and nonreacting were inversely related to all premenstrual symptom measures except craving. Finally, nonjudging was inversely related to the symptom summary score, affect, and water retention. Thus, women reporting more mindfulness generally reported less severe premenstrual symptomatology. However, none of the correlations with the mindfulness facet acting with awareness were statistically significant.

Hierarchical Regressions

To determine if mindfulness contributed to symptom reporting over and above menstrual attitudes, hierarchical regressions were performed with menstrual attitudes entered in the first block followed by the mindfulness variables added in the second block. Model statistics are reported in Table 3. Of the menstrual attitudes assessed, anticipate predicted each premenstrual symptom measure assessed. The attitude bothersome predicted premenstrual craving but none of the other symptoms. After controlling for attitudes, the MAAS predicted both the symptom summary score and premenstrual affect. The mindfulness facet (from the FFMQ) nonreacting predicted the symptom summary score, pain, and affect while the facet describing predicted water retention.

Moderating Effects of Mindfulness

To determine if the statistically significant predictors interacted in their effects on symptom reports, multiple regressions with interaction probing were performed in accordance with the methods of Aiken and West (1991). Two significant interactions were observed with MAAS moderating the relationship between anticipate (i.e., anticipating menses onset) and the overall symptom summary score (cross-product β=−.15; $t(123)$=−2.32, p=.02) and the mindfulness facet describe (i.e., being able to label stimuli with words, either out loud or mentally) moderating the relationship between anticipate and premenstrual water retention reports (cross-product β=−.18; $t(123)$=−2.39, p=.02). As one can see in Fig. 1, women with varied levels of mindful disposition (i.e., MAAS) differ only slightly in premenstrual symptom reports under conditions of low anticipation, while much larger differences in symptom reports were noted under conditions of high anticipation. Similarly, in Fig. 2, one can see that women with varied levels of the mindfulness facet describe did not differ in premenstrual water retention under conditions of low anticipation, while much larger differences in water retention were noted under conditions of high anticipation. While these findings tell us that the slopes for the levels of the moderator (i.e., mindfulness) significantly differ, the increments of variance accounted for by including these interactions in the models tested were small: $R^2\Delta$=.03 for the interaction with MAAS and $R^2\Delta$=.04 for the interaction with describe. Thus, we conducted simple slopes analyses to probe the significant interaction effects. For the moderator (i.e., MAAS or describe), separate variables were created that were ±1 standard deviations from the mean, resulting in high and low levels of the moderators. These variables were then included in separate regression models along with an interaction term consisting of the moderator variable and the menstrual attitude anticipate (i.e., MAAS × anticipate or describe × anticipate).

Results of the simple slopes analyses indicated that higher levels of MAAS weakened the effects of the menstrual attitude anticipate on the overall symptom summary score (β=.45, p<.001) as compared to low MAAS (β=.75, p<.001). In other words, the effect of anticipating menses on premenstrual symptom reports was buffered in women that revealed a high mindful disposition. Similarly, simple slopes analyses indicated that higher

Table 2 Intercorrelations among premenstrual symptom reports, premenstrual craving reports, menstrual attitudes, and mindfulness (n=127)

Measure	*M*	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Symptoms																		
1. PMSR	28.7	8.9																
2. Pain	9.31	3.2	.80**															
3. Affect	11.53	4.1	.82**	.43**														
4. WR	7.87	3.5	.85**	.61**	.51**													
5. Craving	12.24	6.4	.43**	.26**	.44**	.33**												
Attitudes																		
6. Debilitate	44.5	6.3	.32**	.22**	.35**	.20**	.32**											
7. Bother	25.2	4.0	.16	.20*	.05	.16	−.10	.04										
8. Natural	13.1	2.5	.12	.07	.12	.09	.01	.01	−.23**									
9. Anticipate	19.0	5.3	.64**	.47**	.58**	.51**	.44**	.39**	.09	.20*								
10. Deny	20.9	5.6	−.09	−.05	−.11	−.07	−.18	−.14	−.05	.09	−.12							
Mindfulness																		
11. MAAS	56.2	10.0	−.36**	−.22*	−.36**	−.30**	−.25**	−.30**	.02	−.10	−.20*	.33**						
12. Observe	26.4	5.1	−.36**	−.23*	−.33**	−.34**	−.05	−.13	−.08	−.003	−.21*	.10	.24**					
13. Describe	28.3	5.1	−.37**	−.23**	−.30**	−.37**	−.16	−.31**	−.01	−.20*	−.21*	.04	.34**	.30**				
14. ActAware	28.0	4.9	−.12	−.05	−.10	−.14	.07	−.17	−.03	−.19*	−.09	.05	.19*	.18*	.38**			
15. Nonjudge	29.4	5.8	−.20*	−.07	−.19*	−.22*	−.03	−.18*	.12	−.25**	−.19*	−.02	.12	.24**	.49**	.69**		
16. Nonreact	21.1	4.0	−.45**	−.35**	−.45**	−.30**	−.12	−.16	−.02	−.11	−.32**	.09	.29**	.44**	.40**	.27**	.34**	

PMSR Premenstrual Symptom Reports Summary Score, *WR* water retention, *Debilitate* menstruation is a debilitating event, *Bother* menstruation is a bothersome event, *Natural* menstruation is a natural event, *Anticipate* can anticipate and predict menses onset, *Deny* deny any effect of menstruation, *MAAS* Mindful Attention Awareness Scale Summary Score, *Observe* noticing and attending to sensations, perceptions, thoughts, and feelings, *Describe* labeling with words, *ActAware* acting with awareness and concentration rather than with distraction or on automatic pilot, *Nonjudge* nonjudging of experiences, *Nonreact* nonreactivity to inner experiences

*p<.05; **p<.01

Table 3 Predicting premenstrual symptom severity (n=127)

Variable	PMSR		Pain		Affect		WR		Craving	
	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2
Debilitate	.08		.05		.14		.003		.15	
Bother	.11		.16		.00		.12		−.21*	
Natural	.03		.03		.02		.02		−.14	
Anticipate	.59**		.44**		.52**		.50**		.42**	
Deny	−.01		.02		−.03		−.003		−.13	
Model 1		.43**		.25**		.36**		.28**		.28**
MAAS	−.17*		−.08		−.18*		−.16		−.25*	
Observe	−.12		−.03		−.09		−.15		.07	
Describe	−.13		−.09		−.03		−.21*		−.09	
ActAware	.06		.03		.09		.04		.24	
Nonjudge	.01		.11		−.03		−.04		−.12	
Nonreact	−.16*		−.20*		−.21*		−.02		.08	
Model 2		.13**		.06		.11**		.12*		.11*
Total		.55**		.32**		.47**		.40**		.39**

Model statistics reflect R^2 change for addition of the variables listed above it to the model

PMSR Premenstrual Symptom Reports Summary Score, *WR* water retention, *Debilitate* menstruation is a debilitating event, *Bother* menstruation is a bothersome event, *Natural* menstruation is a natural event, *Anticipate* can anticipate and predict menses onset, *Deny* deny any effect of menstruation, *MAAS* Mindful Attention Awareness Scale Summary Score, *Observe* noticing and attending to sensations, perceptions, thoughts, and feelings, *Describe* labeling with words, *ActAware* acting with awareness and concentration rather than with distraction or on automatic pilot, *Nonjudge* nonjudging of experiences, *Nonreact* nonreactivity to inner experiences

*p<.05; **p<.01

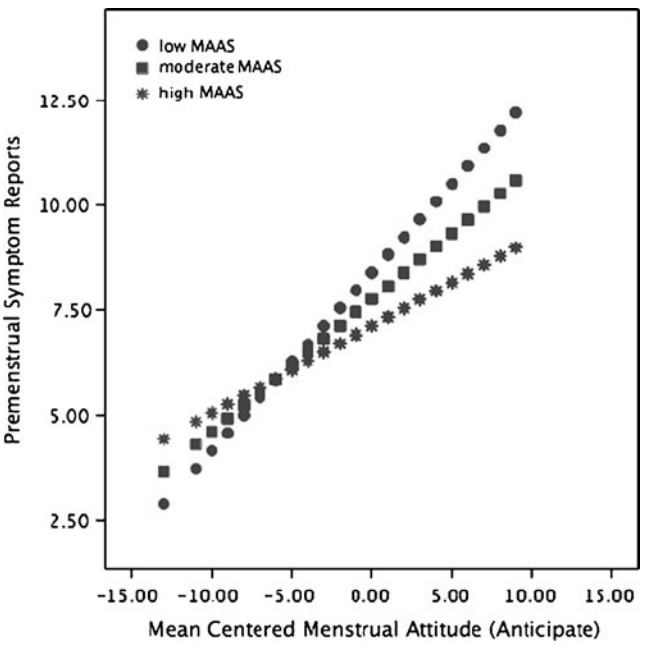

Fig. 1 Regression of premenstrual symptom reports (summary score) on mean centered menstrual attitude (anticipate) at values of dispositional mindfulness (MAAS). *Anticipate* can anticipate and predict menses onset, *MAAS* Mindful Attention Awareness Scale Summary Score

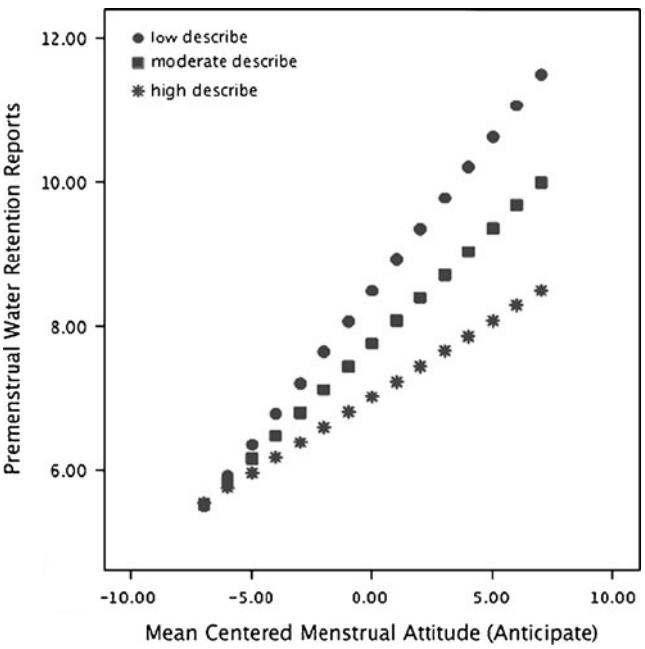

Fig. 2 Regression of premenstrual water retention reports on mean centered menstrual attitude (anticipate) at values of the mindfulness facet, describe. *Anticipate* can anticipate and predict menses onset, *Describe* labeling with words

levels of the mindfulness facet describe weakened the effects of the menstrual attitude anticipate on premenstrual water retention (β=.32, p=.001) as compared to low describe (β=.64, p<.001). Again, the relationship between anticipating menses and water retention reports was buffered by higher mindfulness.

Discussion

The purpose of the current study was to: (1) explore the interrelationships among menstrual symptom reports, menstrual attitudes, and mindfulness; (2) assess the unique contribution of mindfulness on premenstrual symptom reporting over and above menstrual attitudes; and (3) assess whether mindfulness buffers the relationship between menstrual attitudes and premenstrual symptom reports. In general, our results provide further support for the influence of menstrual attitudes on premenstrual symptom severity reports. Also, we introduce evidence that mindfulness is associated with less severe premenstrual symptoms. Finally, we put forward evidence that mindfulness can serve to moderate relationships among menstrual attitudes and premenstrual symptom severity reports.

In the current study, all women reported some level of premenstrual symptomatology as indicated by SPAF reports. It is important to note that the SPAF is not merely a symptom checklist, rather it is a measure of symptom change. As such, it has been shown to reduce recall bias typically associated with retrospective reports (Allen et al. 1991). In addition, the majority of participants reported premenstrual chocolate cravings as indicated on the PACS. Our finding that craving for chocolate accounted for the majority of food cravings is consistent with other research on premenstrual cravings (Michener et al. 1999). We also found a significant negative relationship between mindfulness and craving reports. This is noteworthy given that progesterone or alprazolam treatments fail to reduce premenstrual chocolate or sweets cravings (Michener et al. 1999). Perhaps, pharmacotherapy fails to tap the mechanisms operating with the cultivation of mindfulness.

Findings from the present study offer a novel exploration of mindfulness and craving in the context of the premenstruum. Recent research on MM effects on craving in the context of substance use suggests MM is helpful in reducing subjective craving experiences (Bowen et al. 2009; Ostafin and Marlatt 2008). These findings align with the relationship between mindfulness and non-substance-related premenstrual cravings reported in the current study in so much as higher levels of mindfulness were associated with less subjective craving reports. Still, additional research is needed that measures baseline and cycle-phase-dependent chocolate consumption (or other craved items) while providing mindfulness training in order to delineate potential mechanisms of mindfulness effects on premenstrual craving.

In our hierarchical regression modeling, the attitude anticipate predicted each of the premenstrual symptoms assessed. To assess this attitude, women responded to statements such as “I can tell my period is approaching because of breast tenderness, backache, cramps, or other physical signs” and “I have learned to anticipate my menstrual period by the moods that precede it.” Thus, women’s prediction’s are based on observing and judging the anticipated symptoms, an expectation that is not surprising given the unique cyclical nature of menstrual symptoms. However, given that mindfulness training helps cultivate non-judgmental, present-moment awareness, it is also not surprising that we found that mindfulness moderated the relationship between attitudinal anticipation and premenstrual symptom reports (i.e., premenstrual summary score and water retention). Still, our probing of these interactions revealed that these relationships held even when mindfulness was low, albeit exerting less effect on the relationship than when mindfulness was high. Thus, it appears that a little mindfulness (i.e., one SD below the mean) goes a long way in affecting premenstrual symptoms. In particular, our findings demonstrate that overall symptom reports were less severe in women who anticipate their periods but embrace a more mindful disposition as measured by the MAAS. Recall that Baer et al. (2006) found that only five out of 15 MAAS items contributed to the acting with awareness factor of the FFMQ and the remaining ten items failed to load at all. In the present study, the acting with awareness factor was unrelated to any premenstrual symptoms while MAAS was significantly and inversely related to each symptom assessed. Thus, our findings are capturing some unique qualities of mindfulness measured by the MAAS as it relates to premenstrual symptomatology other than acting with awareness. Given that the MAAS is related to dissociation and absent-mindedness (Baer et al. 2006) and that absent-mindedness is demonstrably present during the premenstruum in women with PMDD (Reed et al. 2008), our findings argue for further research exploring the therapeutic potential of mindfulness for such women.

Another interaction existed between the mindfulness facet describe (i.e., being able to label stimuli with words, either out loud or mentally) and the menstrual attitude anticipate in the relationship with premenstrual water retention. To assess this facet of mindfulness, women responded to statements such as “My natural tendency is to put my experiences into words” and “When I have a sensation in my body, it’s difficult for me to describe it because I can’t find the right words for it.” Our findings indicate that for women who anticipate their periods, they

report less severe problems with water retention as they are able to articulate their present-moment feelings and sensations. This pattern of results between mindfulness and a physical symptom is consistent with findings from other mindfulness-based health interventions whereby a measureable amount of discomfort persists yet the individual develops a changed relationship with their symptoms through increased awareness and decreased reactivity, thereby reducing the negative impact of their symptoms. Future research should explore a potential time order relationship to these variables.

The regression main effects for mindfulness are striking. Independent of menstrual attitudes, mindfulness predicted less premenstrual symptom severity in each symptom assessed. The inverse relationships between mindfulness and premenstrual pain, negative affect, and water retention are noteworthy given that currently no single effective treatment for all of these symptoms, which define PMS and PMDD, exists (Lustyk et al. 2009b; Rapkin 2003). Drug treatments are most common for PMS and/or PMDD, and serotonin-specific reuptake inhibitors (SSRIs) such as fluoxetine and sertraline are the most frequently prescribed medications (Rapkin 2003). Yet, SSRIs carry side-effects such as gastrointestinal disturbance and sleep problems, which can compound the premenstrual symptoms. Currently, one oral contraceptive (i.e., Yaz) is Food and Drug Administration (FDA) approved to treat PMDD (US FDA 2007). Yaz causes anovulation/suppressed fertility, which is undesirable for women wanting to become pregnant. While none of these drug treatments are currently FDA approved for PMS, they are reportedly used off-label despite the American College of Obstetricians and Gynecologists Guidelines, which recommend non-pharmacological first-line intervention for PMS (ACOG 2000).

This initial non-pharmacological treatment standard presents challenges to care providers given the dearth of information supporting evidence-based behavioral interventions that are successful in producing long-lasting lifestyle changes and that are therapeutically beneficial for PMS or PMDD. For example, in a recent systematic review of empirical investigations of cognitive-behavioral therapy (CBT) for PMS or PMDD, Lustyk et al. (2009b) revealed a paucity of evidence providing statistically significant CBT intervention effects. Lustyk et al. argue for the development of more specific and adaptable treatment models for the unique characteristics of PMS and PMDD including newer, more contextually driven, behavioral treatment strategies shown to be effective in both medical and mental health-care settings (Kabat-Zinn et al. 1992; Witkiewitz et al. 2005; Hayes et al. 1999). Many of the strategies in these newer therapies involve mindfulness and acceptance. Thus, results from the current study are timely as they provide innovative evidence that mindfulness qualities are related to premenstrual symptomatology and they can buffer the relationships between menstrual attitudes and premenstrual symptom severity reports.

Limitations to our study exist. Given that our study was a survey, we cannot be certain of the stated direction in the relationships among menstrual attitudes and premenstrual symptom severity reports. However, it stands to reason that the significant moderating effects of mindfulness traits on the relationship between menstrual attitudes and premenstrual symptoms would be beneficial regardless of whether poor attitudes precede or are a consequence of menstrual symptoms. Additionally, our study sample of college students is somewhat limited in age and ethnicity. While a University sample can be limiting in many studies, in our case it provides a larger proportion of freely cycling women not on hormonal birth control. As most women seeking care for premenstrual symptoms are in their late twenties or early thirties (Dell 2004), our sample captures an age range of symptomatic women that may be underrepresented in clinical studies. However, further studies should focus on expanding the ethnicity of the sample.

Also, the numerous inverse relationships between the mindfulness variables and premenstrual symptoms assessed calls for further investigation. Based on the complex relationships between mindfulness, menstrual attitudes, and symptomatology, it stands to reason that if mindfulness is to be taught to women who suffer premenstrual symptoms in an effort to reduce the influence of menstrual attitudes on symptom severity, a multi-dimensional approach to that teaching is warranted. Further research is needed to delineate what a successful mindfulness-based intervention for women who suffer from premenstrual symptoms must entail.

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