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Personality, Menopausal Symptoms, and Physical Activity Outcomes in Middle-Aged Women

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Abstract

The menopausal transition is characterized by increased reporting of various symptoms, however, little is known about what underlies individual differences in their reporting. The present study examined the contribution of personality factors to the reporting of menopausal symptoms in the context of a 4-month randomized controlled exercise trial. Symptomatic middle-aged women (N = 164 M age = 49.9, SD = 3.6) completed measures of menopausal symptoms, personality, physical activity, fitness and body composition assessment at the beginning and end of a 4-month randomized controlled trial involving walking and yoga. After controlling for baseline values, psychological symptoms at the end of the trial were associated with trait anxiety (β = .47, p < .001) and changes in fitness (β = -.20, p < .01); vasomotor symptoms with optimism (β = -.18, p < .05) and changes in fitness (β = -.15, p = .053); and sexual symptoms were associated with changes in fitness (β = -.16, p < .05). Personality characteristics partially explain symptom reports during menopause however improvements in physical parameters such as fitness may reduce reported symptomatology.

1. Introduction

Menopause refers to cessation of ovarian follicular activity and is manifest by the cessation of menstrual flow lasting at least 12 months. The transition from reproductive to non-reproductive years in women (here referred to as the menopausal transition) is characterized by increased reporting of psychological, somatic, vasomotor, and urogenital symptoms (Greene, 1998). Ovarian aging and hormonal changes have been consistently linked to vasomotor symptoms, such as, hot flashes, night sweats, and some urogenital symptoms (NIH, 2005). The causes of other symptoms reported by women in the menopausal transition are multifaceted; moreover it is unclear to what degree these are related to aging generally or other life circumstances coinciding with menopause. Recent reports have also linked musculoskeletal pain, headaches, depressed mood, and perceived stress to menopausal stage and changes in reproductive hormones (Freeman et al., 2007), but these associations have not been consistently reported in other studies.

Although some women appear to be more susceptible to menopausal symptoms, the idea of a universal menopausal syndrome has been refuted (Avis, Brockwell, & Colvin, 2005). Women's menopausal experiences vary considerably, including the rate of reporting menopausal

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symptoms such as hot flashes which have been linked to specific hormonal profiles (Freeman et al., 2007). Women can start exhibiting vasomotor symptoms in late reproductive years when their menstrual cycle is still seemingly regular (Freeman et al., 2007) and these symptoms may persist late into post menopause (Huang et al., 2008). Studies employing objective hot flash assessment techniques (e.g., sternal skin-conductance monitoring) have shown substantial under-reporting rates (43-65%) in ambulatory as opposed to laboratory-based assessment studies (Miller & Li, 2004). Although reasons such as differential interpretations of symptoms and perceptual (e.g., somatic sensitivity), affective (e.g., depression), contextual (e.g., social interactions and stressors), and lifestyle (e.g., diet and physical activity) influences have been offered for these discrepancies, few systematic investigations of these correlates exist. The North American Menopause Society position statement (NAMS, 2004) and two NIH sponsored conferences (Miller & Li, 2004; NIH, 2005) on menopausal symptoms have also highlighted the need for better understanding of individual differences in the reporting of menopausal symptoms as a key issue for improving symptom management and evidence-based treatment for women at this stage of life. Among the topics highlighted was the role of personality traits in symptom perception, interpretation, and coping.

A number of theoretical explanations have been put forth to describe the underlying mechanisms of the relationship between personality and symptom reporting and include various psycho-biological or psycho-immunological mediators (Ericksen & Ursin, 2004; Rappaport, McAnulty, Waggoner, & Brantley, 1987). Although there is consistent support for the relationship between specific aspects of personality and physical symptom reporting (Leventhal, 1986), in particular in women (van Wijk & Kolk, 1997), few empirical examinations of the role that personality traits play in menopause management exist. Bosworth et al. (Bosworth, Bastian, Rimer, & Siegler, 2003) reported that women with higher levels of neuroticism perceive their menopausal transition as more stressful and use less effective coping strategies when dealing with menopause-related distress. Dispositions such as optimism, sense of coherence, and health-related hardiness have also been linked to symptom reporting in peri- and post-menopausal women independent of emotional stability (Caltabiano & Holzheimer, 1999; Kuh, Hardy, Rodgers, & Wadsworth, 2002). However, little is known about how personality dispositions affect the reporting of symptoms by middle-aged women as they transition from reproductive to non-reproductive years and whether these associations change in the context of behavioral interventions.

Exercise training in particular may reduce symptom reporting as a result of improvements in functional or physical parameters such as fitness or body composition (Morey & Zhu, 2003), or as a result of enhancing mood, changing somatic awareness, appraisal and interpretation of physical sensations. Better understanding of what underlies individual differences in the reporting of menopausal symptoms in response to behavioral interventions would thus allow us to identify sub-groups of women who may require additional tailoring of intervention strategies to increase their efficacy. Therefore, the purpose of this study was to examine the contribution of selected personality traits to psychological, somatic, vasomotor, and sexual symptoms reported by middle-aged women and to determine whether personality variables have an effect on symptom reporting that is independent of changes associated with behavioral interventions such as exercise. We hypothesized that higher levels of neuroticism, trait anxiety, and pessimism would be associated with more menopausal symptoms and optimism with fewer symptom reports in all categories and that these associations would remain significant after improvements in physical parameters (e.g., fitness, body mass index, and physical activity) across the intervention are accounted for.

2. Material and methods

2.1. Participants

We recruited 164 sedentary or low active middle-aged women (age range 42-58) for a study of physical activity and quality of life outcomes. Women were eligible if they reported having experienced vasomotor symptoms such as hot flashes or night sweats within a month of entry into the study. The presence and frequency of symptoms was ascertained during telephone screening and enrolled participants subsequently completed a measure of menopausal symptoms as part of a baseline questionnaire battery. The details of recruitment, participant flow through the trial, and study procedures have been published elsewhere (Elavsky & McAuley, 2007a, 2007b). The women had no history of surgical menopause and had not used hormone therapy (HT) for at least six months.

2.2. Procedures

Following telephone screening, eligible participants completed a baseline battery of questionnaires and underwent body composition and cardiorespiratory fitness assessment in a laboratory. Upon completion of all testing, participants were randomly assigned into either a 4-month *walking*, *yoga*, or a *wait-list control* condition. The walking program involved supervised moderate intensity exercise 3 times per week for one hour. The yoga program was of low intensity meeting twice a week for 90 minutes. Iyengar YOGA, a form of Hatha Yoga, was practiced. Attendance in both programs was monitored by instructors and participants in the control group received no treatment but were offered a free 10-week exercise program of their choice at the end of the study. At the end of the 4-month study, participants completed questionnaires again and returned for body composition and cardiorespiratory fitness assessment in a separate lab session.

2.3. Measures

All participants completed and signed an Institutional Review Board-approved informed consent. Basic demographic and health history information was collected and all participants obtained a medical release from their physicians prior to study participation.

Menopausal symptoms—The Greene Climacteric Scale (GCS) (Greene, 1998) is a commonly used measure of 21 menopausal symptoms in the clinical practice. Women are asked to indicate the degree to which they are bothered by the listed symptoms and rate them on a 0-3 scale from “not at all” to “extremely”. Symptoms 1–11 address psychological symptoms reflecting anxiety (a sum of symptoms 1–6 with a possible score range of 0-18) and depression (a sum of symptoms 7–11 with a possible score range of 0-15). Somatic aspects (e.g., muscle and joint pains, headaches) are addressed in symptoms 12–18 (for a possible range of scores 0-21) and vasomotor symptoms (hot flashes, night sweats) in items 19 and 20 (a possible range of scores 0-6). Symptom 21 (i.e., loss of interest in sex) is a probe for sexual dysfunction (a score range of 0-3). The possible range of total symptom disturbance scores is 0-63. Internal consistency of the scale in the present study was acceptable (Cronbach’s α = .85 and .83 for psychological, .66 and .66 for somatic, .80 and .84 for vasomotor symptoms, for baseline and follow-up assessments respectively).

Physical activity—The Aerobics Center Longitudinal Study Physical Activity Survey (ACLS) (Kohl, Blair, Paffenbarger, Macera, & Kronenfeld, 1988) assesses frequency, duration, and intensity of 14 different physical activities and allows for calculation of metabolic equivalents of energy expenditure in reported activities. Only leisure time physical activity items were used to compute the total score.

Fitness and body composition—Women completed a maximal graded exercise test to assess their cardiorespiratory fitness (expressed as peak oxygen uptake or VO_2peak). Additionally, their height and weight was measured and body mass index was computed.

Neuroticism—The International Personality Item Pool (Goldberg, 1999) contains 20 items, with each item composed of a short statement (e.g. "feel threatened easily") to which participants responded on a five point Likert-type scale (1= "very inaccurate" to 5 = "very accurate"). Negative items are reversed and all items are summed to arrive at a total score which can range from 20-100. Higher scores on the scale indicate higher levels of neuroticism. Internal consistency of the scale in the present study was high (Cronbach's $\alpha = .95$).

Optimism and pessimism—The Life Orientation Test (LOT-R) (Scheier, Carver, & Bridges, 1994) is a 10-item measure, with only 6 items used to derive the total optimism (items 1, 4, and 10) and pessimism (items 3, 7, and 9) scores. Respondents are asked to indicate the extent of their agreement with each of the items on a 5-point Likert-like scale that ranged from "strongly disagree" (0) to "strongly agree" (4). Thus, each subscale score can range from 0-12 with higher scores indicating higher levels of optimism or pessimism, respectively. The internal consistency for each of the three-item subscales was acceptable in this study (Cronbach's $\alpha = .70$ and .79 for optimism and pessimism respectively).

Trait anxiety—The State-Trait Anxiety Inventory Form T (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) consists of 20 items rating the frequency of anxiety symptoms on a scale ranging from 1 (almost never) to 4 (almost always). A total score is arrived at by adding up all items and ranges from 20-80, with higher total scores reflecting higher levels of trait anxiety. Internal consistency of the measure was high in this study (Cronbach's $\alpha = .93$).

2.4. Data Analysis

Data were analyzed using the Mplus 5.1 statistical software program (Muthén & Muthén, 1998-2007) with the full-information maximum likelihood estimator. The full-information estimator is an optimal approach for use with missing data (Enders & Bandalos, 2001). At baseline and 4-month follow-up respectively, missing responses represented .04 and 19.5% of physical activity data; .01 and 17.7% of fitness and body mass index data; .01 and 19.5% of psychological, somatic, and vasomotor symptom data; .02 and 23.2% of sexual symptom data. Personality measures were administered only at baseline and were not completed by .01, .04, and 7.9% of women for optimism and pessimism, neuroticism, and trait anxiety respectively.

In separate regression models by symptom category, symptom responses at the end of the trial were regressed on baseline values, personality (neuroticism, trait anxiety, optimism, pessimism) and changes in physical variables (physical activity, fitness, BMI) across the trial. All path coefficients and correlations are reported as standardized estimates. Significance was evaluated based on a two-tailed test with a critical value set at .05.

3. Results

3.1. Sample Description

The sample ($N = 164$; M age = 49.9; $SD = 3.6$) was comprised of relatively healthy and primarily white women (83%), the majority of whom were married or in significant relationships (75%), had college education (64%), and above average income (67%). Based on self-reported menstrual bleeding patterns at baseline 17% of women were categorized as pre-menopausal (i.e., reporting no changes to their menstrual cycles within 12 months preceding the study), 51% as peri-menopausal (reporting irregular menstrual cycles within 12 months preceding the study), and 32% as post-menopausal (reporting no menstrual cycles within the last 12 months

or longer). The majority of women in the sample were overweight or obese (70% of the women had BMI ≥ 25 kg/m^2 with mean value of 29.67, *SD* = 7.06). We have previously reported the flow of participants through the trial (Elavsky & McAuley, 2007b) and the overall retention rate in the trial was 90%.

3.2. Associations Among Personality Traits, Physical Outcomes, and Menopausal Symptoms

Means and standard deviations for all variables for both time points are presented in Table 1. There were significant bivariate associations between psychological symptoms at baseline and neuroticism (r = .68, p < .01), trait anxiety (r = .61, p < .01), pessimism (r = .18, p < .05), and optimism (r = -.30, p < .01); between somatic symptoms and neuroticism (r = .33, p < .01) and trait anxiety (r = .24, p < .01); and between sexual symptoms and neuroticism (r = .18, p < .05). The pattern was the same at four months for psychological symptoms (rs = .47, .62, .30, -.22, p < .01, for neuroticism, trait anxiety, pessimism, and optimism, respectively). Somatic symptoms at four months were associated with neuroticism (r = .33, p < .01); trait anxiety (r = .34, p < .01), and pessimism (r = .19, p < .05); vasomotor symptoms with neuroticism (r = .21, p < .05); and sexual symptoms were associated with trait anxiety (r = .18, p < .05).

Subsequently, for each symptom category we regressed end-of-program values on personality variables and changes in physical outcomes across the trial, after controlling for baseline levels of each symptom construct. As can be seen in Table 2, self-reported psychological symptoms at the end of the trial were uniquely associated with baseline psychological symptoms (β = .29, p < .01), trait anxiety, (β = .47, p < .001), and changes in cardiorespiratory fitness (β = -.20, p < .01) across the trial, with the overall model accounting for 48.1% of the total variance in psychological symptoms. Although psychological symptoms decreased in the sample on average across the intervention, women with higher trait anxiety exhibited less pronounced decreases in psychological symptoms than less trait anxious women. Women who improved their fitness across the trial also reported greater reductions in psychological symptoms as compared to women whose fitness level did not change or decreased.

Although somatic symptoms were associated with neuroticism and trait anxiety in bivariate analyses at both time points, no significant associations were observed in the regression analysis (β = .17, p = .108, and β = .05, p = .691 for trait anxiety and neuroticism, respectively). The overall model accounted for 33.8% of the variance in somatic symptoms. Vasomotor symptoms at the end of the trial were predicted by baseline symptoms (β = .59, p < .001), optimism (β = -.18, p < .05), and marginally by changes in fitness (β = -.15, p = .053). These results indicate that women with higher levels of optimism and improved fitness experienced greater reductions in vasomotor symptoms across the trial than women with lower levels of optimism or no positive changes in fitness. Similarly, sexual symptoms at the end of the trial were significantly associated with changes in fitness (β = -.16, p < .05) after accounting for their baseline values (β = .62, p < .001). Overall, the models accounted for 44.3% and 43.6% of variance in vasomotor and sexual symptoms respectively.

4. Discussion

There is considerable interest in understanding which factors contribute to individual differences in the reporting of menopausal symptoms. Better understanding of these differences would enable us to draw more meaningful conclusions when evaluating individual responses to various treatments, especially for symptoms that appear to be physiologically non-specific. The present study examined associations among selected personality dispositions and multiple dimensions of menopausal symptoms in middle-aged women who participated in a 4-month randomized controlled trial of walking and yoga. The study demonstrated that individual differences in the reporting of symptoms may be partially explained by personality

characteristics such as trait anxiety and optimism but modifiable factors such as fitness also play a role. In this study, patterns of relationships differed by symptom category and across time, with trait anxiety as the only personality characteristic which explained unique variance in residual changes in psychological symptoms and optimism as the only trait accounting for changes in vasomotor symptoms across the trial.

Symptoms are perceptual phenomena that involve processing of external and internal sensory information and their selective monitoring and encoding (Pennebaker, 1982). Personality dispositions such as trait anxiety or optimism may therefore influence this process by shaping attentional biases, attribution styles, and cognitive schemata, leading to differences in the awareness and reporting of menopausal symptoms. Our results indeed suggest that women with high trait anxiety or low optimism may be more vulnerable to negative psychological or vasomotor symptoms. These findings have implications for the design of effective interventions for middle-aged women. For example, high trait anxious women may benefit more from exercise interventions tailored by including cognitive-behavioral strategies or alternative intervention modalities such as yoga with meditation or mindfulness components. Cognitive restructuring may also benefit women with low optimism in terms of their outcome expectations and coping skills associated with menopause, hot flashes, or aging in general. Indeed, Caltabiano & Holzheimer (1999) have shown that personality traits may influence symptom reporting indirectly via stress coping. Specifically, they have shown that the positive effects of personality characteristics such as health-related hardiness, optimism, and sense of coherence on symptom reports are mediated via problem-focused coping or through attitudes. Whether increased symptom reports of high trait anxious or less optimistic women also occur as a result of them more readily adopting less effective coping strategies remains to be determined.

Vasomotor and sexual symptoms were largely unrelated to personality traits in this study but those women who improved their fitness across the trial exhibited decreases in these symptoms over time. This finding is encouraging because cardiorespiratory fitness represents a factor modifiable by physical activity interventions but it must be positioned in the context of existing evidence. Vasomotor symptoms represent primary targets for symptom management interventions during menopause. Interestingly, women in this study perceived these two categories of symptoms as the most bothersome based on subscale symptom ratings standardized by number of items per subscale (vasomotor = .94, sexual = .99, psychological = .79, somatic = .45). Hormone therapy treatments are contraindicated for some women and there is a growing preference for non-pharmacological options by many women. Although preliminary support has been demonstrated for a variety of educational and psychosocial interventions (Tremblay, Sheeran, & Aranda, 2008), the use of physical activity as a treatment modality for hot flashes has remained controversial.

Cross-sectional studies report positive effects of exercise on hot flashes while prospective studies indicate small or no effect. Few well-designed randomized controlled studies exist (Daley, MacArthur, Mutrie, & Stokes-Lampard, 2007) and most studies to date have relied on self-report measures of both physical activity and hot flashes or did not test different exercise modalities or consider fitness as an outcome. Although a small laboratory study has indicated that acute exercise may trigger hot flashes in the short term by increasing core body temperature (Freedman & Krell, 1999) and a recent report has suggested that lifetime physical activity may increase the risk for hot flashes (Whitcomb, Whiteman, Langenberg, Flaws, & Romani, 2007), no studies to date have systematically evaluated the effect of chronic exercise adaptations (e.g., improved fitness, reduced body fat, or changing hormonal profiles) on hot flashes in spite of the plausible physiological explanations for the relationship.

For example, the proposition of a direct effect of exercise on vasomotor symptoms is based on the effects of exercise on endogenous opiate production and the mechanism of hot flashes. Vasomotor symptoms are possibly caused by altered neurotransmitter release in the hypothalamus leading to altered regulation of the thermoregulatory centre. The neurotransmitter β-endorphin, an endogenous opiate, is known to effect thermoregulation and has been suggested to play a role in the mechanism of hot flashes (Spencer, Hruby, & Bursk, 1990). Reduced endorphin levels increase the frequency and amplitude of luteinizing hormone pulsations and provoke vasomotor-like symptoms including hot flashes, increased heart rate, and other symptoms such as insomnia, irritability and muscle and joint aches (Sternfeld & Marcus, 2000). Given that endorphins are also known to decrease in association with falling estrogen concentrations and increase with vigorous exercise (Sternfeld & Marcus, 2000), an effect of habitual physical activity on reduced symptom reporting in middle-aged women may be expected. Although awaiting corroboration, our results demonstrated that increased cardiorespiratory fitness is associated with reduced reporting of vasomotor and sexual symptoms. Because subjectively and objectively reported hot flashes may have different antecedents (Thurston, Blumenthal, Babyak, & Sherwood, 2005), it is essential that future studies include both types of assessment. This approach would also allow for a unique opportunity to evaluate the role of personality in relation to objective experiences and symptom perceptions, respectively. Additionally, examinations of the impact of other chronic exercise adaptations such as weight loss or reduced body fat are needed in light of recent studies indicating that overweight and obese women are more likely to report vasomotor symptoms as compared to their normal weight counterparts (Thurston et al., 2008).

We restricted our assessments to only three personality dispositions that may affect menopausal symptom reporting and subsequent investigations should perhaps consider a more extensive battery of personality measures. Additionally, our measure of symptoms, although validated, included only one item assessing sexual problems which may have biased our results. Qualitative studies as well as studies involving both objective and subjective methods of symptom and physical activity assessment (e.g., sternal skin conductance monitoring for hot flashes and accelerometry for physical activity) are needed to gain further insight into how symptoms are experienced and perceived by diverse samples of middle-aged women. Behavioral interventions of longer durations and exercise interventions targeting activity of different volume or intensity are needed to evaluate their impact on menopause-related symptomatology. Alternative research designs such as within-person intensive longitudinal designs may also offer further insights into the psychological processes underlying menopausal symptom reporting.

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TABLE 1

Means and Standard Deviations for All Variables at Baseline and 4-Month Follow-Up

Outcome	Baseline		Month 4	
	Mean	(*SD*)	Mean	(*SD*)
Neuroticism	49.42	16.59		
Trait anxiety	37.89	10.05		
Optimism	7.80	2.02		
Pessimism	3.76	2.20		
Psychological symptoms	8.66	4.89	5.95	4.17
Somatic symptoms	3.17	2.65	2.63	2.21
Vasomotor symptoms	1.87	1.62	1.48	1.58
Sexual symptoms	0.99	0.97	0.77	0.89
Body mass index (kg/m^2)	29.57	7.06	28.42	6.14
Fitness ($ml \cdot kg^{-1} \cdot min^{-1}$)	23.94	5.06	24.91	4.84
Physical activity (MET $h \cdot wk^{-1}$)	5.27	7.38	7.32	8.92

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TABLE 2

Predictors of Menopausal Symptoms at the End of the Trial

Dependent Variable Predictor	R^2change	β	S.E.	Critical value	*p*-value
Psychological symptoms (Total R^2 = 0.481)					
Baseline psychological symptoms	0.086	0.293	0.094	3.121	0.002
Neuroticism	0.006	0.078	0.111	0.703	0.482
Trait anxiety	0.222	0.471	0.099	4.767	0.000
Optimism	0.000	-0.014	0.082	-0.171	0.864
Pessimism	0.009	0.093	0.081	1.150	0.250
Change in fitness	0.041	-0.203	0.073	-2.773	0.006
Change in body mass index	0.001	-0.035	0.067	-0.524	0.600
Change in physical activity	0.002	-0.039	0.064	-0.610	0.542
Somatic symptoms (Total R^2 = 0.338)					
Baseline somatic symptoms	0.200	0.447	0.070	6.376	0.000
Neuroticism	0.002	0.047	0.117	0.398	0.691
Trait anxiety	0.030	0.173	0.108	1.608	0.108
Optimism	0.001	0.037	0.093	0.400	0.689
Pessimism	0.014	0.117	0.090	1.299	0.194
Change in fitness	0.007	-0.085	0.087	-0.973	0.330
Change in body mass index	0.001	-0.028	0.079	-0.352	0.725
Change in physical activity	0.015	-0.124	0.071	-1.741	0.082
Vasomotor symptoms (Total R^2 = 0.443)					
Baseline vasomotor symptoms	0.350	0.591	0.055	10.680	0.000
Neuroticism	0.026	0.162	0.105	1.537	0.124
Trait anxiety	0.001	0.035	0.098	0.353	0.724
Optimism	0.032	-0.179	0.085	-2.115	0.034
Pessimism	0.014	0.119	0.083	1.437	0.151
Change in fitness	0.022	-0.148	0.076	-1.937	0.053
Change in body mass index	0.014	-0.119	0.069	-1.711	0.087
Change in physical activity	0.008	-0.090	0.066	-1.347	0.178
Sexual Symptoms (Total R^2 = 0.436)					
Baseline sexual symptoms	0.381	0.617	0.056	11.040	0.000

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Dependent Variable Predictor	R^2change	β	S.E.	Critical value	*p*-value
Neuroticism	0.005	0.074	0.108	0.681	0.496
Trait anxiety	0.000	0.011	0.102	0.111	0.911
Optimism	0.007	-0.085	0.090	-0.945	0.345
Pessimism	0.001	0.025	0.084	0.302	0.762
Change in fitness	0.027	-0.163	0.077	-2.123	0.034
Change in body mass index	0.005	-0.068	0.078	-0.871	0.384
Change in physical activity	0.002	-0.039	0.067	-0.586	0.558