Published in final edited form as:

Addict Behav. 2016 June ; 57: 38–41. doi:10.1016/j.addbeh.2016.01.015.

Premenstrual Symptoms and Smoking-Related Expectancies

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Abstract

Given that prior research implicates smoking abstinence in increased premenstrual symptoms, tobacco withdrawal, and smoking behaviors, it is possible that women with more severe premenstrual symptoms have stronger expectancies about the effects of smoking and abstaining from smoking on mood and withdrawal. However, such relations have not been previously explored. This study examined relations between premenstrual symptoms experienced in the last month and expectancies that abstaining from smoking results in withdrawal (i.e., smoking abstinence withdrawal expectancies), that smoking is pleasurable (i.e., positive reinforcement smoking expectancies), and smoking relieves negative mood (i.e., negative reinforcement smoking expectancies). In a cross-sectional design, 97 non-treatment seeking women daily smokers completed self-report measures of smoking reinforcement expectancies, smoking abstinence withdrawal expectancies, premenstrual symptoms, mood symptoms, and nicotine dependence. Affect premenstrual symptoms were associated with increased negative reinforcement smoking expectancies, but not over and above covariates. Affect and pain premenstrual symptoms were associated with increased positive reinforcement smoking expectancies, but only affect premenstrual symptoms remained significant in adjusted models. Affect, pain, and water retention premenstrual symptoms were associated with increased smoking abstinence withdrawal expectancies, but only affect premenstrual symptoms remained significant in adjusted models. Findings from this study suggest that addressing concerns about withdrawal and alternatives to smoking may be particularly important in women who experience more severe premenstrual symptoms, especially affect-related changes.

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Conflicts of Interest

None of the authors report a conflict of interest related to submission of this manuscript.

Keywords

premenstrual symptoms; positive reinforcement smoking expectancies; negative reinforcement smoking expectancies; smoking abstinence withdrawal expectancies

1. Introduction

Some literature suggests that women compared to men are more likely to experience greater difficulty quitting smoking [1–3], but not every study finds this effect [4]. Nevertheless, it is important to investigate the underlying etiologies of smoking behavior in women in order to inform and develop women-specific smoking cessation treatment approaches.

Smoking expectancies and smoking abstinence expectancies (i.e., an individual's cognitions about the effects of smoking and abstaining from smoking, respectively) have been shown to be associated with withdrawal severity and smoking cessation success [5–7]. Research suggests that in women compared to men smoking to relieve negative affect (i.e., negative reinforcement) may be a more salient motivator [8, 9]. Additionally, the pleasurable sensorimotor aspects of smoking may have a stronger influence on the subjective hedonic response to smoking (i.e., positive reinforcement) in women compared to men [10, 11]. Lastly, evidence suggests that, in comparison to men, women may experience greater tobacco abstinence-induced withdrawal [12, 13]. These findings suggest that reinforcement from smoking and abstinence-induced withdrawal might be particularly important factors for smoking in women, which could enhance the development of expectancies for such outcomes. Indeed, research suggests that women report stronger negative reinforcement smoking expectancies and smoking abstinence withdrawal expectancies [14–16].

There is reason to believe that smoking expectancies and smoking abstinence expectancies may vary by severity of premenstrual symptoms (i.e., changes in negative affect, water retention, and pain occurring the week before menstrual onset). Smoking abstinence is associated with increased premenstrual symptoms and withdrawal [17]. Moreover, a study showed premenstrual symptoms are attenuated by nicotine replacement therapy [18].

Additionally, women with greater phase-related variability in premenstrual symptoms have been shown to be at greater risk for relapse [19]. Given the overlap of premenstrual and withdrawal symptom severity and relief of these symptoms via nicotine, there is the possibility that individual variation in premenstrual symptoms could be an important source of variation in smoking experiences and thus could impact expectancies about smoking and smoking abstinence.

In this cross-sectional study, we examined associations between premenstrual symptoms, smoking reinforcement expectancies, and smoking abstinence withdrawal expectancies. Based on previous work, we hypothesized that women with more severe premenstrual symptoms would report greater positive reinforcement smoking expectancies, negative reinforcement smoking expectancies, and smoking abstinence withdrawal expectancies.

2. Methods

2.1 Participants and Procedures

Participants included 97 non-treatment seeking women smokers recruited from the Los Angeles area via advertisements announcing the opportunity to take part in a study investigating menstrual cycle effects on smoking from 2013–2015. The ethnic/racial distribution was 47.4% African American, 32.0% White, and 20.6% Other. The ‘Other’ category included Asian ($n = 6$), Middle Eastern ($n = 1$), Hispanic or Latino ($n = 4$), and Multi-Racial ($n = 9$).

Participants included were 18–40 years old, regular smokers for 2+ years, currently smoking 10 cigarettes/day with a breath CO ≤ 10 ppm, with normal menstrual cycles of average cycle length 24–35 days for the past three months. Participants were excluded for use of hormonal birth control in the past three months, pregnancy or breastfeeding in the past six months, current non-nicotine substance use disorder, current use of nicotine replacement or smoking cessation medications, reported regular use of other nicotine or tobacco products (e.g., cigars, e-cigarettes), and the desire to cut down or quit smoking in the next 30 days.

Participants attended a session at the laboratory, which involved informed consent, breath alcohol (required to be .00 at sessions or participants were rescheduled) and carbon monoxide level analysis, administration of the Structured Clinical Interview for DSM-IV Non-Patient Edition [20], and paper-and-pencil measures described below. Additional procedures took place after the baseline study visit (not described here). The University of Southern California Internal Review Board approved the protocol.

2.2 Predictor Variable

The **Shortened Premenstrual Assessment Form** (PAF; [21]) measured extent of symptom change (1 = *no change* to 6 = *extreme change*) between the premenstrual phase versus the rest of the menstrual cycle. Three subscales were used: affect (4 items), water retention (3 items), and pain (3 items). A sum score for each subscale was computed.

2.3 Outcome Variables

2.3.1 The **Smoking Consequences Questionnaire** (SCQ; [5, 6]) assessed how true (1 = *Not true of me at all* to 7 = *Very true of me*) various statements described different expected effects of smoking. Two subscales were included: negative reinforcement smoking expectancies (12 items) and positive reinforcement smoking expectancies (15 items). A mean score was computed for each subscale.

2.3.2 The **Smoking Abstinence Questionnaire** (SAQ; [7]) measured smokers’ expectancies (0 = *Not at all likely* to 6 = *Extremely likely*) for the abstinence process. The 7-item smoking abstinence withdrawal scale was used. A mean score was computed.

2.4 Covariate Measures

2.4.1 Questionnaires assessed demographics, smoking characteristics, and menstrual cycle characteristics.

2.4.2 The **Fagerström Test of Nicotine Dependence** (FTND; [22]) assessed nicotine dependence severity. A sum score was computed for each participant.

2.4.3 The **Center for Epidemiologic Studies Depression Scale** (CESD; [23]) measured frequency (0 = *rarely or none of the time* to 3 = *most or all of the time*) of depressive symptoms over the past week. A sum score for all questions was computed.

2.5 Data Analysis

Preliminary analyses involved examining relationships between predictors, outcomes, and covariates. Given that the PAF asked about change in symptoms during the premenstrual phase, defined in the questionnaire as seven days prior to menstrual onset, we created a phase variable (coded as seven days before expected next period vs. any other time). To create this variable, we subtracted the data collection date from the next expected menstrual onset, which was estimated by adding the average cycle length to the self-reported last menstrual onset. Bivariate correlations were run between predictors, outcomes, and covariates including age, smoking characteristics (i.e., number cigarettes per day, age of onset for regular smoking, nicotine dependence, and number of quit attempts), depression, average cycle length, and phase. An ANOVA was used to determine whether the predictors varied according to race/ethnicity.

Primary analyses utilized separate linear regression models for each of the three predictor variables (i.e., affect premenstrual symptoms, water retention premenstrual symptoms, pain premenstrual symptoms) and three outcome variables (i.e., positive reinforcement smoking expectancies, negative reinforcement smoking expectancies, smoking abstinence withdrawal expectancies). Unadjusted models included individual premenstrual symptom scales as the sole predictor. All unadjusted models were subsequently adjusted by inclusion of covariates significantly associated with the predictor of that model. Results are reported as standardized regression coefficients (β), which reflect the standard deviation change of the outcome for every one standard deviation increase in the predictor. Significance was set at $p < .05$.

3. Results

Age, cigarettes per day, age of onset for regular smoking, average cycle length, and phase were not significantly associated with any PAF subscales. Baseline levels of depression were significantly correlated with each of the PAF scales ($r_s = .31 - .48$, $p_s < .001$). Thus, all unadjusted models were subsequently adjusted to include baseline depression as a covariate. Water retention premenstrual symptoms were significantly correlated with number of past quit attempts ($r = .24$, $p = .02$). Thus, the adjusted model for water retention also included the number of past quit attempts as a covariate. There was a main effect of race/ethnicity for the pain subscale [$F(2, 94) = 4.33$, $p = .02$], but not for any other scales [$F_s(2, 94) = 1.59 - 3.05$, $p_s > .05$]. Thus, the adjusted model for the pain subscale also included race/ethnicity as a covariate.

Table 1 provides the sample descriptives and results of the bivariate analyses. Affect premenstrual symptoms were significantly positively associated with negative reinforcement smoking expectancies in unadjusted models only ($\beta = .21$, $p = .047$). Affect and pain

premenstrual symptoms were positively associated with positive smoking reinforcement expectancies (β s = .21 – .24, $ps < .04$), but only affect premenstrual symptoms remained significant in adjusted models ($\beta = .23$, $p = .045$). Affect, pain, and water retention were positively associated with smoking abstinence withdrawal expectancies¹ (β s = .21 – .38, $ps < .05$), but only affect remained significant when controlled for covariates ($\beta = .30$, $p = .01$).

4. Discussion

Both affect and pain premenstrual symptoms were associated with positive reinforcement smoking expectancies, but only affect premenstrual symptoms remained significant in adjusted models. Affect, pain, and water retention symptoms were associated with smoking abstinence withdrawal expectancies, but only affect remained significant in adjusted models. These findings cohere with current literature showing abstinence-induced increases in premenstrual and withdrawal symptoms [17], that nicotine can offset premenstrual symptoms [18], and women with more severe phase-related variability in premenstrual symptoms are at a greater risk for relapse [19]. Perhaps women with greater premenstrual symptoms, especially symptoms related to changes in affect, experience exaggerated withdrawal during periods of abstinence. Over time, these experiences may accumulate to alter cognitions about the consequences of smoking abstinence, which could lead to the noted associations between premenstrual symptoms and smoking abstinence withdrawal expectancies.

Only affect premenstrual symptoms were associated with negative smoking reinforcement expectancies, but only in unadjusted models. Lack of significant effects in adjusted models may be due to the comorbidity of depression and affect-related premenstrual symptoms [24], which may be particularly relevant to negative reinforcement expectancies.

This study was limited by its cross-sectional design. Thus, no causal inferences can be made. Another limitation is that premenstrual symptoms were assessed at different phases for different participants. However, analyses did not show any relationship between reported premenstrual symptoms and whether or not the participant was in the premenstrual phase, which somewhat offsets this concern. Future studies could examine whether associations between current premenstrual symptoms and smoking expectations vary across the cycle prospectively. Additionally, this study used self-report measures and did not directly assess premenstrual symptoms effects on cessation outcomes. The use of self-report measures raises the possibility that reporting style (i.e., symptom minimizers vs. symptoms exaggerators) could be driving the findings. However, if it was the case that all the variance reported was solely related to individuals tendency to rate symptoms in the same manner, we would expect that all of the predictors would be associated with all of the outcomes because minimizers would be on the low end for all variables and exaggerators would be on the high end for all variables. Additionally, we adjust for depression in all models, which also accounts for response tendencies because we would expect that this measure would also be laden with reporting style variance. There is also the possibility that overlapping symptoms

¹Affect premenstrual symptoms were also associated with expectations that smoking abstinence results in withdrawal specific to cigarette cravings in both adjusted and unadjusted models.

in predictor and outcome variables (e.g., irritability) could underlie some of the findings. However, we do not think this is the case because relations between affect premenstrual symptoms and smoking abstinence withdrawal expectancies remained even when we limited the outcome variable to cigarette craving (i.e., a symptom that is specific to withdrawal). Lastly, this study had a relatively small sample, which could limit power to detect effects.

Despite these limitations, this study is the first to our knowledge that investigated premenstrual symptoms, smoking reinforcement expectancies, and smoking abstinence withdrawal expectancies. Current results suggest that women that experience greater premenstrual symptoms may have greater expectations about the pleasurable effects of smoking (e.g. positive smoking reinforcement expectancies) and expectations for smoking abstinence withdrawal. Given the relationship between smoking reinforcement expectancies and smoking abstinence withdrawal expectancies and motivation to quit [6, 7, 15], current findings indicate that women who experience greater premenstrual symptoms, especially premenstrual changes in affect, may benefit from addressing these symptoms during smoking cessation treatment. For example, providing coping skills to deal with withdrawal and/or pharmacotherapies that address withdrawal [25] may improve cessation success in women who experience more severe premenstrual symptoms. Furthermore, these results suggest that premenstrual symptom variation may be an important factor to consider when conducting studies investigating gender differences in smoking outcome and abstinence expectancies because there may be variability amongst women on these expectancies as a function of variability in premenstrual symptoms.

Acknowledgments

Source of Funding

This research was supported by funding from Tobacco-Related Disease Research Program of the University of California, Grant Number 22FT-0062 and by National Institute on Drug Abuse grant #R21-DA034768. Funding sources had no role in the study design, collection, analysis, interpretation of the data, writing the manuscript, or the decision to submit the paper for publication. Authors Pang, Leventhal, Huh, Monterosso, and Haselton designed the study and wrote the protocol. Authors Pang and Stone conducted the statistical analysis. Authors Pang, Bello, Fales, and Kirkpatrick conducted literature searches and provided summaries of previous research studies. Author Pang wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

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Highlights

- This study explored premenstrual symptoms (PR) and smoking related expectancies
- Affect and pain PR were associated with positive reinforcement expectancies
- After adjustment, affect PR associated with positive reinforcement expectancies
- Affect, pain, and water retention PR associated with withdrawal expectancies
- After adjustment, affect PR associated with abstinence withdrawal expectancies

Table 1

Sample Descriptives and Primary Analyses

	M (SD) or n (%)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Univariate												
Correlations (<i>r</i>)												
1. SCQ-NR	5.07 (1.51)	–										
2. SCQ-PR	4.86 (1.27)	.54***	–									
3. SAQ-Withdrawal	3.99 (1.42)	.42***	.49***	–								
4. CESD	0.58 (0.48)	.26**	.12	.32**	–							
5. FTND	4.74 (1.98)	.31**	.22*	.16	.11	–						
6. Cigs/Day	13.86 (5.10)	.15	.08	.24*	.02	.39***	–					
7. Age regular smoker	18.53 (3.39)	–.06	–.13	.01	.08	–.18	–.15	–				
8. Quit Attempts	3.15 (6.21)	.14	–.04	–.05	–.01	.08	.00	–.09	–			
9. Cycle Length	29.25 (1.85)	–.03	–.09	–.03	.05	.13	.09	.02	.06	–		
10. Current Phase-PM	22 (22.7%)	–.05	–.13	.05	.15	.02	.03	.03	.11	–.04	–	
11. Age	29.58 (5.93)	–.04	–.08	–.02	–.04	.10	.21*	.14	–.07	–.02	.05	–
Unique Effects - Un-Adj β (Adj β)												
PAF-Affect ^a	10.96 (5.73)	.21* (.10)	.24* (.23)	.38*** (.30**)								
PAF-Water Retention ^{a b}	8.80 (4.38)	.15 (.01)	.19 (.19)	.21* (.14)								
PAF-Pain ^{a c}	8.77 (4.26)	.11 (–.01)	.21* (.11)	.25* (.06)								

Note: *N* = 96–97. SCQ = Smoking Consequences Questionnaire (NR = Negative Reinforcement; PR = Positive Reinforcement); SAQ = Smoking Abstinence Questionnaire; CESD = Center for Epidemiologic Studies Depression Scale; FTND = Fagerström Test for Nicotine Dependence; Current Phase-PM = 7 days before next expected period; PAF = Premenstrual Assessment Form.

^a Adjusted models - CESD;

^b Adjusted models – quit attempts;

^c Adjusted models – Race.

* *p* < .05;

** *p* < .01;

100 > *d'*

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