



Full length article

Cigarette craving and stressful social interactions: The roles of state and trait social anxiety and smoking to cope

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ABSTRACT

Background: Previous research indicates that social anxiety (SA) is a risk factor for the maintenance and relapse of smoking behaviors. However, little is known about the mechanisms underlying this relationship. The current study tested the effects of state and trait levels of SA as well as smoking to cope with symptoms of SA on craving during a social stressor task in abstinent conditions.

Methods: Participants (n = 60) were daily smokers, aged 18–30. Participants attended two sessions: a baseline session and a second session, wherein they engaged in a social stressor task while deprived from nicotine for 24 h. Subjective ratings of cigarette craving and state levels of SA were assessed six times throughout the task. Data were analyzed via multilevel modeling.

Results: Both trait SA and some forms of smoking to cope with symptoms of SA were more likely to predict increased craving during times of high, relative to low, social stress. Further, individuals with higher state SA, greater smoking to cope behaviors, and those who experience greater relief of social distress by smoking experienced greater craving throughout the task. These effects remained after controlling for nicotine dependence, withdrawal symptoms, depression, and other symptoms of anxiety and stress. Smoking to cope with symptoms of SA did not moderate the relationship between state SA and craving.

Conclusions: Smokers high in SA (state and trait) and smoking to cope with symptoms of SA may be at risk for continued smoking and relapse because of the intensity of cravings they experience during stressful social situations.

1. Introduction

Several lines of research highlight the importance of the relationship between social anxiety (clinical and subthreshold) and cigarette smoking. Approximately 36% of smokers meet criteria for social anxiety disorder (SAD) at some point in their lifetime (Lasser et al., 2000), and individuals with SAD have twice the lifetime prevalence rates of nicotine dependence compared to those without SAD (33% vs 17%, respectively; Grant et al., 2005). Smokers with a history of SAD are more likely to report previous unsuccessful quit attempts (63.9% vs 49.2%) than other smokers (Coughe et al., 2010). Similarly, compared to smokers who have never met criteria for an anxiety disorder, smokers with SAD are less likely to quit smoking in response to standard treatments (28.6% vs 36%; Piper et al., 2011). Individuals with subthreshold social anxiety also exhibit higher prevalence rates of smoking and nicotine dependence than their less socially anxious counterparts

(Fehm et al., 2008; Sonntag et al., 2000; Wittchen et al., 2000). Although the mechanisms underlying the relationship between social anxiety (SA) and smoking are understudied, two major themes emerge in the literature: coping-motivated smoking and cigarette craving.

According to contemporary models of co-occurring SA and substance use (Buckner et al., 2013) and negative reinforcement of addictive behaviors (Baker et al., 2004), individuals who use substances to reduce or avoid negative affect are vulnerable to continued use. Thus, socially anxious individuals may use smoking to cope with SA symptoms, including physiological arousal, fears of negative evaluation, and social avoidance (Buckner et al., 2013). Indeed, socially anxious smokers (i.e., smokers with clinical and subthreshold SA) report smoking to cope with symptoms of SA (Watson et al., 2012) and negative affect more broadly (Buckner et al., 2014b; Kimbrel et al., 2014). One study suggests that socially anxious smokers actually experience the relief they anticipate from smoking. Specifically, smokers with high SA

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Table 1
Descriptives and zero-order correlations of baseline variables.

	α	M	SD	1	2	3	4	5	6	7	8	9	10
1. STC1 (% STC)	–	47.02	33.49										
2. STC2 (# cigs needed)	–	1.52	1.03	.67									
3. STC3 (% avoid)	–	10.02	18.07	.48	.24 ^{NS}								
4. STC4 (% relief)	–	50.97	33.21	.80	.48	.35							
5. STCgoals	.88	38.68	21.97	.44	.28*	.56	.36						
6. Trait SA (SIAS)	.92	20.78	13.68	.43	.26*	.59	.30	.62					
7. Nicotine Dependence (FTND)	.54	2.50	1.78	.03^{NS}	.10^{NS}	.29*	.05^{NS}	.18^{NS}	.01^{NS}				
8. Depression (CES-D)	.87	14.90	8.98	.26	.19^{NS}	.40	.16^{NS}	.45	.51	.04^{NS}			
9. Withdrawal (TWSC)	.81	10.15	6.03	.39	.46	.50	.41	.39	.43	.23^{NS}	.37		
10. Stress (DASS-Stress)	.85	6.40	4.59	.50	.45	.50	.37	.52	.45	.24^{NS}	.49	.53	
11. Anxiety (DASS-Anxiety)	.73	5.55	3.86	.49	.42	.40	.27^{NS}	.42	.34	.00^{NS}	.44	.35*	.60

Note. All correlations are significant at $p < .01$ except those followed by an “NS” superscript (non-significant correlation) or an asterisk* (significant at $p < .05$). Correlations greater than $|\text{.50}|$ are shown in bold. DASS-Anxiety scores are missing for four participants.

experienced increases in negative affect after being told they would be giving a speech, and their negative affect reduced significantly after smoking despite still anticipating giving a speech (Dahne et al., 2015).

Relatedly, among treatment-seeking smokers, SA is also associated with greater smoking-specific experiential avoidance (Buckner et al., 2014a; Watson et al., 2017), a form of coping-motivated smoking. That is, socially anxious smokers have a proclivity to avoid aversive internal smoking-related stimuli (e.g., thoughts, feelings, and sensations) by smoking. When controlling for nicotine dependence, depression, and other forms of anxiety, SA is uniquely associated with avoiding sensations (e.g., cravings) and feelings (e.g., state SA) that cue smoking (Watson et al., 2017). Thus, because socially anxious smokers experience elevated levels of negative affect before (Piper et al., 2011) and after a quit attempt (Buckner et al., 2016a), they may be at risk for continued smoking to regulate their affect.

The second mechanism pertains to craving. Trait SA and smoking to cope with symptoms of SA (STC) are positively associated with craving in response to smoking cues during abstinence (not satiation) among college-aged smokers (Watson et al., 2012). Similarly, among adult (Kimbrel et al., 2014) smokers, SA was uniquely associated with increases in craving after wearing a nicotine-free placebo patch for five hours. These findings remained after controlling for smoking characteristics, other forms of anxiety, and depression (Kimbrel et al., 2014). Because craving is one of the most robust predictors of relapse (Allen et al., 2008; Shiffman et al., 1997), the experience of intense craving during abstinence may put these smokers at risk for continued smoking and relapse—particularly if they smoke to avoid these sensations (Buckner et al., 2014a; Watson et al., 2017).

Still, much remains unknown about the smoking-SA relationship. First, only one study (Dahne et al., 2015) induced SA symptoms using an *anticipated* speech task. However, speech tasks may not generalize to the full range of social contexts that might influence smoking among socially anxious individuals. Second, although previous work demonstrates that inducing symptoms of SA (via speech tasks) increases cravings (Buchmann et al., 2010; Childs and de Wit, 2010; Niaura et al., 2002), prior studies have not examined how trait SA, state SA, and smoking to cope with symptoms of SA (STC) influence craving in real time amidst an interactive social stressor task that more closely resembles real-world situations. Finally, these studies that examined the relationship between social stress and craving did not do so during abstinence.

This study expands upon previous research by examining the effects of both state and trait SA as well as STC on craving in response to a social interaction task after 24 h of abstinence. We hypothesized trait SA and STC would predict craving when experiencing high social stress, and that state SA would positively predict craving regardless of assessment time point. Finally, we predicted the relationship between state SA and craving would be stronger among individuals with greater levels of trait SA and STC. We examined these hypotheses among young

adults, as lifetime prevalence of SAD increases in young adulthood (Merikangas et al., 2011; Wittchen et al., 1999) and because socially anxious young adults are at risk of developing nicotine dependence (Sonntag et al., 2000).

2. Materials and methods

2.1. Participants

Participants were recruited from a public university via listserv announcements and face-to-face methods from May 2013–September 2014. Recruitment materials indicated that the study focused on smoking status, mood, and communication and provided basic procedural details. To be eligible, participants were required to smoke ≥ 5 cigarettes per day for ≥ 6 months (cf. Dahne et al., 2015), have an expired air carbon monoxide (CO) of ≥ 7 parts per million (Bedfont piCO + Smokerlyzer Operating Manual), and be 18–30 years old. We excluded women who were nursing or pregnant, individuals with a history of panic attacks in social situations, and those using cessation medications. Of the 84 consented participants, 24 were excluded because of low CO levels ($n = 11$), failure to complete Day 2 ($n = 11$), grossly not following instructions during the task ($n = 1$), and familiarity with the confederate ($n = 1$). The final sample included 60 participants (70% male) with an average age of 21.6 ($SD = 3.2$). The racial and ethnic composition of the sample was 62% Caucasian, 15% Asian, 13% Hispanic, 7% African American, and 3% other. On average, participants smoked 8.7 ($SD = 4.1$) cigarettes per day and became a regular smoker by age 18 ($SD = 2.3$). Average CO readings were 18.6 ($SD = 8.5$) and 3.6 ($SD = 2.6$) on Days 1 and 2, respectively. Descriptions of other baseline characteristics are shown in Table 1.

2.2. Procedure

After a phone screening, potential participants were scheduled for two sessions that would take place 24 h apart. Participants were instructed to smoke within the hour prior to the first session to control for time since last cigarette. At baseline, if participants had not smoked within the hour, they were given an option to smoke before smoking status was confirmed. Next, participants completed baseline measures and were asked to refrain from smoking until after the second session.

For the second session, consistent with past work in our lab (VanderVeen et al., 2013), abstinence was confirmed by $\geq 50\%$ CO reduction. If this criterion was not met, participants were rescheduled. Participants provided subjective ratings of cigarette cravings and state SA (described in Section 2.3) six times: three times before the interaction task (T1, T2, T3), two minutes into the task (T4), right before the task ended (T5), and after the task (T6) (Fig. 1).

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