CHEWING GUM AND CIGARETTE SMOKERS:

RESPONSE TO A LABORATORY STRESSOR

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NOMENCLATURE

CDC	Centers for Disease Control
HR	Heart Rate
DSM	Diagnostic and Statistical Manual of Mental Disorders
MCDD	Multiple Complex Developmental Disorder
IDDM	Insulin-Dependent Diabetes Mellitus
MS	Multiple Sclerosis
STAI-T	State-Trait Anxiety Inventory – Trait
STAI-S	State-Trait Anxiety Inventory – State
POMS	Profile of Mood States
BDI-2	Beck Depression Inventory-2nd Edition
EAS-ANX	Emotion Assessment Scale – Anxiety Subscale
TWSC	Tobacco Withdrawal Symptom Checklist
AAS	Audience Anxiousness Scale
HHQ	Health Habits Questionnaire
SRRS	Social Readjustment Rating Scale
VAS	Visual Analogue Scale
FTND	Fagerstrom Test of Nicotine Dependence
FTQ	Fagerstrom Tolerance Questionnaire
BUS	Behavior Urges Scale
N	Sample Size

F	Value of the test statistic for analysis of variance
M	Mean
SD	Standard Deviation
p	Statistical Significance Level
ANOVA	Analysis of Variance
MANOVA	Multivariate Analysis of Variance

CHAPTER I

INTRODUCTION

Chewing gum has a number of benefits. For one, it has been shown to provide commonly accepted health benefits such as freshening breath, providing a low-calorie snack, and helping fight tooth decay (Xie, Ba, Zhang, & Liu, 1998). Chewing gum has also been shown to be capable of improving concentration and easing tension (Wilkinson & Scholey, 2002), increasing blood circulation to the mouth and brain (Nakata, 2003), reducing postprandial acid reflux (Robinson, 2003), and increasing salivary flow that is important to oral health (Dawes, 2003). The William Wrigley Company, the world's largest manufacturer of chewing gum, promoted gum chewing as a healthy alternative activity to smoking throughout the 1980's and 1990's. As would be expected, this advertising campaign received much attention from health professionals, especially those interested in reducing the popularity of smoking and subsequently improving smoking cessation programs.

Smoking is the most preventable form of premature death worldwide (Centers for Disease Control and Prevention [CDC], 2002). The unimpressive rates of success that smoking cessation programs yield, 10-32% (CDC, 2002), suggest that current interventions need improvement. Alternatives to aid individuals in their struggle to quit smoking may enhance cessation rates and work in our laboratory suggests that chewing gum, which is relatively low-cost and free of health risks, decreases desire to smoke.

Further, it has been observed that chewing gum is selected over other viable alternatives when smokers are put in a hypothetical situation in which cigarette smoking is limited by increasing cost of a cigarette (Jennings, Collins, Cohen, Miller & Haala, in press).

Recent studies have suggested that chewing gum can help an individual to manage symptoms associated with nicotine withdrawal (Britt, Cohen, Collins, & Cohen, 2001; Cohen, Collins, & Britt, 1997; Cohen, Britt, Collins, al'Absi, & McChargue, 2001). Likewise, recent work by Britt and colleagues (2001) has indicated that chewing gum may also aid smokers in recovery (e.g., decrease negative affect) from a laboratory stressor. Collectively, this research may suggest that chewing gum functions in some way to reduce overall stress levels associated with removal of nicotine from the body and, at least for smokers, it helps reduce laboratory stress. Specifically, the observed relationship between chewing of gum and subsequent nicotine withdrawal symptom reduction provides promise for the use of chewing gum in smoking cessation programs.

The literature is sparse in regards to examining gum chewing and nonsmokers. In a hallmark study conducted in 1939, Hollingworth proposed that chewing gum is a means by which individuals can work off nervous energy and thus implicitly suggested chewing gum reduces stress. Miller (2005) evaluated the role of chewing gum as a stress management technique in non-smokers by examining how chewing gum influences subjective levels of stress and anxiety in response to a laboratory induced stressor and found, contrary to Britt et al. (2001), chewing gum did not significantly aid nonsmokers in recovery from a laboratory stressor over an oral, non-chewing alternative (e.g., breath strips) or nothing (control). Therefore it appears that the use of chewing gum as a stress reduction technique may be limited to stress linked to smoking withdrawal (or possibly is unique to smokers). Consequently, the primary goal of the present study was to examine whether chewing gum significantly decreases subjective levels of stress and anxiety in smokers over a non-chewing oral alternative (e.g., breath strips) in response to a laboratory induced stressor where smokers are not allowed access to cigarettes.

In order to provide a context for the present study, a review of literature will focus on the function of chewing among both animals and humans, as well as what is known about the use of chewing gum in relation to cognitive abilities, stress, and smoking cessation. Next, a review of the relationship between stress and smoking is presented. A brief review of the relationship between taste and stress is also included. A review of the existing research on the proposed laboratory-induced stressor will then be detailed. This will be followed with a detailed description of the goals and hypotheses of the proposed study, as well as how the study was conducted. Finally, proposed analyses will also be presented.

CHAPTER II

REVIEW OF LITERATURE

It has been shown (Miller, 2005) that for a group of nonsmokers the combined properties of chewing and taste (e.g., chewing gum) and taste alone (e.g., breath strip) do not significantly reduce reported anxiety/stress in response to a laboratory stressor (e.g., public speaking task) compared to nothing (control). It has also been shown that for a group of dependent smokers undergoing the combined stressor of acute nicotine withdrawal and a public speaking task (Britt et al., 1999), chewing and taste combined (e.g., chewing gum) significantly reduces subjective anxiety/stress as compared to nothing (control). Therefore, it appears that the property of chewing has differential anxiolytic effects in smokers than nonsmokers. However, it remains unclear how chewing aids smokers in anxiety/stress reduction compared to an alternative without the property of chewing. Since it is believed that the physical act of chewing is the mechanism by which stress reduction occurs, the main hypothesis of the current study is that chewing gum, which has the properties of chewing and taste, will significantly reduce subjective levels of stress/anxiety in smokers, compared to the use of breath strips, which has the shared property of taste while lacking the property of chewing.

Evidence to support the above claim is provided in the following literature review section. In order to highlight why chewing of gum is believed to have greater stress ameliorating properties than alternatives without a chewing component, an examination of research focusing on chewing behavior (not gum chewing), gum chewing, the relationship between smoking and stress, and the relationship between taste and stress is provided. A detailed review of the laboratory technique to be used to induce stress in the participants serves to illustrate the effectiveness and consistency of the task in producing the desired effect.

Chewing Behavior

Chewing is an essential behavior in the early stages of digestion; however, chewing is not limited to the processing of food items. Research addressing cognitive functioning suggests that deteriorations in oral health (i.e., missing teeth), which may minimize the ability to chew effectively, may be associated with mental declines such as Alzheimer's disease or dementia. Specifically, Onozuka and colleagues (1999) assessed spatial memory in SAMP8 mice by using the Morris water maze. The SAMP8 mice strain exhibits accelerated aging in the latter half of their life. This fact was coupled with the mice having their upper molars surgically removed. Results indicated that the molar extracted group showed clear and statistically significant decrements in spatial memory, as compared to the intact molar group. The CA1 area of the hippocampus, which has a mediating effect on spatial memory, was also found to have a reduced cell count in the molar extracted mice. No impairment was observed when the platform was visible, thus suggesting that the learning impairment may have been specific to spatial memory and not general visual or motor abilities. Subsequent work by Watanabe and his colleagues (2002) indicated that when the mice had their molars replaced with dental crowns, their performance gradually returned to that exhibited by the controls on the Morris water maze. Thus, the results of these two studies suggest that the ability to chew is associated with cognitive performance in SAMP8 mice. The studies also illustrate that cognitive deficits, in some instances, are reversible.

Given what we know about the function of chewing, it is possible to begin to have some insight into the additive effects of chewing. Not only does chewing assist with digestion and appears to alter cognitive performance, but other relationships have been noted. For example, a consistently observed behavior in rats and other animals that are purposely stressed is that they exhibit increased vacuous chewing movements, or fictive or purposeless chewing behavior (Glenthoj & Hemmingsen, 1991; Hayes et al., 1997; Sakai, 2001). This repetitive behavior, as others (e.g., pacing, facial tics) are assumed to be uncontrollable, especially under conditions of increased stress (Appleby, 1989), however, it is not known whether these behaviors are in response to stress or a byproduct of stress.

Indeed, work by Appleby (1989) observed that pregnant sows raised in close proximity to restless neighbors appeared to experience stress as indicated by an increase in vacuous chewing. Glenthoj and Hemmingsen (1991) found similar results in non-medicated rats, who had been housed in an environment with uncontrollable noise. These rats developed more vacuous chewing movements compared to control animals.

One interpretation of this finding is that increased chewing behavior is a byproduct of induced stress. Conversely, it is possible that increased chewing behavior has a more adaptive function, such as to reduce stress. In support of the latter explanation, Gomez et al. (1999) found that increased striatal dopamine levels in rats, associated with non-functional masticatory activity (purposeless chewing), attenuates the effects of stress by lowering levels of corticosterone, the hormone associated with inducing stress in animals (cortisol in humans). Thus, these findings lend support to the view that increasing chewing behavior may indeed hold an adaptive function.

These findings at the hormonal level echo some of the much earlier hypotheses of the additive role of chewing on tension and enjoyment. Mursell (1925) attributed much of the enjoyment experienced from activities such as pipe smoking, alcohol and caffeine consumption, chewing gum, and candy-eating as deriving from the oral manipulation of these substances. As noted previously, Hollingworth (1939) proposed that chewing gum served to reduce tension. This view of gum chewing was further refined by Freeman (1940) as a means for individuals to work off excessive neuromuscular excitation. Thus chewing may reduce stress levels.

Gum Chewing

Recently, Wilkinson, Scholey, and Wesnes (2002) examined whether gum chewing positively impacts cognitive performance, specifically, attention, working memory and long-term memory. Seventy-five participants were randomly assigned to either a “chewing”, “sham chewing”, or “quiet control” group. The “chewing” group chewed a piece of sugar free Wrigley’s Extra Spearmint throughout the procedure, while participants in the “sham chewing” group were asked to pretend that they were chewing gum without gum actually being in their mouth. The “quiet control” group was given no gum and was not given any special instructions. It was found that gum chewing improved episodic memory and working memory, although, no improvements to attention were observed (Wilkinson et al., 2002). Further, results indicated that the mere motion of chewing, as produced with sham chewing, did not enhance cognitive abilities. Sham chewing was believed to be experienced as a novel behavior that appears to require more cognitive abilities (i.e., attention) than the typical oral manipulation of an actual object.

Thus it appears that there is something specific about chewing gum in a manner that is comfortable and natural that may contribute to improvements of memory and cognitive abilities. Although the mechanisms associated with gum chewing and memory enhancement are unclear, several hypotheses have been suggested. One hypothesis is that gum chewing may aid in memory by increasing cerebral blood flow in the fronto-temporal regions which boost metabolic function (Sessay, Tanaka, Ueno, Lecaroz & De Beaufort, 2000) and cause increased insulin release (Kennedy & Scholey, 2000). These activities are thought to have a mediating effect on memory via increasing oxygen levels. Increased oxygen levels may also serve a more global function of making one feel more alert and charged up (Scholey, 1999).

Research with smoking populations has indicated that gum chewing appears to be helpful in managing levels of nicotine withdrawal symptoms and urge to smoke in response to a stressor, as compared to a control group (Britt, Cohen, Collins, & Cohen, 1998; Cohen, Britt, Stott, & Carter, 1999; Cohen, Collins, & Britt, 1997). Britt et al. (1998) examined the anxiolytic effects of cigarette smoking and chewing gum on withdrawal, urges to smoke, and anxiety in 45 undergraduate smokers. All participants were exposed to a public speaking task stressor and randomly assigned to a cigarette, chewing gum, or control group, allowing for full access to these items throughout the experimental procedure. Results suggested that chewing gum and cigarette smoking was significantly more effective at decreasing both anxiety and withdrawal as compared to the control group. Withdrawal and urges to smoke have consistently been linked to stress (e.g., Doherty, Kinnumen, Miitello, & Garvey, 1995; Tiffany, 1990), and gum chewing appears to reduce these symptoms in dependent smokers.

Cohen and colleagues (1997) examined whether having access to chewing gum would affect craving and withdrawal over an acute period of abstinence (Cohen et al., 1997). Participants were instructed to smoke an initial cigarette at the start of the experimental session. Following this initial cigarette, participants were asked to watch a full length (approximately 2 hours) movie and informed that they would not be able to smoke for the rest of the experiment. At the start of the movie, participants in the gum condition were asked to chew at least one piece of gum, for standardization purposes only. The no-gum group was not given any special instructions. Craving and withdrawal were assessed immediately after the movie and 30 minutes after that. Results indicated that craving and withdrawal was significantly lower in the gum condition than the no gum condition.

In a related study, Cohen et al. (1999) examined whether the addition of having access to chewing gum would have the effect of delaying first cigarette above being encouraged to not smoke (i.e., prizes would be given for not smoking). Participants were asked to smoke an initial cigarette at the start of the experimental session, and randomly assigned to either a group with access to chewing gum and cigarettes or a group with only cigarettes. It was found that the individuals in the gum condition abstained longer before their first cigarette. Additionally, it was noted that individuals in the gum condition took significantly fewer puffs overall, suggesting that chewing gum may facilitate quit attempts (Cohen et al., 1999).

Shiffman et al. (2003) examined the effect of active nicotine gum versus inactive gum on cravings induced by cue exposure (smoking cues). It was observed that craving for cigarettes returned to baseline (pre-cue values) after only 5 minutes of chewing either the active or inactive gum (Shiffman et al., 2003). Of note, 15 minutes are required before nicotine gum yields significant blood levels of nicotine (Jarvik & Schneider, 1992). Therefore, it was expected that at least 15 minutes would have to elapse before an effect for the nicotine gum would have been observed. Consistent with Jarvik and Schneider (1992), the active nicotine gum was found to reduce craving for cigarettes significantly more than inactive gum 15 minutes post cue exposure.

Shiffman and colleagues (2003) suggest that the inactive gum might not have decreased craving to a true baseline, arguing that prior to the formal experimental cue exposure the participants were likely thinking of smoking and anxious. Therefore, although complete symptom reduction was not obtained, it is suggested that chewing plays a role in managing negative affective states, such as that induced by brief nicotine abstinence. However, an alternative way to interpret these results is that nicotine withdrawal and urges to smoke increase in situations that are highly stressful (i.e., public speaking, when smoking is prohibited, cue exposure). Therefore, the reduction in negative affect observed may have occurred because of chewing behavior, which ultimately reduces stress.

To further test the generalizability of chewing gum as an anxiolytic agent, independent of its apparent aid with nicotine withdrawal, Miller (2005) examined a group of 58 undergraduate nonsmokers who regularly (e.g., daily or almost daily) chewed gum. Miller (2005) examined the effects of the use of chewing gum and breath strips on state anxiety, anxious emotion and urge to chew gum. All participants were exposed to a public speaking task stressor and randomly assigned to a chewing gum, breath strip, or control group, allowing for full access to these items throughout the experimental procedure (e.g., Britt et al., 2001). Results suggested the rejection of the generalization hypothesis, in that chewing gum was not more effective at decreasing anxiety as compared to the breath strip and control groups. Overall, the chewing gum literature suggests that chewing gum selectively enhances some cognitive abilities (Wilkinson et al., 2002), decreases cigarette craving (Cohen et al., 1997) and nicotine withdrawal (Britt et al., 1998; Cohen et al., 1997), and is inconclusive in regards to its anxiolytic function in smokers.

Smoking and Stress

Urge to smoke increases during stress and even more general, urge to smoke increases in response to rises in negative affect (Conway, Vickers, Ward, & Rahe, 1981; Russell, Peto, & Patel, 1974; Lindenthal, Myers, & Pepper, 1972). Some early hypotheses regarding the observed increased desire to smoke and actual smoking in response to stress and negative affect suggested that smoking either decreases the individual's negative affect (Levenson, Sher, Grossman, Newman, & Newlin, 1980; Conger, 1956), aids in performance on tasks (Perkins, Epstein, & Jennings, 1991), or helps the individual because they believe that smoking helps them in these ways (Shadel & Mermelstein, 1983; Pomerleau & Pomerleau, 1984; Wesnes & Warburton, 1983).

Overall, the literature addressing cigarette smoking as a stress reducer appears greatly mixed. Support for cigarette smoking as a stress reducer includes the finding that smokers experience decreased muscle tension (Epstein, Dickson, McKenzie, & Russell, 1984), smoking in social situations leads to less than expected increases in heart rate (Gilbert & Spielberger, 1987), smoking decreases anticipatory anxiety to an anagram task (Jarvik, Caskey, Rose, Herskovic, & Sadeghpour, 1989), and the shared belief by smokers and nonsmokers that smoking helps smokers settle their nerves (Shor, Williams, Canon, Latta, & Shor, 1981).

Likewise, there are several studies that have found evidence to refute smoking as a stress reducer including smoking did not effect any emotional behavior in preparation and during the speaking task despite verbal reports prior that smoking was experienced as relaxing (Hatch, Bierner, & Fisher, 1983), smoking increased heart rate but did not affect pain threshold or anxiety scores (Shiffman & Jarvik, 1984), smoking does not decrease motoric anxiety in smokers who are rat phobic compared to nonsmokers who were also rat phobic (Fleming & Lombard, 1987), and smoking had borderline significant effects on reducing anxiety for a cold pain task and no effect on both a white noise and auditory vigilance tasks (Jarvik et al., 1989). The most compelling evidence against the hypothesis that smoking decreases stress is the finding that reported stress decreases as smoking abstinence time increases, and an increase in reported stress is found with smoking relapse (Cohen & Lichtenstein, 1990) suggesting the relationship between smoking and stress may be bidirectional. Despite differing opinion on whether smoking actually reduces stress, there is no argument that increasing stress increases desire to smoke.

When smokers are prohibited from smoking they report increases in urges to smoke, withdrawal symptoms, and negative affect. In other words, smokers experience an increase in stress when prohibited from smoking. Cohen et al. (1997) examined whether the availability/use of chewing gum during a time when smoking is prohibited would aid smokers in combating negative affect associated with this demand. When participants entered the lab they were instructed to smoke an initial cigarette and then were required to watch a full length movie, followed by a 30 minute delay, therefore approximately 3 hours of prohibited smoking was achieved. The additional 30 minute delay was used to significantly increase the smoker's cravings and withdrawal symptoms because in the "real world" the dependent smoker is expected to smoke a cigarette immediately following the end of the movie (Cohen et al., 1997). Indeed, smokers who had access to chewing gum reported significantly less cravings for a cigarette and fewer withdrawal symptoms than the group without access to chewing gum.

Cohen et al. (1999) expanded on their previous study (Cohen et al., 1997) by using the same procedure except for also making cigarettes available in the gum and no gum conditions and also offering an incentive for not smoking. The gum group was required to chew only an initial piece of gum at the start of the session. The main findings were that the gum group abstained longer from smoking their first cigarette and also took fewer puffs. One explanation of these findings is that chewing gum helps combat negative affect (e.g., anxiety) associated with acute nicotine withdrawal, however, since general anxiety was not assessed it cannot be assumed that chewing gum staved time to first cigarette due to its decrease in anxiety.

In order to specifically examine the relationship between cigarette smoking, chewing gum, and stress, Britt et al. (2001) measured anxiety, urge to smoke, and withdrawal in 45 undergraduate dependent smokers' before and after a public speaking task. Prior to collection of baseline (Time 1) data, all participants were asked to smoke an initial cigarette. After the completion of Time 1, one third of the participants were given free access to cigarettes for the remainder of the experimental procedure, one third had access to chewing gum and the remaining had access to nothing. Immediately after being instructed that a speech was to be performed (Time 2) and immediately after preparation for the speech (Time 3) anxiety was found to be significantly greater in all groups as compared to baseline, however, not significantly different between groups. This finding provides empirical support that cigarette smoking does <u>not</u> decrease self reported anxiety while undergoing a stressful task compared to not smoking.

The assessment of anxiety across groups at two times post stressor, immediately following the speech (Time 4) and after a 30 minute delay (Time 5), found that the cigarette group and chewing gum reported significantly less anxiety than the control group. Further, the cigarette group and gum group did not differ from each other in reported anxiety. Results of urge to smoke across the experimental procedure found the group with access to cigarettes reported significantly lower urges to smoke than the gum and control groups, and that the gum and control groups did not differ from each other. Therefore, the observed decrease in anxiety in the gum group cannot be attributed to the ability of chewing gum to decrease urge to smoke.

A comparison of reported withdrawal across groups found the level of withdrawal reported by the gum group to be consistently between the control group (highest level of withdrawal) and cigarette group (lowest level of withdrawal). Pre-speech (Time 2 and Time 3), the gum group did not differ significantly from the other groups. At Time 3 the cigarette group reported significantly lower withdrawal than the control group. Post stressor (Time 4 and Time 5), the differences between groups were all statistically significant, again with the control group reporting highest withdrawal and the cigarette group reporting the lowest (Britt et al., 2001). In summary, urge to smoke and withdrawal were best attenuated by the cigarettes post stressor, although withdrawal symptoms were also significantly reduced by chewing gum compared to nothing. Given the advantage of cigarettes in both decreasing withdrawal and urge, it is surprising that anxiety was not significantly lower for the cigarette group compared to the gum group, unless chewing gum reduced anxiety in dependent smokers unrelated to urge to smoke and nicotine withdrawal.

Taste and Stress

Chewing gum not only stimulates the jaw muscles, but it also leads to a change in taste. Evidence suggests that, for rats and human infants, a relationship exists between taste and affect (Dess & Edelheit, 1998). A brief review of how taste may be related to emotion and other physiological processes is described in this section.

In particular, the relationship between taste and pain has received much attention. Research with human infants sucking on a pacifier that had been dipped in a sucrose solution (e.g., sweet taste) indicates that taste has an additive effect to the oral activity in attenuating pain perception as measured in a reduction in crying (Blass & Hoffmeyer, 1991; Blass & Watt, 1999). The typical pain-inducing agent used in these studies was a heel stick for blood collection or circumcision, both standard procedures.

Lewkowski et al. (2003) examined whether sweet taste, rhythmic oral movements (produced by chewing gum), and sweet taste plus rhythmic oral movements had an analgesic effect in a clinical sample. The sample consisted of 99 children (7.3 to 12.2 years of age), of a large metropolitan hospital, who where in the process of getting their blood drawn. These three groups and a control group all chewed gum, however, some groups were asked to stop chewing prior to the procedure. Overall, the pain response was not attenuated by either sweet taste or chewing. However, when gender was considered, sweet taste combined with chewing led to increases in reported pain in boys, but in girls sweet taste and chewing decreased subjective pain. Interestingly, in girls, sweet taste and the absence of chewing led to increases in reported pain. One speculation for the absence of the effect of sweet taste was that preference for sweet taste declines with age (Desor, Maller & Greene, 1977).

Mercer and Holder (1996) examined the relationship between sweet intake and pain perception in human adults using a university sample. Results indicated that sweet taste alone is not the critical factor in increasing pain tolerance in adults, but rather the total enjoyment rating of the substance is most important. In addition, this effect of taste on pain tolerance appears to be limited to females and only specific measures of pain responsivity (Mercer & Holder, 1996).

Overall the literature is limited in regard to the relationship between sweet taste and negative affect. It appears that sweet taste has a significant relationship with pain perception. However, it has been found that the desire for sweet flavor decreases as age increases, therefore limiting its application. Specifically, the positive effects of sweet flavor have been observed in newborns and young children, but not with adults (e.g., greater than 18-years-old). Based on the existing literature it is highly speculative to whether the sweet flavor of chewing gum exerts an effect on subjective levels of stress in adults. Therefore, determining the individual contribution of flavor, if any actually exists, to the hypothesized contribution of chewing on stress was beyond the scope of the present study.

Public Speaking Task

The main goal of this section is to review the literature involving the use of public speaking tasks to induce stress and negative affect. Additionally, a description of the public speaking task used in the present study is presented along with a review of the literature using this task. Illustrated are the various populations, settings, and research areas in which the public speaking task has been utilized. The main lines of research reviewed focus on the physiological effects produced and subjective reports of the task on emotion.

Public speaking tasks typically involves giving participants a short period of time to formulate a speech (typically about an uncomfortable and personal topic), followed by having the individual actually giving the speech. The speech itself is often video recorded, given to a live audience, or both. Stress and anxiety levels are assessed at several points before and after preparation and speech delivery providing an understanding of how each element contributes to negative affect.

Dimsdale (1984) demonstrated the potency of public speaking as an anxiety-provoking stimulus by comparing 11 healthy males during 3 tasks: baseline conditions, mental arithmetic calculations in the laboratory, and public speaking in the field. Self-report of anxiety and plasma levels of catecholamines were markedly higher in the public speaking condition.

Turner, Carroll, Dean, and Harris (1987) compared heart rate (HR) reactions of 24 young male and female participants to standard laboratory stressors (i.e., mental arithmetic and a video game) to public speaking in the laboratory setting. Of the 24 participants, the three highest and three lowest average HR reactors for the mental arithmetic and video game were selected for a public speaking ‘competition’, which served as the public speaking task, and the remaining 18 participants served as audience members to enhance anxiety. Heart rate was measured during the entire 10-minute ‘competition’, although each participant only spoke for a portion of the 10 minutes. Five of the six participants had greater HR reactions in the public speaking task, with all three of the low HR reactors showing marked increases. Therefore, the public speaking task was shown to be effective in evoking cardiovascular responding particularly in individuals that are normally low in reactivity.

Beidel, Turner, and Jacob (1989) utilized a public speaking task to assess physiological, cognitive, and behavioral response parameters in 36 outpatients meeting DSM-III-R criteria for social phobia. In this version of the public speaking task, participants were given 5 possible topics and instructed to use up to 3 of them to give a 10-minute speech (3 minutes minimum), following a 3-minute preparation period. The speeches were delivered to an audience consisting of 3 members of the research staff, as well as being video recorded. Notably, this assessment was duplicated approximately one week following the first, only altering the choice of speech topics. Comparing the two speech sessions revealed consistent increases in systolic blood pressure, length of time participants spoke, and positive and negative cognitions. Interestingly, even though the participants knew the demands of the task prior to the second assessment, it did not decrease in its clinical relevance (Beidel et al., 1989). In other words, the public speaking task produced significant increases in subjective stress, even when the task was anticipated.

More recently, Abrams, Kushner, Lisdahl, and Voight (2002) examined self-administration of alcohol by individuals with social phobia before and after a public speaking challenge versus a neutral task. Participants were asked to engage in two 2-minute dialogues with another participant, in front of an audience, while being videotaped. The neutral task required silent reading from a magazine for 30 minutes, without being videotaped or asked questions about content later. Results confirmed that the speaking task was experienced as significantly more anxiety-provoking. Main findings revealed that both men and women drank more prior to the silent reading activity and following the speaking task. Additionally, men drank significantly less than the women prior to the social stressor. Abrams et al. (2002) speculated that the mixed findings of previous investigations of drinking prior to stress and anxiety provoking activities, and suggested that various qualities (e.g., gender of participant and confederate) of the stressor-anxiety provocation predicts anticipatory drinking. Again, the public speaking task was principally used to reliably induce stress in the participants.

Gilbert, Johnson, Silverstein, and Malone (1989) compared 30 adolescents with insulin-dependent diabetes mellitus (IDDM) to 15 nondiabetic controls on self-report, behavioral, and physiological measures of anxiety or arousal across three laboratory stressors, a venipuncture and two public speaking tasks. Gilbert and colleagues selected the public speaking task because it demonstrated itself to be a stressful task, particularly, producing physiological and hormonal stress reactions (Knight & Borden, 1979; Pinter-Peterfly, Cleghorn, & Pattee, 1967). The two 3-minute speeches were given in front of an audience and video recorded. Prior to the speech participants were given a 3-minute plan period, and following the speech a 3-minute recovery period was allotted. Overall results suggest that adolescents with IDDM respond similarly to their nondiabetic peers. The diabetic and control groups did not differ on self reported speech fear and observed anxiety-related behaviors as measured by the Personal Report of Confidence by Speaker and Timed Behavior Checklist for Performance Anxiety, respectively (Gilbert et al., 1989). Changes in physiological measures (i.e., heart rate and skin conductance) and the lack of derangement in metabolic control were consistent across groups as well as across speeches.

The public speaking task has also been used as means to induce acute psychological stress to determine whether the immunologic response in multiple sclerosis (MS) patients differs from healthy controls (Ackerman, Marttino, Heyman, Moyna, & Rabin, 1996). An unknown 'instructor' introduced the participants to the public speaking task 30 minutes after having an indwelling catheter inserted to allow for blood withdrawals. Participants were given 2 minutes to prepare, while being observed by an additional observer, for a 3-minute videotaped speech, which was performed with the observer and instructor present. Subjectively, the MS patients and controls found the task equally stressful, involving, and engaging. Physiological responses (i.e., pulse, blood pressure, and cortisol secretion) were also indistinguishable across groups. Similarly, the effect of acute stress on peripheral blood leukocyte distribution, lymphocyte proliferation, and natural killer cell activity did not differ between MS patients and controls (Ackerman et al., 1996). Taken together, the task led to a robust response in both groups and genders, with no differences in subjective, autonomic, neuroendocrine and immunologic response.

al'Absi et al. (1997) evaluated cardiovascular, neuroendocrine, and psychological adjustment to repeated presentations of a public speaking task and mental arithmetic in a sample of 52 healthy males. For the public speaking task, three scenarios were presented in a counterbalanced order with 4 minutes given for silent preparation of the 4-minute speech. The participants were told that the speeches would be videotaped and reviewed by three staff members, and two experimenters served as an audience. Overall, the public speaking task produced greater cardiovascular, adrenocortioctropic hormone, and cortisol responses, as well as a more stable pattern of cardiac activation then mental arithmetic. Additionally, correlations between endocrine, cardiovascular, and negative moods were only significant during the public speaking task (al'Absi et al., 1997). al'Absi and colleagues suggest that the public speaking stressor is a socially relevant experimental protocol for studying reactivity in the laboratory due to the high, stable, and homogenous response it elicits.

Using the same public speaking task as al'Absi et al. (1997), Bongard, al'Absi, and Lovallo (1998) examined how hostility and anger-expression style affects cardiovascular reactivity to stressors (e.g., public speaking, mental arithmetic) varying in social characteristics. Results indicated that the greatest cardiovascular responses occurred in the High Anger-Out/Low-Hostile participants, and even more pronounced with the public speaking task (Bongard et al., 1997). Therefore, the public speaking task can be used as a potential screener of risk for the development of cardiovascular disease.

In a related study, Fichera and Andreassi (2000) examined the effects of individual differences (i.e., Type A personality, hostility, & gender) on cardiovascular reactivity using non-simulated classroom speech (6 minutes) for which the participants, students in a psychology class, receives a grade. Of note, 56 of the 86 participants were female, and the sample contained a diversity of ethnic backgrounds (e.g., only 28% Caucasian). Results revealed that the magnitude of cardiovascular reactivity to the task was very large, regardless of gender, Type A or Type B, and hostility level, except for high hostile men. The greater reactivity in this study compared to previous studies was hypothesized to be due to the real consequences involved, and this may have overridden the subtle contributions that personality factors operate. Findings also suggested that although men and women both react strongly to the task, their patterns are different. For example, women produced greater heart rate increases and men yielded greater diastolic blood pressure and mean arterial pressure, however, it was noted that these subtle differences are consistent with the cardiovascular reactivity literature (Fichera et al., 2000). This study illustrates that the public speaking task results in a consistent response irrespective of gender and/or ethnicity.

Gonzalez-Bono et al. (2002) investigated the cardiovascular and electrodermal activation, in 45 undergraduate females, that occurs prior to anticipation of public speaking (anticipatory autonomic responses) versus activation that occurs in a situation with similar evaluative threat and mental effort but when public speaking is not expected. Additionally, the role of trait anxiety on autonomic responses to the anticipated public speaking task was evaluated. The group that anticipated the speech was instructed that they had 2.5 minutes to prepare for a 2.5 minute speech, whereas the group that was not expecting a speech was told they were preparing for a written essay. However, when the 2.5 minutes elapsed, participants in both groups were asked to give a speech.

Results indicated that significant autonomic changes occurred in both groups, with only the finger pulse volume change being specific to the speech anticipation group. It was hypothesized that the scarcity of observed differences was likely due to strong similarities between both conditions (i.e., mental effort, psychological threat, and social evaluation), particularly the evaluative component of the task (Gonzalez-Bono et al., 2002). Secondarily, when the sample was divided by State Trait Anxiety Inventory - Trait (STAI-T) scores, only the high-anxious women in the speech group showed significant increases in heart rate during the preparation period, suggesting that cognitive anxiety may be an important factor to consider when cognitive processes are involved in the task (Gonzalez-Bono et al., 2002).

Carillo et al. (2001) further examined gender differences in several physiological (i.e., cardiovascular and electrodermal) responses to a speech, as well as how anxiety (STAI-S and STAI-T) and mood states (Profile of Mood States [POMS] and Beck Depression - Hopelessness Index [BDHI]) may moderate these responses. Consistent with previous research, heart rate was found to increase during the preparation period and speech with respect to the rest period (al'Absi et al., 1997; Kirschbaum et al., 1995) however, no gender differences emerged. Conversely, women had higher finger pulse volume in all periods except during the task and exhibited greater amplitude of non-specific skin conductance responses. Gender differences in regards to subjective responses to the task were absent for trait anxiety, hostility/aggressiveness, or in the appraisal of the task, except for state anxiety, indicating that women were more reactive to the stressor (Carillo et al., 2001). Furthermore, it was concluded that anxiety plays a clearer role in women than for men when studying the cardiovascular response to the speech task.

al'Absi and Wittmers (2003) investigated gender differences in adrenocortical activity (e.g., cortisol release) and responses to behavioral stress (i.e., public speaking task) in hypertension-prone individuals. On one day of testing the same version of the public speaking task used by al'Absi et al. (1997) was used, and the subsequent day was a rest day. The task was chosen to simulate socially challenging tasks of real world application, as well as because the task has been shown to be a potent laboratory stressor, inducing significant cardiovascular, endocrine, and mood changes (al'Absi et al., 1997). Results were analyzed by gender, low or high risk for hypertension, and the interaction. Overall, both men and women at high risk for hypertension produced greater cardiovascular and cortisol responses to the stressor than low-risk individuals. These results served to confirm previous findings for men and highlights that women at risk for hypertension respond to acute stress similarly to men, which may reflect an altered stress response (al'Absi et al., 2003). Notably, both low-risk and high-risk groups reported a similar amount of distress by the public speaking task.

The relationship between stress cortisol responses and the performance on tasks that require working memory was investigated, specifically, by evaluating performance on a dichotic listening task following a 30-minute period of alternating public speaking and mental arithmetic (al'Absi, Hugdahl, & Lovallo, 2002). Status of low or high responders was determined by cortisol secretion during the stressors. Of note, the public speaking task resulted in greater cortisol responding than the mental arithmetic task for all the participants, although both groups reported feeling equally aroused by the stressors. Consequently, the high responders had fewer attempts and correct answers on the mental arithmetic task, however, they outperformed the low responders on all conditions of the dichotic listening task (nearing significance). Specific to the present study, this study provides another example of the potency of the public speaking task in producing the desired effect (i.e., aroused, acutely distressed individuals).

To better understand how individuals with impairments in social responsiveness are affected by social pressure Jansen, Wied, Gaag, and Engeland (2003) compared the cortisol response of children diagnosed with Autism and Multiple Complex Developmental Disorder (MCDD) to a physical stressor (i.e., 10-minute bicycle exercise) and a psychological stressor (i.e., public speaking task). Rather than using the DSM-IV diagnosis Pervasive Developmental Disorder – Not Otherwise Specified, MCDD is used to describe a specific set of children with autism like symtomatology, who often develop schizophrenia as adults (Jansen et al., 2003). A healthy control group was also used in this study for comparison purposes. The speaking task involved a 10-minute preparation for a 5-minute speech that was recorded. The children were told that a 'jury' of 'teachers' would review their speech.

No differences were found during the physical stressor between diagnostic groups (e.g., autistic, MCDD, & controls) for heart rate and salivary concentration of cortisol. However, during the psychosocial stressor (public speaking task) differences between diagnostic groups were observed on the physiological measures. Specifically, autistic children showed increases in the cortisol response while MCDD children produced decreased salivary cortisol when compared to controls. It was concluded that the disturbed reactions to the social environment observed in both of these disorders appears to be a result of different biological backgrounds (Jansen et al., 2003).

A recent study conducted in our laboratory examined how smoking and chewing gum influenced anxiety, urge to smoke, and nicotine withdrawal symptoms in response to a laboratory stressor (public speaking task) among college smokers (Britt et al., 2001). The speaking task was chosen due to its ecological validity as a stressor, in order to address criticisms of previous literature that investigated the anxiolytic properties of smoking in response to stress. The specifics of the public speaking task used by Britt and colleagues (2001) were replicated by Miller (2005) and are detailed in the methods section of the present study. The participants were randomly assigned to one of three groups (e.g., smoke, gum, & control), thus only the participants in the smoke group had access to cigarettes, the gum group had access to only gum, while the control group had access to nothing throughout the experimental session. Main results revealed that the smoke and gum groups reported fewer withdrawal symptoms than did the control group post-stressor, suggesting that chewing gum was helpful in managing levels of withdrawal (Britt et al., 2001). Of note, the public speaking task resulted in significant increases in anxiety in all groups as measured by the STAI-S and EAS-ANX (Miller, 2005).

Collectively, these studies illustrate the consistency of the public speaking task to produce significant increases in both subjective and objective anxiety, across a numerous variety of settings and populations and sample characteristics. The studies illustrate that the public speaking task results in increased physiological responses (i.e., cardiovascular activity, neuroendocrine release, electrodermal conductivity, and immunological adjustment), as well as demonstrate the public speaking task to be a clinically relevant tool to induce arousal, anxiety, and a general worsening of mood. Additionally, the task has been shown to be so potent that it induces stress and anxiety even when anticipated.

CHAPTER III

THE PRESENT STUDY

The present study was designed to examine whether chewing gum, which has the properties of chewing and taste, has a significant effect on reducing stress associated with acute nicotine withdrawal and laboratory stress, as compared to the effect of an oral substitute (e.g., breath strip) that lacks the chewing property while maintaining the taste property. In essence, the present study was a replication of Britt et al. (2001), which examined the relationship between nicotine withdrawal, craving and gum chewing (as well as *cigarettes* and *nothing*) in smokers, as well as a partial replication of Miller (2005), which examined the relationship between anxiety/stress, urge to chew gum and gum chewing (as well as *breath strips* and *nothing*) in non-smoking regular gum chewers. Data from these studies suggest that gum chewing may help a nicotine-deprived smoker by decreasing the subjective feeling of stress imparted by withdrawal and craving, whereas non-smokers do not appear to be aided by chewing gum in regards to stress reduction. However, the literature is lacking in examining whether chewing has a stress reducing effect, unique to alternatives without a chewing component in individuals who are undergoing nicotine withdrawal. In order to determine if the property of chewing is the possible mechanism for the reduction in stress and/or nicotine withdrawal the present study will compare the effectiveness of chewing gum and breath strips in relieving laboratory-induced stress in smokers.

The current study assessed anxiety throughout the experimental session using multiple self-report measures. A 4 X 5 mixed-factorial design was used, with independent variables of interest: (a) Group condition, with four (4) levels: Gum, Breath Strip (oral control), Cigarette, and Control (given nothing); and (b) Time, with five (5) assessment points, Times 1-5. Time 1 served as the baseline measurement, whereas Time 2 – 5 measured changes due to the experimental manipulation. Specifically, data were collected at Time 2 (immediately following instructions/introduction of the stressor), Time 3 (directly preceding the speech), Time 4 (directly following the speech), and Time 5 (recovery; 30 minutes after the speech).

The five dependent variables (state anxiety, anxious emotion, tobacco withdrawal, tobacco craving, and urge to smoke) were measured at all assessments points. At baseline (Time 1) only, demographic information, fear of public speaking, recent life events, general mood, and measures assessing drug use, smoking and gum chewing behavior were administered.

It was predicted that participants who had access to chewing gum and cigarettes would report lower levels of stress following the laboratory stressor compared to participants in the Breath Strips (oral control) or control (no treatment) conditions.

Hypotheses

Hypothesis 1 – State Anxiety. It was predicted that all groups would exhibit significant increases in state anxiety, compared to baseline, as measured by the State-Trait Anxiety Inventory-State (STAI-S; Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1983) in anticipation of the stressor (speech). However, no significant differences between groups were expected in anticipation of the speech (Time 2 – 3), consistent with

Miller (2005) and Britt et al. (2001). Consequently, during the post-stressor phases (Time 4 – 5) it was hypothesized that the Gum and Cigarette groups would report less anxiety than the other two groups, and further, the Breath Strip Group and Control Group would be indistinguishable from each other as chewing is believed to be the primary mechanism of stress reduction. Additionally, it was expected that the largest effect of gum (chewing) as an anxiolytic agent would be observed at the later most post-stressor phase, “recovery” (Time 5), consistent with Britt et al. (2001).

Hypothesis 2 – Anxious Emotion. It was predicted that all groups would exhibit significant increases in anxious emotion, compared to baseline, as measured by the Emotion Assessment Scale – Anxiety subscale (EAS-ANX; Carlson et al., 1989) in anticipation of the stressor (Time 2 – 3). However, no significant differences between groups are expected in anticipation of the speech (Time 2 – 3), consistent with prediction regarding state anxiety and Miller (2005). Additionally, during the post-stressor phases (Time 4 – 5) it was hypothesized that the Gum and Cigarette groups would report less anxious emotion than the Breath Strip Group and Control Group, which was predicted to be indistinguishable from each other as chewing is believed to be the primary mechanism of stress reduction. Lastly, it was expected that the largest effect of gum (chewing) as an anxiolytic agent would be observed at the later most post-stressor phase, “recovery” (Time 5), consistent with the general trend found in Britt et al. (2001).

Hypothesis 3 – Tobacco Withdrawal (Total). It was predicted that all groups, except for the cigarette group, would exhibit significant increases in tobacco withdrawal, compared to baseline, as measured by the Tobacco Withdrawal Symptom Checklist (TWSC; Hughes & Hatsukami, 1986) in anticipation of the speech (Time 2 – 3). Further, no significant differences between the non-cigarette groups were expected in anticipation of the speech (Time 2 – 3). However, it was anticipated that, during the post stressor phases (Time 4 – 5), the chewing gum group and the cigarette group would report significantly fewer withdrawal symptoms than the breath strip group and control group, consistent with Britt et al. (2001) and Cohen et al. (1997). Further, it was predicted that there would be a significant difference between the Cigarette Group and Gum Group regarding withdrawal symptoms during recovery (Time 5). Therefore, it was expected that the largest effect of gum (chewing) as an aid in nicotine withdrawal, compared to non-cigarette alternatives, would be observed post-stressor (or recovery), consistent with Britt et al. (2001).

Hypothesis 4 – Tobacco Craving. It was predicted that all groups, except for the cigarette group, would exhibit significant increases in tobacco craving, compared to baseline, as measured by the craving item on the Tobacco Withdrawal Symptom Checklist (TWSC; Hughes & Hatsukami, 1986). Further, no significant differences between the non-cigarette groups are expected in anticipation of the speech (Time 2 – 3). Similar to predictions regarding withdrawal, it was anticipated that, during the post stressor phases (Time 4 – 5), the chewing gum group and the cigarette group would report significantly less craving to smoke than the breath strip group and control group, consistent with Cohen et al. (1997). Further, it was predicted that the cigarette group would continue to report significantly less craving to smoke than the chewing gum group during the post-stressor phases (Time 4 – 5). Therefore, it was again expected that the largest effect of gum (chewing) in decreasing urge to smoke, compared to non-cigarette alternatives, would be observed post-stressor (or recovery).

Hypothesis 5 – Urge to Smoke. It was predicted that all groups, except for the cigarette group, would exhibit significant increases in urge to smoke, compared to baseline, as measured by a questionnaire of smoking and chewing urges developed for this study. Further, no significant differences between the non-cigarette groups are expected in anticipation of the speech (Time 2 – 3). Similar to predictions regarding withdrawal and craving, it was anticipated that, during the post stressor phases (Time 4 – 5), the chewing gum group and the cigarette group would report significantly less urge to smoke than the breath strip group and control group. Further, it was predicted that the cigarette group would continue to report significantly less urge to smoke than the chewing gum group during the post-stressor phases (Time 4 – 5). Therefore, it was again expected that the largest effect of gum (chewing) in decreasing urge to smoke would be observed post-stressor (or recovery).

CHAPTER IV

METHODOLOGY

Subjects

A total of 56 participants, 14 per group (Gum Group, Breath Strip Group, Cigarette, and Control Group), described below, were recruited from undergraduate courses at Oklahoma State University, and individuals from the general community at the University of Mississippi Medical Center in Jackson, Mississippi. Eligibility for the study was determined by pre-screening information collected using a pre-screening question and phone contacts. Participants meeting the following criteria were included in the study: those reporting (a) dependent smokers (at least 15 cigarettes per day and/or a score of 4 or greater on the Fagerström Test for Nicotine Dependence), (b) no medical problems which would exempt participation, and (c) to be at least 18-years-old and willing to give informed consent.

Across the entire sample 37 participants self-identified themselves as Caucasian (66.1%), followed by 10 African American (21.4%), 3 Native American (5.4%), 2 International/non-U.S. born (3.6%), 1 Hispanic (1.8%) and 1 other (1.8%). Although gender differences were not investigated in the current study, an equal number of each gender per condition was formed. This was accomplished by using the following procedure for each gender independent of each other. Groups of four participants of the same gender were treated as a block. The first participant in a block was randomly assigned to one of the four conditions. The second participant in the block was assigned to one of the remaining three conditions. The third participant in the block was assigned to one of the remaining two conditions, and the fourth participant was assigned to the remaining condition of that block. This procedure was repeated for the entire sample.

Measures

Several scales were administered at Time 1 only, to characterize the sample of subjects prior to participation in the public speaking task. These scales were used to allow for a quick and non-invasive assessment of smoking behavior, chewing gum use, depressed mood, trait anxiety, recent events that may account for elevated anxiety, and fear of public speaking. Furthermore, these measures ensured that the sample was of dependent smokers, not experiencing any chronic or acute stressors that could account for experiencing anxiety over and beyond the stressor and acute nicotine withdrawal, respectively. Additionally, these measures would verify that the stressor was a task that was perceived as anxiety provoking. It is noted that all measures used in the study were administered at Time 1. This allowed for the establishment of a baseline for the repeated measures as well.

Baseline Measures

Gum Chewing Survey. This self report measure assessed the frequency, amount, gum preference, and reasons for gum use. This information was used for descriptive purposes only.

Beck Depression Inventory-2 (BDI-2; Beck& Steer, 1987). The BDI-2 is a 21-item self report instrument designed to assess the presence and severity of depressive symptomatology as defined in the DSM-III. Each item contains choices arranged in order of increasing severity. The severity index, ranging from 0 to 63, is obtained by summing each item's answer, with higher scores representing greater levels of depressive symptomatology.

Overall the BDI-2 has been found to be a psychometrically sound instrument. The test-retest correlations for nonclinical samples are generally high, .60 to .90 (Beck, Steer, & Garbin, 1988) and .90 for undergraduates (Lightfoot & Oliver, 1985). In a review, Beck et al. (1988) found average coefficient alphas of .86 for psychiatric patients and .81 for nonpsyciatric samples. Osman et al. (1997) found high internal consistency (0.90) and good construct validity when assessed against several other established predictors of anxiety and depression. Additionally, the BDI-2 has demonstrated good content, discriminant, concurrent, and factorial validity (Beck et al., 1987).

Health Habits Questionnaire (HHQ; Britt, 1996). The HHQ is a self-report measure designed to assess use (i.e., frequency, amount, reasons for use, etc.) of cigarette smoking, caffeine, alcohol, and chewing gum. This information was primarily used for descriptive purposes only. Miller (2005) utilized the HHQ to conduct exploratory analyses examining the relationship between beliefs about chewing gum and anxiety levels and urge to chew gum.

Social Readjustment Rating Scale (SRRS; Holmes & Rahe, 1967). The SRRS is a self-report instrument in which respondents rate the stressfulness of 43 major life events in the past 12 months, on a scale from 1 – 100. A revised version of the SRRS contains 51 items and has been renormed on a national sample of 3122 in 1997. Five overlapping themes in the top 20 rated life events are commonly found: death and dying, healthcare, crime and criminal justice system, financial and economic issues, and family related issues (Hobson et al., 1998). Although gender, age and income differences have been found in regards to item ratings, the mean ratings of the 51 items are viewed as a reasonably reliable measure of perceived stressfulness in the US population (Hobson et al., 1998).

Audience Anxiousness Scale (AAS; Leary, 1983). The AAS, is a self report measure designed to assess anxiety in public speaking. Specifically, this 12 item instrument assesses the cognitive and affective elements of anxiety associated with public speaking and similar situations in which the individual's social responses are not contingent upon the behaviors of others. Each item is answered from 1 ("uncharacteristic of me" or "not me") to 5 ("characteristic of me" or "true"), yielding a total score range from 12-60, with higher scores indicative of greater levels of anxiety. An 8-week test-retest coefficient of 0.84 and a Cronbach alpha of 0.91 were reported for this measure, which is highly correlated with measures of public speaking (Corcoran & Fischer, 1987; Leary, 1983). This measure allowed for the detection of any differences in our groups in regards to the nature of the task to follow. It was our goal to have non-significant differences between groups on their subjective ratings of the target task prior to engaging in the task.

Fagerström Test of Nicotine Dependence (FTND; Fagerström, 1978; Heatherton, Kozlowski, Frecker, & Fagerström, 1991). The FTND is a 6 item noninvasive self-report measure to assess: time to first cigarette, difficulty refraining from smoking, total cigarettes smoked daily and general pattern of intake. Total score on the FTND ranges from 0 – 12, with higher scores representing greater degree of dependence on nicotine.

The average participant in Britt et al. (2001) smoked about 22 cigarettes per day and obtained a mean total FTND score of 4.67 (*SD* = 2.28).

The FTND is a revision of the Fagerstrom Tolerance Questionnaire (FTQ: Fagerstrom, 1978) which included the additional items of nicotine yield and inhalation. Heatherton et al. (1991) found that many smokers are unsure of the nicotine yield of the cigarettes they smoke and the inhalation question does not discriminate degrees of dependence due to a ceiling effect (e.g., almost all state "inhale always"). Pomerleau, Pomerleau, Majchrzak, Kloska, and Malakuti (1990) found significant correlations between the questions assessing total cigarettes smoked, time after waking to first cigarette, and smoking when ill with plasma cotinine (metabolite of nicotine) levels. Overall, the FTND has been found to be a valid measure of nicotine dependence and have acceptable levels of internal consistency (Heatherton et al., 1991; Pomerleau, Majchrzak, & Pomerleau, 1989).

Repeated Measures

State-Trait Anxiety Inventory (STAI; Speilberger et al., 1983). The STAI is a 40 item measure designed to assess both transitory or state dependent (STAI-S) and stable or enduring trait (STAI-T) levels of anxiety. Each scale contains 20 questions that can be answered from 1 ("not at all or almost never") to 4 ("very much so or almost always"), yielding a score range from 20 to 80. Higher scores reflect greater levels of anxious qualities, such as feelings of tension, apprehension, nervousness, worry, and or autonomic arousal. The (STAI-T) was assessed at Time 1 only to evaluate how the participant generally feels, and the (STAI-S) was measured across all assessment points, which allowed for the measurement of subtle changes in anxiety across the experimental session.

Overall the STAI has been found to be a psychometrically sound instrument. The test-retest correlations for the T-Anxiety scale for college students are generally high (.73 to .86), and expectantly low for the S-Anxiety scale given the transitory nature of anxiety states. Measured alpha reliability coefficients found above .90 demonstrates the excellent internal consistency for both scales of the STAI. Notably, the STAI State-Anxiety scale typically has an even higher alpha coefficient when given under conditions of psychological distress. Also, the STAI has been used extensively to examine real life and laboratory-induced stressors in both clinical and research populations (Chapin, 1985; Spielberger et al., 1983). Additionally, the STAI scales have shown good concurrent, convergent, divergent, and construct validity (Spielberger et al., 1983).

Emotion Assessment Scale (EAS; Carlson et al., 1989). The EAS, is a 24-item, self-report measure designed to measure current emotional states. The measure is divided into eight subscales; however, only the Anxiety subscale (EAS-ANX) was analyzed in this study. Versions of the EAS include the use of a Likert-type format in which items are rated from 1 ("Least Possible") to 7 ("Most Possible"), and scales range from 3 to 21, as well as a visual analogue scale (VAS) format in which items are rated by marking a slash on a 100mm line. Higher scores indicate greater levels of the specified emotion. The VAS format, which was utilized in the present study, has the benefit of providing ratio level measurement and analysis, rather than ordinal measurement of Likert scales. Further, given that the design of the present study assessed changes in emotions several times over a relatively short time period, it is less likely that prior measurements would influence later rating because no numbers are provided on a visual analogue scale (Carlson et al., 1989). The addition of a secondary anxiety measure allows for a thorough and multiple assessment of the target construct, anxiety.

The EAS demonstrates good to excellent psychometric properties. Coefficients for inter-item validity range from .70 to .91, and .94 for split half reliability. The measure demonstrates good criterion validity and correlates well with other measures of mood (Carlson et al. 1989). Research found that the measure holds up well to repeated measurement using the Likert format (Collins, Street, & Shields, 1996) and is sensitive to changes in stress ratings (Fischer & Corcoran, 1994). Miller (2005) found that the anxiety scale of the EAS correlated consistently with the STAI-S. Pearson's correlation coefficients were computed at each of the five assessments points. Coefficients ranged from .47 to .77 ($p < 0.001$). This indicated a positive association between the two scales of moderate strength, such that individuals who scored higher on the EAS-ANX also tended to score higher on the STAI-S. Cronbach alpha for the current sample was .70 to .93 (EAS) and .78 to .93 (EAS-ANX).

Tobacco Withdrawal Symptom Checklist (TWSC; Hughes & Hatsukami, 1986). The TWSC is a 12 item noninvasive self-report measure to assess nicotine withdrawal. Symptoms include several of the DSM-IV criteria and associated features for nicotine withdrawal, which allows for the comparison between total nicotine withdrawal and DSM-IV nicotine withdrawal severity. The scale utilizes a Likert-type format for the participant to rate degree of each symptom (e.g., 0 = not present; 1 = mild; 2 = moderate; 3 = severe). The TWSC has been shown to be valid and reliable (Hughes & Hatsukami, 1986). There is support suggesting that craving as assessed by the "craving" item of the

TWSC behaves distinctly from the other withdrawal items (Hughes, 1986; Hughes & Hatsukami, 1998). Cronbach alpha for the current sample was .83 to .89.

Behavior Urges Scale. The BUS is a 2 item self-report measure designed for the present study. The scale utilizes a visual analogue scale-type format for the participant to rate their urge to smoke a cigarette and urge to chew a piece of gum. A slash is made by the participant on a 100mm line to indicate degree of urge of each item. This measure is similar to the brief assessment of "craving for tobacco" using a 100mm line (Hatsukami et al, 1991), which demonstrated high internal consistency reliability (r = .70).

Procedure

Volunteers were recruited from undergraduate courses at Oklahoma State University for a study examining habits of college students. Volunteers were also recruited from the University of Mississippi Medical Center campus in Jackson, Mississippi via campus fliers. Potential participants were initially contacted to confirm study eligibility (e.g., age, smoking status). If eligible, each potential participant was scheduled for a 2 hour laboratory session.

A detailed outline of the time course of the proposed study is presented in Table 1. At the beginning of the experimental sessions, participants were welcomed to the laboratory, and seated in a comfortable armchair in a sound-proof experimental room. A study investigator briefly described the study, obtained a signed informed consent, and an initial cigarette was smoked by all participants.

After the initial cigarette was smoked, participants were asked to complete the Time 1 instruments: demographic information, HHQ, BDI-2, EAS, STAI-S, STAI-T, SRRS, AAS, FTND, TWSC, chewing gum survey, and a questionnaire of smoking and chewing urges developed for this study. It was expected that the participants would require 20-30 minutes to complete these measures. Participants were encouraged to read from an assortment of magazines or work on crossword puzzles upon completion of these measures. The time allotted to complete the Time 1 measures, optionally read or work on puzzles, and rest was 45 minutes. At the conclusion of this time period, an objective nicotine abstinence period of 45 minutes was assured.

Once 45 minutes elapsed, participants were given the following instructions: "In a few minutes, you will be asked to give a 3-minute speech. You will be given 2 minutes in which to mentally prepare your speech, and then you will be asked to speak on the topic for 3 minutes. The topic of your speech will be 'what I dislike about my body and physical appearance." Participants were also informed that their speech will be videotaped so that their performance could be evaluated by three other graduate student laboratory members for demonstration of psychological factors, such as openness and defensiveness. To further enhance the stress inducing properties of the task an actual video camera was present in clear sight of the participant, a tape was inserted, and set to record. In actuality, no evaluation process would occur. Once the experimental session was completed the tape was erased. Similar procedures to the one just described have successfully induced acute feelings of anxiety and mental stress (al'Absi et. al., 1997; Kassel & Shiffman, 1997; Miller, 2005).

Based on group placement, predetermined prior to the participants' arrival using the procedure described in the participants section, participants were instructed to either (1) chew 1 piece of gum (Wrigley's Extra Winterfresh) (Gum Group), (2) place 1 breath strip (Wrigley's Eclipse Flash Peppermint) on their tongue (Breath Strip Group/Oral

Control Group), (3) take at least one puff on a cigarette, or (4) do nothing (Control Group), immediately following the instructions for the speech. The gum and breath strip chosen are matched for taste and sugarless status. A study experimenter verified that the participants in the Gum Group started chewing, the participants in the Smoking Group took a puff, and that the participants in the Breath Strip Group placed the breath strip on their tongue. Participants in the Gum, Breath Strip, and Cigarette Groups were also informed that they would be free to chew gum (Gum Group only), use breath strips (Breath Strip Group only), or smoke cigarettes (Cigarette Group only) throughout the remainder of the experiment. It is important to note that in intervals of 20 minutes the participants were asked to replace the gum with a fresh piece of gum (Gum Group), insert another breath strip (Breath Strip Group), take at least one puff on a cigarette (Cigarette Group), or no special instructions were given (Control Group). These instructions ensured that all participants in the Gum, Breath Strip, and Cigarette conditions used the products assigned to them throughout the entire protocol.

Next, participants were informed that one of the aspects of interest is the change in one's mood and stress over time. Participants were told that they would be asked to report how they are feeling at several points during the study. At that moment (Time 2) participants were asked to rate their present anxiety (STAI-S), mood (EAS), withdrawal symptoms (TWSC), and urge to smoke/chew gum. The order in which the instruments were completed across all assessment periods was randomly determined (i.e., experimenter shuffled the order of measures prior to the experimental session).

When the participants completed the Time 2 measures they were notified that they have "two minutes" to mentally prepare for the speech. Participants in the Gum Group, Breath Strip Group, and Cigarette Group were reminded that they could continue chewing gum, using breath strips or smoke, respectively, if they desired to do so while preparing for the speech. At that point in time, 20 minutes would not have elapsed since inserting the first piece of gum or breath strip, or cigarette smoked, therefore participants were not required to replace their gum, insert another breath strip, or take a puff on a cigarette. A study experimenter timed two (2) minutes with the aid of a stopwatch, while pretending to check the operating function of the video camera. When the two minutes have elapsed, the experimenter yelled “stop”, and asked the participants to rate their feelings of anxiety and anxious mood, prior to the speech, (Time 3) by administering the STAI-S, EAS, TWSC and urge to smoke/chew measures.

At the completion of the Time 3 measures the experimenter turned the video camera on and informed the participant to “wait for their signal before beginning the speech”. The participants were instructed to dispose of any chewing gum, to not insert another breath strip or smoke. At that moment the participants were instructed to begin their speech and that the experimenter would signal them to stop in 3 minutes. Since the primary interest of the study was to invoke anxiety via the public speaking task, and not the content or length of the speech, the experimenter was not present in the room while the participant gave his/her speech. Therefore, none of the speeches were heard by any of the study investigators. At the conclusion of the 3-minute time period, participants were instructed to stop speaking. Participants were again informed that they were free to chew gum (Gum Group only), use breath strips (Breath Strip Group only), or smoke (Cigarette Group only) for the remainder of their time in the laboratory. Of note, participants were only required to chew gum (Gum Group only), use breath strips (Breath

Strip group only), and take a puff on a cigarette (Cigarette Group only) in intervals of 20 minutes, as stated earlier. All participants were asked to rate their feelings of anxiety, anxious mood, withdrawal, and urge to smoke/chew as assessed using the STAI-S, EAS, TWSC, and urge to smoke/chew measure based on how they are feeling immediately after finishing the speech (Time 4).

When participants completed the Time 4 measures they were instructed to "relax for a short time" and reminded again that they have access to chewing gum (Gum Group only), access to breath strips (Breath Strip Group only), and access to cigarettes (Cigarette Group only) for the remainder of the experiment. If 20 minutes elapsed since last instruction to insert chewing gum, a breath strip, or cigarette puff then participants were instructed to insert another piece of chewing gum, breath strip, or cigarette based on group assignment. Participants were also reminded that they could work on crossword puzzles or read magazines at their choice. At the conclusion of 30 minutes, the relaxation period was interrupted and participants were asked to complete the STAI-S, EAS, TWSC, and measure developed for the study once again to assess for anxiety, anxious mood, withdrawal, and urge to smoke/chew at that moment (Time 5).

A study experimenter would enter the laboratory following completion of the Time 5 measures, announced that they were finished, and debriefed the participants on the intentions and purposes of the study. All participants were thanked for their participation. The participants who were currently enrolled in psychology classes at Oklahoma State University had their names and number of hours spent in the study recorded, which would allow their instructor to decide how much extra credit or research participation credit to be allotted. Participants participating in the study for monetary compensation at the University of Mississippi Medical Center were compensated $30 for their participation.

CHAPTER V

RESULTS

Overall Analytic Strategy

The study used a 4 X 5 mixed-factorial design, with two independent variables: (a) Group Condition, with four levels: Gum, Breath Strip, Cigarette, and Control; and (b) Time, with five assessment points, Times 1-5. The dependent variables (DV) were state anxiety (STAI-S), anxious emotion (EAS-ANX), tobacco withdrawal (TWSC), tobacco craving (TWSC-Craving), and urge to smoke (BUS-Smoke) were measured at all five assessment points.

To assess change over assessment points, four 4 (Group) X 5 (Time) repeated-measures analyses of variance (ANOVAS) were conducted to specifically assess state anxiety, anxious emotion, tobacco withdrawal, tobacco craving, and urge to smoke as measured by the STAI-S, EAS-ANX, TWSC, TWSC-Craving, and BUS-Smoke, respectively. Although a repeated-measures multivariate analysis of variance (MANOVA) could have been employed for the STAI-S and EAS-ANX to help reduce the family wise error rate, it was believed that EAS-ANX measure might have been more sensitive to changes in negative affect across time. Further, utilizing ANOVAS for the STAI-S and EAS-ANX measures allows for easier comparisons with Britt et al. (2001) and Miller (2005). Simple effects tests would have been conducted if significant interactions were found. If significant group differences had been found at Time 1, difference scores would have been computed, and a 4 (Group) X 4 (Time) repeated-measures ANOVA would have been conducted. Planned comparisons to identify group differences were determined a priori, tested by simple effects tests, and Tukey post-hoc tests were employed when appropriate.

Preliminary Analyses

Descriptive statistics were calculated for participant demographic characteristics and are presented in Table 2. No significant group differences were found at baseline (Time 1) for any of these measures, except for ethnicity. This significant difference was found to be a result of the Control group being significantly more diverse than the other three groups, which did not differ from each other. It is also noted that no significant gender differences were found and therefore all remaining analyses were performed on the full sample ($N = 56$).

Primary Analyses

Hypothesis 1 (State Anxiety). It was predicted that the level of state anxiety as measured by the STAI-S would differ at all assessment points beyond baseline (Time 1) for each group. Specifically, it was hypothesized that if the physical behavior of gum chewing truly has stress ameliorating properties, then the Gum Group would report significantly less anxiety than the Breath Strip and Control groups, and that the Breath Strip Group and Control Group would be indistinguishable from each other at both pre-stressor and post-stressor. Further, it was predicted that the Cigarette Group would report equivalent pre-stressor and post-stressor anxiety as the Gum Group, in accordance with Britt et al. (2001). A 4 X 5 repeated-measures ANOVA was conducted. A significant main effect for Time only was found [$F\ (4,208) = 12.29$, $p < .001$, partial eta squared =

.191, power = 1.00]. No main effect of Group [F (3,52) = 1.04, $p > .05$, partial eta squared = .056, power = .265] nor of the Group x Time interaction was found [F (12,208) = 0.53, $p > .05$, partial eta squared = .030, power = .299]. Further, at all five assessment points (Time 1 – Time 5), no significant differences between groups at each time emerged. Therefore no mean group differences in state anxiety across time of assessment were observed. Differences in reported levels of state anxiety were influenced by time of assessment, rather than by group assignment.

It was expected that the largest effect of gum as an anxiolytic agent would have been observed at Time 5 (recovery), consistent with Britt et al. (2001); however, this was not found. All four groups had significant decreases in post-stressor anxiety that were not significantly different from each other (See Figure 1).

Hypothesis 2 (Anxious Emotion). It was predicted that groups would differ in anxious emotion as measured by the Emotion Assessment Scale – Anxiety subscale (EAS-ANX; Carlson et al., 1989) at assessment points 2-5. Specifically, it was predicted that the groups instructed to chew gum (Gum Group) or smoke (Cigarette Group) would report lower levels of anxious emotion than the Breath Strip Group and Control Group. Additionally, it was expected that the largest effect of gum as an anxiolytic agent would be observed at Time 5 (recovery), consistent with Britt et al. (2001) and current prediction regarding state anxiety.

A 4 X 5 repeated-measures ANOVA was employed. A significant main effect for Time only was detected [F (4,208) = 17.33, $p < .001$, partial eta squared = .250, power = 1.00]. The interaction between Group X Time and the main effect for Group were both non-significant [F (12,208) = .90, $p > .05$, partial eta squared = .049, power = .516 and F

(3,52) = .55, $p > .05$, partial eta squared = .031, power = .156]. Further, at all five assessment points (Time 1 – Time 5), no significant differences between groups at each time emerged. These findings suggest that the observed differences in anxious emotion is better explained by the factor of Time than Group. Therefore, differences in reported levels of anxious emotion were influenced by time of assessment, rather than by group assignment.

Although it was expected that the largest anxiolytic effect would be for the gum group at Time 5 (recovery), consistent with Britt et al. (2001), this was not found. All four groups displayed significant decreases in post-stressor anxiety that were not significantly different from each other (See Figure 2).

Hypothesis 3 – Tobacco Withdrawal (Total). It was predicted that groups would differ in total tobacco withdrawal symptoms as measured by the Tobacco Withdrawal Symptom Checklist (TWSC), at assessment points 2-5. Specifically, it was predicted that the groups instructed to smoke (Cigarette Group) or chew gum (Gum Group) would report lower tobacco withdrawal symptoms than the other two groups. Additionally, it was expected that the Breath Strip Group and Control Group would report significantly greater tobacco withdrawal symptoms than both the Cigarette Group and Gum Group. Further, it was expected that tobacco withdrawal symptoms would be lowest for the Cigarette Group at Time 5. Lastly, it was predicted that, at Time 5, the Cigarette and Gum groups would report significantly lower withdrawal symptoms that the Breath Strip and Control groups, consistent with Britt et al. (2001) and Cohen et al. (1997).

A 4 X 5 repeated-measures ANOVA was conducted. The interaction between Group X Time was non-significant [F (12,208) = 1.20, $p > .05$, partial eta squared = .065, power = .675]. Further, the main effect for Group and main effect for Time were both non-significant, [*F* (3,52) = 1.56, $p > .05$, partial eta squared = .083, power = .387, and *F* (4,208) = 2.02, $p > .05$, partial eta squared = .037, power = .599] indicating that neither group assignment nor time of assessment influenced reported total tobacco withdrawal symptoms.

Although it was expected that total tobacco withdrawal symptoms would be lowest for the Cigarette and Gum groups at Time 5 (recovery), consistent with Britt et al. (2001) and Cohen et al. (1997), this was not found. Rather, all four groups displayed non-significant changes in total tobacco withdrawal symptoms throughout the experiment (See Figure 3).

Hypothesis 4 – Tobacco Craving. It was predicted that groups would differ in craving to smoke as measured by the "cravings" question of the Tobacco Withdrawal Symptom Checklist (TWSC), at assessment points 2-5. Specifically, it was predicted that the group instructed to smoke (Cigarette Group) would report lower craving than the Gum Group. Further, it was expected that the Breath Strip Group and Control Group would report significantly greater craving to smoke than the Cigarette Group and Gum Group, consistent with Cohen et al. (1997). Lastly, it was expected that, at Time 5, craving would be lowest for the Cigarette Group, and that the Gum Group would report significantly less craving than the Breath Strip and Control groups.

A 4 X 5 repeated-measures ANOVA was conducted. The interaction between Group X Time was significant [*F* (12,208) = 2.96, $p = .001$, partial eta squared = .146, power = .989]. In addition, the main effect for Group and main effect for Time were both significant [*F* (3,52) = 3.87, $p = .014$, partial eta squared = .182, power = .794, *F* (4,208)

= 6.21, $p < .001$, partial eta squared = .107, power = .987]. Simple effects test were used to analyze the observed Group X Time interaction. A significant difference was observed at Time 2 (F (3,52) = 3.24, p = .007) and Time 5 (F (3,52) = 8.79, $p < .001$). Planned contrasts of the significant simple effects tests found that the Cigarette Group reported significantly less tobacco craving than the other groups at Time 2 and Time 5 [F (1,52) = 7.09 to 9.65, p = .01 to .003, F (1,52) = 14.50 to 19.73, $p < .001$], respectively. Further, the other groups were not significantly different from each other in reported craving at Time 2 and Time 5 [F (1,52) = 0.00 to 0.20, $p > .05$, F (1,52) = 0.04 to 0.40, $p > .05$], respectively. Therefore, the observed interaction is better explained by the Cigarette Group reporting significantly less craving for tobacco at Time 2 and Time 5 than the other groups.

Hypothesis 5 – Urge to Smoke. It was predicted that groups would differ in urge to smoke a cigarette as measured by the Behavioral Urge Scale (BUS-Smoke), developed for this study, at assessment points 2-5. Specifically, it was predicted that the group instructed to smoke (Cigarette Group) would report lower urge to smoke than the Gum Group. Further, it was expected that the Breath Strip Group and Control Group would report significantly greater urge to smoke than the Cigarette Group and Gum Group. Lastly, it was expected that, at Time 5, urge would be lowest for the Cigarette Group, and that the Gum Group would report significantly less urge than the Breath Strip and Control groups, consistent with current predictions regarding craving

A 4 X 5 repeated-measures ANOVA was conducted. The interaction between Group X Time was significant [F (12,208) = 2.30, p = .009, partial eta squared = .117, power = .954]. In addition, the main effect for Time was significant [F (4,208) = 11.05, p

< .001, partial eta squared = .175, power = 1.00]. Further, a trend for the main effect for Group emerged [F (3,52) = 2.30, p = .088, partial eta squared = .117, power = .547]. Simple effects tests were used to analyze the observed Group X Time interaction. A significant difference was observed at Time 2 (F (3,52) = 4.13, p = .011) and Time 5 (F (3,52) = 5.71, p = .002). Planned contrasts of the significant simple effects tests found that the Cigarette Group reported significantly less tobacco craving than the other groups at Time 2 and Time 5 [F (1,52) = 4.45 to 11.20, p = .040 to .002; F (1,52) = 10.44 to 12.62, p = .002 to .001], respectively. Further, the other groups were not significantly different from each other in reported urge at Time 2 and Time 5 [F (1,52) = 0.24 to 1.53, p > .05, F (1,52) = 0.01 to 0.10, p > .05], respectively. Therefore, the observed interaction is better explained by the Cigarette Group reporting significantly less urge to smoke at Time 2 and Time 5 than the other groups, similar to that found for craving.

As seen in Figures 1 and 2, participants' rating of anxiety, as measured by the STAI-S and EAS anxiety subscale, appear to follow a consistent pattern across the experimental session. Although total tobacco withdrawal symptoms remained constant throughout the experimental session, irrespective of group and time, craving for tobacco was significantly less for the Cigarette Group at recovery (as well as Time 2),as seen in Figures 3 and 4. Further, and consistent with craving for tobacco, urge to smoke was significantly less for the Cigarette Group at recovery (as well as Time 2), as seen in Figure 5. The means and standard deviations of the Gum, Breath Strip, Cigarette, and Control groups, across Time 1 – Time 5, on the STAI-S, EAS-ANX, TWSC, TWSC-Craving, and BUS- Smoke are presented in Table 3.

CHAPTER VI

DISCUSSION

General Findings

The primary aim of the present study was to investigate whether the behavior of chewing (via chewing gum) exerts an anxiolytic effect in response to stress in smokers. Specifically, this study examined how using chewing gum, cigarettes, and a no chew oral control (breath strips) during a laboratory stressor affects anxiety post stressor. A secondary aim of the present study was to investigate whether chewing gum helps smokers combat tobacco withdrawal, tobacco cravings, and urge smoke a cigarette. Specifically, this study examined how using chewing gum affects withdrawal, craving, and urge to smoke during and in recovery from a stressor, compared to the use of cigarettes, and a no chew oral control (breath strips).

None of the proposed primary hypotheses were supported. The introduction of the public speaking task was successful in significantly increasing levels of negative emotions (e.g., anxiety, stress) of all participants in the final analyses irrespective of group assignment (see Figures 1 and 2). Post-stressor, significant reductions in negative emotion (e.g., anxiety and anxious emotion) were observed; however, these reductions also occurred irrespective of whether one had access to chewing gum, breath strips, cigarettes or nothing.

The proposed secondary hypotheses, regarding the potential influence of chewing gum on withdrawal, craving, and urge, were also not supported. That is, chewing gum was not observed to aide in combating tobacco withdrawal, craving, and urge to smoke compared to a no chew oral control, breath strips or nothing (control). The Cigarette Group, indeed, reported significantly less craving and urge to smoke than by those who did not have access to cigarettes. However, this was observed only at recovery (Time 5) and at the introduction of the stressor (Time 2). Surprisingly, total tobacco withdrawal was not significantly less for the Cigarette Group, compared to the other groups, across all times of assessment.

Taken together, the results of the present study found that smokers who were experiencing acute nicotine withdrawal (e.g., not allowed to smoke), and were instructed to chew gum, did not experience significant anxiety reduction when stressed, compared to those without access to chewing gum. In addition, smokers who were not experiencing acute nicotine withdrawal (e.g., permitted to smoke), did not experience significant anxiety reduction when stressed, compared to those without access to cigarettes. Thus, in regards to the Cigarette Group during the stressor (Time 2 and Time 3), the present study replicated Britt et al.'s (2001) finding that smoking in response to a stressor does not significantly reduce negative emotion. Further interpretations of the results of the present study are given in comparison to previous studies from our lab.

How Findings are Related to the Literature

The present study sought to replicate the findings from Britt et al. (2001), and further, to provide support for the proposed mechanism to explain why chewing gum aides in recovery from a stressor. Specifically, the current study hypothesized that chewing gum, which has the properties of chewing and taste, has a significant effect on reducing stress associated with acute nicotine withdrawal and laboratory stress, as compared to the effect of an oral substitute (e.g., breath strip) that lacks the chewing property while maintaining the taste property. Britt et al. (2001) found that chewing gum in the presence of a laboratory stressor lead to significant subjective anxiety reduction post-stressor in a group of smokers in acute nicotine withdrawal, compared to a control group. The results obtained in the present study failed to replicate these findings, as participants instructed to chew gum did not report significantly less negative emotion post-stressor than the other groups. Further, in the present study, the Breath Strip Group also did not report significantly less negative emotion post-stressor than the control group. Thirdly, all four groups in the present study reported decreases in negative emotion post-stressor regardless of group. Consequently, support for the proposed mechanism (e.g., chewing behavior) to explain why chewing gum aided in recovery from the stressor in Britt et al. (2001) was not obtained, nor was support obtained for the alternative mechanism (e.g., taste).

An examination of effect sizes (partial eta squared) and power of the Group X Time interactions obtained for state anxiety and anxious-emotion suggest very small effect sizes with very small to small degrees of power. Although an increase in sample size would be one remedy to the observed low power, the effect size for chewing gum as a stress reducing agent is so small that it is likely not producing a meaningful change in subjective stress or negative affect associated with nicotine withdrawal. Miller (2005), using the same experimental paradigm, failed to find support of chewing gum providing a stress ameliorating effect in non-smokers who were regular (daily or almost daily) gum chewers. The results from the present study and Miller (2005) suggest that the anxiolytic effect of chewing gum observed by Britt et al. (2001) post-stressor was limited to that particular sample.

Secondly, Britt et al. (2001) found that withdrawal symptoms were significantly lower in participants who had access to cigarettes compared to chewing gum, and participants who had access to chewing gum reported significantly fewer withdrawal symptoms than participants with access to nothing. Cohen et al. (1997) and Cohen et al. (2001) also demonstrated significant reductions in withdrawal symptoms in smokers who were prohibited from smoking but had access to chewing gum. In the present study, withdrawal symptoms were not influenced by group assignment or time of assessment. In the present sample, surprisingly, the participants who had access to cigarettes did not report significantly lower withdrawal symptoms than the other groups, including the control group. Although it is reasonable to suggest differences in nicotine dependence (e.g., FTND score, number of cigarettes smoked per day) between the present sample and Britt et al. (2001), the two samples were highly similar on measures/variables of nicotine dependence (FTND: 4.67 vs. 4.79; Cigarettes per day: 21.89 vs. 17.43).

Thirdly, and similar to Britt et al. (2001), urge to smoke (and tobacco craving) were significantly lower in the Cigarette Group compared to the other groups at recovery (Time 5), although the non-cigarette groups did not differ from each other. Further, although Cohen and colleagues (2001) found that gum chewing aided with withdrawal, they too were unable to demonstrate that chewing gum helps with self-reported craving when a smoker is prevented from smoking.

Fourthly, a noted weakness of Britt et al. (2001) was the use of a primarily college based sample. In the present study 50 percent of the sample was non-college attending (community based). Further, the mean age of the participants in the present study (29.61 years) was 6.25 years greater than that in Britt et al. (2001). Consequently, it is likely that the sample in the present study had approximately an equally greater smoking history than the sample in Britt et al. (2001). Thus, it would appear that a true anxiolytic effect of chewing gum may be limited to its' effects on a college sample and/or a sample with a shorter smoking history.

Lastly, it is possible that the observed differences between the present sample and Britt et al.'s (2001) sample are best explained by cohort effects. That is, it is reasonable to suggest that the smoker of the mid 1990's are different (e.g., behaviorally, cognitively, and/or personality) than the smoker of 2006/2007. In deed, Irvin and Brandon (2000) suggest that smokers of more recent years are likely more nicotine dependent, have more comorbid psychiatric and substance abuse disorders, less educated, and are of lower economic status. It is plausible then that the present sample represents a "harder core" smoker than Britt et al. (2001). Therefore, and notably speculative, it may be that chewing gum is limited to its' effect on less dependent smokers.

Exploratory Analyses

Post hoc it was hypothesized that participant's beliefs about why they smoke cigarettes moderate the relationship between the dependent measures (anxiety, anxious-emotion, tobacco withdrawal, tobacco craving, and urge to smoke) and group assignment. The participant's beliefs about cigarettes were obtained from their rating of one of the questions from the Health Habits Questionnaire: When you are tense or stressed, do you tend to (1) "smoke more"; (2) "smoke less"; or (3) "smoke about the same number of cigarettes." The sample was divided into two groups for this question. The two groups consisted of participants answering that they smoke more ($N = 49$) and participants answering that they smoke about the same number of cigarettes ($N = 7$). Notably, none of the participants indicated that they smoked less when tensed or stressed.

The overall results of these exploratory analyses (See Figures 6 – 10) revealed that the participant's beliefs on how smoking cigarettes affects their negative emotional states had no effect on their reported anxiety. Further, these beliefs did not appear to have an effect in regards to tobacco withdrawal, tobacco craving, and urge to smoke. The participants that affirmed that they smoke more when they are tense or stressed exhibited a similar trend to the full sample on the above smoking related variables. Specifically, any observed significant difference at a given time of assessment, was found to be related to the cigarette group reporting significantly less tobacco craving or urge to smoke than the other groups, and the other groups not being significantly different from each other (see Figures 9 & 10).

These exploratory findings appear to support the notion that some dependent smokers have beliefs that smoking cigarettes helps them to control negative emotions; however, it does not appear that smoking is facilitating them in this way. These findings may also be suggestive that, if smokers generally tend to hold the belief that smoking helps them manage negative emotions, then they likely experience additional distress in situations that are evaluated as stressful and smoking is prohibited. Therefore, it is plausible to speculate that smoking in response to the belief that smoking facilitates negative affect management (e.g., cope with a stressor) is only effective in decreasing the mild anxiety associated with being prohibited from smoking in a stressful situation. Although not statistically significant, a general trend was observed suggesting that the participants who indicated they smoke more when tense or stressed, and had access to cigarettes (Cigarette Group), appeared to report less anxiety and anxious emotion (see Figures 6 & 7).

In addition, post hoc it was hypothesized that the participant's reported frequency of gum chewing could moderate the relationship between the dependent measures (anxiety, anxious-emotion, tobacco withdrawal, tobacco craving, and urge to smoke) and group assignment. The participant's gum chewing frequency was obtained from their rating of one of the questions from the Health Habits Questionnaire: How often do you chew gum (1) "daily or almost daily"; (2) "1 – 3 times a week"; (3) "4 – 5 times a week"; (4) 1 – 3 times per month"; (5) "only on occasions"; or (6) "never or almost never". The sample was divided into two groups for this question. The two groups consisted of participants answering that they chewed gum at a "high frequency," arbitrarily defined as chewing gum at least a few times per week (e.g., answered this question as either 1, 2, or 3) ($N = 30$) and participants answering that they chew gum at a "low frequency," arbitrarily defined as chewing gum less than once per week (e.g., answered this question as either 4, 5, or 6) ($N = 26$).

The overall results of the secondary exploratory analyses (See Figures 11 – 20) revealed that the participant's chewing gum frequency had an effect on their reported anxiety. A significant Group X Time interaction was observed on the STAI-S and EAS-ANX for participants indicating that they chew gum at a high frequency [F (12,104) = 2.18, $p = .018$, partial eta squared = .201, power = .927; F (12,104) = 2.89, $p = .002$, partial eta squared = .250, power = .983]. However, these observed significant interactions appear to be a result of the Breath Strip Group reporting significantly greater anxiety and anxious emotion pre-speech (Time 2 and Time 3), which parsimoniously may be a function of the novelty of the breath strip. Given the exploratory nature of this analysis, further speculation regarding this observation may be premature.

The low frequency gum chewers' STAI-S was similar to the full sample. However; on the EAS-ANX a main effect for Group and Time was observed [F (3,22) = 3.68, p = .027, partial eta squared = .334, power = .724, F (4,88) = 8.31, p < .001, partial eta squared = .274, power = .998]. The observed significant Group main effect (see Figure 17) appears to be a result of the Gum Group and Control Group reporting significantly greater anxious emotion pre-speech (Time 2 and Time 3), which parsimoniously may be a function of the low frequency gum chewers' experiencing the addition of chewing gum to be aversive. The apparent finding that the Breath Strip Group reported the lowest (non-significant) anxious emotion, may suggest the possible use of less temporal-mandibular stimulating oral alternatives (i.e., sucking candy) as a cessation aide in smokers that do not prefer chewing gum. This suggestion is somewhat supported by the observed trend of the Breath Strip Group in the low frequency gum chewer sample to report lower tobacco withdrawal, tobacco craving, and urge than the Control Group. The high frequency gum chewers' tobacco withdrawal, tobacco craving, and urge to smoke were similar to that of the full sample.

Limitations

While this study was conducted with a great attempt to ensure a methodologically sound study, the present study is not without some limitations that would suggest caution in interpreting the findings. The primary concern is in relation to the specific sample used in the study. The participants from the present study were comprised of both college students, primarily from Oklahoma State University, and a community sample (largely non-college educated), from Jackson, Mississippi. Despite the dichotomous sample, analyses comparing the two groups on the primary hypotheses were equivalent. Therefore this limitation may in fact be a strength of the study in regards to generalization to the general population.

Second, although it was emphasized to the participants that their data would be confidential and that they could withdraw from the study at any time without penalty, it is still possible that participants' responses may have been influenced by extraneous factors (e.g., nature of questions). Overall, the researchers feel that the results of the present study are generally based on accurate information. Although the primary concern is in relation to the sample being comprised of college students, it is noted that Britt et al., (2001) also utilized a college student based sample.

Future Directions

Data from the current study failed to replicate previous findings suggestive of chewing gum aide smokers with negative emotions that may be limited to tobacco withdrawal. Due to the failure to replicate, evidence to support the mechanism by which chewing gum produced its' stress-ameliorating effect was also lacking. Some dependent smokers in the present study reported that they smoke more when stressed, and presumably hold the belief that smoking helps them to relax or feel less anxious. However, reports of anxiety levels pre- and post-stressor does not support the hypothesis that smoking effectively helps smokers manage negative emotions undergoing a laboratory stressor.

The collective findings of the present study and Britt et al. (2001) and Cohen et al.

(1997, 2001) appear to suggest that some smokers in acute nicotine withdrawal may benefit from chewing gum when they are not allowed to smoke. However, the benefit that some of these smokers receive from gum may be limited to helping smokers decrease symptoms associated with nicotine withdrawal (i.e., craving, urge) and overall withdrawal, rather than as a means to cope with stress (e.g., public speaking task).

Further investigations examining the relationship between chewing gum and negative emotions associated with tobacco withdrawal, in smokers, are clearly warranted. However, in order to precisely investigate how chewing gum may aide smokers with managing symptoms associated with nicotine withdrawal, future study should re-examine smokers experiencing acute nicotine withdrawal without also being concurrently stressed. Specifically, for example, one study could involve bringing participants into the laboratory to watch a 2-hour movie (e.g., non stress inducing task). The movie would be followed by extended 30 minute periods (e.g., Cohen et al. 1997 and 2001). Participants would be randomly assigned to the Gum Group, Breath Strip Group, Sucking Candy Group, Cigarette Group, or Control Group. Withdrawal, craving, and urge to smoke would be measured at baseline (Time 1), end of movie (Time 2), 30 minutes (Time 3) and 60 minutes (Time 4) after the end of the movie. Such a design could provide support for the use of chewing gum to assist with acute nicotine withdrawal over other oral alternatives. Additionally, extending the time in which smokers are prohibited from smoking, following the movie (e.g., 3 hours), would allow for the examination of oral alternatives' potential effect on prolonged nicotine withdrawal.

Clearly, a further examination of the relationship between the use of oral alternatives to smoking (i.e., chewing gum) and smokers is worthwhile. It is not posited that chewing gum (or alternative commodities) will help all smokers manage withdrawal symptoms. However, there is enough evidence to suggest that the findings of the above proposed study could provide useful information regarding the use of relatively inexpensive strategies for nicotine cessation programs.

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APPENDICES

Appendix A

RELEVANT RESULTS

Table 1

Timeline of Procedure and Activities

Procedure	Elapsed Time	Activity	Measures
Introduction	0:00:00	All participants introduced to lab, project described, consent from signed, and initial required cigarette is smoked.	
Time 1	0:10:00	Relax: magazines, cross-word puzzles, and/or sit.	Complete Time 1 measures: HHQ, gum chewing history, BDI-2, EAS, AAS, SRRS, STAI-T, STAI-S, FTND, TWSC, & BUS.
Time 2	0:55:00	Speaking task instructions given	
Free access to gum, breath strips, cigarettes or nothing		Chew gum, insert breath strip, take at least one puff on cigarette, or do nothing (depending on group assignment).	Complete Time 2 measures: STAI-S, EAS, TWSC, and BUS.
Prepare for Speech Free access to gum, breath strips, cigarettes or nothing	0:57:00	Mentally prepare for speech – 2 minutes. Chew gum, use breath strips, smoke a cigarette, or do nothing depending on group assignment.	
Time 3 Free access to gum, breath strips, cigarettes or nothing	1:05:00	Chew gum, insert breath strip, take puff on cigarette, or do nothing depending on group assignment.	Complete Time 3 measures: STAI-S, EAS, TWSC, and BUS.
Speech No gum/breath strip/cigarette permitted	1:08:00	Participant gives 3 minute speech to video camera	

Procedure	Time	Activity	Measures
Time 4 Free access to gum, breath strips, cigarettes or nothing	1:16:00	Chew gum, insert breath strip, take puff on cigarette, or do nothing depending on group assignment.	Complete Time 4 measures: STAI-S, EAS, TWSC, and BUS.
Rest	1:46:00	30 minute rest Chew gum, use breath strips, smoke cigarette(s), or do nothing depending on group assignment	
Time 5 Free access to gum, breath strips, cigarettes or nothing	1:54:00	Chew gum, insert breath strip, take puff on cigarette, or do nothing depending on group assignment.	Complete Time 5 measures: STAI-S, EAS, TWSC, and BUS.
Debriefing	2:04:00		

Table 2

Participant Characteristics and Demographics

Participant Characteristics	Group					
	Sample	Gum	Breath Strip	Cigarette	Control	*F*/(*p*)
Gender						
Male	31	8	7	8	8	.067
Female	25	6	7	6	6	(.977)
Ethnicity						
Caucasian	37	12	10	10	5	6.236
African American	12	2	3	3	4	(.001)
Native American	3	0	1	1	1	
International	2	0	0	0	2	
Hispanic	1	0	0	0	1	
Other	1	0	0	0	1	
Age						
Mean	29.61	26.50	28.71	30.71	32.50	.710
SD	11.39	6.98	11.75	12.57	13.50	(.550)
Range	(18 – 58)	(19 – 39)	(18 – 51)	(18 – 53)	(18 – 58)	
STAI-S						
Mean	40.79	42.50	38.50	38.14	44.00	.909
SD	11.41	10.45	11.35	11.59	12.29	(.443)
Range	(21 – 64)	(27 – 62)	(21 – 54)	(22 – 58)	(22 – 64)	

Participant Characteristics	Group					
	Sample	Gum	Breath Strip	Cigarette	Control	*F*/(*p*)
STAI-T						
Mean	43.63	45.36	42.93	40.71	45.50	.448
SD	12.50	12.28	11.12	12.23	14.84	(.720)
Range	(22 – 71)	(23 – 65)	(28 – 63)	(22 – 62)	(24 – 71)	
BDI-2						
Mean	13.55	13.50	11.64	13.93	15.14	.265
SD	10.34	11.88	7.68	10.28	11.82	(.850)
Range	(0 – 37)	(1 – 37)	(0 – 31)	(1 – 33)	(1 – 35)	
AAS						
Mean	34.68	36.50	38.50	28.93	34.79	1.826
SD	11.67	13.98	11.99	10.25	8.79	(.154)
Range	(14 – 58)	(14 – 58)	(20 – 56)	(15 – 56)	(21 – 56)	
Smoking Duration (years)						
Mean	11.63	9.86	9.86	12.71	14.07	.521
SD	10.82	6.79	9.87	11.87	14.02	(.670)
Range	(0 – 43)	(1 – 20)	(0 – 29)	(1 – 35)	(2 – 43)	
FTND						
Mean	4.79	4.93	4.64	4.43	5.14	.379
SD	1.88	1.64	1.55	2.53	1.75	(.768)
Range	(1 – 9)	(1 – 7)	(2 – 8)	(1 – 9)	(2 – 8)	

Participant Characteristics	Group					
	Sample	Gum	Breath Strip	Cigarette	Control	*F*/(*p*)
TWSC						
Mean	7.54	7.00	5.21	7.07	10.86	1.611
SD	7.12	7.21	4.08	7.73	8.23	(.198)
Range	(0 – 31)	(1 – 24)	(0 – 15)	(0 – 20)	(1 – 31)	

Note. STAI-S = State Trait Anxiety Inventory-State; STAI-T = State Trait Anxiety Inventory-Trait; BDI-2 = Beck Depression Inventory 2; AAS = Audience Anxiousness Scale; FTND = Fagerstrom Test of Nicotine Dependence; TWSC = Tobacco Withdrawal Symptom Checklist.

Table 3

Mean and Standard Deviations of Repeated Measures ANOVAS

		STAI-S		EAS-ANX		TWSC		Craving		Urge	
Group	Time	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)
Gum	1	42.50	(10.00)	73.07	(47.19)	7.00	(7.21)	0.71	(0.83)	25.71	(22.81)
Breath Strip	1	38.50	(11.35)	44.57	(41.66)	5.21	(4.08)	0.71	(0.83)	33.07	(21.91)
Cigarette	1	38.14	(11.59)	66.86	65.16)	7.07	(7.73)	0.71	(0.99)	26.36	(27.06)
Control	1	44.00	(12.29)	69.64	(69.57)	10.86	(8.23)	1.36	(1.15)	37.71	(26.59)
Gum	2	47.36	(13.94)	119.79	(95.54)	9.21	(5.43)	1.50	(0.76)	43.07	(21.95)
Breath Strip	2	46.00	(16.61)	86.07	(90.59)	7.57	(5.91)	1.50	(0.76)	55.79	(28.64)
Cigarette	2	41.71	(17.67)	75.21	(68.14)	6.07	(7.79)	.50	(0.86)	21.43	(28.16)
Control	2	48.21	(14.30)	94.64	(89.67)	8.86	(6.08)	1.36	(1.01)	48.14	(29.24)
Gum	3	47.93	(15.05)	105.64	(88.58)	10.29	(6.73)	1.50	(0.76)	46.50	(26.68)
Breath Strip	3	49.00	(15.36)	107.00	(97.01)	9.21	(8.19)	1.64	(1.08)	52.21	(31.75)
Cigarette	3	41.00	(14.42)	67.93	(58.55)	6.00	(6.69)	0.71	(0.99)	34.93	(33.61)
Control	3	49.14	(16.08)	95.00	(83.56)	11.21	(8.27)	1.36	(1.22)	51.93	(29.54)
Gum	4	44.43	(12.23)	62.93	(68.87)	9.21	(5.79)	1.71	(0.73)	50.29	(26.08)
Breath Strip	4	39.29	(11.60)	41.79	(54.90)	6.14	(3.74)	1.50	(0.76)	53.79	(28.80)
Cigarette	4	37.14	(10.17)	39.29	(33.04)	5.29	(3.85)	0.93	(0.92)	43.43	(38.01)
Control	4	44.86	(15.00)	65.14	(65.12)	9.43	(6.98)	1.43	(1.28)	54.21	(33.33)
Gum	5	41.71	(11.41)	41.93	(24.76)	9.64	(6.90)	1.71	(0.73)	53.64	(22.31)
Breath Strip	5	37.43	(11.72)	32.71	(45.40)	8.14	(5.33)	1.79	(0.70)	54.64	(33.00)
Cigarette	5	34.64	(11.64)	34.64	(35.60)	5.50	(4.57)	0.29	(0.61)	18.57	(24.47)
Control	5	42.36	(13.22)	49.71	(69.72)	10.71	(7.97)	1.57	(1.34)	57.14	(33.39)

Note. STAI-S = State-Trait Anxiety Inventory-State; EAS-ANX = Emotion Assessment Scale – Anxiety subscale; TWSC = Tobacco Withdrawal Symptom Checklist; Craving = craving to smoke; Urge = urge to smoke; M = average value; SD = standard deviation.

Figure 1

Mean State Anxiety Score for Gum and No Gum Conditions at Time 1 – Time 5

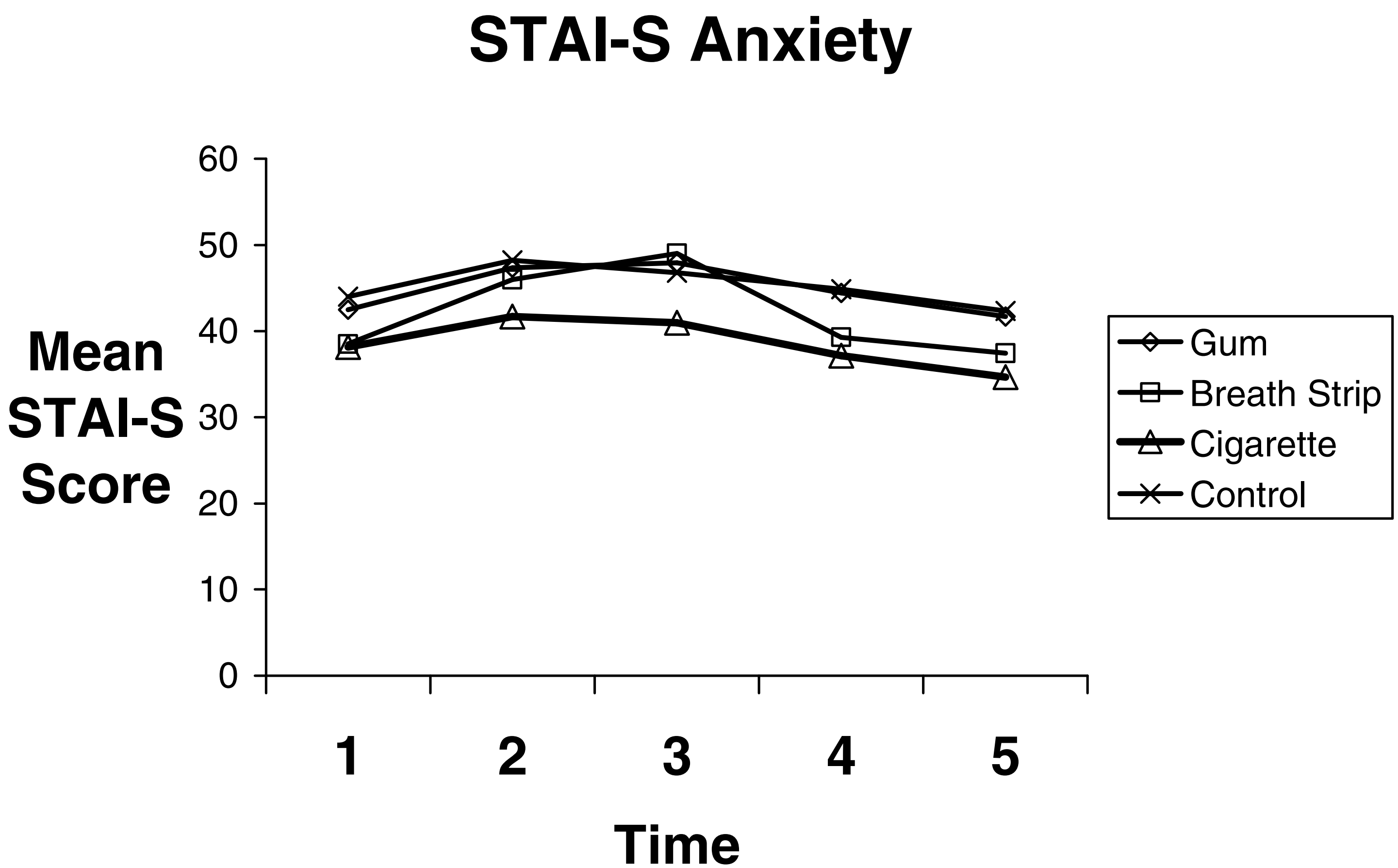


Figure 2

Mean Anxious Emotion Score for Gum and No Gum Conditions at Time 1 – Time 5

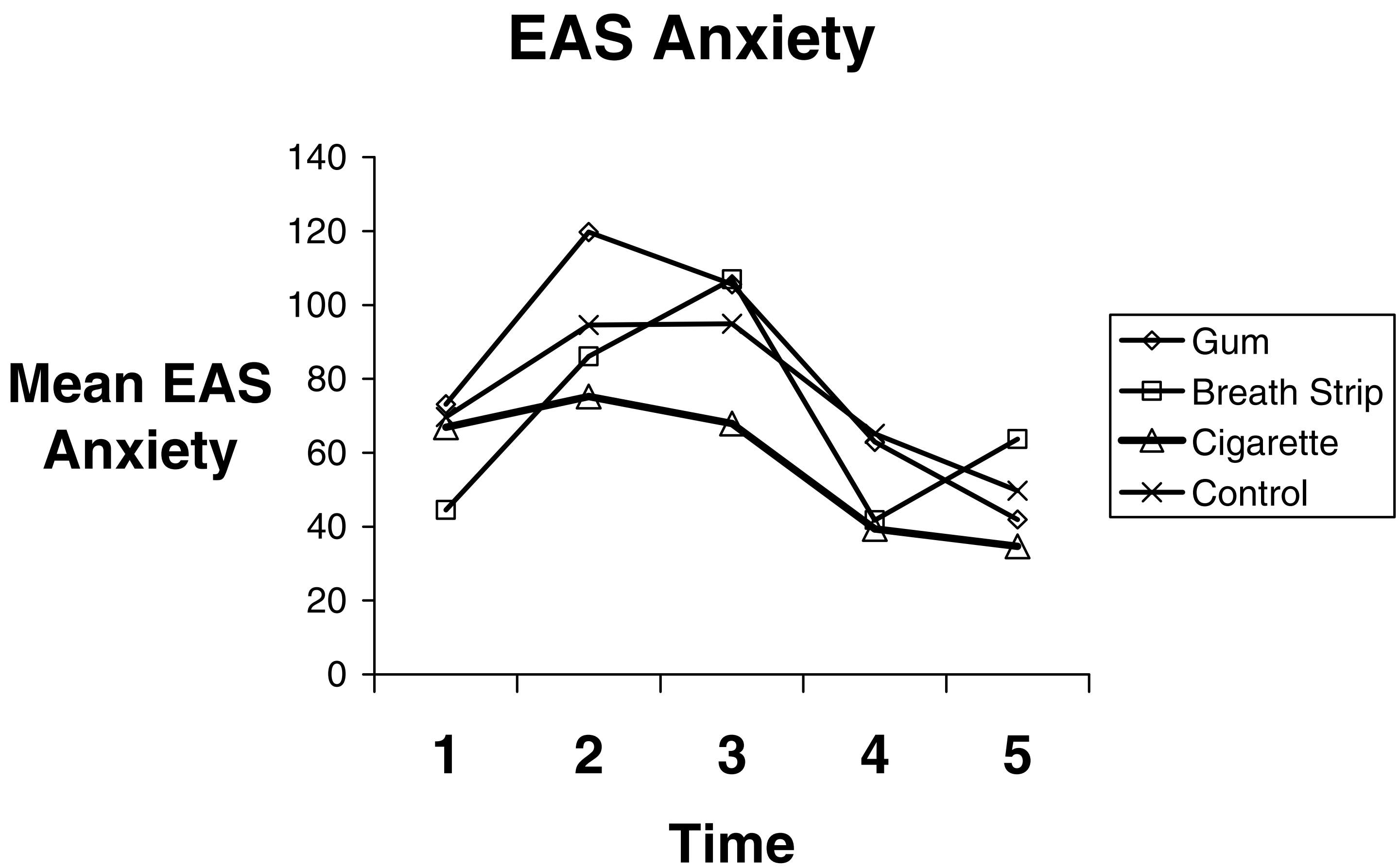


Figure 3

Mean Tobacco Withdrawal Score for Gum and No Gum Conditions at Time 1 – Time 5

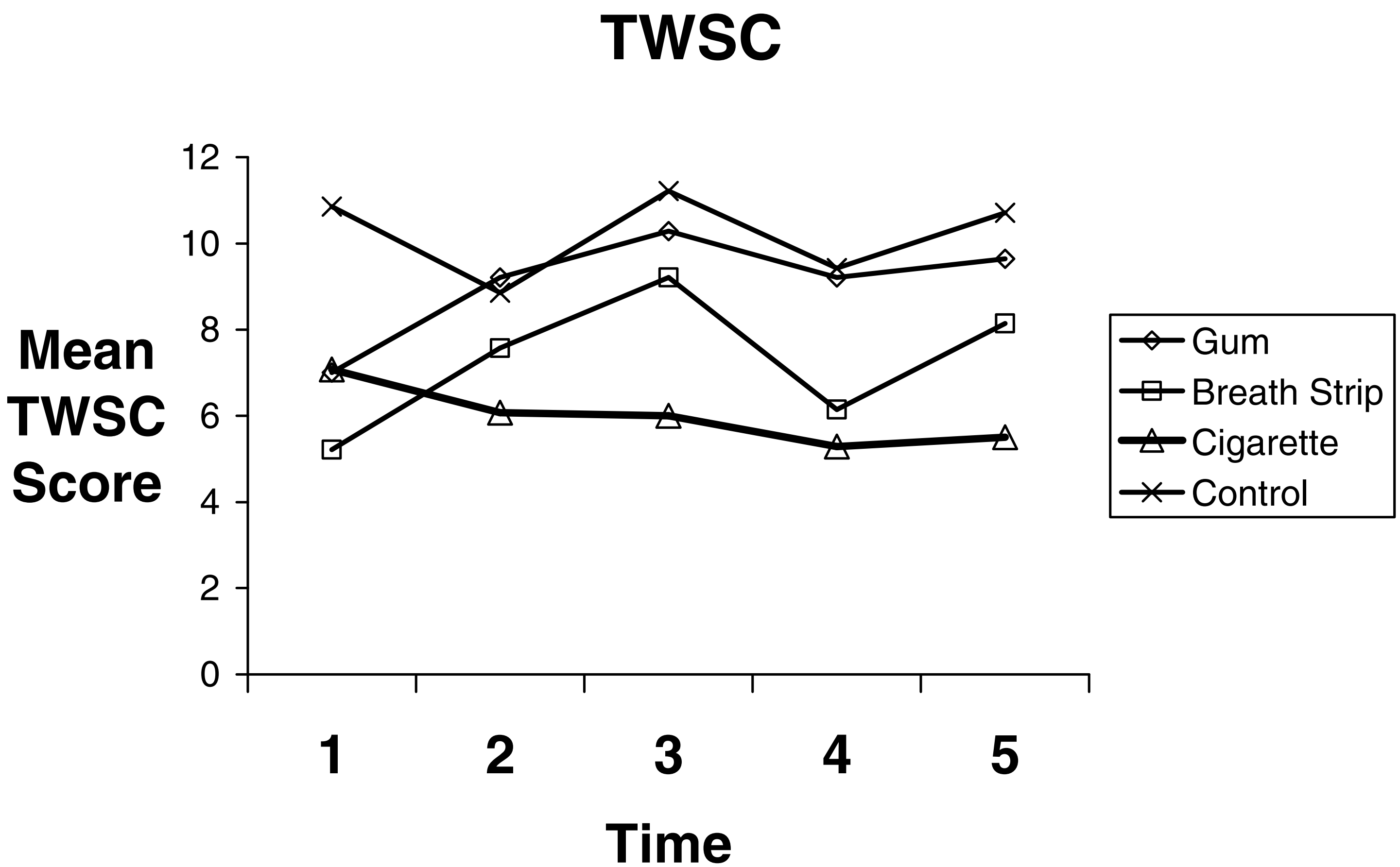


Figure 4

Mean Tobacco Craving Score for Gum and No Gum Conditions at Time 1 – Time 5

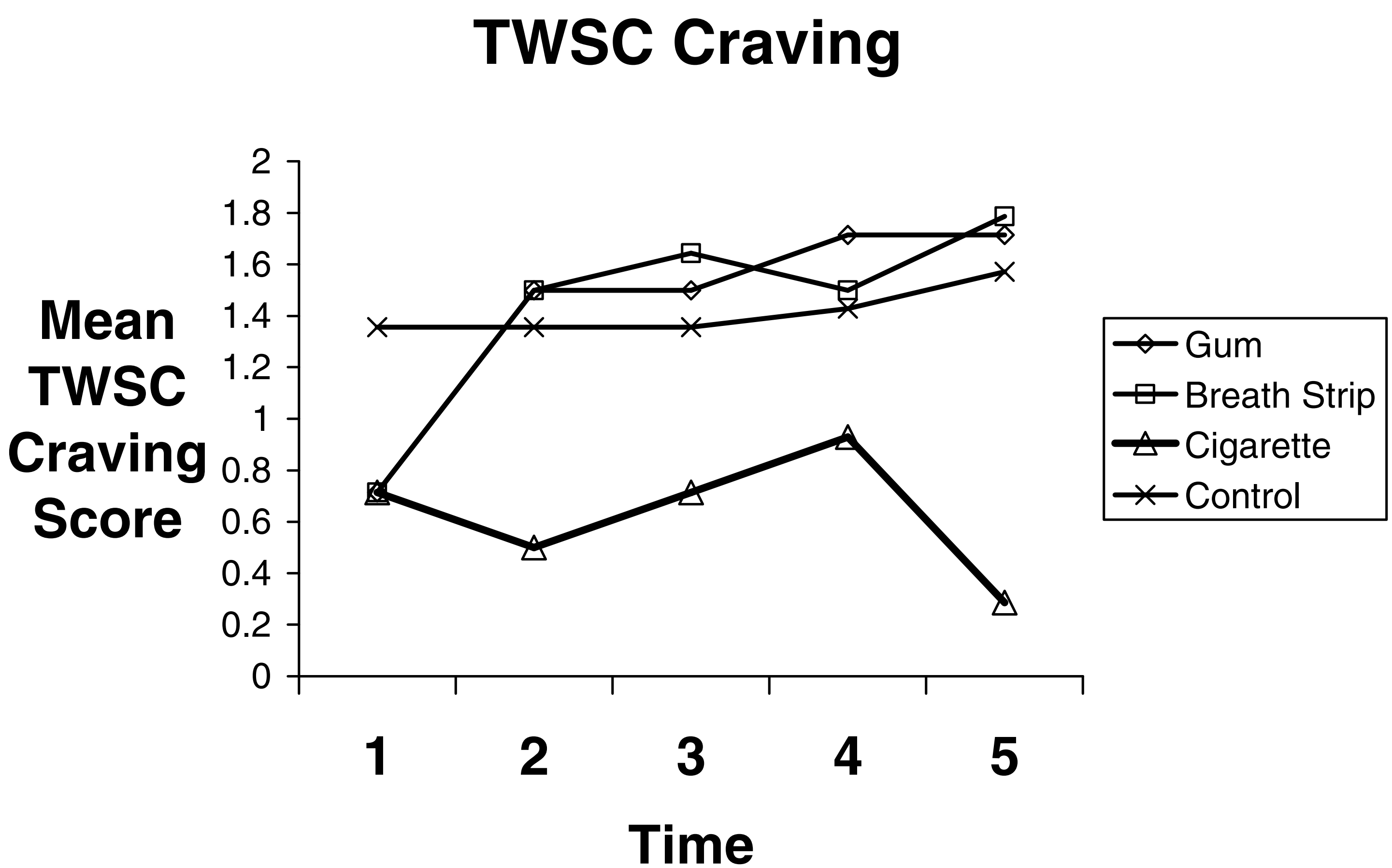


Figure 5

Mean Urge to Smoke Score for Gum and No Gum Conditions at Time 1 – Time 5

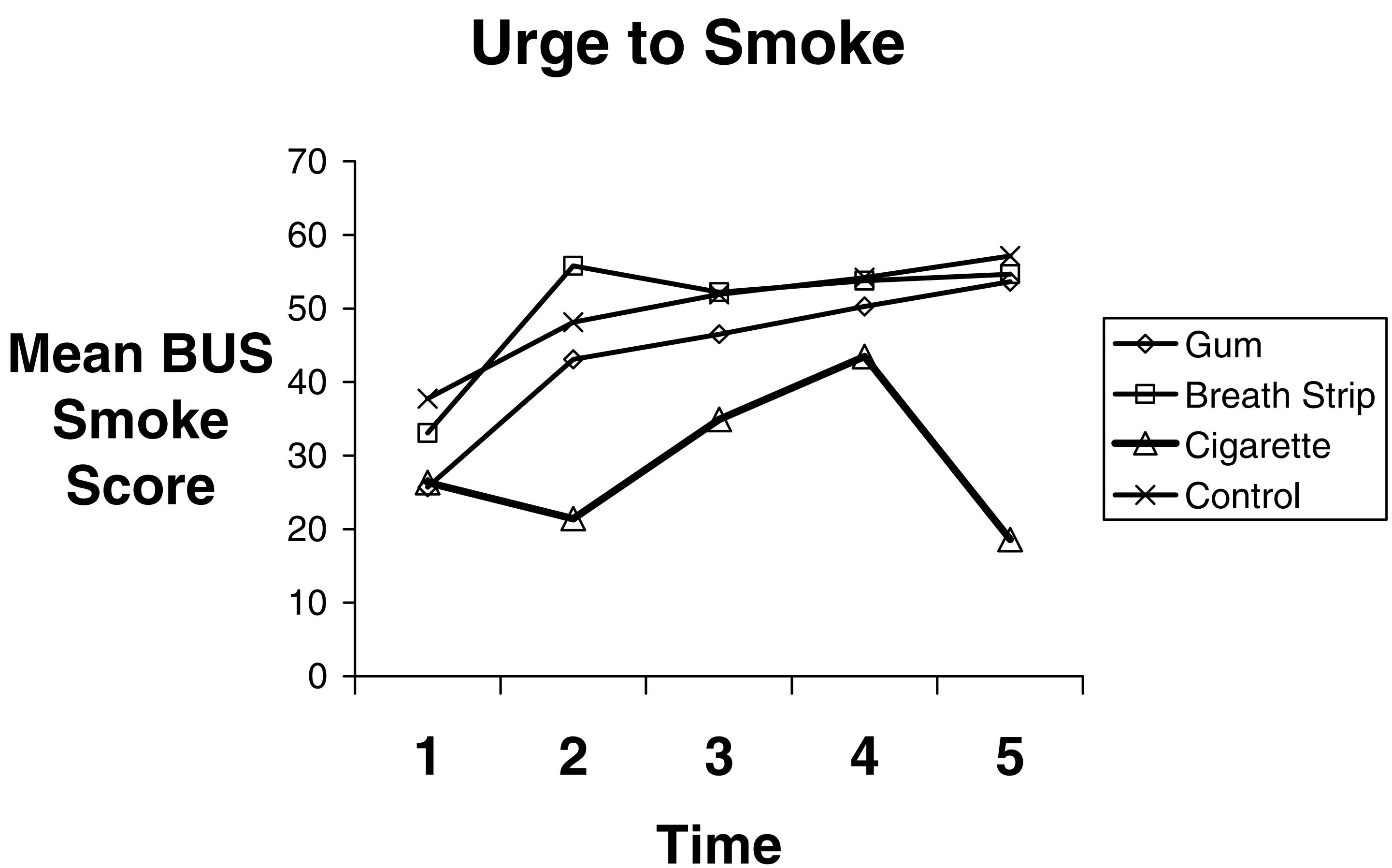


Figure 6

Mean State Anxiety Score for Participants Indicating They Smoke More When Tense

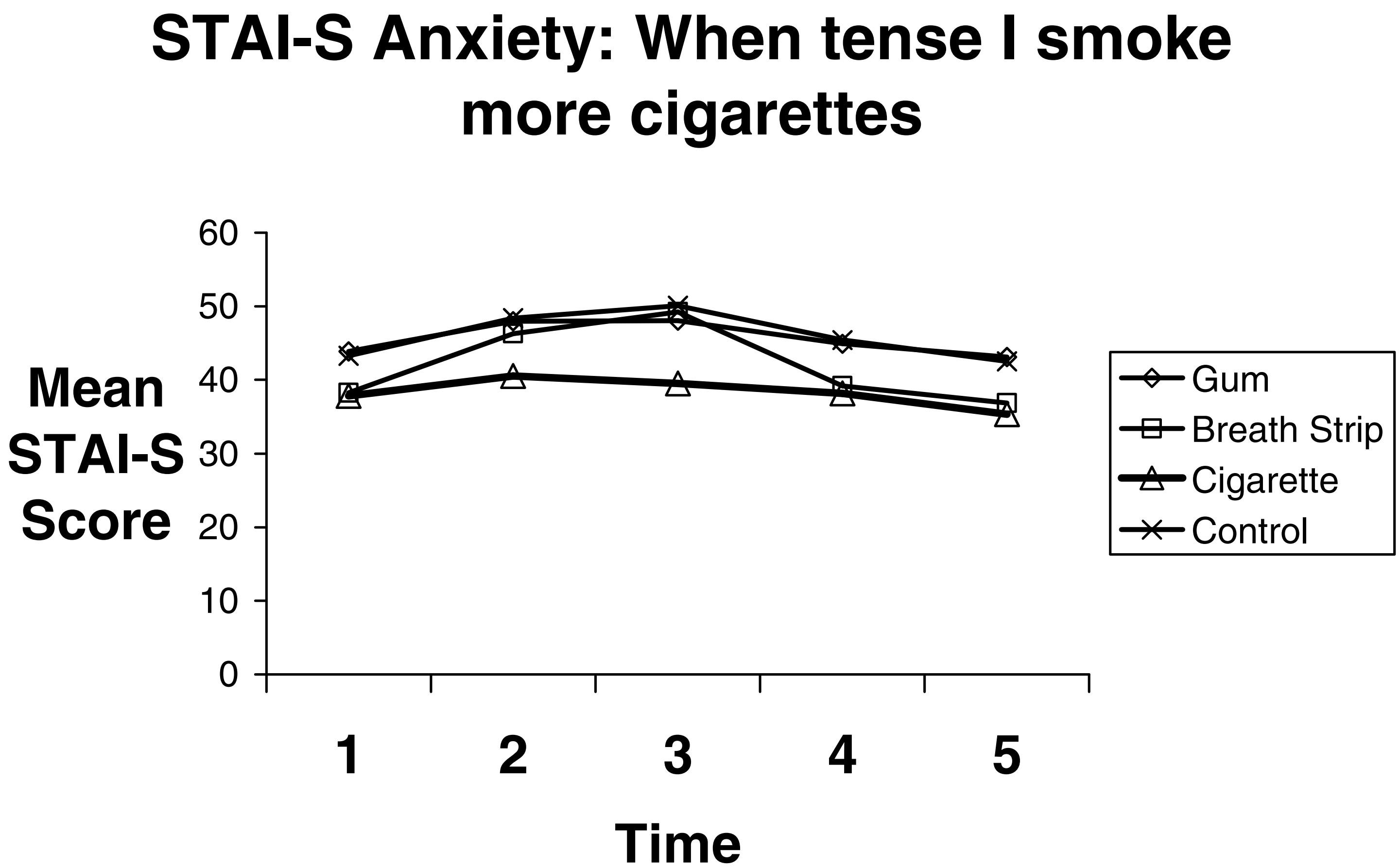


Figure 7

Mean Anxious Emotion Score for Participants Indicating They Smoke More When Tense

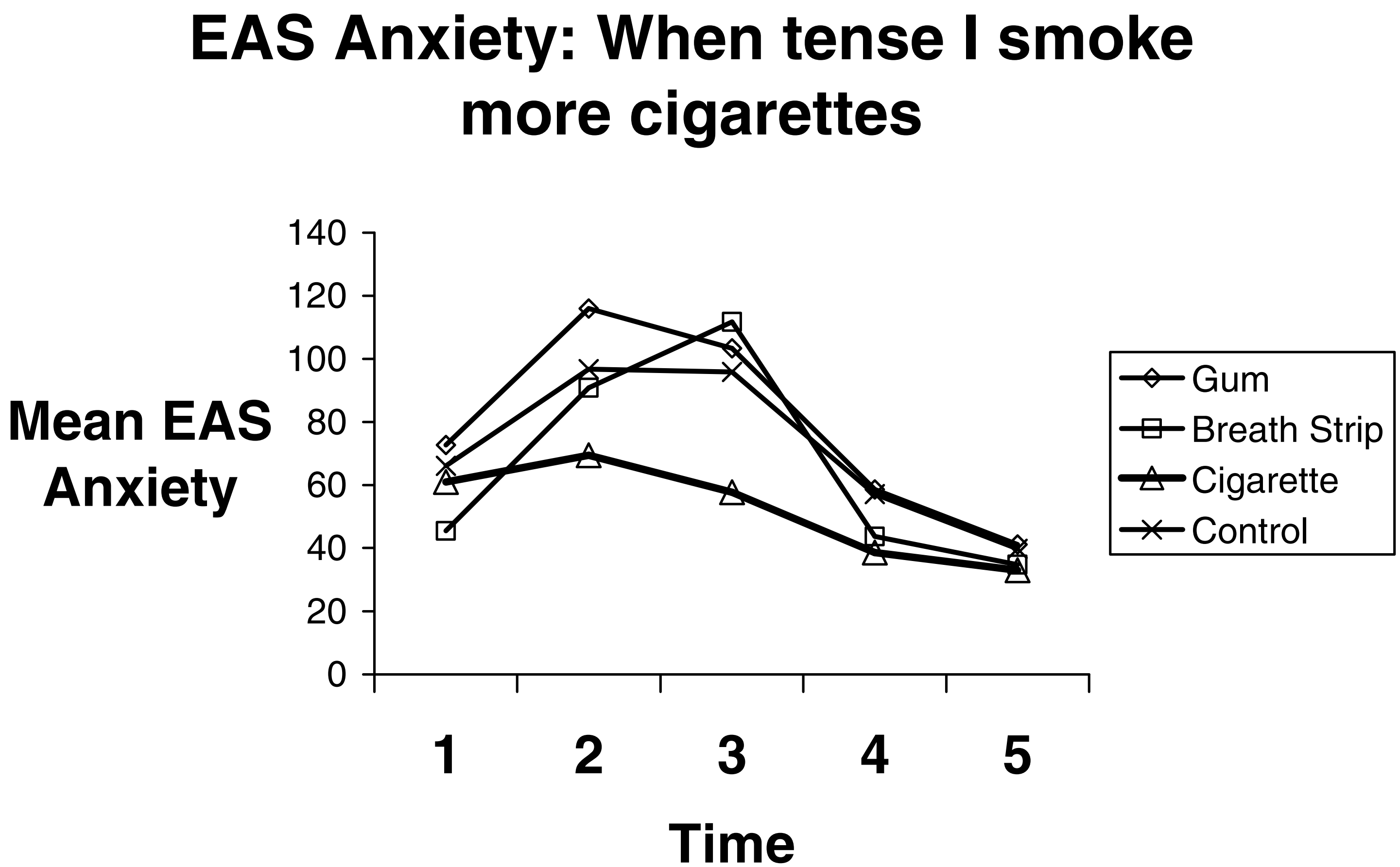


Figure 8

Mean Tobacco Withdrawal Score for Participants Indicating They Smoke More When Tense

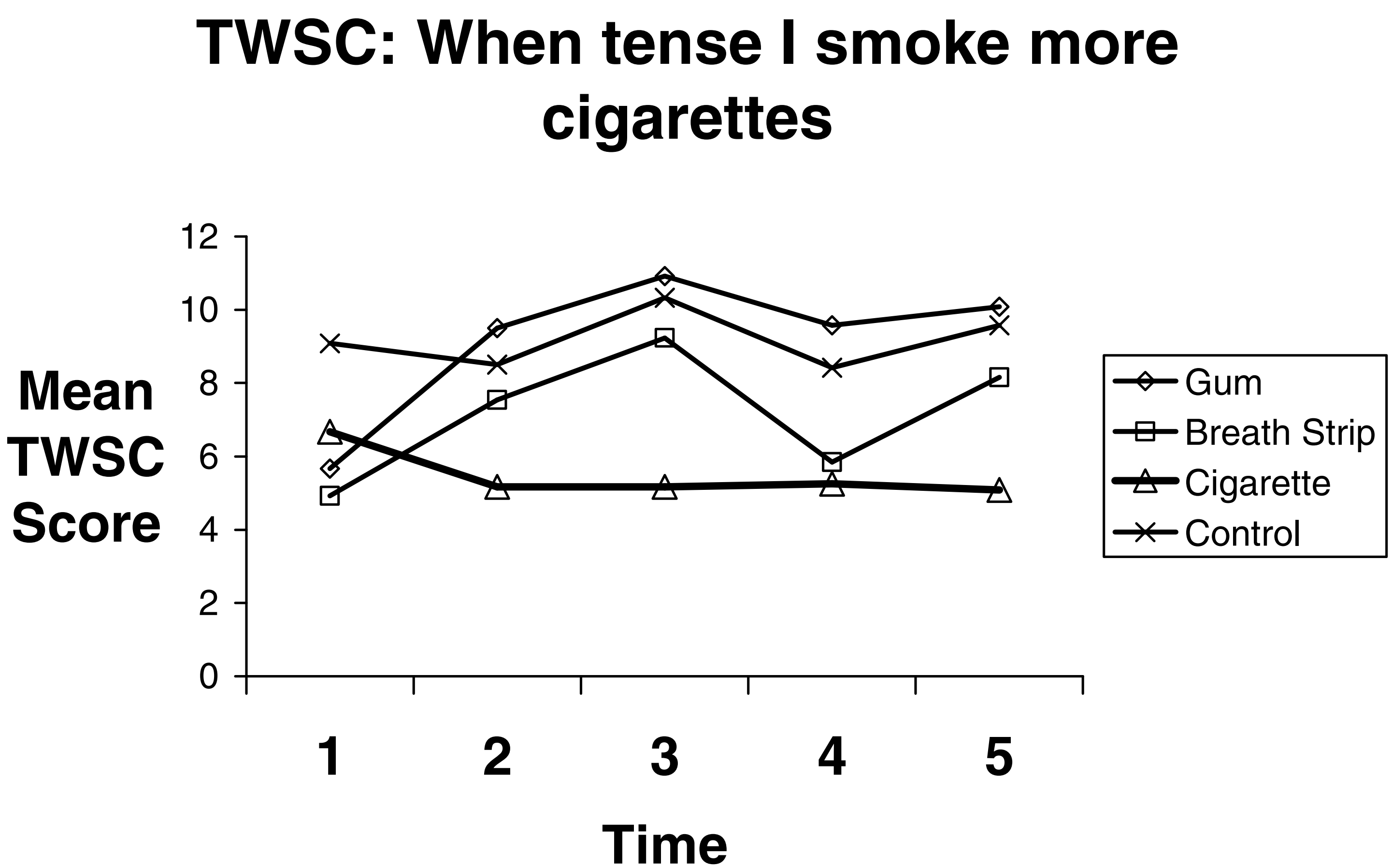


Figure 9

Mean Tobacco Craving Score for Participants Indicating They Smoke More When Tense

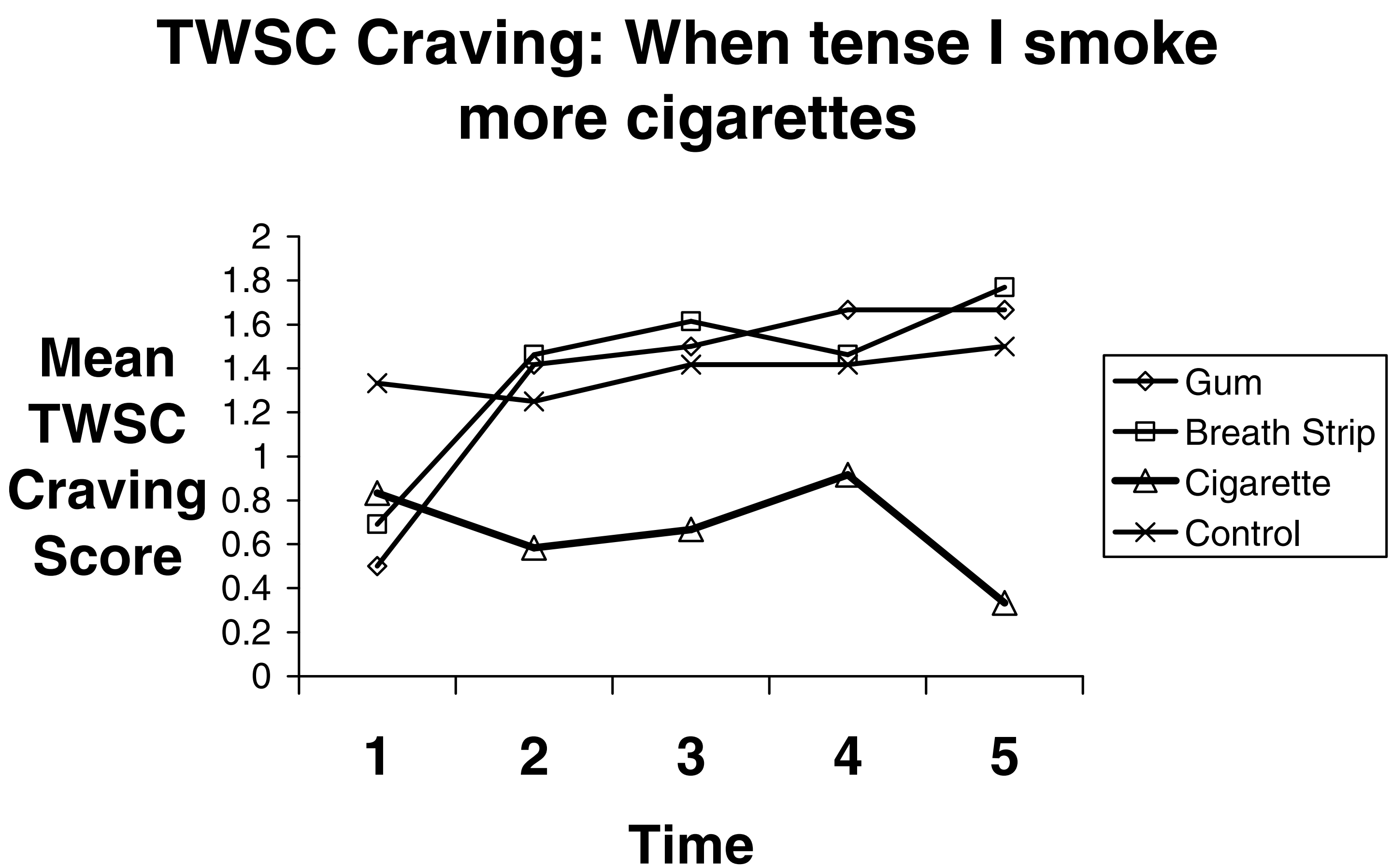


Figure 10

Mean Urge to Smoke Score for Participants Indicating They Smoke More When Tense

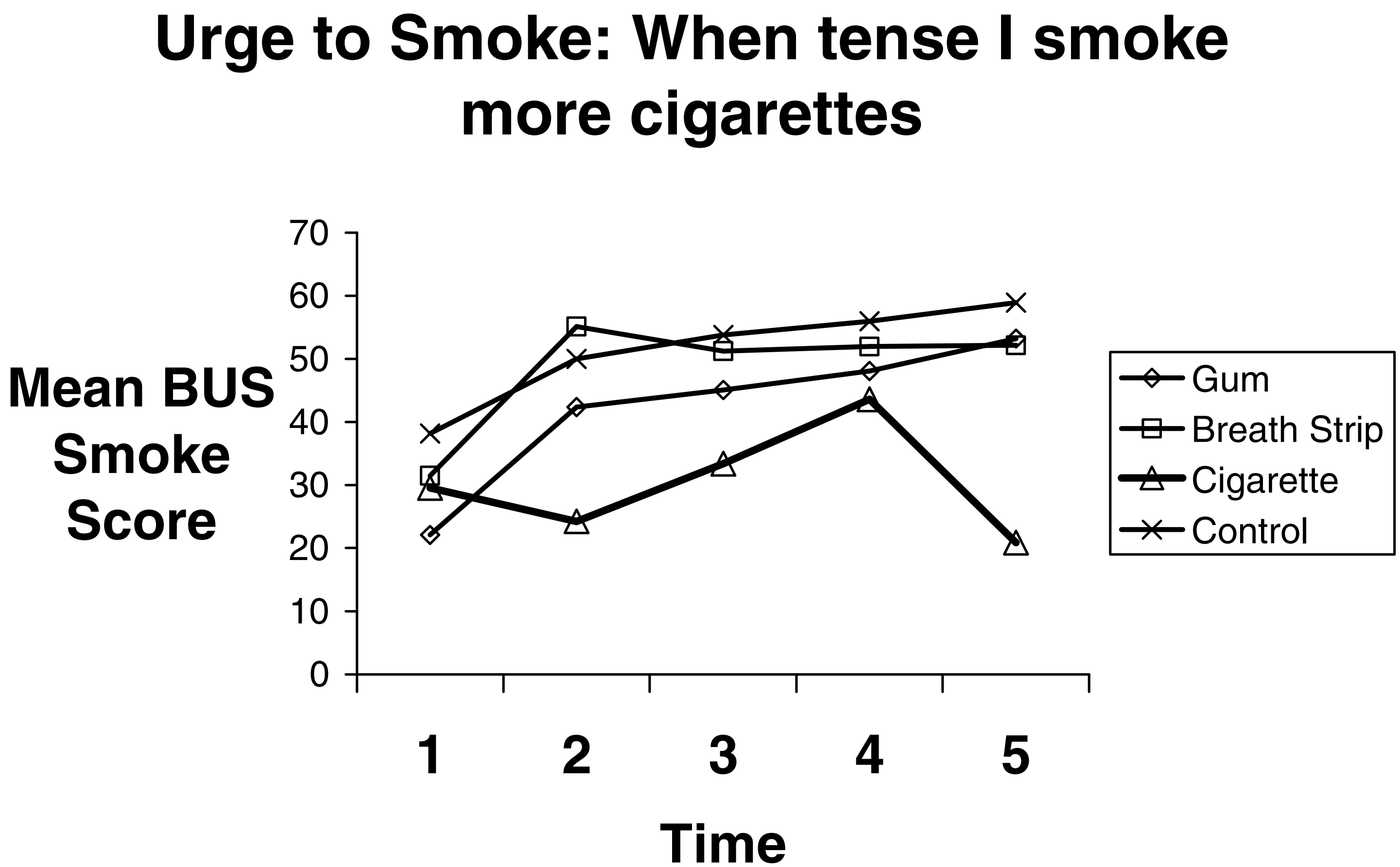


Figure 11

Mean State Anxiety Score for Participants Indicating They Chew Gum Frequently

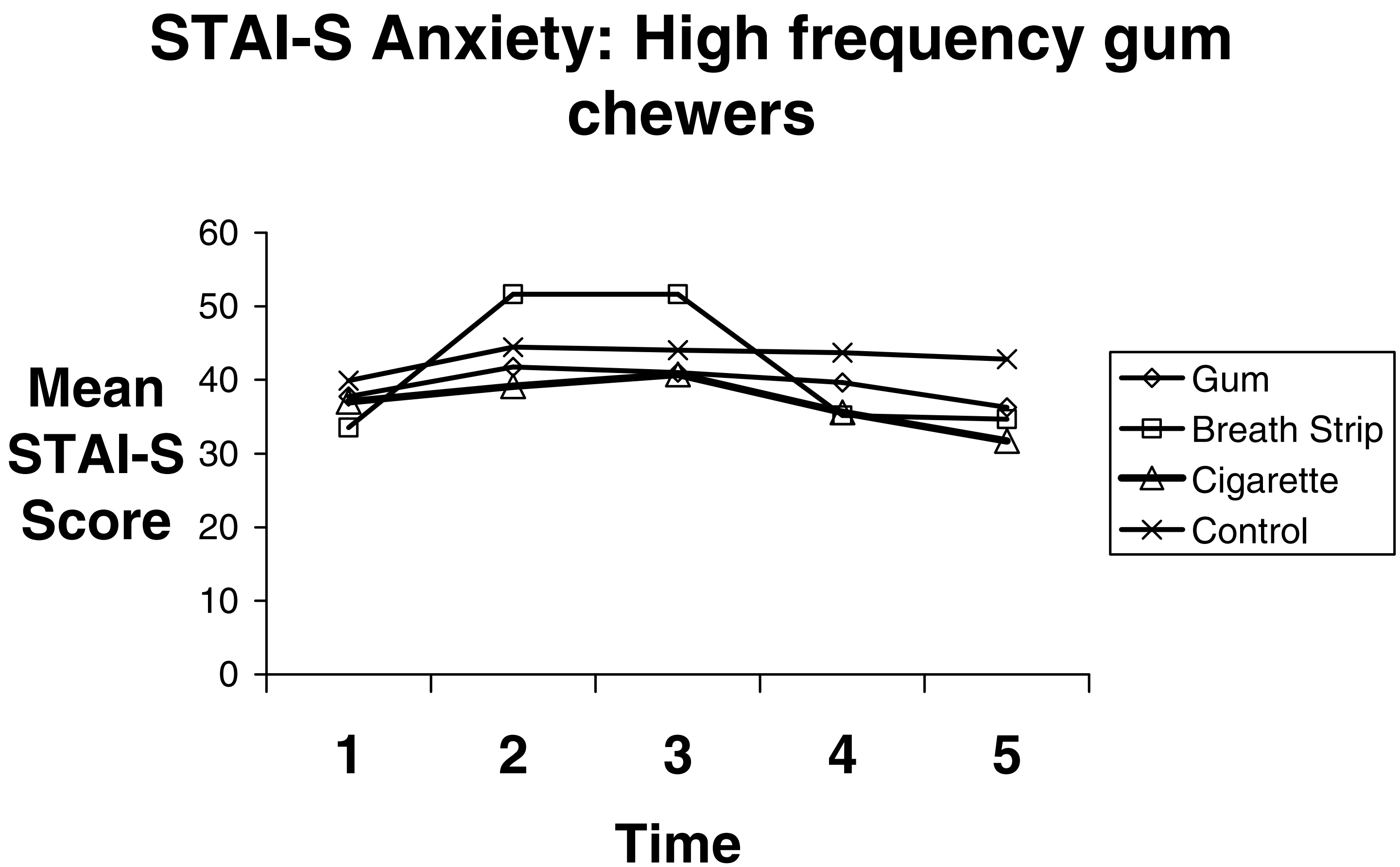


Figure 12

Mean Anxious Emotion Score for Participants Indicating They Chew Gum Frequently

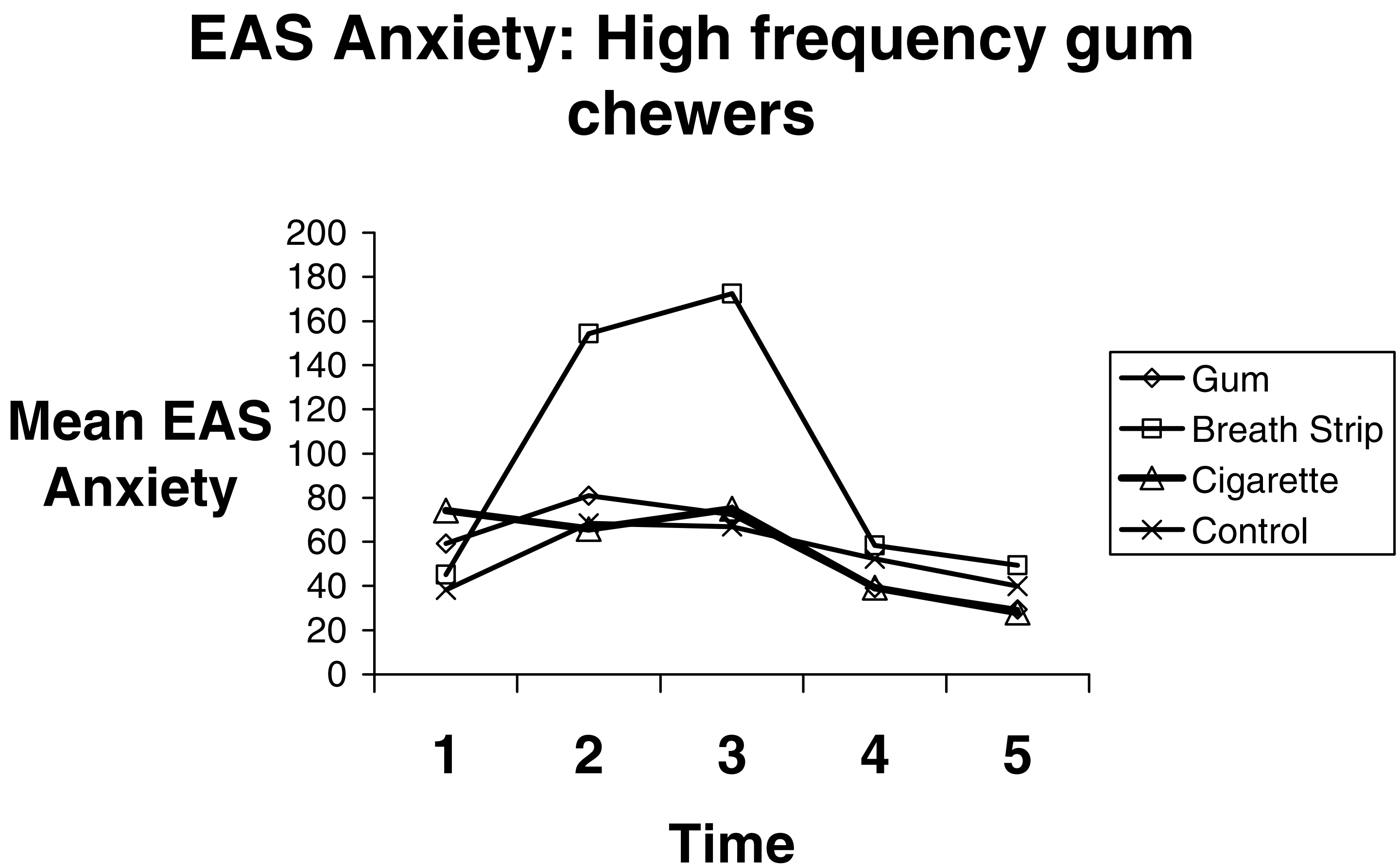


Figure 13

Mean Tobacco Withdrawal Score for Participants Indicating They Chew Gum Frequently

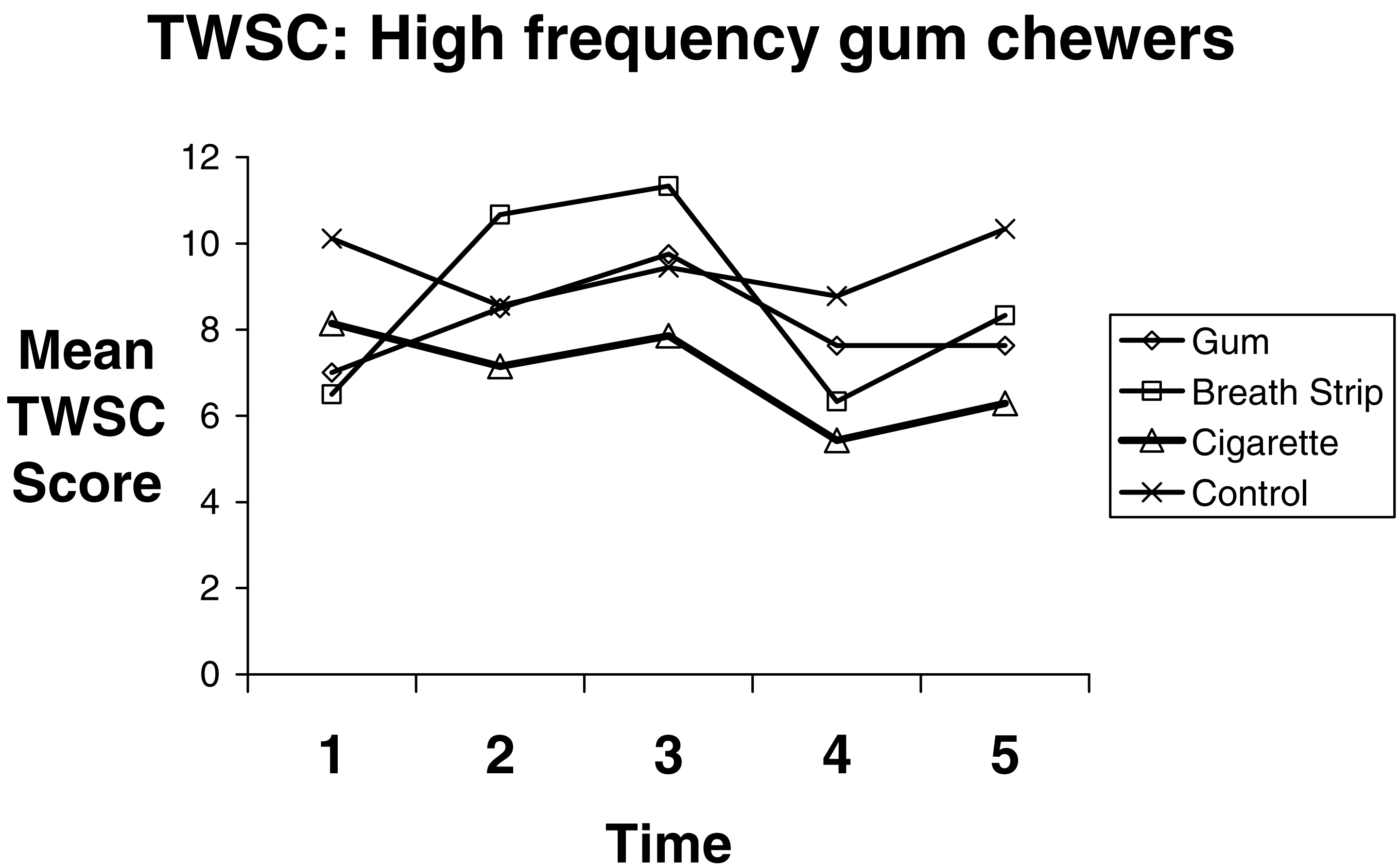


Figure 14

Mean Tobacco Craving Score for Participants Indicating They Chew Gum Frequently

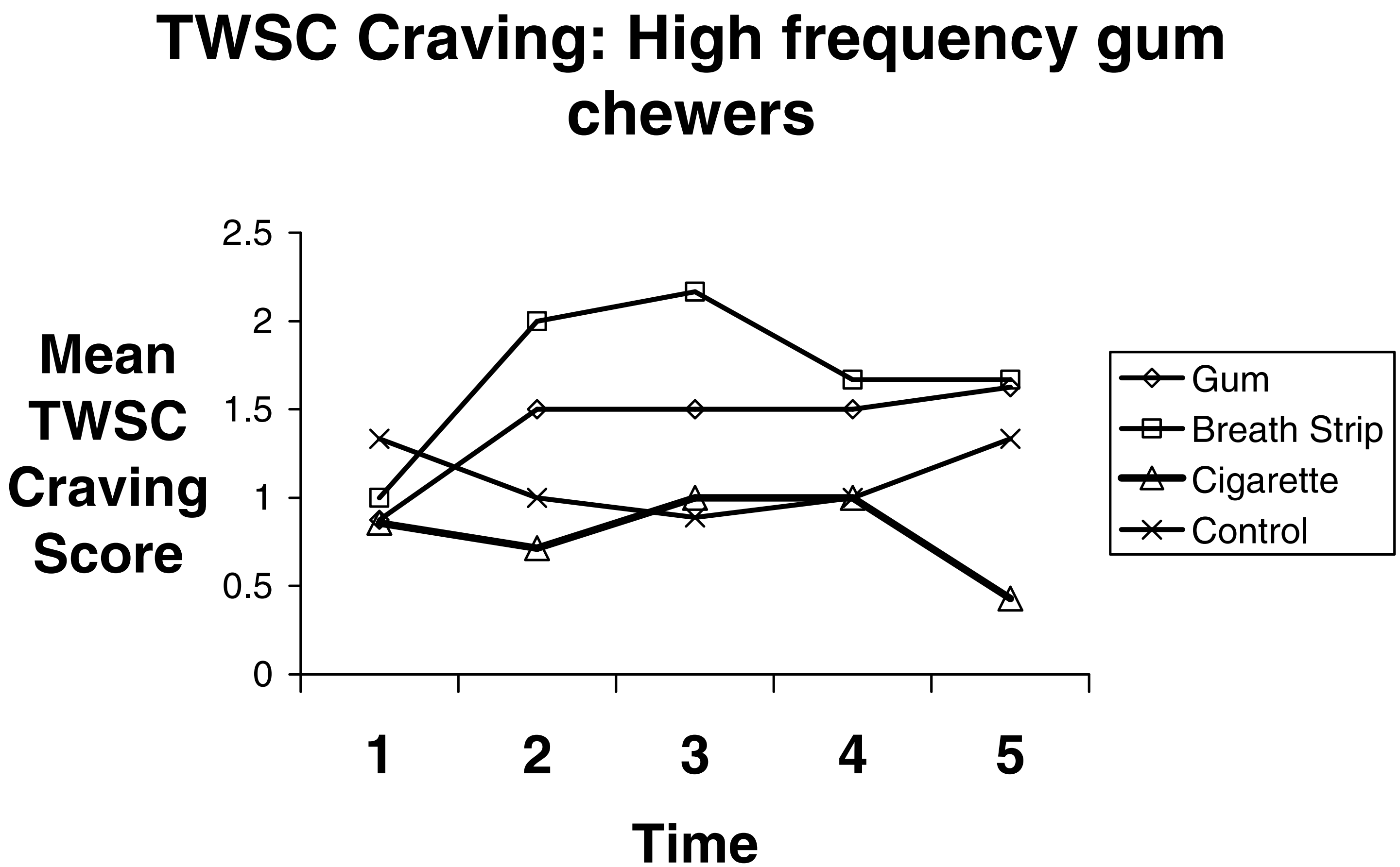


Figure 15

Mean Urge to Smoke Score for Participants Indicating They Chew Gum Frequently

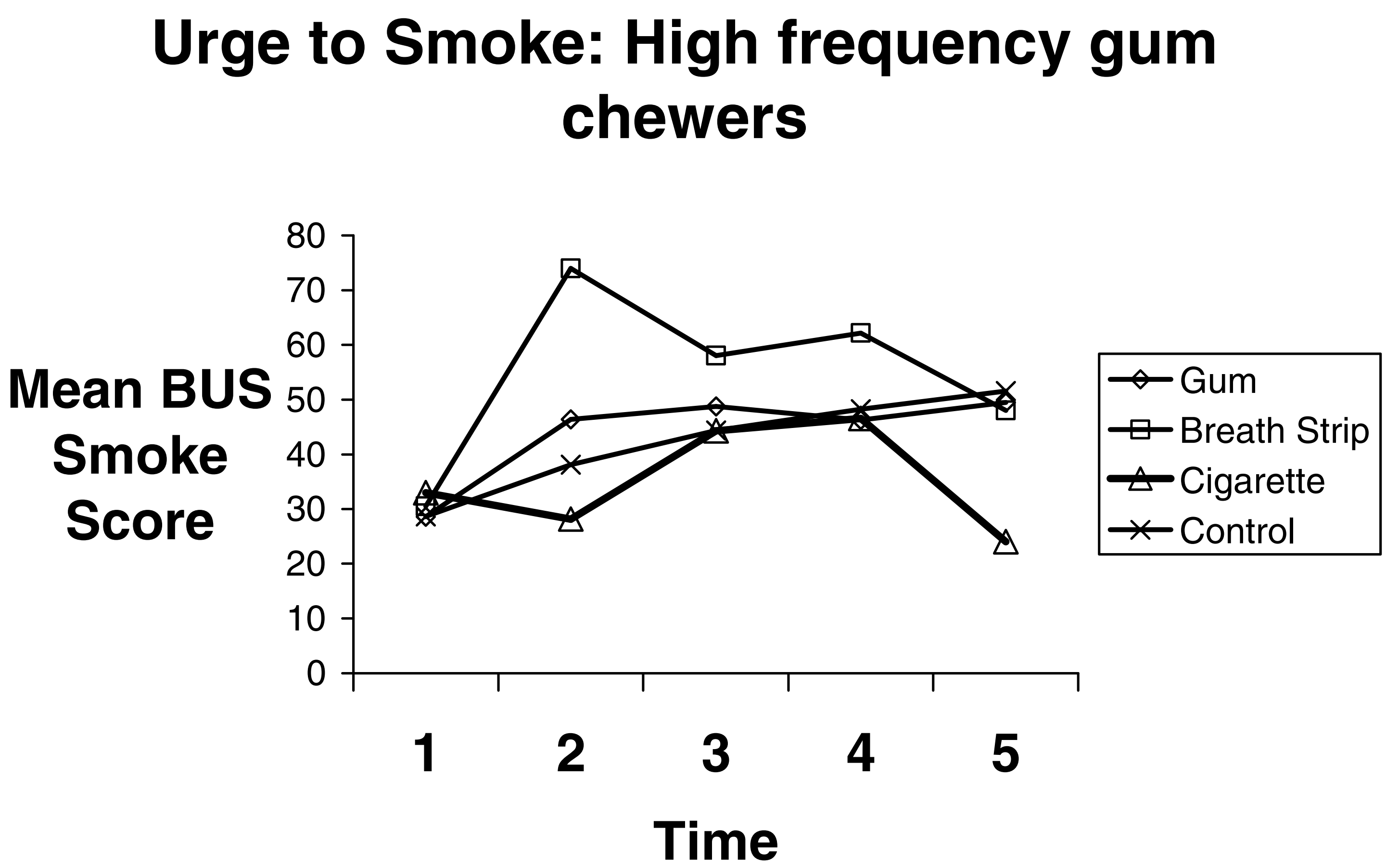


Figure 16

Mean State Anxiety Score for Participants Indicating They Chew Gum Infrequently

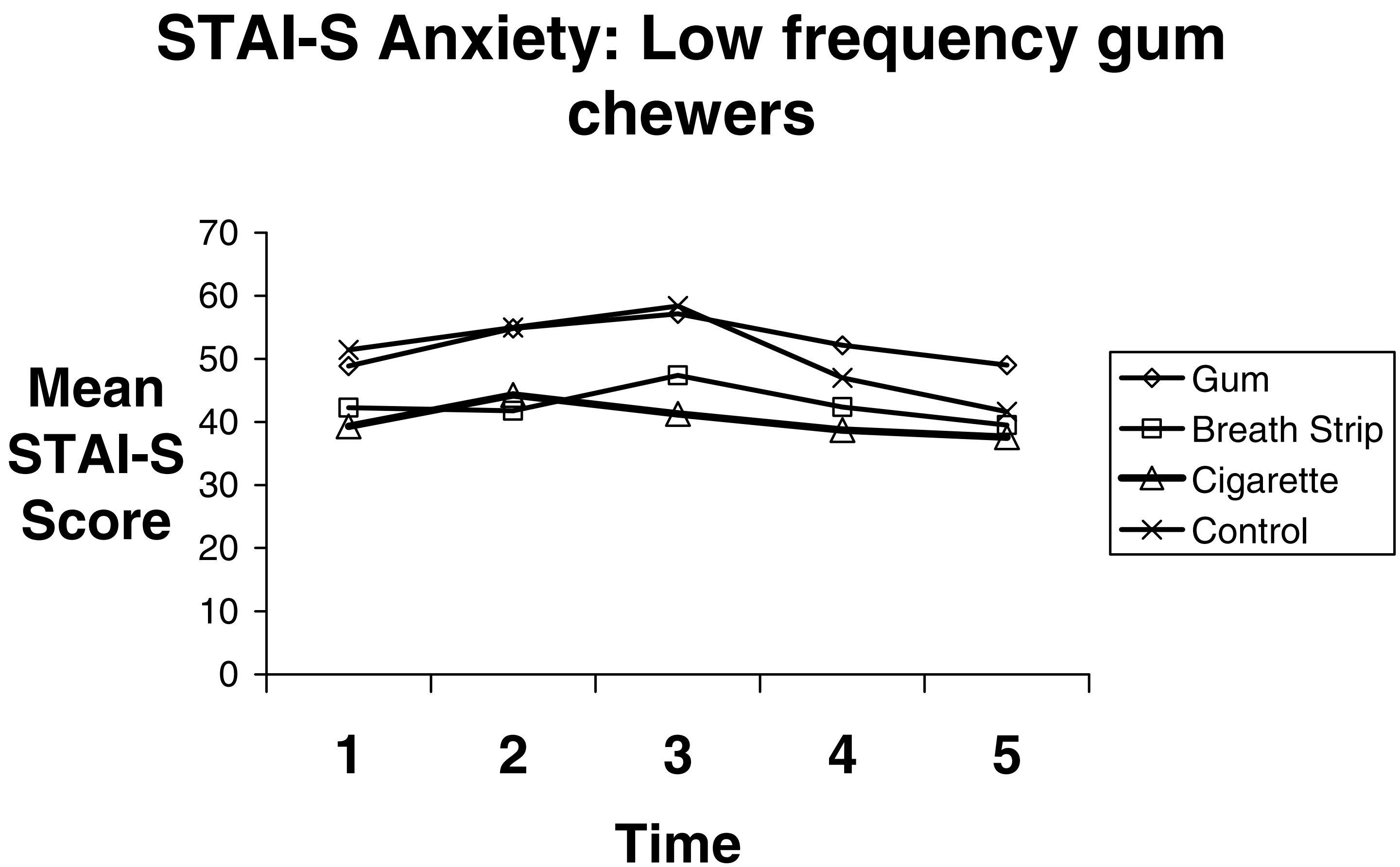


Figure 17

Mean Anxious Emotion Score for Participants Indicating They Chew Gum Infrequently

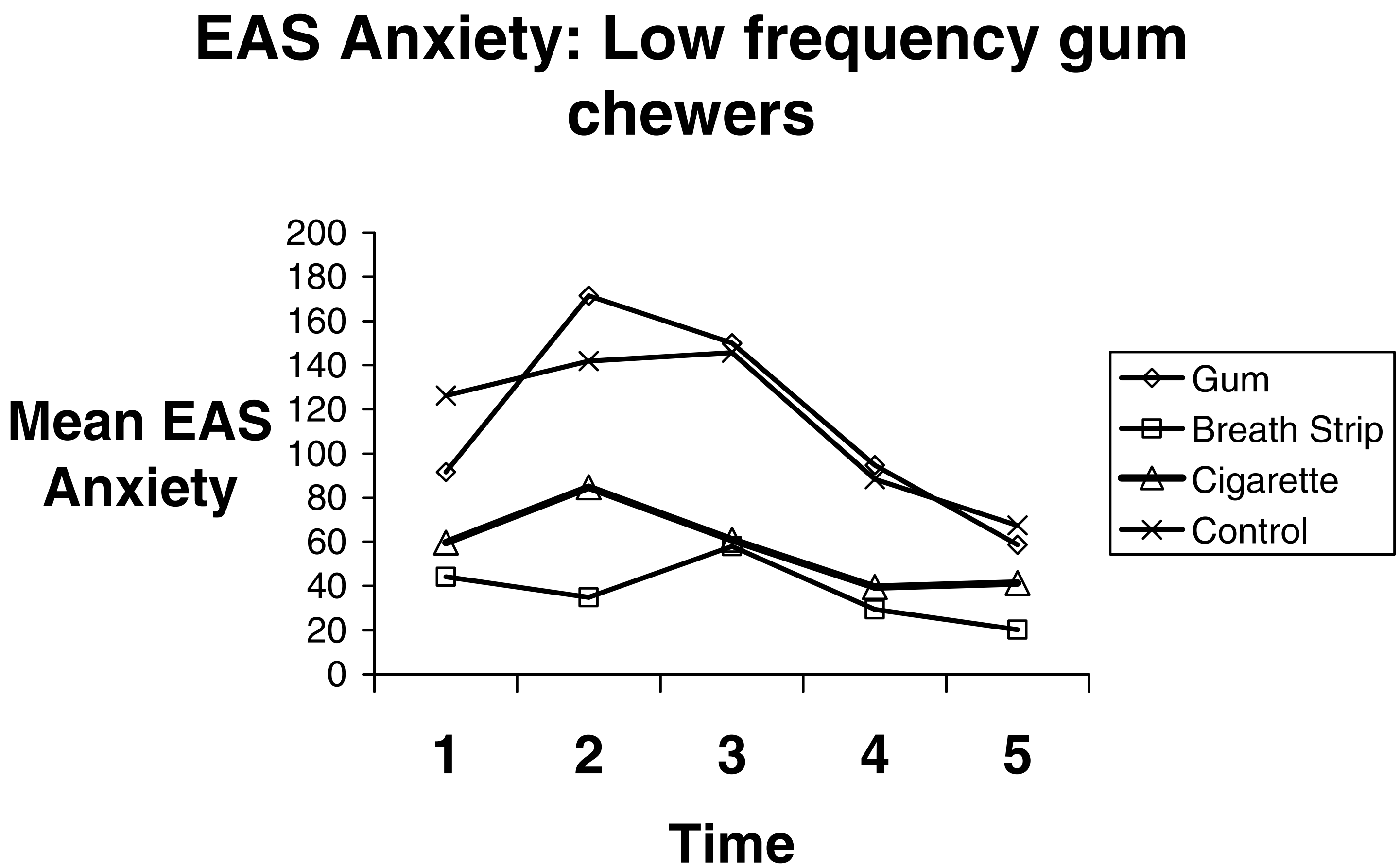


Figure 18

Mean Tobacco Withdrawal Score for Participants Indicating They Chew Gum Infrequently

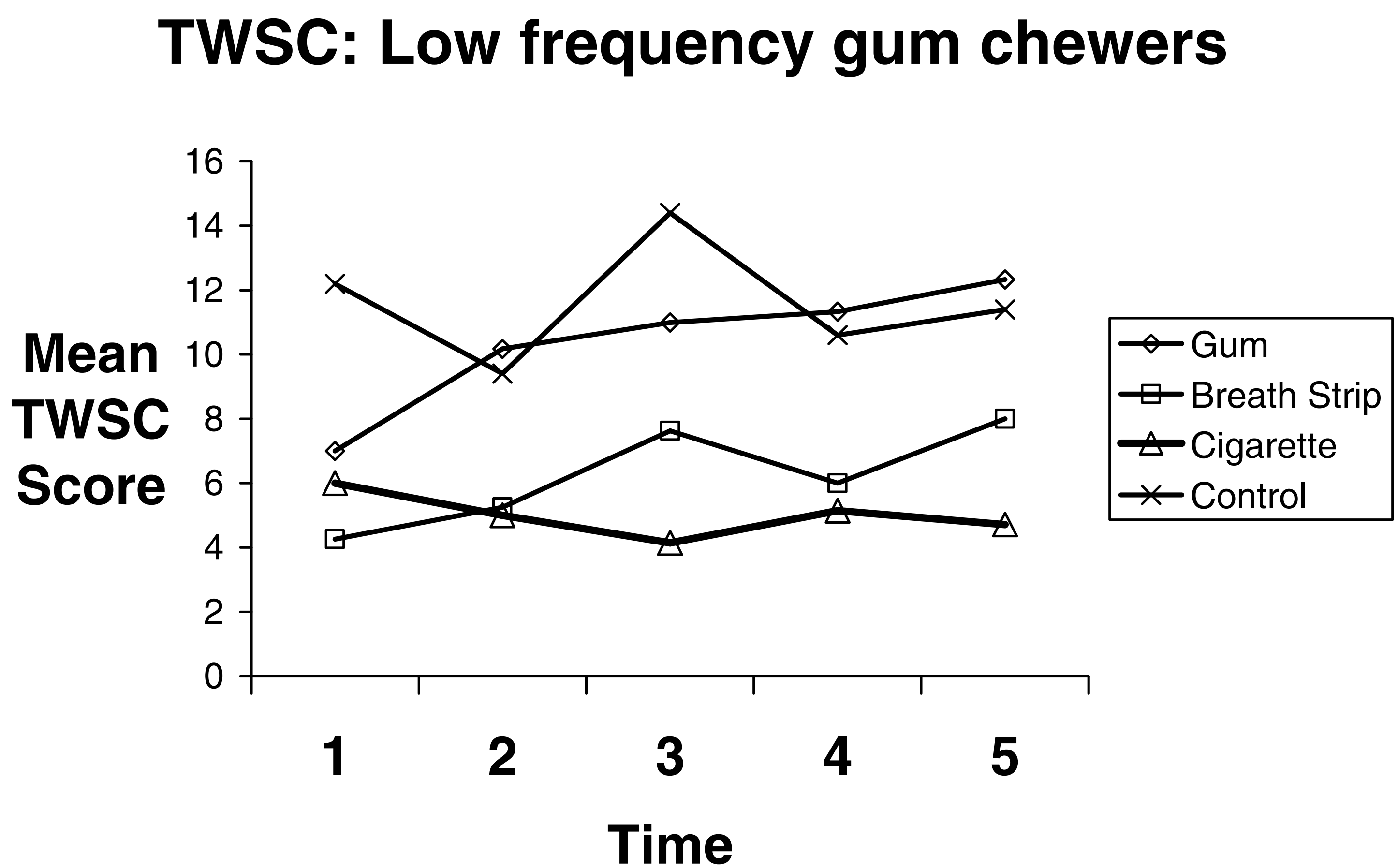


Figure 19

Mean Tobacco Craving Score for Participants Indicating They Chew Gum Infrequently

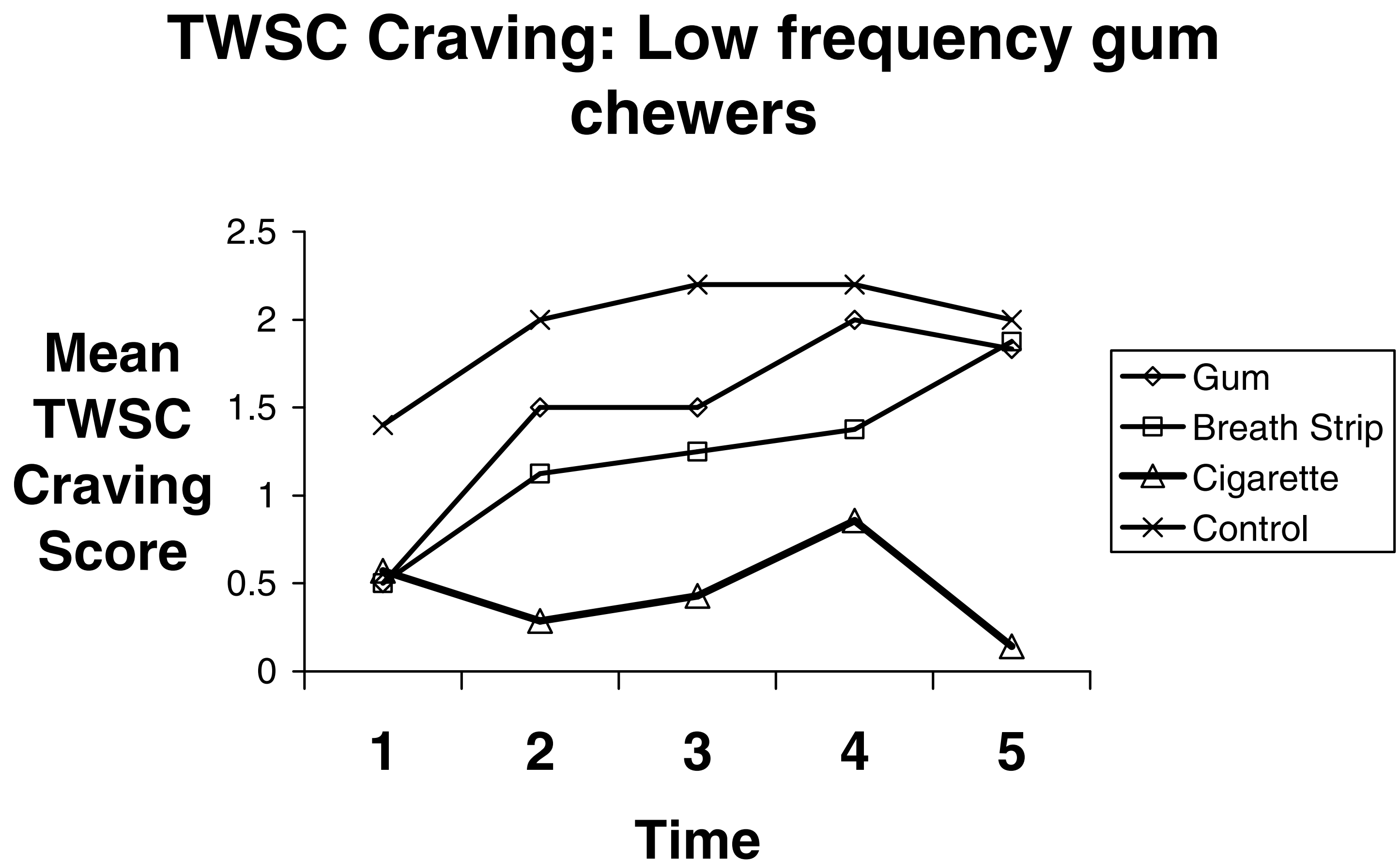
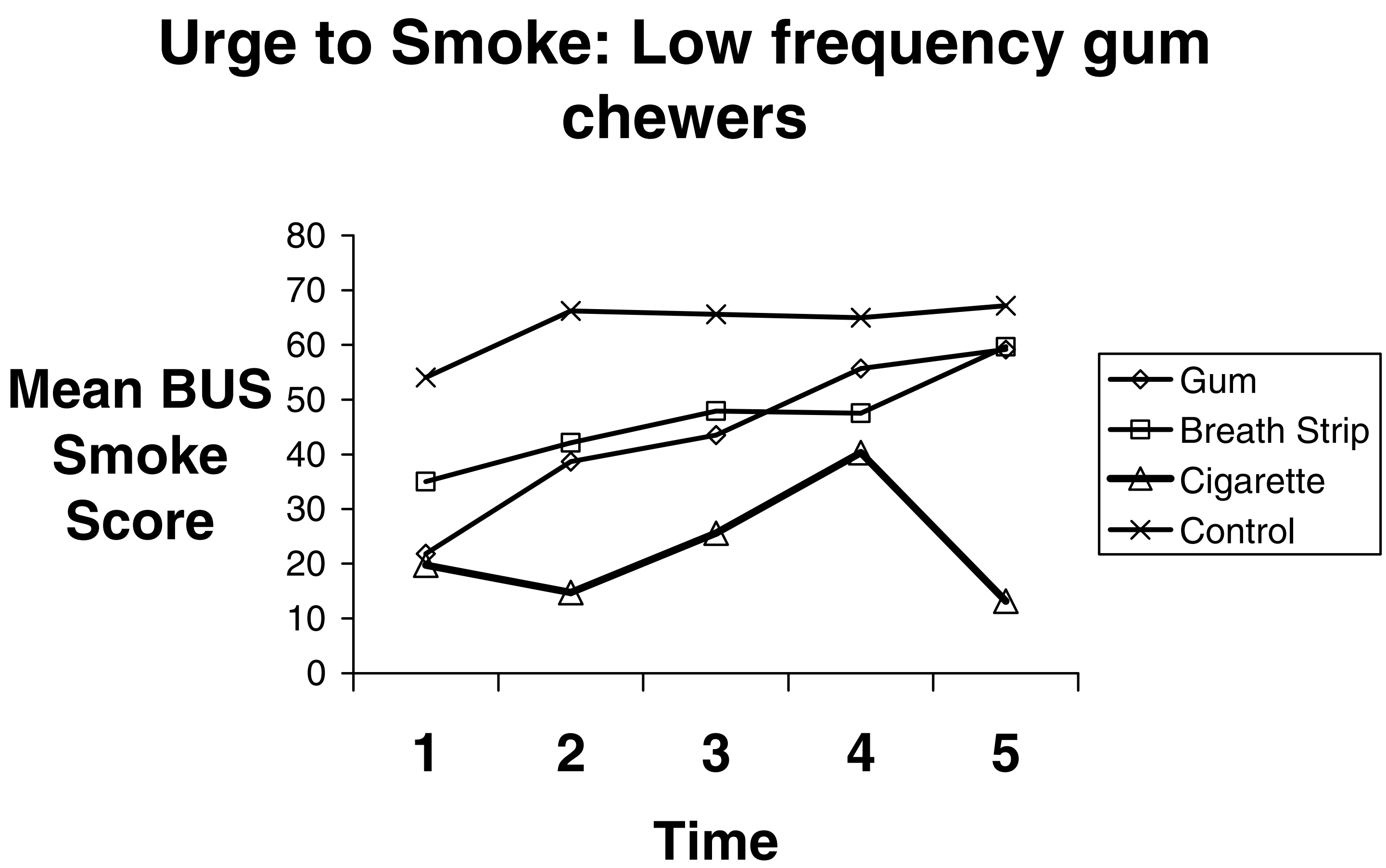


Figure 20

Mean Urge to Smoke Score for Participants Indicating They Chew Gum Infrequently



Appendix B

OKLAHOMA STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD APPROVAL

Oklahoma State University Institutional Review Board

Date	Wednesday, September 13, 2006	**Protocol Expires:**	**9/12/2007**
IRB Application No:	AS067		
Proposal Title:	Chewing Gum and Cigarette Smokers: Response to a Laboratory Stressor		
Reviewed and Processed as:	Expedited **Continuation**		

Status Recommended by Reviewer(s): **Approved**

Principal Investigator(s) :

Brian Miller 215 North Murray Stillwater, OK 74078	Frank L Collins 215 N Murray Stillwater, OK 74078

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

[X] The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

Signature : Sue C Jacobs

Sue C. Jacobs, Chair, Institutional Review Board

Wednesday, September 13, 2006
Date

VITA

Brian Isaac Miller

Candidate for the Degree of

Doctor of Philosophy

Dissertation: CHEWING GUM AND CIGARETTE SMOKERS: RESPONSE TO A LABORATORY STRESSOR

Major Field: Clinical Psychology

Biographical:

Personal Data: Born in Brooklyn, NY, on May 17, 1978, the son of Marc Miller and Marilyn Brettschneider.

Education: Graduated from Midwood High School, Brooklyn, New York, in June 1996; received a Bachelor of Science degree in Psychobiology in May 2000 from the State University of New York at Binghamton; received a Master of Science degree in Psychology in August 2005 from Oklahoma State University, Stillwater, Oklahoma. Completed the requirements for the Doctor of Philosophy degree in Clinical Psychology at Oklahoma State University in July 2007.

Experience: Employed by Oklahoma State University as a graduate teaching assistant from 2001 – 2002, and as a graduate instructor from 2002 – 2006. Volunteered as a graduate practicum student at the Substance Abuse Treatment Unit of the VA Medical Center of Oklahoma City from 2003 – 2004. Also volunteered as a graduate practicum student at the Neuropsychology Laboratories of the University of Oklahoma Health Sciences Center and VA Medical Center of Oklahoma City from 2004 – 2006. Completed pre-doctoral internship at the University of Mississippi Medical Center from July 2006 - June 2007.

Professional Memberships: American Psychological Association
Association for Behavioral and Cognitive Therapies
International Neuropsychological Society

Name: Brian Isaac Miller Date of Degree: July, 2007

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: CHEWING GUM AND CIGARETTE SMOKERS: RESPONSE TO A LABORATORY STRESSOR

Pages in Study: 104 Candidate for the Degree of Doctor of Philosophy

Major Field: Clinical Psychology

Scope and Method of Study: Several studies have suggested that chewing gum can assist individuals to manage symptoms associated with nicotine withdrawal. Likewise, recent work in our laboratory has indicated that chewing gum may aid dependent smokers in recovery from a laboratory stressor; however, this was not replicated with nonsmokers. Collectively, this research suggests that chewing gum may function by reducing overall stress levels associated with removal of nicotine from the body, and at least for smokers, it helps reduce laboratory stress. The present study was designed to extend previous research by reexamining the relation between gum chewing and stress reduction in smokers experiencing acute nicotine withdrawal, as well as a potential mechanism for the stress reduction by using a non-chewing oral control (breath strips) that share flavor properties of gum without chewing. Participants were assigned to four conditions: Chewing Gum, Breath Strip (Chewing Control), Cigarette, and Non-oral Control. A total of 56 participants were studied (14 per group). The experimental procedure was identical to previous studies conducted in our laboratory which indicated that chewing gum was helpful in the recovery from acute stress. Participants were exposed to a public speaking task followed by a 30 minute recovery period. Measures of subjective stress were obtained using the State-Trait Anxiety Inventory and the Emotion Assessment Scale. Symptoms of acute nicotine withdrawal were obtained using the Tobacco Withdrawal Symptom Checklist and a measure developed for the present study.

Findings and Conclusions: Analyses indicated that the public speaking task was successful in significantly increasing levels of negative emotions for all participants irrespective of group assignment. Post-stressor, significant reductions in anxiety were observed; however, these reductions also occurred irrespective of group. Overall, the results of the present study found that dependent smokers were not aided by chewing gum as a means to regulate negative emotions. Additionally, gum chewing was not found to be associated with the amelioration of symptoms associated with acute nicotine withdrawal.

ADVISER’S APPROVAL: Frank L. Collins, Ph.D.