CHEWING GUM AND NON-SMOKERS: RESPONSE TO A LABORATORY STRESSOR

By

BRIAN ISAAC MILLER

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Thesis Approved:

Frank L. Collins, Jr.

Thesis Adviser

Thad R. Leffingwell

David G. Thomas

A. Gordon Emslie

Dean of the Graduate College

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Chewing Gum and Non-smokers: Response to a Laboratory Stressor

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 as capable of improving concentration and easing tension (Wilkinson & Scholey, 2002), increases blood circulation to the mouth and brain (Nakata, 2003), reduces postprandial acid reflux (Robinson, 2003), and increases salivary flow that is important to oral health (Dawes, 2003). The William Wrigley Company, the world's largest manufacturer of chewing gum, had promoted gum chewing as a healthy alternative activity to smoking throughout the 1980's and 1990's. As would be expected, this advertising campaign has 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), 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 suggest that chewing gum, which is relatively low-cost and free of health risks, decreases desire to smoke.

Recent studies have suggested that chewing gum can help an individual to manage symptoms associated with nicotine withdrawal (Cohen, Collins, & Britt, 1997; Cohen, Britt, Collins, al'Absi, & McChargue, 2001; Britt, Cohen, Collins, & Cohen, 2001). Likewise, recent work by Britt and colleagues (2001) has indicated that chewing gum may also aid 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.

Despite research in the use of chewing gum among smokers, there is little data in regards to the use of chewing gum among 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. Since then, there have been no empirical studies conducted to evaluate the role of chewing gum as a stress management technique. Consequently, the goal of the proposed study is to examine whether chewing gum influences subjective levels of stress and anxiety in non-smokers in response to a laboratory induced stressor.

In order to provide a context for the proposed 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. 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 will be conducted. Finally, proposed analyses will also be presented.

CHAPTER II: REVIEW OF THE LITERATURE

The main hypothesis of the current study is that the physical act of chewing gum has the effect of reducing subjective stress. Evidence to support this claim is provided in the following literature review section. In order to highlight why chewing of gum is believed to have stress ameliorating properties an examination of research focusing on chewing behavior (not gum chewing), gum chewing, 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.

Stress and Oral Activities

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. The studies also illustrate that cognitive deficits 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 30 minute 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.

Taste

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, Barr, Sherrard, Lessard, Harris and Young (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 of 99 children, of ages 7.3 to 12.2 years, of a large metropolitan hospital for blood collection. 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 affect 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 regards 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 affects 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 affect 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 current project.

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 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) noted on 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 were 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 (Kirschbaum et al., 1995; al'Absi et al., 1997); however, no gender differences emerged. On the other hand, 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) have been replicated in the present study and are detailed in the methods section of this proposal. 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 only, 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 Emotion Assessment Scale - Anxiety (EAS-ANX).

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.

The Present Study

The present study is designed to examine whether gum chewing has a stress reducing effect independent of the effect observed during nicotine deprivation. In essence, the present study is a replication of Britt et al., (2001), which examined the relationship between nicotine withdrawal, craving and gum chewing in smokers. Data from this study suggested that gum chewing may help a nicotine-deprived smoker by decreasing the subjective feeling of stress imparted by withdrawal and craving. However, the literature is lacking in examining the relationship between gum chewing and stress in individual who are not undergoing nicotine withdrawal. In order to determine if chewing gum has a stress reducing effect, independent of the ability to attenuate nicotine withdrawal symptoms, the present study evaluated the effectiveness of chewing gum in relieving laboratory-induced stress in non-smokers.

The current study assessed anxiety throughout the experimental session using multiple self-report measures. A 3 X 5 mixed-factorial design was used, with independent variables of interest: (a) Group condition, with three (3) levels: Gum, Breath Strip (oral control), 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; 10 minutes after the speech).

The three dependent variables (state anxiety, anxious emotion, and urge to chew) 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 and gum chewing behavior was administered.

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

Hypotheses

<u>Hypothesis 1 – State Anxiety</u>. It was predicted that groups will differ in state anxiety as measured by the State-Trait Anxiety Inventory-State (STAI-S; Spielberger,

Gorsuch, Lushene, Vagg & Jacobs, 1983) at assessment points 2-5. It was expected that a significant increase in state anxiety would be found for all three groups in anticipation of the stressor (assessment points 2-3), however, no significant differences between groups was expected. Additionally, 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 other two groups, and further, the Breath Strip Group and Control Group would be indistinguishable from each other. Specifically, 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).

Hypothesis 2 – Anxious Emotion. It was predicted that groups will differ in anxious emotion as measured by the Emotion Assessment Scale – Anxiety subscale (EAS-ANX; Carlson et al., 1989) at assessment points 2-5. It was expected that significant increases in anxious emotion would be found for all three groups in anticipation of the stressor (assessment points 2-3), however, no significant differences between groups were expected. Specifically, it was predicted that the group with access to chewing gum (Gum Group) would report lower levels of anxious emotion than the Breath Strip Group and the Control Group; however, the latter two groups would be indistinguishable from each other. 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).

Hypothesis 3 – Urge to Chew. It was predicted that groups would differ in urges to chew gum at assessment points 2-5 as measured by a questionnaire of chewing urges developed for this study. Specifically, it was predicted that the group with access to chewing gum (Gum Group) would report significantly lower levels of urges to chew than the Breath Strip Group and Control Group (assessment points 2-5). Additionally, it was expected that participants in the Breath Strip Group and Control Group would report equally higher urges to chew gum than the participants in the Gum Group. Also, urges to chew gum were expected to increase from assessment points 2-5 for the Breath Strip Group and Control Group, whereas urges to chew gum for the Gum Group were expected to remain constant. Lastly, it was expected that the largest urges to chew gum, by the Breath Strip Group and Control Group, would be reported at Time 5. This secondary prediction was based on Britt et al. (2001) who found that urges to engage in a behavior (e.g., smoking) that is associated with stress reduction, increase steadily throughout the experimental procedure.

CHAPTER III METHODOLOGY

Subjects

A total of 58 participants, 18 each in the Gum Group and Control Group and 22 in the Breath Strip Group, described below, were recruited from undergraduate courses at Oklahoma State University. 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) regular/daily gum chewing, (b) to be non-smokers, (c) not currently taking psychoactive medications, (d) no medical problems which would exempt participation, (e) no recent (e.g., past three months) life events, (f) to be at least 18-years-old and willing to give informed consent. The eligibility requirements excluded 15 potential participants from being included in the study due to; previous psychological treatment ($\underline{n} = 6$), no regular gum chewing ($\underline{n} = 4$), not stressed by the laboratory stressor ($\underline{n} = 4$), or had a wired broken jaw ($\underline{n} = 1$).

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 three participants of the same gender were treated as a block. The first participant in a block was randomly assigned to one of the three conditions. The second participant in the block was assigned to one of the remaining two conditions, and the third participant was assigned to the remaining condition of that block. This procedure was repeated for the entire sample.

Measures used to describe sample

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 chosen to allow for a quick and non-invasive assessment of regular gum use, depressed mood, trait anxiety, recent events that account for elevated anxiety, and fear of public speaking. Furthermore, these measures ensured that our sample was of regular gum chewers, not experiencing any chronic or acute stressors that could account for experiencing anxiety over and beyond the stressor, and that the stressor was a task that was perceived as anxiety provoking, respectively. 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.

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

Beck Depression Inventory-2 (BDI2; Beck& Steer, 1987). The BDI2 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. Due to the high comorbidity between depression and anxiety, participants scoring in the severe range (29-63) of depression (Beck, Steer, & Brown, 1996) were excluded to ensure that the experimental procedure accounted for the anxiety experienced, not unknown factors.

Overall the BDI2 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 BDI2 has demonstrated good content, discriminant, concurrent, and factorial validity (Beck et al., 1987).

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 S-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).

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 Chronbach 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.

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. The questions regarding cigarette use was removed from the HHQ since the sample was pre-screened to have a non-smoking status. This information was used for descriptive purposes only.

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).

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) will be used in this study. Items are rated from 1 ("Least Possible") to 7 ("Most Possible"), and scales range from 3 to 21. Higher scores indicate greater levels of the specified emotion. The addition of a second anxiety measures allows for a thorough and multiple assessment of the target construct, anxiety.

The EAS demonstrates good to excellent psychometric properties. Coefficients for interitem 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).

Questionnaire of Chewing Urges (QCU). The QCU is a 33-item, self-report questionnaire designed to assess an individual's urge to chew gum. This questionnaire is derived from the 32-item Questionnaire of Smoking Urges (QSU; Tiffany & Drobes); however, all wording had been revised from "smoke" to "chew." The additional question added to the QCU (question 1) required the participant to give an overall urge to chew gum rating. The QSU demonstrates two factors to explain desire to chew. Factor 1 reflects anticipated pleasure (e.g., enjoyable, tastes good) and Factor 2 reflects anticipated relief of negative affect. A factor analysis of our sample provided insight to why individuals choose to chew gum. No psychometric properties are known for this new measure. Only the first question, assessing overall urge to chew, was used in the analyses.

Dependent Measures

Three of the instruments listed above (e.g., STAI-S, EAS, and QCU) were repeatedly administered at each of the assessment points to assess state anxiety, anxious emotion, and urge to chew gum.

Procedure

Volunteers were recruited from undergraduate courses at Oklahoma State University for a study examining habits of college students. Potential participants were initially contacted by email to confirm or acquire a telephone number in which they could be reached for a prescreening interview, the Chewing Gum Questionnaire, modified. This served to confirm the status of regular gum chewer and preferred gum of choice. Each session was scheduled to last 2 hours.

A detailed outline of the time course of the 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 and obtained signed consent.

After consent was obtained, participants were asked to complete the Time 1 instruments: demographic information, HHQ, BDI2, EAS, STAI-S, STAI-T, SRRS, AAS, QCU and chewing gum survey. 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 gum chewing abstinence period of 45 minutes was assured

Once 45 minutes have 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 would 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 ever occurred. 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).

Based on group placement, predetermined prior to the participants' arrival using the procedure described in the subjects section, participants were instructed to either (1) chew 1 piece of gum (Gum Group), (2) place 1 breath strip on their tongue (Breath Strip Group/Oral Control Group), or (3) do nothing (Control Group), immediately following the instructions for the speech. A study experimenter verified that the participants in the Gum Group started chewing and that the participants in the Breath Strip Group placed the breath strip on their tongue. Participants in the Gum Group and Breath Strip Group were also informed that they would be free to chew gum (Gum Group only) or use breath strips (Breath Strip 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), or no special instructions were given (Control Group). This instruction ensured that all participants in the Gum and Breath Strip 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), and urge to chew/withdrawal symptoms (QCU). The order in which the instruments were completed across all assessment periods was randomly determined (i.e., experimenter shuffled order of measures prior to the experimental session).

When the participants completed the Time 2 measures they were notified that they had “two minutes” to mentally prepare for the speech. Participants in the Gum Group and Breath Strip Group were also reminded that they could continue chewing gum or using breath strips, respectively, if they desired to do so while preparing for the speech. At this point in time 20 minutes had not elapsed since inserting the first piece of gum or breath strip, therefore participants were not required to replace their gum or insert another breath strip. 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 had elapsed, the experimenter said “stop”, and asked the participants to rate their feelings of anxiety, anxious mood, and urge to chew, prior to the speech, (Time 3) by administering the STAI-S, EAS, and QCU measure.

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 via intercom to dispose of any chewing gum or to not insert another breath strip. At that moment the participants were instructed to begin their speech and that the experimenter signaled 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 intercom was turned off during the time that the participant gave their 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) and use breath strips (Breath Strip Group only) for the remainder of their time in the laboratory. Of note, participants were only required to chew gum

(Gum Group only) and use breath strips (Breath Strip group only) in intervals of 20 minutes, as stated earlier. All participants were asked to rate their feelings of anxiety, anxious mood, urge to chew, as assessed using the STAI-S, EAS, QCU, based on how they are feeling at that moment (Time 4).

When participants completed the Time 4 measures they were instructed to "relax for a short time" and reminded again that they had access to chewing gum (Gum Group only) or access to breath strips (Breath Strip Group only) for the remainder of the experiment. If 20 minutes had elapsed since last instruction to insert chewing gum or a breath strip, then participants were instructed to insert another piece of chewing gum or breath strip, based on group assignment. Participants were also reminded that they could work on crossword puzzles or reading of 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, and QCU once again to assess for anxiety, anxious mood, and urge to chew at that moment (Time 5).

A study experimenter entered 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. Three participants were compensated $10 for the time and participation. The remaining participants who were currently enrolled in psychology classes had their names and number of hours spent in the study recorded, which allowed for their instructor to decide how much extra credit or research participation credit would be allotted.

CHAPTER IV: RESULTS

Overall Analytic Strategy

The study used a 3 X 5 mixed-factorial design, with two independent variables: (a) Group Condition, with three levels: Gum, Breath Strip, 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), and urge to chew (QCU) were measured at all five assessment points.

To assess change over assessment points, three 3 (Group) X 5 (Time) repeated-measures analyses of variance (ANOVAS) were conducted to specifically assess state anxiety, anxious emotion, and urge to chew as measured by the STAI-S, EAS-ANX, and QCU, respectively. 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 3 (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. 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. It is also noted that no significant gender differences were found and therefore all remaining analyses were performed on the full sample (N = 58).

Repeated Measures Analysis of Variance

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 other two groups, and further, the Breath Strip Group and Control Group would be indistinguishable from each other at both pre-stressor and post-stressor. A 3 X 5 repeated-measures ANOVA was conducted. A significant main effect for Time only was found [F (4,220) = 41.42, $p < .001$, partial eta squared = .430, power = 1.00]. No main effect of Group [F (2,55) = .11, $p > .05$, partial eta squared = .004, power = .068] nor of the Group x Time interaction was found [F (8,220) = 1.25, $p > .05$, partial eta squared = .043, power = .568]. 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 three 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 group instructed to chewing gum (Gum Group) would report lower levels of anxious emotion than the Breath Strip Group, which would report lower levels of anxious emotion than the 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).

A 3 X 5 repeated-measures ANOVA was employed. A significant main effect for Time only was detected [F (4,220) = 37.58, p < .001, partial eta squared = .406, power = 1.00]. The interaction between Group X Time and the main effect for Group were both non-significant [F (8,220) = .21, p > .05, partial eta squared = .008, power = .115 and F (2,55) = .43, p > .05, partial eta squared = .015, power = .120]. These findings suggest that the observed group 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 three groups displayed significant decreases in post-stressor anxiety that were not significantly different from each other (See Figure 2).

Hypothesis 3 – Urge to Chew. It was predicted that groups would differ in urges in chew gum as measured by the questionnaire of chewing urges (QCU), developed for this study, at assessment points 2-5. Specifically, it was predicted that the group instructed to chewing gum (Gum Group) would report lower levels of urges to chew than the Breath Strip Group. Additionally, it was expected that the Breath Strip Group and Control Group would report equally high levels of urges to chew than the Gum Group.

Lastly, it was expected that urges to chew gum would be lowest for the Gum Group at Time 5.

A 3 X 5 repeated-measures ANOVA was conducted. A significant main effect for Time only was detected [F (4,200) = 7.71, $p < .001$, partial eta squared = .134, power = .997]. The interaction between Group X Time and main effect for Group were both non-significant, [F (8,200) = .86, $p > .05$, partial eta squared = .033, power = .396, and F (2,55) = 2.04, $p > .05$, partial eta squared = .076, power = .401] indicating that observed group differences in urge to chew gum is better explained by the factor of Time than Group.

It was expected that the effect of lack of gum, as exhibited as an increase in urge to chew gum, would have been observed to be consistently greater at Time 2 – Time 5 in those individuals that had no access to chewing gum (Breath Strip and Control groups), consistent with Britt et al. (2001). However, this was not found. All three groups exhibited a general trend of reduction in urge to chew gum from the start to the end of the experimental session (see Figure 3).

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. Also, as seen in Figure 3, urge to chew gum did not increase for groups that did not have access to chewing as predicted. The means and standard deviations of the Gum, Breath Strip, and Control groups, across Time 1 – Time 5, on the STAI-S, EAS-ANX, and QCU are presented in Table 3.

CHAPTER V: DISCUSSION

General Findings

The primary aim of the present study was to investigate whether chewing gum exerts an anxiolytic effect in response to stress in non-smokers. Specifically, this study examined how using chewing gum and a no chew oral control, breath strips, during a laboratory stressor affects anxiety and urge to chew gum post stressor.

None of the proposed 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 or nothing. Additionally, an increase in urge to chew gum was not reported by those who did not have access to chewing gum.

Taken together, the results of the present study found that nonsmokers who are regular gum chewers, and were instructed to chewing gum, did not experience significant anxiety reduction when stressed, compared to those without access to chewing gum. Also, when stressed those without access to gum did not experience a craving for chewing gum. Therefore, chewing gum did not produce the proposed anxiolytic effect in response to the laboratory stressor used, (See Figures 1 and 2, Time 5). Secondly, since craving to chew gum by the group without access to chewing gum did not increase pre-stressor (See Figure 3, Time 2 – Time 3), and the group instructed to chew gum did not report the lowest urges at Time 5 (See Figure 3), it does not appear that regular gum chewers utilize chewing gum as a means to regulate negative emotions (e.g., stress and anxiety). If chewing gum use was positively correlated with negative emotion then we would have expected the no treatment group to report the highest urges to chew gum at Time 5, however the groups did not differ at Time 5. 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 examine whether the findings from Britt et al. (2001) generalized from a group of smokers to a group of nonsmokers. Britt et al. (2001) found that chewing gum in the presence of a laboratory stressor lead to subjective anxiety reduction post-stressor in a group of smokers. The results obtained in the present study do not support this generalization hypothesis, as participants instructed to chew gum did not report significantly less negative emotion post-stressor than the other groups (Breath Strip, Control).

An examination of effect sizes (partial eta squared) and power of the Group X Time interactions obtained for state anxiety, anxious-emotion, and urge to chew all 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 for nonsmokers is so small that it is likely not producing a meaningful change in subjective stress. Thus, the results from the present study and Britt et al. (2001), using the same experimental paradigm, suggest that the anxiolytic effect of chewing gum post-stressor is limited to a group of smokers that had been in acute nicotine deprivation.

Further, although the present study and Britt et al. (2001) utilized the same experimental stressor, it is reasonable to suggest that participants in both studies experienced different types of stress. Specifically, the participants in the previous study, except for the group with access to cigarettes, experienced the combined stress of the public speaking task and nicotine withdrawal. The participants in the present study only experienced the stress of the public speaking task, as all the groups reported decreases in urges to chew gum regardless of group.

Taking into consideration that the previous and present study's participants were experiencing different types of stressors, additional conclusions about the effect of chewing gum and cigarettes on laboratory stressor anxiety are warranted. First, Britt et al. (2001) found that urge to smoke and withdrawal symptoms increased throughout the experimental session for participants without access to cigarettes. In the present study, all participants reported a general decrease in urge to chew gum throughout the experimental session. Therefore it would appear that the emotional and physiological effects of smoking a cigarette and chewing gum on stress operate differently.

Secondly, Britt et al. (2001) found that withdrawal symptoms were significantly lower in participants who had access to cigarettes compared to chewing gum, however, participants who had access to chewing gum reported significantly fewer withdrawal symptoms than participants with access to nothing. Cohen et al. (1997) also demonstrated significant reductions in withdrawal symptoms in smokers who were prohibited from smoking but had access to chewing gum. It appears logical to conclude that individuals experiencing greater withdrawal symptoms would also experience greater levels of negative emotion (e.g., stress and anxiety).

Although no measure to access chewing gum withdrawal was used, and does not exist to the knowledge of the present researchers, it is reasonable to believe that urge and withdrawal to chew gum would follow a similar trend. Consequently, it does not appear that the groups that did not have access to chewing gum experienced significant increases in negative emotion over that induced by the laboratory stressor due to the lack of access to chewing gum, as indicated by no increase in urge to chew post stressor in the non-gum groups. In contrast, the no treatment group in Britt et al. (2001) reported the highest urge to smoke as well as the highest level of anxiety.

Thirdly, the main finding of Britt et al. (2001) demonstrated that chewing gum produced significant reductions in the combined anxiety produced from the public speaking task and nicotine withdrawal compared to the control group. The main finding from the present study was that chewing gum produced non-significant reductions in anxiety produced from the public speaking task compared to the control group.

Lastly, these three additional conclusions about the effect of chewing gum and cigarettes on laboratory stressor anxiety appears to suggest that the significant reduction in reported anxiety by participants in the chewing gum group in the previous study is better explained by chewing gums' reduction of nicotine withdrawal. Thus, it would also appear that a true anxiolytic effect of chewing gum may be limited to its' effects on nicotine withdrawal.

Exploratory Analyses

Post hoc it was hypothesized that participant's beliefs about why they chew gum moderate the relationship between the dependent measures (anxiety, anxious-emotion, and urge to chew gum) and group assignment. The participant's beliefs about chewing gum were obtained from their rating (not at all – very much) of three questions from the Health Habits Questionnaire: To what degree does chewing gum make you feel (1) "relaxed"; To what degree do you chew gum (2) "to help you relax"; (3) "because you are anxious." The sample was divided into two groups for each of the three questions. The two groups consisted of participants answering non-neutral, either at or approaching "not at all" versus those at or approaching "very much".

The overall results of these exploratory analyses (See Table 4) revealed that the participant's beliefs on how chewing gum affects their negative emotional states had no effect on their reported anxiety; however, these beliefs appeared to have an effect in regards to urge to chew gum. The participants that affirmed that chewing gum makes them feel relaxed exhibited a general *increase* in urge to chew gum from Time 1 – Time 4 (see Figure 4). In the group of participants that indicated that chewing gum does not relax them (see Figure 5), and the overall sample (see Figure 3), a general *decrease* in urge to chew gum from Time 1 – Time 4 was observed. These findings appear to support the notion that some regular gum chewers have beliefs that chewing gum helps them to control negative emotions; however, it does not appear that chewing gum is facilitating them in this way. These findings are also suggestive that chewing gum behavior likely operates primarily by the process of positive reinforcement (e.g., taste, pleasure from chewing, increase concentration), while negative reinforcement may be limited to gum's ability to combat bad breath.

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. All the participants from the present study were comprised of college students; therefore results may not generalize 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). Lastly, the public speaking task may not have been the perfect stressor (four participants were eliminated from the final analyses for not exhibiting being stressed by the task); however, this only represented five percent of the entire sample tested and previous studies have used similar procedures with good results (al'Absi et al., 1997; Kassel & Shiffman, 1997, Britt et al., 2001). 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 do not support the generalization from smokers to nonsmokers of the stress-ameliorating effects of chewing gum. Some regular gum chewers in the present study reported the belief that chewing gum helps them to relax or feel less anxious. However, reports of anxiety levels pre- and post-stressor does not support the hypotheses that beliefs about chewing gum, nor gum chewing, play a role in emotional regulation of negative emotions for nonsmokers undergoing a laboratory stressor.

The findings from the present study and Britt et al. (2001) suggest that the use of chewing gum as a means to reduce anxiety may have limited applications. First, it appears that chewing gums' role as an anxiolytic agent may be limited to smokers. Second, chewing gum may reduce overall reported stress in smokers undergoing a laboratory stressor due to its effect on nicotine withdrawal, rather than by reducing stress associated with the laboratory stressor (e.g., the speech).

Further investigations examining the relationship between chewing gum and negative emotions, in smokers, are clearly warranted. Particularly intriguing is deciphering the exact role chewing gum has in regards to stress reduction with smokers. Specifically, determining the underlying mechanisms (e.g., rate of chew, brain areas activated, etc.) by which chewing gum exerts its anxiolytic effect. The present study sought to isolate the chewing component of chewing gum from the flavoring component of chewing gum as a possible mechanism of stress reduction. This was accomplished by utilizing an alternative (e.g., Breath Strips) that had the shared property of taste with gum, however lacked the property of chewing.

A subsequent study examining chewing and stress could focus on the rate at which individuals chew gum when undergoing a laboratory stressor. For example, participants would be instructed to chew a piece of gum while working on a non-stressful task on a computer. During this no-stress period the chewing rate would be recorded. After establishing a baseline chew rate, the participant would be exposed to a laboratory stressor. During the stressor a new chew rate would be recorded. This same procedure would be used to establish a chew rate immediately post-stressor and after a relaxation period. Using this proposed methodology could provide insight on whether chewing is used in preparation of a stressor, during a stressor, or as a means to recover from a stressful event.

Additional studies could focus on the brain areas (e.g., reward and stress pathways) effected by chewing gum in both smokers and nonsmokers. These studies may find that the laboratory stressor is perceived (e.g., effects stress pathways) by smokers and nonsmokers in distinct ways. The same relationship may be found in regards to the pleasurable effects of chewing gum between smokers and nonsmokers.

Furthermore, it must be demonstrated that, for smokers, chewing gum has a significant anxiolytic effect over other alternatives. Consequently, a logical follow-up study to the present study and Britt et al. (2001) would be to reexamine the use of chewing gum with smokers, with the addition of examining other alternatives (e.g., breath strips). In such a study, smokers would be instructed, and verified by a carbon monoxide monitor, to abstain from smoking two hours prior to the experimental session. The session would follow the exact procedure outlined in the present study. Ultimately, this would directly address the question of what is the unique contribution of chewing gum with smokers, over anything, in regards stress induced by a laboratory stressor.

Finally, the present study found that chewing gum has no significant effect on stress and emotional regulation in nonsmokers, in response to the laboratory induced stressor (e.g., public speaking). However, it is not without possibility that the use of other types of stressors (e.g., physical stressor – cold stressor), as opposed to a mental stressor (e.g., public speaking task), would demonstrate the reinforcing properties of chewing gum with nonsmokers in regards to stress reduction and management of negative emotions, although the evidence for this claim is severely limited. If other types of stressors yielded similar results to the present study, this could suggest that the beneficial use of chewing gum in stress research and as a stress management technique may be limited to smoking populations. Consequently, a further examination of the relationship between chewing gum and smokers, in regards to stress management and nicotine cessation, may have far reaching ramifications for health psychology and behavioral medicine.

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APPENDIX

QCU

For each statement listed, place a (/) somewhere on the appropriate line to indicate how you are feeling at this moment.

1. My current urge to chew gum right now is
   0% ________________________________ 100%

The following questions will ask some more specific questions about your urge to chew gum right now.

2. Chewing gum would make me feel very good right now
   0% ________________________________ 100%

3. I would be less irritable now if I could chew gum
   0% ________________________________ 100%

4. Nothing would be better than chewing gum right now
   0% ________________________________ 100%

5. I am not missing gum chewing right now
   0% ________________________________ 100%

6. I will chew gum as soon as I get the chance
   0% ________________________________ 100%

7. I don't want to chew gum now
   0% ________________________________ 100%

8. Chewing gum would make me less depressed
   0% ________________________________ 100%

9. Chewing gum would not help me calm down now
   0% ________________________________ 100%

10. If I were offered chewing gum, I would chew it immediately
    0% ________________________________ 100%

11. Starting now, I could go without chewing gum for a long time
    0% ________________________________ 100%

12. Chewing some gum would not be pleasant
    0% ________________________________ 100%

13. If I were chewing gum this minute, I would fell less bored
    0% ________________________________ 100%

14. All I want right now is a piece of chewing gum
    0% ________________________________ 100%

15. Chewing gum right now would make me feel less tired
    0% ________________________________ 100%

16. Chewing gum would make me happier now

0% ———————————————— 100%

17. Even if it were possible, I wouldn't chew gum right now

0% ———————————————— 100%

18. I have no desire for a piece of chewing gum right now

0% ———————————————— 100%

19. My desire to chew gum seems overpowering

0% ———————————————— 100%

20. Chewing gum now would make things seem just perfect

0% ———————————————— 100%

21. I crave a piece of chewing gum right now

0% ———————————————— 100%

22. I would not enjoy a piece of chewing gum right now

0% ———————————————— 100%

23. A piece of chewing gum would not taste good right now

0% ———————————————— 100%

24. I have an urge for a piece of chewing gum

0% ———————————————— 100%

25. I could control things better right now if I could chew gum

0% ———————————————— 100%

26. I am going to chew gum as soon as possible

0% ———————————————— 100%

27. I would not feel better physically if I were chewing gum

0% ———————————————— 100%

28. A piece of chewing gum would not be very satisfying right now

0% ———————————————— 100%

29. If I had a piece of gum in my hand, I probably wouldn't chew it

0% ———————————————— 100%

30. If I were chewing gum now I could think more clearly

0% ———————————————— 100%

31. I would do almost anything for a piece of chewing gum now

0% ———————————————— 100%

32. I need to chew gum now

0% ———————————————— 100%

33. Right now, I am not making plans to chew gum

0% ———————————————— 100%

Table 1
Timeline of Procedure and Activities

Time of procedure		Activity
Introduction		Participants introduced to lab, project described, consent form signed
Time 1 (45 minutes)		Complete Time 1 (baseline) measures: demographics (HHQ), gum chewing history, mood (BDI2, EAS), fear of public speaking (AAS), urge to chew gum (QCU), recent stressors (SRRS), and anxiety (STAI-T, STAI-S). Relax: magazines, cross-word puzzles, and/or sit.
Time 2	Free access to gum, breath strips, or nothing	Speaking task instructions given. Chew gum, insert breath strip, or do nothing (depending on group assignment) Complete Time 2 measures (STAI-S, EAS, QCU).
Prepare for Speech	Free access to gum, breath strips, or nothing	Mentally prepare for speech – 2 minutes Chew gum, use breath strips, or do nothing depending on group assignment.

Time of procedure		Activity
Time 3	Free access to gum, breath strips, or nothing	Complete Time 3 measures (STAI-S, EAS, QCU) Chew gum, use breath strips, or do nothing depending on group assignment.
Speech	NO gum/breath strips	Give 3 minute speech.
Time 4	Free access to gum, breath strips, or nothing	Complete Time 4 measures (STAI-S, EAS, QCU) Chew gum, use breath strips, or do nothing depending on group assignment.
Rest	Free access to gum, breath strips, or nothing	30 minute rest Chew gum, use breath strips, or do nothing depending on group assignment.
Time 5	Free access to gum, breath strips, or nothing	Complete Time 5 measures (STAI-S, EAS, QCU). Chew gum, use breath strips, or do nothing depending on group assignment.

Debriefing

Table 2

Participant Characteristics and Demographics

Participant Characteristics	Sample	Gum	Breath Strip	Control	F/(p)
		Group			
Gender					
Male	14	4	6	4	.090
Female	44	14	16	14	(.914)
Age					
Mean	19.29	19.28	19.00	19.67	.386
SD	2.36	1.45	1.20	3.82	(.681)
Range	(17-34)	(18-24)	(18-22)	(17-34)	
QCU-q1					
Mean	55.33	68.72	48.59	50.17	2.985
SD	29.04	24.70	31.23	27.14	(.059)
Range	(2-100)	(14-100)	(2-100)	(6-93)	
STAI-S					
Mean	37.05	34.56	37.45	39.06	1.004
SD	9.68	10.92	9.88	7.94	(.373)
Range	(20-56)	(20-55)	(22-56)	(24-53)	
STAI-T					
Mean	38.86	36.89	40.00	39.44	.658
SD	8.86	9.39	8.99	8.32	(.522)
Range	(21-58)	(23-50)	(24-57)	(21-58)	

Participant Characteristics		Group			
	Sample	Gum	Breath Strip	Control	F/(p)
BDI2					
Mean	8.17	7.11	8.73	8.56	.513
SD	5.33	5.62	5.86	4.42	(.601)
Range	(0-22)	(0-22)	(0-20)	(1-14)	
AAS					
Mean	38.98	39.17	41.64	35.56	1.289
SD	11.99	14.12	10.99	10.57	(.284)
Range	(12-60)	(16-60)	(12-56)	(16-59)	
SRRS-3					
Mean	195.21	195.22	190.27	201.22	.091
SD	79.55	88.14	69.42	86.17	(.913)
Range	(39-441)	(95-403)	(39-324)	(70-441)	

Note. QCU-q1 = Questionnaire on Chewing Urge-current urge to chew. STAI-S = State-Trait Anxiety Inventory-State. STAI-T = State-Trait Anxiety Inventory-Trait. BDI2 = Beck Depression Inventory II. AAS = Audience Anxiousness Scale. SRRS-3 = Social Readjustment Rating Scale-last 3 months.

Table 3

Mean and standard deviations of repeated measures ANOVAS

Group	Time	STAI-S M (SD)	EAS-ANX M (SD)	QCU-Q1 M (SD)
Gum	1	34.56 (10.92)	66.78 (51.93)	68.50 (26.27)
Breath Strip	1	37.46 (9.88)	57.82 (44.32)	49.10 (31.91)
Control	1	37.05 (9.68)	50.67 (39.65)	47.13 (27.23)
Gum	2	46.33 (15.34)	108.06 (69.02)	54.38 (35.40)
Breath Strip	2	51.41 (13.95)	106.82 (65.72)	40.14 (33.75)
Control	2	49.11 (12.41)	93.61 (62.34)	39.56 (18.56)
Gum	3	52.61 (12.65)	106.94 (56.74)	60.75 (35.77)
Breath Strip	3	50.09 (12.62)	107.59 (63.25)	52.33 (31.23)
Control	3	48.44 (13.71)	92.78 (67.69)	35.56 (30.98)
Gum	4	42.22 (14.72)	62.72 (61.45)	59.56 (34.57)
Breath Strip	4	41.86 (13.62)	59.59 (50.84)	45.24 (33.82)
Control	4	43.50 (9.94)	61.83 (53.03)	47.50 (29.51)
Gum	5	34.72 (11.24)	36.06 (43.14)	43.31 (23.87)
Breath Strip	5	36.50 (11.49)	32.77 (35.91)	34.95 (32.13)
Control	5	32.67 (6.62)	20.56 (20.09)	28.81 (29.77)

Note. STAI-S = State-Trait Anxiety Inventory-State. EAS-ANX = Emotion Assessment Scale – Anxiety subscale. QCU-q1 = Questionnaire on Chewing Urge-current urge to chew. M = average value, SD = standard deviation.

Table 4

Participant beliefs about chewing gum

HHQ	STAI-S	EAS-ANX	QCU-Q1
Beliefs		Group X Time	
Chewing gum makes me feel relaxed	0.64	0.86	2.06*
Chewing gum does not make me feel relaxed	1.34	1.28	1.33
Chewing gum to help me relax	1.93	0.57	1.02
Chewing gum does not help me relax	1.42	0.90	1.34
Chew gum when I am anxious	0.74	0.29	0.75
Do not chew gum when I am anxious	1.35	0.65	0.68

Note. HHQ = Health Habits Questionnaire. STAI-S = State-Trait Anxiety Inventory-State. EAS-ANX = Emotion Assessment Scale – Anxiety subscale. QCU-q1 = Questionnaire on Chewing Urge-current urge to chew. ***** denotes a significant F value ($p \leq .05$).

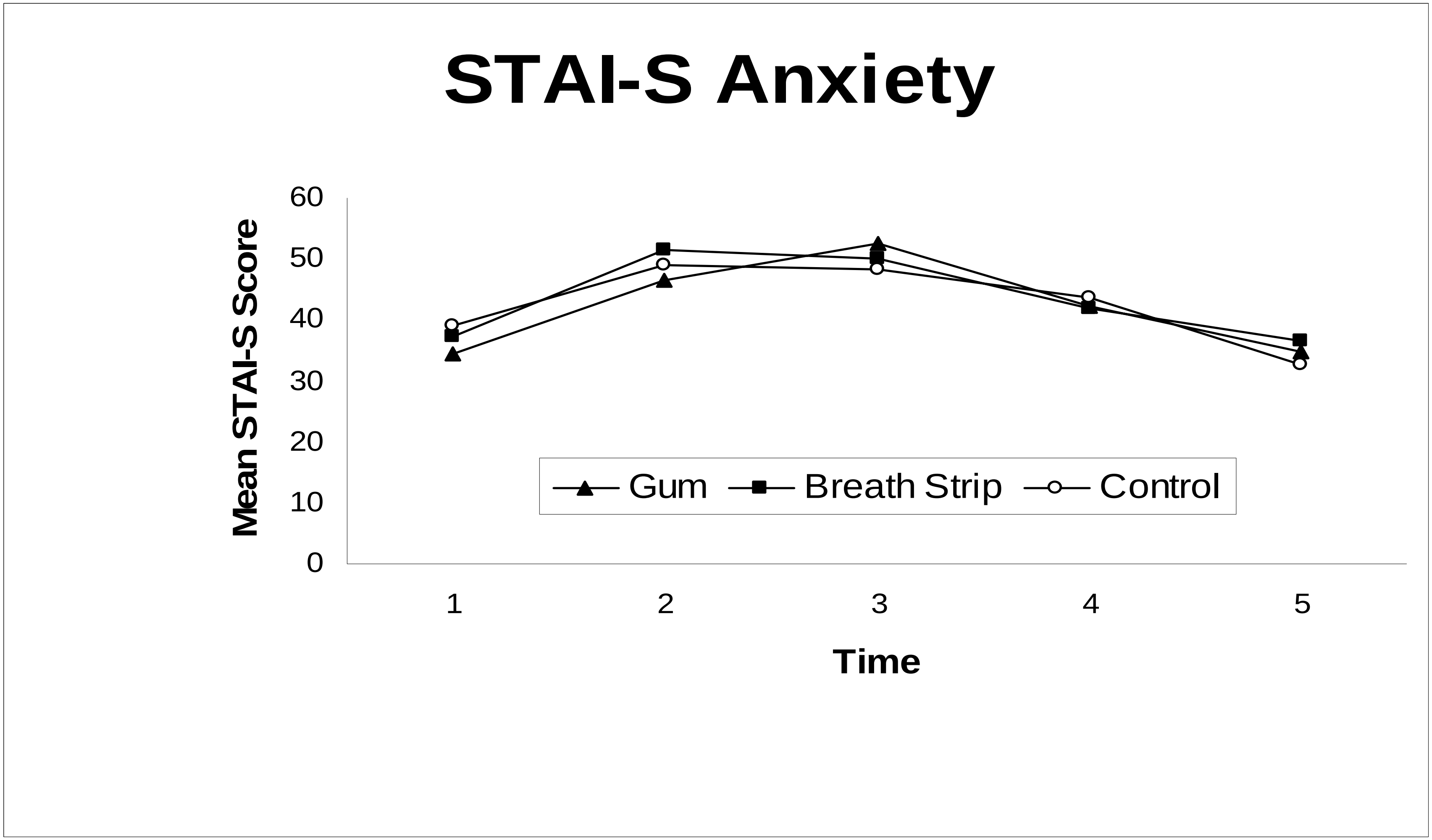
STAI-S Anxiety
Mean STAI-S Score
0
10
20
30
40
50
60
1
2
3
4
5
Time
Gum
Breath Strip
Control

Figure 1

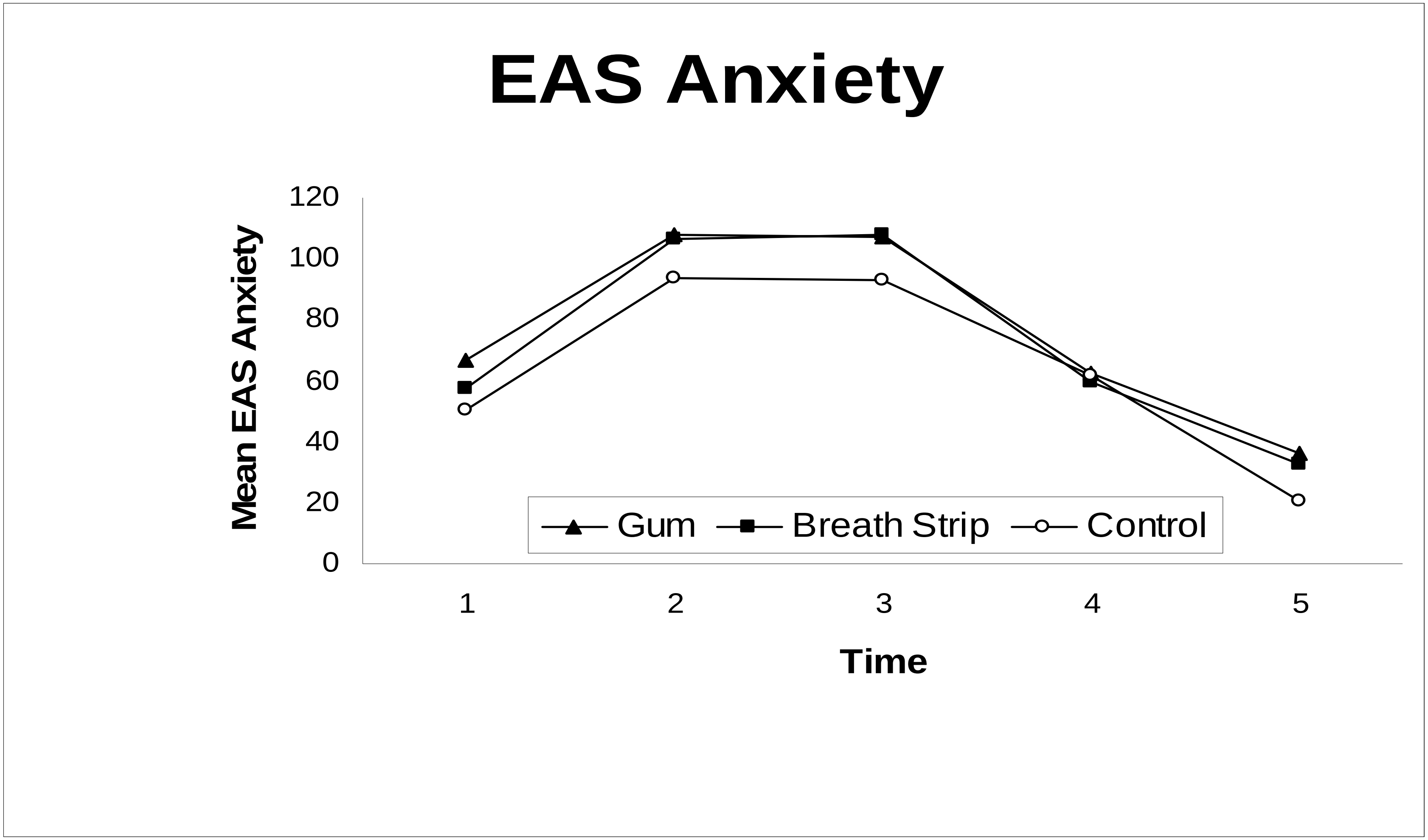
EAS Anxiety
Mean EAS Anxiety
120
100
80
60
40
20
0
Gum
Breath Strip
Control
1
2
3
4
5
Time

Figure 2


Urge to Chew Gum
Mean QCU Total Score
80
60
40
20
0
Gum
Breath Strip
Control
1
2
3
4
5
Time

Figure 3

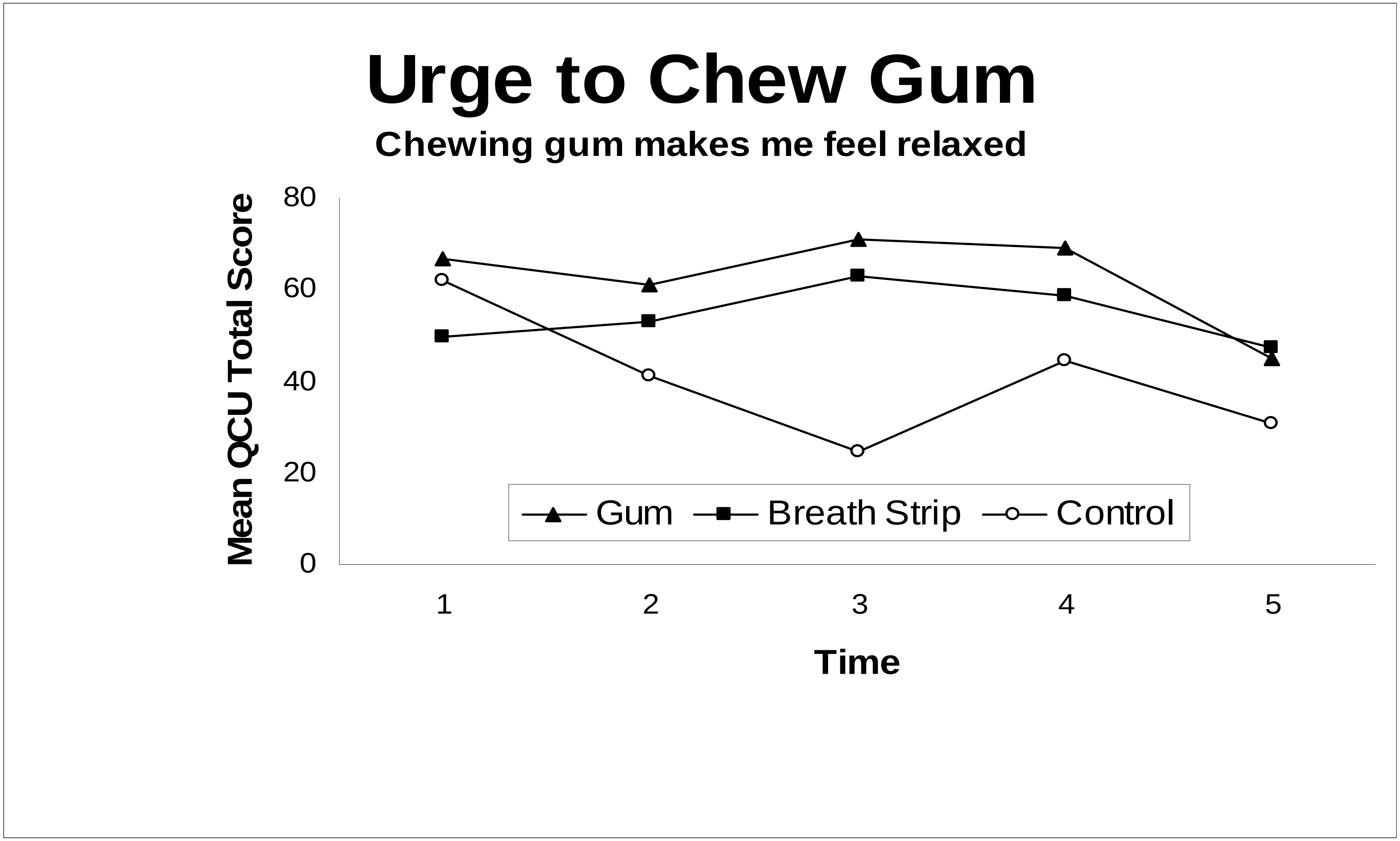
Urge to Chew Gum
Chewing gum makes me feel relaxed
Mean QCU Total Score
0
20
40
60
80
1
2
3
4
5
Time
Gum
Breath Strip
Control

Figure 4

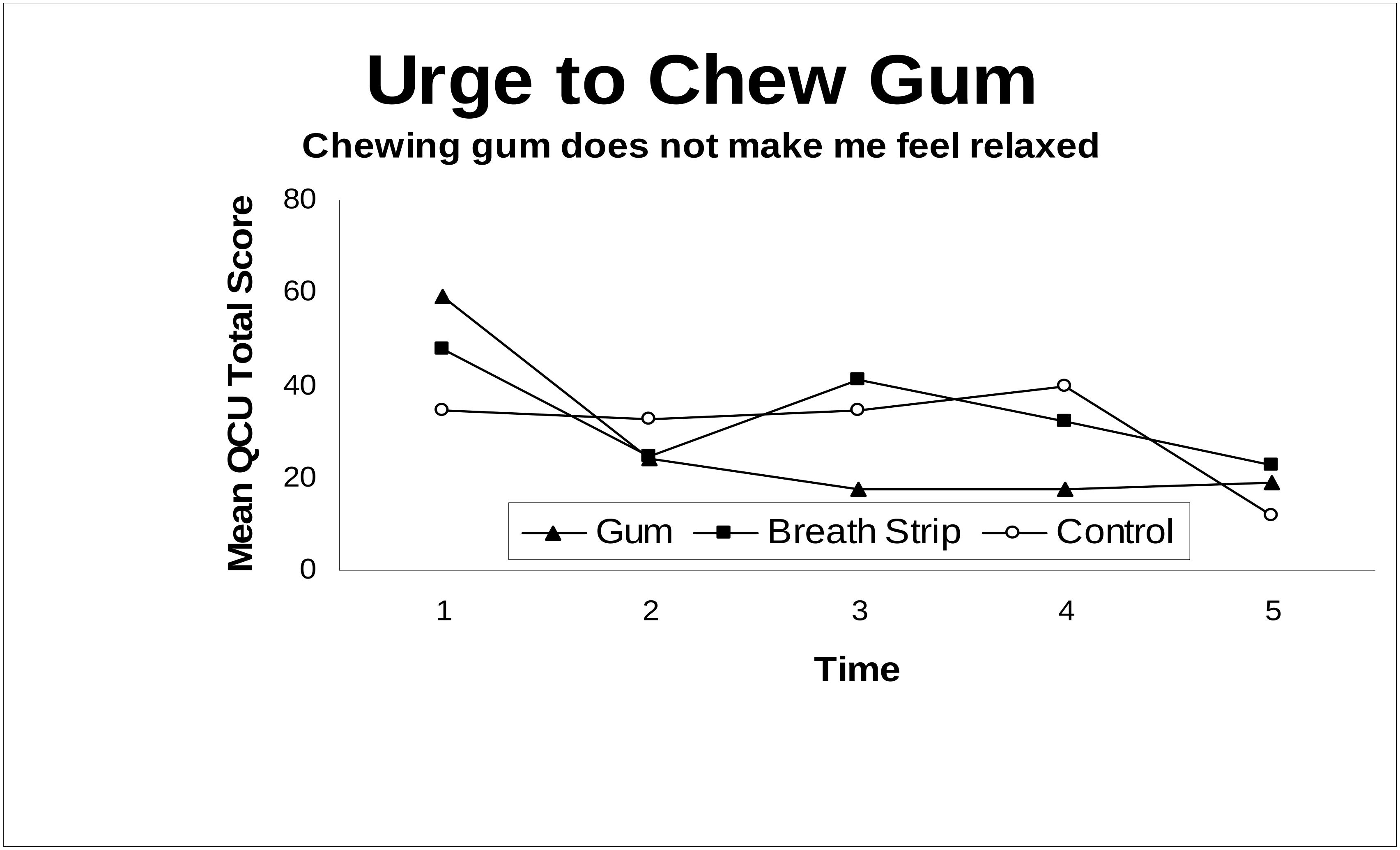
Urge to Chew Gum
Chewing gum does not make me feel relaxed
Mean QCU Total Score
80
60
40
20
0
1
2
3
4
5
Time
Gum
Breath Strip
Control

Figure 5

Oklahoma State University
Institutional Review Board

Protocol Expires: 5/9/2005

Date: Monday, May 10, 2004 IRB Application No AS0482

Proposal Title: Chewing Gum and Non-Smokers: Response to a Laboratory Stressor

Principal
Investigator(s):

Brian Miller	Frank L Collins
215 North Murray	205 N Murray
Stillwater, OK 74078	Stillwater, OK 74078

Reviewed and
Processed as: Expedited

Approval Status Recommended by Reviewer(s): Approved

Dear PI :

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact me in 415 Whitehurst (phone: 405-744-5700, colson@okstate.edu).

Sincerely,

Carol Olson

Carol Olson, Chair
Institutional Review Board

VITA

Brian I. Miller

Candidate for the Degree of

Master of Science

Thesis: CHEWING GUM AND NON-SMOKERS: RESPONSE TO A LABORATORY STRESSOR

Major Field: Psychology

Biographical:

Personal Data: Born in Brooklyn, New York, May 17, 1978

Education: Graduated from Midwood High School at Brooklyn College, Brooklyn, New York in June 1996; received Bachelor of Science degree in Psychobiology from the State University of New York at Binghamton, Binghamton, New York in May 2000. Completed the requirements for the Master of Science degree with a major in Psychology at Oklahoma State University in May, 2005.

Professional Memberships: American Psychological Association, Association for the Advancement of Behavior Therapy, Oklahoma Psychological Association.

Name: Brian I. Miller | Date of Degree: May, 2005

Institution: Oklahoma State University | Location: Stillwater, Oklahoma

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

Pages in Study: 73 | Candidate for the Degree of Masters of Science

Major Field: Psychology

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. 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.

Despite research in the use of chewing gum for reducing nicotine withdrawal and stress levels in smokers, there is little data in regards to the potential benefit of chewing gum for reducing stress in nonsmokers. In a hallmark study conducted in 1939, Hollingworth proposed that chewing gum is a means for individuals to work off nervous energy and thus implicitly suggested chewing gum reduces stress. Since then, there have been no empirical studies conducted evaluating the role of chewing gum as a stress management technique. The goal of the present study was to fill this gap.

The present study was designed to extend previous research by examining nonsmokers and by using a non-chewing oral control (breath strips) that share flavor properties of gum without chewing. Participants were assigned to three conditions: Chewing Gum, Breath Strip (Chewing Control), and Non-oral Control. A total of 58 participants were studied (18 in both the Gum and Control groups, and 22 in the Breath Strip group).

The experimental procedure was identical to a previous study 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. 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 regular gum chewers do not utilize chewing gum to regulate negative emotions.

ADVISER'S APPROVAL: Frank L. Collins, Jr., Ph.D.