CIGARETTE SMOKING AND CHEWING GUM: RESPONSE TO A LABORATORY-INDUCED STRESSOR

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Cigarette Smoking and Chewing Gum: Response to a Laboratory-induced Stressor

Cigarette smoking is the most preventable form of premature death worldwide. The World Health Organization estimates that 3 million people die worldwide each year as a result of smoking (American Cancer Society [ACS], 1997). Some researchers have predicted that during the 1990s among developed countries in the world, tobacco will be responsible for approximately 30 percent of all deaths among individuals aged 35-69, making it the largest single cause of death in the developed world (Peto, Lopez, Boreham, Thun, & Heath, 1992). Half of all individuals who continue to smoke will die prematurely from smoking. Of these continuing smokers, half will die in middle age (35-69), losing an average of 20-25 years of life expectancy (ACS, 1997).

Cigarette smoking remains the number one public health problem in the United States, accounting for thousands of premature deaths yearly. In 1994, nearly 48 million adults (22.7 million women and 25 million men) were current smokers in the U. S., and twenty-one percent of those adults were daily smokers (Centers for Disease Control and Prevention [CDC], 1996). In this country, nearly 420,000 deaths each year, or 1 out of every 5 deaths, are attributed to tobacco. This number far exceeds the combined number of deaths yearly related to alcohol, homicide, suicide, AIDS, heroin, cocaine, and motor vehicle accidents (ACS, 1997).

Chronic cigarette smoking is linked to numerous health problems such as cancer, heart disease, and stroke, the three leading causes of death in the U. S. Smoking accounts for nearly 30% of all cancer deaths; however, smoking is also associated with numerous conditions ranging from colds and gastric ulcers to chronic bronchitis, emphysema, and

cardiovascular disease (ACS, 1997; Bartecchi, MacKenzie, & Schrier, 1994; Epstein & Jennings, 1986). Additionally, evidence now suggests that environmental tobacco smoke (passive smoking) poses significant risks for non-smokers (U.S. Department of Health and Human Services [USDHHS], 1991).

It is estimated that 35,000-40,000 nonsmokers die each year from heart disease. In fact, environmental tobacco smoke, a human carcinogen, has also been found to exacerbate asthmatic conditions, bronchitis, pneumonia, and impaired blood circulation. Children who have been exposed to secondhand smoke have increased rates of respiratory illnesses, ear infections, and impaired lung development and functioning (ACS, 1997). Infants born to women who smoked during pregnancy are also at greater risk at dying from sudden infant death syndrome (ACS, 1997).

The costs of tobacco to the American society are probably best measured by the number of people who die or suffer from tobacco-related illnesses as a result of tobacco use. However, chronic tobacco use also exhausts the U. S. economy of over $100 billion yearly in health care and lost productivity costs (CDC, 1993). These figures do not include costs associated with diseases resulting from environmental tobacco smoke, burn care caused by smoking-related fires, or perinatal care for low birth weight infants of smoking mothers.

Despite the recognition that smoking is related to a significant number of deaths yearly, and that smoking is a key factor (if not the major causal factor) in developing one of various diseases, many individuals continue to smoke. Smoking cessation could reduce excessive costs associated with health care and lost productivity, delay the onset

of a large number of life-threatening illnesses, and prevent a large number of deaths each year. However, each year numerous smokers fail to quit smoking.

Smoking behavior is at least partially maintained as a result of the reinforcing effects of smoking. Research suggests that the reinforcing agent in cigarette smoke is nicotine (Russell, 1976). Nicotine effects reinforce individuals who smoke; however, the relative importance of nicotine as a reinforcer varies between individuals (Mangan & Golding, 1984). Some individuals appear to enjoy the taste and smell of cigarettes. For others, nicotine serves as a mood control agent when individuals are over-excited or anxious (Mangan & Golding, 1984). Smoking has also been found to decrease fatigue and drowsiness, suppress appetite, reduce irritability, facilitate memory or attention, and have alerting and muscle relaxant effects (Mangan & Golding, 1984). Perhaps some of the most reinforcing aspects of nicotine include positive mood enhancement, negative mood reduction, and a means of coping with stress, anxiety, boredom, or lack of stimulation (Hatsukami & Lando, 1993). The various reinforcing effects of cigarette smoking may help explain why so many individuals continue to smoke despite the well-known health consequences associated with smoking. In fact, it is estimated that two-thirds of American adult smokers wish to quit smoking. Over seventeen million smokers try to quit yearly, yet fewer than 1 out of 10 actually succeed. For every smoker who successfully quits, nine others try and fail (Kessler, 1994).

Fortunately, the prevalence of smoking in the United States has declined considerably in the last 30 years. Research and clinical efforts to assist smokers in their cessation efforts have been fueled by the federal government with its emphasis on wellness, disease prevention, lifestyle change, and health promotion. As a result,

smoking cessation is receiving immense and increasing attention. However, smoking cessation programs have had limited success rates.

Hajek (1994) estimates that 1-year abstinence rates are less than 30%. With such significant health risks attributable to smoking, low success rates are inadequate and unacceptable. To improve cessation success rates, some researchers argue that it may be necessary to rejuvenate interest and progress in smoking cessation, which is currently perceived as stalled (Shiffman, 1993). It is time for the field to once again produce innovative approaches to smoking cessation, which may require getting back to basics (Hajek, 1996; Shiffman, 1993). Within the last decade, our understanding of pharmacological aspects of nicotine has increased greatly. However, the behavioral aspects of smoking have often taken a back seat to the pharmacological aspects where treatment is concerned. Shiffman (1993) has estimated that behavioral smoking cessation programs have averaged 25%-35% abstinence rates at the end of 6 months. However, relapse remains a significant problem. If 35% of smokers remain abstinent at the end of 6 months, 65% are either still smoking or have relapsed. Efforts are needed to help understand why relapse rates are so high.

Shiffman (1982) has suggested that relapse to smoking is linked to stress and anxiety. Laboratory and naturalistic studies generally support the notion that stress (in the form of negative affect, urge to smoke, etc.) may serve as a cue for smoking behavior. However, while many smokers report that they smoke in response to stress, and that smoking reduces stress levels, the empirical literature on the stress-ameliorating effects of cigarette smoking is not consistent.

The primary goal of the present study is to examine how smoking and chewing gum influence urge to smoke, withdrawal symptoms, and anxiety in response to a laboratory-induced stressor among college smokers. It is predicted that smokers with access to smoking will report fewer urges to smoke and withdrawal symptoms as compared to those without access to smoking. The present study will also examine the influence of smoking on anxiety in response to a laboratory stressor compared to an alternative, chewing gum.

The literature review will be organized as follows: a brief overview of the literature on stress, coping, and substance use will be presented. Next, the role that stress plays in urges to smoke and smoking behavior will be discussed. A brief review of the stress ameliorating effects of smoking follows. Next, a brief section discussing the use of a behavioral alternative (chewing gum) in lieu of smoking will be presented. Finally, specifics of the proposed study will be presented.

Coping with stress and substance use: A way of reducing tension

According to a social stress model, individuals engage in substance use as a means of coping with various stressors, such as family, school, peer, work, academic, or community (Beman, 1995; Rhodes & Jason, 1990). Several studies have found that stress is significantly related to adolescents' use of tobacco, alcohol, marijuana, and other drugs (Beman, 1995; Rhodes & Jason, 1990). Some researchers speculate that the use of drugs in response to stress may temporarily reduce feelings of anxiety and depression in individuals. However, as substance use becomes a major means of coping with stress, regular substance use tends to increase stress over time rather than decrease it

(Aneshensel & Huba, 1983). Regular substance use may not be an effective means of coping with stress.

Conger (1956) proposed the "tension reduction theory" to explain increased substance use in response to stress. The theory was originally developed to study alcohol consumption in response to stress, but this theory can be applied to other psychoactive substances. Generally speaking, the tension reduction theory states that drugs reduce tension and that people consume psychoactive substances in order to reduce tension. Thus, exposure to or anticipation of stressors should lead to increased substance use. The tension reduction theory asserts that reducing aversive affective or physiological levels maintains substance use behavior; in other words, people are self-medicating symptoms of anxiety. The stress response dampening effect validates the layperson's belief that substance use has a beneficial value when consumed in the context of a stressful situation (Levenson, Sher, Grossman, Newman, & Newlin, 1980).

The tension reduction theory may help explain why stress cues smoking behavior and why smokers tend to smoke more in response to stress. Smokers often view smoking behavior as an effective mechanism of coping with the affective states elicited by stressful events. It is likely that smoking increases smokers' perceived control over stressors when engaged in smoking as compared to when not smoking (Epstein & Perkins, 1988; Pomerleau & Rosecrans, 1989). However, if exposed to stress during times in which smoking is restricted or not allowed, perception of the smoker's control and coping may be impaired. Such consequences may help explain stress-related craving and relapse, particularly why abstinence after smoking cessation may lead to difficulties coping with stressful situations (Hughes, Higgins, & Hatsukami, 1990) and why stress

may increase craving and relapse post cessation (Shiffman et al., 1986). In fact, Shiffman (1982) found that most smoking relapse crises were associated with negative affect, particularly anxiety, which was reported in more than half of the crisis events. Thus, the perceived benefits of smoking contribute to the maintenance of smoking behavior. Smokers are presumed to have strong desires to engage in such a well-established response when confronted with stressors and their accompanying emotional states (Wills & Shiffman, 1985).

Perkins, Epstein, and Jennings (1991) demonstrated that exposure to a stressor in the absence of smoking can lead to diminished performance and greater distress. Thus, when smokers who normally smoke in response to stress encounter a stressful situation, they will likely rely on their previously learned coping mechanism, smoking. However, if that coping mechanism (smoking) has been removed (say after a cessation program or in situations in which individuals cannot smoke), coping and performance will likely be adversely affected. Diminished performance and increased distress may thus encourage resumption of drug use (smoking) in response to stressful situations. Based on these findings, it appears that if individuals, however, have other means of coping with stressful situations rather than smoking, relapse rates may not be so high. Identification of alternative means of coping with stressful situations in lieu of cigarette smoking may provide adequate alternative reinforcers for smoking.

Shadel and Mermelstein (1993) examined smoker's expectations about their ability to cope with stressful situations while remaining abstinent and their expectations about the stress-ameliorating and coping benefits of smoking under stress. Results from their study support an association between coping expectancies and smoking behavior.

Smokers who expected more from smoking in terms of coping benefits had greater urges to smoke and a greater likelihood of smoking than smokers with low expectations about the coping benefits of smoking. In other words, the greater one's expectations about his/her ability to cope while abstinent, the less probable s/he was to subsequently smoke.

The smoking-stress literature suggests that many smokers believe that smoking helps them cope with stressful situations. The more one expects from smoking in terms of coping benefits, the greater the likelihood one will turn to smoking in times of crisis. Research suggests that many smokers utilize smoking to help cope with feelings of anxiety and distress, claiming that smoking helps reduce tension; thus, it appears that smokers may be smoking to self-medicate their feelings of anxiety. Consequently, many feel that they cannot cope effectively without the aid of smoking. Thus, smoking in response to stress is an attempt for smokers to gain perceived control over the stressful situation and to regulate negative affect (e.g., anxiety). Smokers typically regard smoking as an effective means of coping (if not the most effective means) with affective states elicited by stressful events; hence, it is presumed that they have strong urges to return to such a well-established behavior in response to stressors (Wills & Shiffman, 1985).

Stress: A cue to smoke

One of the primary reasons many individuals smoke is to relax or reduce tension, particularly in response to stress (Pomerleau, Adkins, & Pertschuk, 1978). Both naturalistic and laboratory-based studies suggest that psychological stress may cue smoking behavior, and that stress is associated with increased smoking (Conway,

Vickers, Ward, & Rahe, 1981; Lindenthal, Myers, & Pepper, 1972). In a recent survey (Britt, 1996), nearly 88% of smokers retrospectively reported that they smoked more when feeling stressed or tense. These findings are consistent with other studies which found that approximately 80% of smokers report smoking cigarettes when feeling stressed or worried (Russell, Peto, & Patel, 1974). Increased smoking during stress may be related to smoking's presumed influence on the reduction of negative affect (O. F. Pomerleau & Pomerleau, 1984) or its task-enhancing performance (Wesnes & Warburton, 1983).

Stress in its many forms is associated with negative affect. Many smokers report that they smoke more in response to negative affect, such as anxiety, sadness, and anger (Britt, 1996; Gilbert & Wesler, 1989; Russell et al., 1974). In fact, one of the more important factors in maintaining smoking behavior is the use of tobacco to regulate affect, particularly to cope with negative affects states (Gilbert & Wesler, 1989; Russell et al., 1974). In addition, more than half of all relapse-related crises are associated with negative affective or interpersonal situations (Bliss, Garvey, Heinhold, & Hitchcock, 1989; Shiffman, 1982). Laboratory studies examining smoking urges and affective states have demonstrated that smoking urges are related to dysphoric mood states (Zinser, Baker, Sherman, & Cannon, 1992). In fact, merely imagining situations involving negative affect can generate urges to smoke (Tiffany & Drobes, 1990).

Laboratory studies generally support the hypothesis that stress and anxiety are causally related to smoking. Rose, Ananda, and Jarvik (1983) exposed smokers to three conditions (stage fright anxiety, monotonous concentration, and relaxation) and recorded smoking behavior and topography. Subjects smoked significantly more in the two

stressful conditions as compared to the relaxation condition, providing support that anxiety-provoking and attention-demanding situations induce smoking, when cigarette deprivation is equated across conditions. Significant increases in smoking behavior have been documented in response to various laboratory-induced stressors, including electric shock (Schachter, Silverstein, Kozlowski, Herman, & Liebling, 1977), public speaking, (Dobbs, Strickler, & Maxwell, 1981; Rose et al., 1983), and aversive white noise (Golding & Mangan, 1982).

Smokers often report significant urges to smoke during periods of abstinence and it is theorized that urges to smoke are important instigators of relapse (Tiffany, 1990). In a study conducted on 215 smokers enrolled in a placebo-controlled randomized trial of nicotine gum, researchers found a significant relationship between urges to smoke after quitting and relapse (Doherty, Kinnunen, Militello, & Garvey, 1995). Individuals who reported stronger urges to smoke were more likely to relapse than those who reported weak urges. Urges to smoke were consistently correlated with dysphoric emotions. In addition, higher levels of negative emotions (e.g., anxiety, anger, sadness, and confusion) predicted stronger urges to smoke. These group findings support results of laboratory studies (Tiffany & Drobes, 1990; Zinser et al., 1992) demonstrating significant relationships among dysphoric emotional states and smoking urges among smokers who have been abstinent over short periods of time. These findings together suggest that smokers who are trying to quit may benefit from interventions that help them better cope with their stress levels and negative emotions after quitting (Doherty et al., 1995).

Research on the stress-smoking relationship and what cues smoking behavior is fairly consistent: stress in its many forms cues smoking. Smokers acknowledge that stress

cues smoking behavior. Many will also agree that they smoke more when stressed. Stress, though, can take many forms. Specific stressors may cue smoking behavior. Negative affect, such as anxiety, sadness, and anger may cue smoking behavior. Urges to smoke appear to be stressful as well, cueing smoking behavior. Thus, it appears that stressful situations, as well as the dysphoric emotions accompanying them, may serve as cues for smoking.

Individuals who quit smoking and subsequently relapse often report that their resumption of smoking was triggered by some stressful event or negative affective state (Baer & Lichtenstein, 1988; Shiffman, 1982; USDHHS, 1988). This result is often perceived as supportive of the hypothesis that stress triggers smoking relapse. However, it is less clear that resumption of smoking actually reduces levels of distress assumed to trigger relapse.

Smoking: Does it really reduce anxiety?

Although feelings of stress and stressful situations may increase smoking in various contexts, it is not clear that the opposite is true, that smoking actually decreases feelings of anxiety or distress. It is commonly believed that smoking a cigarette can reduce feelings of anxiety. Such conclusions are supported by the reports of smokers who state that they smoke in order to relieve feelings of anxiety, stress, tension. However, from a pharmacological point of view, this is puzzling. Nicotine acts as a stimulant, increasing blood pressure and heart rate, activating the EEG, stimulating the brain, and mediating sympathetic nervous system arousal. Since anxiety is an emotion related to high arousal, it is somewhat paradoxical that an anxious smoker tries to reduce

feelings of anxiety by using a substance, which may elevate levels of arousal even further (Ashton & Stepney, 1982; Maisto, Galizio, & Connors, 1995).

In spite of nicotine's pharmacological classification as a stimulant drug, smokers paradoxically report that smoking relaxes them, that they smoke most when they are tense and upset, and that cigarettes help them cope with stress and anxiety. Cigarette smoking is retrospectively reported to reduce subjective distress and increase feelings of calm and relaxation, effects that may be important in reinforcing tobacco use. Yet, empirical support for the stress-ameliorating effects of smoking is surprisingly mixed. Although most would agree that stress serves as a cue for smoking, and that smokers smoke more when stressed, studies examining the stress-ameliorating effects of cigarette smoking have provided equivocal findings. Some studies have found that smoking does reduce stress and anxiety (Coan, 1973; Epstein, Dickson, McKenzie, & Russell, 1984; Gilbert & Spielberger, 1987; Jarvik, Caskey, Rose, Herskovic, & Sadeghpour, 1989; C. S. Pomerleau & Pomerleau, 1987; Shor, Williams, Canon, Latta, & Shor, 1981), while other studies have found little support for the stress-reducing effects of smoking (Cohen & Lichtenstein, 1990; Fleming & Lombardo, 1987; Gilbert & Hagen, 1980; Hatch, Bierner, & Fisher, 1983; Jarvik et al., 1989; Shiffman & Jarvik, 1984). Thus, although an overwhelming majority of smokers clearly believe that smoking reduces their levels of stress and anxiety, controlled laboratory studies have had difficulty reliably producing these effects.

Additionally, it appears that the stress-ameliorating effects of smoking are inconsistent across stressors. Jarvik et al. (1989) examined the anxiolytic effects of smoking in four stressors. Smoking had no effect on anxiety generated by anticipation of

auditory vigilance or of white noise, marginal reduction in anxiety in anticipation of cold pain, and significant reduction of anxiety in anticipation of a difficult anagram. Jarvik et al. (1989) concluded that the temporal relationship between the actual stressor and smoking behavior was important, since even when smoking reduced pre-task anxiety, post-task anxiety was not diminished.

Perkins, Grobe, Fonte, and Breus (1992) had subjects smoke or sham smoke while engaged in high and low challenge computer tasks. Researchers found that smoking did alleviate subjective stress as assessed by self-report instruments; however, this finding was demonstrated only in the high-challenge task. Additionally, this stress-ameliorating effect was very brief and had generally vanished by the midpoint of each task (10 minutes after smoking). Additionally, smoking had no effect on the State Trait Anxiety Inventory, a commonly used instrument of acute changes in anxiety. Such transience and selectivity of smoking effects may help explain why past studies have failed to find the stress-reducing effects of smoking if subjective assessment was not completed immediately after smoking and several instruments were not used. Nonetheless, this short-lived, mood-regulating effect may be satisfactory to provide substantial reinforcement from smoking under stress conditions observed in some studies.

Kassel and Shiffman (1997) examined the effect of smoking and not smoking on anxiety with and without concurrent distractors in 82 smokers. Distraction effects were also assessed in nonsmokers. All subjects were asked to prepare a potentially embarrassing, self-disclosing speech. As expected, anxiety rose in response to speech instructions for subjects in all groups. These findings indicate that smoking had no effect on changes in anxiety levels prior to the distraction/no-distraction period. Smokers who

smoked without distraction (rating art slides) demonstrated no significant changes in anxiety. Smokers who smoked and were distracted experienced the greatest reduction in anxiety. This study suggests that smoking itself is not inherently stress-ameliorating or anxiolytic; rather, smoking enhances or provides the smoker a distraction or diversion from thoughts or worries that might otherwise produce anxiety. Researchers found that smoking in conjunction with a distractor led to a reduction in anxiety levels that surpassed those experienced by smokers who smoked in the absence of distraction, deprived smokers, and nonsmokers. In addition, even though smokers who both smoked and were distracted showed the most reduction in anxiety, their absolute level of anxiety at the end of the study was comparable to that of the smokers who were not allowed to smoke. Thus, it appears that smoking's anxiolytic effects have "less to do with direct, pharmacologically mediated effects than it does with smoking's propensity to affect attentional processing" (Kassel & Shiffman, 1997, p. 366).

Although many smokers smoke to relieve stress, there is little evidence to suggest that they actually achieve the desired effects. Rather, smokers consistently score higher on measures of psychological distress (anxiety, depression, and negative life events) than do nonsmokers or ex-smokers (Billings & Moos, 1983; Cohen & Williamson, 1988; West, 1993). Additionally, smokers who give up smoking report diminished rather than greater levels of perceived stress, unless they relapse, when their stress levels rise again (Cohen & Lichtenstein, 1990). These findings are consistent with the hypothesis that, instead of being stress-reducing, smoking is actually stress-inducing (Jarvis, 1994).

Cohen and Lichtenstein (1990) followed 260 smokers as they attempted to quit smoking on their own. Subjects were interviewed by phone before their planned quit

date, and at 1, 3, and 6 months after their quit date. Perceptions of stress and smoking status were assessed at all assessment periods. Analyses examined stress levels of successful and unsuccessful quitters in addition to the relation between changes in smoking status and changes in stress that occurred between interviews. Findings from this naturalistic study provide compelling evidence for a relation between changes in stress levels and changes in smoking behavior. In particular, those who failed to quit smoking for more than 24 hours maintained a relatively high and consistent level of stress over the entire course of the study. For those who quit smoking and remained abstinent, stress levels decreased as duration of abstinence increased. Relapse was associated with increases in stress, whereas quitting was related to decreases in stress. Those who relapsed had the highest stress scores, whereas those who quit had the lowest.

Unfortunately, these data do not allow researchers to distinguish whether stress resulted in failure to quit smoking and relapse, whether relapse and failure to quit caused stress, or whether both directions of causality occurred concurrently. Cohen and Lichtenstein (1990) argue that what is clear from these data, however, is that the longer one remained continuously abstinent, the less stress they experienced. It is possible that such findings may be related to a successful quitter's heightened feelings of efficacy and self-esteem in coping behavior and decrease in physiological arousal. In other words, those who consistently abstained learned more adaptive means of coping with stressful situations instead of automatically reaching for a cigarette (Cohen & Lichtenstein, 1990).

This study supports the notion that stress appears to cue smoking behavior. However, it does not allow researchers to conclude that smoking reduces stress. One limitation of this study is that it does not allow us to control for same life experiences

because of the nature of the study, i.e., a naturalistic study. An alternative explanation suggests that those individuals who experienced low levels of stress had no cravings to smoke, and hence did not return to smoking. Without stress, there was no need to smoke. Rather, those individuals who had higher levels of stress encountered more intense cravings and negative affect, and thus, did not refrain from smoking. Both Cohen and Lichtenstein's explanation and the alternative explanation may be correct. It is possible that smoking is related to higher levels of stress, and that abstinent smokers perceive lower levels of stress (Cohen & Lichtenstein, 1990). It is just as plausible that those with higher levels of perceived stress resumed their smoking behavior, while those without life stressors did not have cravings and negative affect associated with relapse. A more controlled laboratory study in which all individuals received the same type of stressor, some with access to smoking and some without, would help determine if smoking really does reduce stress.

The beneficial effects of smoking in response to stress remain unclear. A better understanding of this relationship is critical in helping researchers and clinicians understand smoking behavior and smoking cessation efforts. If smokers sincerely profit psychologically from cigarette smoking, maintenance of smoking behavior and return to smoking after attempts to quit could be seen as a trade off between health risks and psychological benefits. As long as smokers positively view the benefits of smoking, former smokers may experience pressure to smoke and be at risk of relapse. Additionally, smokers will argue that urging smokers to quit smoking is to deprive them of a valuable psychological resource. On the other hand, if researchers can document that cigarette smoking does not offer psychological benefits, rather only appears to, a major

aim of cessation interventions should be to dispel such myths. Once the acute withdrawal effects and discomfort associated with nicotine pass, abstinent smokers should then recognize that smoking is of no advantage or benefit, and be at less risk of relapse (West, 1993). Conclusive information on whether or not smoking actually reduces anxiety is critical in smoking cessation efforts and treatment. If smoking truly has no effect on anxiety reduction, it may help explain why stress management techniques have been less than favorable (Leventhal & Cleary, 1980). Although many smokers firmly believe that smoking may in some way better their lives and help them cope with life's demands, there is as yet little clear empirical evidence to support this.

Undoubtedly, stress cues smoking behavior and smokers smoke more when stressed; however, the stress-reducing benefits of smoking are less conclusive. Some studies have found that smoking does reduce subjective stress; others have failed to demonstrate the stress-reducing effects of smoking. Such inconsistent findings may be related to various types of stressors, methods of measuring stress and its temporal relationship to the stressor, length of abstinence, and perceived levels of stress. As long as a significant relationship between stress and cigarette smoking remains, smokers may be vulnerable to relapse, particularly in response to stress. Cessation interventions which train the smoker to identify alternative behaviors when exposed to stress may be a valuable supplement to a stress-reduction approach (Rose et al., 1983). Undoubtedly, smokers believe that cigarette smoking can be used to effectively regulate affect and emotions. This belief alone may be adequate for negative affect to motivate smoking behavior. However, despite what smokers believe, it remains unclear that smoking can

actually regulate affect. Little research has focused on providing smokers an alternate means of coping with stress in lieu of smoking during a stressful situation.

Chewing gum: An alternative to smoking

Several authors (e.g., Bickel, DeGrandpre, Hughes, & Higgins, 1991; Epstein, Bulik, Perkins, Caggiula, & Rodefer, 1991; Perkins, Epstein, Grobe, & Fonte, 1993) have advocated that principles derived from behavior economic theory provide a novel approach to the understanding of drug dependence. This theory provides a mechanism for investigating variables that influence an individual's drug-taking behavior. For instance, behavior economic theory posits that access to alternative reinforcers or activities will influence drug consumption. When applied to smoking, this theory asserts that the reinforcing value of smoking is dependent upon the constraints placed upon it (e.g., cost, availability, deprivation) as well as the alternative reinforcers available (Epstein et al., 1991). Drug abuse treatment programs may be more successful if satisfactory behavioral substitutes for drugs were identified.

One alternative behavior that has been linked to cigarette smoking is chewing gum. It sweetens breath, moistens and freshens the mouth, helps clean and strengthen teeth, aids in digestion, helps reduce plaque when brushing is not an option, and tastes good (O'Connor, O'Mullane, & Whelton, 1993). Chewing gum may also help alleviate thirst and hunger, increase concentration, help the chewer stay alert, strengthen jaw muscles, aid in speech therapy, give gums a healthier firmness, give chewers a pleasant little lift, pop ears in planes and submarines, and be used as a diet aid (Hendrickson, 1976).

Chewing gum has also been promoted as a way of reducing muscular tension to help people feel more relaxed (Hollingworth, 1939). Early studies examining the use and effects of chewing gum suggest that gum chewers report feeling more relaxed while chewing gum compared to non-chewers and to those who chewed on a flavored wafer (Hollingworth, 1939). Subjects reported reduced tension in the sense of the subjective feeling of strain, reduction in fatigue, and decrease in muscular tension while chewing gum.

Recently, it has been suggested that drug users consider increasing alternative activities in lieu of drug consumption. For example, the William Wrigley Jr., Co. has promoted their chewing gum as something to do "when you can't smoke." Although marketing trends suggest higher rates of gum use among individuals who are less likely to smoke (Rivenburg, 1993), there is little empirical research examining the naturally existing relationship among these substances. Britt, Collins, and Cohen (in press) examined the relationship among cigarette smoking and chewing gum use (a possible alternative reinforcer) in 584 college students. Analyses indicated that non-smokers were more likely to be gum chewers than smokers. Additionally, these analyses suggest a possible trend to this relationship: the heavier smoker one is, the less likely one is to chew gum.

Recent studies conducted in our laboratory have demonstrated that simple alternative reinforcers, such as chewing gum, appear to influence urge to smoke and nicotine withdrawal. Cohen, Collins, and Britt (1997) provided smokers access to chewing gum in situations where smoking was prohibited and demonstrated significant decreases in craving for a cigarette and withdrawal symptoms as compared to smokers

who did not have access to chewing gum. In a second study (Cohen, Britt, Collins, Stott, & Carter, in press), smokers were given small incentives not to smoke. Significant differences were found in latency to first cigarette and number of puffs among gum and smoking groups, with the gum group waiting longer to first cigarette and taking fewer puffs. Researchers are not suggesting that chewing gum completely alleviates craving or withdrawal; rather, evidence suggests that chewing gum may reduce these symptoms in dependent smokers and alter smoking behavior (topography). Chewing gum may, in fact, be a viable alternative to cigarette smoking when individuals cannot smoke.

Numerous smoking cessation programs have informally incorporated chewing gum and other alternative behaviors into their treatment programs as something to do in lieu of smoking. While Britt et al.'s (in press) data alone do not support gum as a behavioral substitute for smoking, these data combined with our laboratory studies suggest that gum may indeed be an effective alternative in lieu of smoking for smokers who chew gum. Smoking cessation programs should consider the role of chewing gum and other alternative reinforcers in drug use.

The present study

The proposed research represents one area that has been largely understudied, but which may further our understanding of the role stress plays in cigarette smoking behavior. The primary goal of the present study is to examine potential differences in how smoking and chewing gum influence urge to smoke, withdrawal symptoms, and anxiety in response to a laboratory-induced stressor (public speaking task) among college smokers. This study builds upon previous work in the area and addresses some of the

short-comings of prior work. While numerous studies have examined the anxiolytic properties of smoking in response to stress, many studies fail to utilize stressors that are ecologically valid (i.e., white noise, anagrams, etc). The current study addresses this potential problem by including the use of an ecologically valid stressor, a public speaking task of a personal nature (satisfaction of physical appearance). Prior work (Perkins et al., 1992b) has also suggested that subjective assessment of anxiety immediately after smoking should be used as well as the inclusion of multiple measures of anxiety. The present study includes multiple self-report measures of anxiety assessed throughout the experimental session.

The current study is a 3 (Group Condition) x 5 (Time) mixed-factorial design, with two factors of interest, Group and Time of assessment. The three levels of the Group Condition are (1) Smoke Group (subjects in this group have access to smoking), (2) Gum Group (subjects in this group have access to chewing gum) and (3) Control Group (subjects in this condition did not have access to cigarettes or chewing gum).

The four dependent variables (urge to smoke, withdrawal symptoms, state anxiety, and anxious emotion) were measured at five (5) assessment points: Time 1 (baseline), Time 2 (immediately following introduction of the stressor), Time 3 (just prior to the speech stressor), Time 4 (immediately following the speech), and Time 5 (recovery phase). Demographic information, smoking history, and measures assessing drug use, fear of public speaking, and general mood were administered at Time 1. A detailed timeline for the current study is presented in Table 1 and outlined in the Method section.

Hypotheses

Hypothesis 1 – Urge to smoke. It was predicted that groups would differ in urge to smoke as measured by the Questionnaire of Smoking Urges (QSU; Tiffany & Drobes, 1991) pre-stressor (Times 2-3) as well as post-stressor (Times 4-5). Since the Smoke Group was the only group allowed to smoke at Time 2, immediately following introduction of the stressor, it was predicted that the Smoke Group would report lower urges to smoke than the Gum Group, which would report fewer urges to smoke than the Control Group. Additionally, it was hypothesized that significant group differences in urge to smoke would be found at Time 3, immediately prior to the speaking task. Specifically, it was predicted that the Smoke Group would report lower urges to smoke than the Gum Group, who would report fewer urges to smoke than the Control Group.

We also predicted that group differences in urge to smoke would also be found once the stressor was no longer present (e.g., following the speaking task --Time 4, and after a recovery period -- Time 5). Based on previous research, it was hypothesized that having access to chewing gum may be better than not having access to anything at all (Cohen et al, in press). Specifically, it was expected that individuals who continued to smoke (Smoke Group) would report fewer urges to smoke than subjects in the Gum Group, who would report fewer urges to smoke than subjects in the Control Group.

Hypothesis 2 – Withdrawal Symptoms. It was predicted that significant group differences in symptoms of withdrawal as measured by the Nicotine Abstinence Scale (NAS; McChargue, Cohen, Britt, & Collins, 1999) would be found pre-stressor (Times 2-3) as well as post-stressor (Times 4-5). We hypothesized that since only the Smoke

Group had access to cigarettes at Time 2, that significant group differences in withdrawal would be detected at Time 2, immediately following introduction of the stressor (instructions for the speaking task). Specifically, it was predicted that the Smoke Group would report fewer withdrawal symptoms than subjects in the Gum Group, which would report fewer withdrawal symptoms than the Control Group (who neither smoked nor chewed gum). Additionally, it was hypothesized that significant group differences in withdrawal would be found at Time 3, immediately prior to the speaking task, with the Smoke Group reporting fewer withdrawal symptoms than the Gum Group, which would report fewer withdrawal symptoms than the Control Group.

It was also predicted that group differences in symptoms of withdrawal would also be found once the stressor was no longer present (following the speaking task -- Time 4, and after a recovery period -- Time 5). Specifically, it was expected that individuals who continued to smoke (Smoke Group) would report fewer withdrawal symptoms than subjects in the Gum group, who would report fewer symptoms of withdrawal than subjects in the Control Group.

Hypothesis 3 – State Anxiety. It was predicted that significant group differences in state anxiety as measured by the State-Trait Anxiety Inventory-State (STAI-S; Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1983) would be detected pre-stressor (Times 2-3) as well as post-stressor (Times 4-5). It was predicted that if smoking is truly anxiolytic as many smokers report, then the group with access to smoking (Smoke Group) would report lower levels of state anxiety at Time 2, immediately following introduction of the stressor, than the Gum Group, which would report less anxiety than

the Control Group. Additionally, it was hypothesized that significant group differences in anxiety would be found at Time 3, immediately prior to the speaking task and while the stressor was still active. Specifically, it was predicted that if smoking is truly stress-reducing, the Smoke Group would report lower levels of anxiety than the Gum Group, which would report less anxiety than the Control Group.

We also predicted that group differences in anxiety would be found after removal of the stressor (following the speaking task -- Time 4, and after a recovery period -- Time 5). Specifically, it was expected that individuals who continued to smoke (Smoke Group) would report less anxiety than subjects in the Gum Group, who would report less anxiety than subjects in the Control Group.

Hypothesis 4 – 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) pre-stressor (Times 2-3) as well as post-stressor (Times 4-5). We hypothesized that groups would differ on rating of anxious emotion at Time 2, immediately following presentation of the stressor. Specifically, it was predicted that the group with access to smoking (Smoke Group) would report lower levels of anxious emotion than the Gum Group, which would report lower levels of anxious emotion as compared to the Control Group. We predicted that significant group differences in anxious emotion would also be found at Time 3, immediately prior to the speaking task. Specifically, it was predicted that the Smoke Group would report lower levels of anxious emotion than the Gum Group, which would report lower levels of anxious emotion than the Control Group.

Finally, we predicted that group differences in anxious emotion would be found after removal of the stressor (following the speaking task -- Time 4, and after a recovery period -- Time 5). Specifically, it was expected that individuals who continued to smoke (Smoke Group) would report lower levels of anxious emotion than subjects in the Gum Group, who would report less anxious emotion than subjects in the Control Group.

Method

Subjects

Forty-five subject volunteers were recruited from undergraduate courses at Oklahoma State University. Based on pre-screening information obtained via screening questionnaires and phone contacts, subjects meeting the following criteria were included in the study: those who (1) reported smoking at least 16 cigarettes daily, (2) were not currently taking psychoactive medications, (3) had no medical problems preventing them from participating in the study (e.g., TMJ), (4) at least occasionally chewed gum, and (7) were at least 18 years of age and willing to give informed consent.

Measures used to describe sample

Several scales were administered to categorize or describe the subject sample (e.g., to assess subjects' levels of nicotine dependence, depressed mood, trait anxiety, and fear of public speaking). The following scales were those measures used to describe the subject sample and were administered only at Time 1.

Health Habits Questionnaire (HHQ; Britt, 1996). The HHQ, a self-report measure developed by the first author, assesses use (i.e., frequency, amount, reasons for use, etc.)

of cigarette smoking, caffeine, alcohol, and chewing gum. This information was used for descriptive purposes only.

Fagerström Test for Nicotine Dependence (FTND; Fagerström, 1978; Heatherton, Kozlowski, Frecker, & Fagerström, 1991). The FTND, a revised version of the original Fagerström Tolerance Questionnaire (FTQ; Fagerström, 1978), is a noninvasive measure of nicotine dependence. The FTND is a brief, self-report inventory designed to assess various components of smoking behavior, including number of cigarettes smoked daily, time to first cigarette, and difficulty refraining from smoking. Scores can range from 0-12, with higher scores indicating greater levels of dependence. The FTND has been found to be a reasonably psychometrically sound, valid measure of nicotine dependence (Heatherton et al, 1991; Pomerleau, Majchrzak, & Pomerleau, 1989; Payne, Smith, McCracken, McSherry, & Antony, 1994).

Inventory to Diagnose Depression (IDD; Zimmerman, Coryell, Corenthal, & Wilson, 1986). The IDD is a 22-item, self-administered instrument designed to assess the severity of depressive symptomatology as described in the Diagnostic and Statistical Manual of Mental Disorders – 4th edition [DSM-IV] (American Psychiatric Association, 1994). Subjects are asked to answer each item with one of five statements accompanying the items, which are arranged in order of increasing severity. Each item's answer is summed to obtain a severity index of depressive symptomatology. Scores can range from 0-88, with higher scores indicating greater levels of depressive symptomatology.

The psychometric properties of the IDD have been well documented and have demonstrated that the IDD is a psychometrically sound instrument (Zimmerman & Coryell, 1987, 1988; Zimmerman et al., 1986) with excellent test-retest reliability (.98),

split-half reliability (.91-.93), and excellent internal consistency. Cronbach's alpha is estimated to be .92 (Zimmerman & Coryell, 1987; Zimmerman et al., 1986). The IDD also has excellent concurrent validity as is evidenced by the significant correlations between the IDD and other standardized measures of depression. The IDD also discriminates significantly between different levels of depression and is sensitive to clinical change (Zimmerman & Coryell, 1987; Zimmerman et al., 1986).

State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983). The STAI is a 40-item, self-report measure designed to assess state and trait anxiety. Responses range from 1 (not at all) to 4 (very much so). Scores for each scale can range from 20 to 80, with higher scores reflecting greater levels of anxiety. The essential qualities evaluated by the STAI are feelings of apprehension, tension, nervousness, and worry. Trait anxiety (STAI-T) was assessed at baseline only. State anxiety (STAI-S) was measured at all five assessment points.

The STAI is a psychometrically sound instrument. Test-retest coefficients are generally high for the T-Anxiety scale and low for the S-Anxiety scale, which is expected for an instrument assessing changes in anxiety resulting from environmental or situational stress. The STAI has excellent internal consistency for both scales as measured by alpha coefficients and item-remainder correlations. The STAI has also been shown to demonstrate good concurrent, convergent, divergent, and construct validity (Spielberger et al., 1983).

Audience Anxiousness Scale (AAS; Leary, 1983). The AAS is a 12 item, self-report measure designed to asses the cognitive and affective aspects of anxiety in public speaking and other situations in which individuals' social responses are not contingent

upon the behaviors of others. Items are rated on a five point scale ranging from 1 (uncharacteristic of me or not true) to 5 (characteristic of me or true). Scores can range from 12-60, with higher scores suggesting greater levels of anxiety. Chronbach's alpha of 0.91 was reported for this measure and an 8-week test-retest coefficient of 0.84. The AAS is highly correlated with measures of public speaking (Corcoran & Fischer, 1987; Leary, 1983).

Dependent Measures

Other instruments were used repeatedly to assess urge to smoke, withdrawal symptoms, state anxiety, and anxious emotion and were administered at all five (5) assessment points. The following list of measures are those instruments that served as dependent measures.

Questionnaire of Smoking Urges (QSU; Tiffany & Drobes, 1991). The QSU is a 32-item, self-report questionnaire designed to assess an individual's urge to smoke. Responses range from 1 (strongly disagree) to 7 (strongly agree), with higher scores reflecting greater urges to smoke. Analyses of QSU items reveal two distinct, yet related, manifestations of verbal report of smoking urges. These results are different from most theoretical conceptualizations, which assume that, at any point in time, smoking urges are unidimensional states. Factor 1 primarily reflects intention and desire to smoke and anticipation of pleasure from smoking (e.g., it would taste good, be enjoyable). Items from factor 2 are primarily comprised of anticipation of relief from negative affect and nicotine withdrawal, urgent and overwhelming desire to smoke, and allow for greater clarity of thinking and control. Reliabilities of the two factors are exceptionally high as

demonstrated by internal consistency coefficients: Factor 1 = 0.95, Factor 2 = 0.93. The intercorrelations of the two factor scales is 0.71. By virtue of its high reliabilities and inclusion of a scale more closely linked to negative affect and nicotine withdrawal, the QSU appears to be a sensitive instrument for the detection of potential changes in urge report.

Nicotine Abstinence Scale (NAS; McChargue et al, 1999). The NAS, a modified version of the Withdrawal Symptoms Checklist (Hughes & Hatsukami, 1986), is a 14-item self-report measure designed specifically for this study to assess the presence of tobacco withdrawal symptoms and the severity of each symptom. The severity of each symptom is based on a 4-point Likert scale, ranging from 0 (not present or none) to 3 (severe). Since craving is no longer considered a symptom of nicotine withdrawal in the DSM-IV, (APA, 1994), the craving item was dropped from the total score for purposes of the current study. Based on the remaining 13 items, NAS scores can range from 0-39, with higher scores indicating greater withdrawal symptoms associated with nicotine abstinence.

State-Trait Anxiety Inventory-State (STAI-S; Spielberger et al., 1983). The STAI-S is a 20-item, self-report measure designed to assess state anxiety. Responses range from 1 (not at all) to 4 (very much so). Scores for this scale can range from 20 to 80, with higher scores reflecting greater levels of anxiety. The essential qualities evaluated by the STAI are feelings of apprehension, tension, nervousness, and worry. Research has demonstrated that the state anxiety scale (S-Anxiety) is a sensitive measure of changes in transient anxiety. The STAI has been used extensively in both clinical practice and research to assess the level of state anxiety in laboratory-induced stress and

real-life stressors (Chaplin, 1985; Spielberger et al., 1983). State anxiety (STAI-S) was measured at all five assessment points.

Emotion Assessment Scale (EAS; Carlson et al., 1989). The EAS, a 24-item, self-report measure designed to measure emotional state, is divided into eight basic emotion subscales. Items are rated from 1 (least possible) to 7 (most possible). Responses for the anxiety subscale (EAS-ANX), chosen for this study, range from 3 to 21, with higher numbers indicating greater levels of anxious emotion. The EAS can be used to measure transient levels and changes in emotions, can be completed in less than one minute, and can be used in various clinical settings (Fischer & Corcoran, 1994).

The EAS demonstrates good to excellent reliability, and very good concurrent validity (Collins, Street, & Shields, 1996; Fischer & Corcoran, 1994). EAS subscales are sensitive to changes in stress ratings (Fischer & Corcoran, 1994). Research has also demonstrated that the Likert version of the EAS holds up well to repeated measurement (Collins et al., 1996).

Procedure

Volunteers were recruited from undergraduate courses at Oklahoma State University for a study examining social factors and personality variables of smokers. Potential subjects were contacted by telephone. Telephone contacts were used to confirm smokers' rate of smoking, and obtain information regarding preferred brand of cigarettes, chewing gum use, and current attempts to quit smoking. Following an initial telephone screening, each subject meeting study criteria and interested in participation was scheduled for an experimental session. Each session lasted approximately 2 ½ hours.

Table 1 provides a detailed outline of the current study. At the beginning of the experimental session, subjects were welcomed to the laboratory, and seated in a comfortable armchair in a sound-proof experimental room. A study investigator briefly explained the study, after which subjects were asked to sign consent forms.

In order to acquire a uniform minimal deprivation period, and since the magnitude of subjective effects of smoking and nicotine may in fact depend on predrug baseline subjective states (Perkins, Grobe, Epstein, Caggiula, & Stiller, 1992a), each subject was asked to smoke one (1) cigarette of his/her preferred brand which was provided by the experimenter. Subjects were told that they may or may not be asked to smoke again later in the study. Since tobacco deprivation was minimal throughout the study, it was not expected that subjects would experience substantial withdrawal effects. Following this initial contact, all other instructions were administered through an intercom to help ensure standardization of procedures. Subjects were also observed through a one-way mirror.

After the initial mandatory cigarette, subjects were asked to complete Time 1 instruments: demographic information, HHQ, QSU, FTND, NAS, IDD, EAS, STAI, and AAS. It was estimated that subjects would require 30-45 minutes to complete these measures. Subjects were encouraged to read magazines or work on crossword puzzles upon completion of the Time 1 measures. Subjects were then given a 15-minute rest period following completion of Time 1 measures. Other than the mandatory cigarette at the beginning of the experimental session, no subject was allowed to smoke during this baseline period. Time 1 measurements and the short rest period lasted approximately 60 minutes.

After 60 minutes had elapsed, subjects 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.'" A very similar task has been previously shown to elicit significant stress responses (Hatch et al., 1983; Kassel & Shiffman, 1997; Levenson et al., 1980; Steele & Josephs, 1988). Subjects were also told that their speeches would be videotaped and that several graduate student laboratory members would view the tapes and evaluate their performances for psychological factors, such as openness and defensiveness. To make this procedure more convincing, a video camera was set up in the experimental room within participants' sight. In reality, subjects' performances were not recorded or evaluated by laboratory personnel; however, similar procedures have successfully induced acute mental stress and feelings of anxiety (al'Absi et al., 1997; Kassel & Shiffman, 1997).

Immediately following the instructions for the speech, subjects were instructed to either (1) smoke 1 cigarette (Smoke Group), (2) chew 1 piece of gum (Gum Group), or (3) do nothing (Control Group) based on group assignment, which was randomly determined prior to subjects' arrival. Chewing gum and subjects' preferred brand of cigarettes were provided and were accessible in the experimental room. Gum was accessible only to subjects in randomly assigned to the Gum Group. A study experimenter verified that subjects in the Smoke Group actually began smoking and subjects in the Gum Group started chewing gum before proceeding with remainder of the

experiment. Time 2 is more than a measure of the effects of an immediate stressor. It is also an effect of smoking availability.

Following these instructions, subjects were told that one of the things this study was interested in were the changes in mood and stress over time. To assess this, subjects were informed that they would be asked to report how they were feeling at several points during the study, one of which was at that moment (Time 2). Subjects were asked to rate their anxiety (STAI-S), mood (EAS), withdrawal symptoms (NAS), and urge to smoke (QSU) based on how they were feeling at that moment (Time 2). Order of instruments was counterbalanced across assessment periods. Following the Time 2 cigarette or piece of gum immediately after the speech instructions, subjects in the Smoke Group were informed that they were free to smoke throughout the experiment unless instructed otherwise. Subjects in the Gum Group were informed that they were free to chew gum throughout the experimental session unless otherwise instructed.

When subjects had completed Time 2 measurements, they were given several minutes in which to mentally prepare for their speech. Subjects in the Smoke Condition were reminded that they could smoke if they liked, and subjects in the Gum Condition were reminded that they were free to chew gum if they desired. A study experimenter allowed subjects two (2) minutes to mentally prepare for the speech. At the end of a two minute period and just prior to the speech, subjects were again asked to rate their feelings of anxiety, anxious mood, urge to smoke and withdrawal symptoms (Time 3) as assessed by the STAI-S, EAS, QSU, and NAS, respectively.

After completion of Time 3 measurements, subjects were instructed via intercom to extinguish all cigarettes or expectorate their chewing gum. Subjects were instructed to

begin their speech and were informed that the experimenter would stop them 3 minutes later. No subject was allowed to smoke or chew gum during the speech itself. Immediately after instructing subjects to begin speaking, the experimenter turned off the intercom, so that none of the subjects' speeches were actually heard by study investigators. Our primarily interest was in the anxiety invoked by the speaking task, rather than the speeches themselves, thus, we were less concerned about subjects' speech content or length. At the end of a 3-minute period, subjects were told to stop speaking. Subjects in the Smoke Condition were reminded that they were free to smoke, and subjects in the Gum Condition were instructed that they were free to chew gum for the remainder of the experimental session. All subjects were asked to rate their feelings of anxiety, anxious mood, withdrawal symptoms, and urge to smoke as assessed by the STAI-S, EAS, NAS, and QSU, respectively, based on how they were feeling at the moment (Time 4).

Following completion of Time 4 instruments, subjects were asked to "relax for a short time." They were permitted to read magazines or work on crossword puzzles. Subjects in the Smoke Condition were reminded that they were free to smoke for the remainder of the study, and subjects in the Gum Condition were reminded that they were free to chew gum for the remainder of the study. Following a 10 minute rest period, subjects were asked once again to complete measures of anxiety, withdrawal symptoms, anxious mood, and urge to smoke as assessed by the STAI-S, NAS, EAS, and QSU, respectively (Time 5).

Following completion of instruments at Time 5, a study experimenter entered the laboratory room, debriefed the subject as to the study's purposes and intentions, thanked

the subject for his/her participation and reminded subjects that his/her name would be placed in a lottery drawing for his/her participation. Prizes included a gift certificate to a local restaurant and movie passes. For subjects currently enrolled in psychology classes, subjects' names were recorded and forwarded to instructors for recording of extra credit participation.

Results

Overall Analytic Strategy

The current study was a 3 X 5 mixed-factorial design, with two independent variables: A) Group Condition, with three (3) levels: Smoke, Gum, and Control; and B) Time, with five (5) assessment points, Times 1-5. Dependent variables (DV) were urge to smoke (QSU), withdrawal symptoms (NAS), state anxiety (STAI-S), and anxious emotion (EAS-ANX) and were measured at all five assessment points. A mixed-factorial design was chosen for this study to simultaneously examine these independent variables in relation to the DV.

Four 3 (Group) X 5 (Time) repeated-measures analyses of variance (ANOVAS) were planned to assess urge to smoke, withdrawal symptoms, state anxiety, and anxious emotion as measured by the QSU, NAS, STAI-S, and EAS-ANX, respectively. If significant interactions were detected, simple effects tests were conducted to identify group differences. If groups were found to significantly differ at Time 1, difference scores were computed, and a 3 (Group) X 4 (Time) repeated-measures ANOVA was conducted. Planned comparisons to identify group differences were determined a priori,

and were tested by simple effects tests, with Tukey post-hoc tests used to determine differences among groups.

Preliminary Analyses

Descriptive statistics. Descriptive statistics were computed for subject characteristics. Subject demographic information is presented in Table 2. No significant group differences were found on any these measures at Time 1 (baseline).

Correlational analyses. While hypotheses did not directly address correlations among measures, investigators were interested in the pre-existing relationships among the dependent variables. Table 3 presents the correlation matrix of all dependent variables at the baseline assessment. Several of the findings merit comment. Urge to smoke was significantly associated with symptoms of withdrawal, state anxiety, and anxious emotion. Greater levels of withdrawal were positively associated with higher levels of anxiety and greater urge to smoke. Higher levels of anxiety were associated with stronger urges to smoke and higher rating of withdrawal distress. Relationships among dependent variables are consistent with previous research. Urge to smoke is correlated with dysphoric emotions, and higher levels of negative affect (e.g., anxiety) predict stronger urges to smoke (Doherty et al., 1995; Tiffany & Drobes, 1990; Zinser et al., 1992).

These findings are particularly interesting given that baseline measures were completed after subjects had smoked a cigarette. These results suggest that just participating in an experiment may be anxiety provoking for subjects who are generally anxious. Additionally, participation in a laboratory experiment may influence urge to

smoke and withdrawal distress even if subjects had just smoked a cigarette. The greater the anxiety levels, the greater the urge to smoke and withdrawal distress even pre-stressor.

Repeated Measures Analyses of Variance

Hypothesis 1 (Urge to smoke). Hypothesis 1 predicted that groups would differ on urge to smoke at all assessment points beyond Time 1 (baseline). Urge to smoke was assessed by the QSU, a measure of an individual's urge to smoke and a function of smoking availability, at Time 1, Time 2, Time 3, Time 4, and Time 5. This hypothesis specifically predicted that beyond the baseline period (Time 1), the Smoke Group would report less urge to smoke than the Gum Group, which would report fewer urges to smoke than the Control Group.

A repeated-measures ANOVA was conducted on urge to smoke. A significant Group X Time interaction using QSU total score was found, F (8,168) = 8.61, $p < .001$, indicating that mean differences between groups on urge to smoke were dependent upon time of assessment. Simple effects tests indicated that no significant group differences in urge to smoke were detected at Time 1, when all groups had had equal access to smoking. As expected, group differences in urge to smoke were found when smoking availability differed (See Figure 1).

The hypotheses that significant group differences in urge to smoke in anticipation (Times 2-3) and removal of the stressor (Times 4-5) were partially confirmed. As expected, simple effects tests indicated that significant group differences in urge to smoke were found at Time 2, F (2,168) = 13.96, $p < .05$; Time 3, F (2,168) = 30.18, $p <$

.05; Time 4, F (2,168) = 37.70, $p < .05$; and Time 5, F (2,168) = 69.22, $p < .05$, when smoking availability differed among groups. Just as we had predicted, Tukey post-hoc tests indicated that the group with access to smoking (Smoke Group) reported significantly less urge to smoke than the other two groups at all assessment points beyond Time 1 (baseline). However, the Gum and Control Groups were not significantly different from each other at any of these assessment points. Smoking availability reduced urge to smoke, and was clearly the best of these alternatives in reducing smoking urge. Chewing gum was not effective in reducing urge to smoke, and was virtually no different in relieving urge to smoke than having access to nothing at all (See Figure 1).

Hypothesis 2 (Withdrawal symptoms). Hypothesis 2 predicted that the Smoke Group would report less withdrawal than the Gum Group, which would report lower withdrawal levels than the Control Group at all assessment points beyond Time 1 (baseline). Withdrawal symptoms were assessed by the NAS, a measure of the number and severity of an individual's withdrawal symptoms, at Time 1, Time 2, Time 3, Time 4, and Time 5. This hypothesis specifically predicted that beyond the baseline period (Time 1), the Smoke Group would report fewer withdrawal symptoms than the Gum Group, which would report fewer withdrawal symptoms than the Control Group.

A 3 X 5 repeated-measures ANOVA was conducted. A significant Group X Time interaction was found, F (8,168) = 3.188, $p < .005$. Simple effects tests indicated that groups differed significantly at Time 1, thus, difference scores were computed and a 3 X 4 repeated-measures ANOVA was performed on difference scores. A significant Group X Time interaction was found, F (2,126) = 2.76, $p < .05$, indicating that mean differences

between groups on withdrawal symptoms were dependent upon time of assessment (See Figure 3). As expected, significant group differences in withdrawal were detected.

The hypotheses that significant group differences in withdrawal symptoms in anticipation of the stressor (Times 2-3) were partially confirmed. The hypothesis that groups would differ in withdrawal symptoms at Time 2 was not confirmed, F (2,126) = 2.67. This is somewhat surprising since the Smoke Group was the only group with access to smoking at this point in time. However, it is important to note that Time 2 is more than a measure of immediate presentation of the stressor. Time 2 is also a measure of smoking availability. Since all subjects had smoked 60 minutes prior to Time 2 measurements, it is possible that not enough time had elapsed to influence significant withdrawal distress. Simple effects tests indicated that significant group differences in withdrawal symptoms were found at Time 3, F (2,126) = 6.55, $p < .05$. Tukey post-hoc tests indicated that at Time 3, the Smoke Group reported significantly lower levels of withdrawal as compared to the Control Group. The Gum Group's level of withdrawal was between the two and did not significantly differ from either the Smoke or Control Groups.

The hypotheses that significant group differences in withdrawal symptoms post-stressor (Times 4-5) were confirmed. As expected, simple effects tests indicated that significant group differences in level of withdrawal were found at Time 4, F (2,126) = 16.22, $p < .05$, and Time 5, F (2,126) = 28.75, $p < .05$. Tukey post-hoc tests indicated that at Times 4-5, the Smoke Group reported significantly lower levels of withdrawal than both the Gum and Control Groups. Additionally, the Gum Group reported significantly lower levels of withdrawal as compared to the Control Group post-stressor

(See Figure 2). These findings demonstrate that while smoking may be most helpful at reducing withdrawal symptoms, chewing gum may help manage symptoms of withdrawal and appears to be better than having access to no alternative at all.

Hypothesis 3 (State Anxiety). Hypothesis 3 predicted that groups would differ in levels of state anxiety as measured by the STAI-S at all assessment points beyond baseline. Specifically, this hypothesis specifically predicted that if smoking was truly anxiolytic as many smokers report, the Smoke Group would report less state anxiety than the Gum Group, who would report lower levels of anxiety than the Control Group pre- and post-stressor. A 3 X 5 repeated-measures ANOVA was conducted. As expected, a significant Group X Time interaction was found, F (8,168) = 2.17, $p < .05$, indicating that mean group differences in state anxiety were dependent upon time of assessment (See Figure 3).

The hypotheses that significant group differences in anxiety in anticipation of the stressor at Times 2-3 were not confirmed, F (2,168) = 1.05; F (2,168) = 1.82, respectively. No groups differed in level of anxiety pre-stressor, indicating that smoking in the context of a stressful situation does not appear to alleviate state anxiety, as levels of anxiety reported by the Smoke Group were no different than anxiety levels of the other two groups. Although smokers report that smoking is helpful in reducing anxiety, these findings do not support such claims.

The hypothesis that significant group differences in anxiety after removal of the stressor (Times 4-5) was confirmed. Simple effects tests indicated that significant group differences in anxiety were found at Time 4, F (2,168) = 4.61, $p < .05$, and Time 5, F

(2,168) = 6.53, $p < .05$. Specifically, Tukey post-hoc tests indicated that at both Time 4 and Time 5, both the Smoke and the Gum Groups reported significantly less anxiety than the Control Group. The Smoke and Gum Groups did not significantly differ from each other in anxiety at Times 4 or 5 (See Figure 3).

As seen in Figure 3, changes in anxiety over time for the Smoke Group are inconsistent with what one would predict based on what smokers report – that smoking relaxes them and helps them cope with anxiety. Thus, exploratory analyses on the Smoke Group's anxiety were performed to determine if level of anxiety reported at Times 2 and 3 (the highest levels of anxiety for any group) were different from the levels of anxiety reported at other points in time. As seen in Figure 4, the Smoke Group reported significantly higher levels of anxiety at Time 2 and at Time 3 as compared to Time 1 or to either of the 2 assessment periods following the speech, Times 4 and 5. These exploratory analyses combined with results previously discussed provide further evidence that smoking does not relieve symptoms of anxiety during the presence of a stressor.

Hypothesis 4 (Anxious Emotion). Hypothesis 4 predicted that groups would differ in level of anxious emotion as measured by the EAS-ANX at all assessment points beyond baseline. Specifically, this hypothesis predicted that if smoking was truly anxiolytic in reducing anxious emotion, the Smoke Group would report lower levels of anxious emotion than the Gum Group, which would report less anxious emotion than the Control Group pre- and post-stressor.

A 3 X 5 repeated-measures ANOVA was conducted. Significant Condition X Time interactions were detected, F (8,168) = 2.45, $p < .05$, indicating that mean

differences between groups on anxious emotion were dependent upon time of assessment. The hypotheses that significant group differences in anxious emotion pre-stressor (Times 2-3) and post-stressor (Times 4-5) were partially confirmed. As predicted, no significant group differences were detected at Time 1. Simple effects tests indicated that groups differed significantly only at Time 2, F (2,168) = 4.71, $p < .05$, a period during which the Smoke Group was the only group allowed to smoke. Tukey post-hoc tests indicated that at Time 2, the Smoke Group reported significantly higher levels of anxiety than the Control Condition (See Figure 5), providing further support for non-anxiolytic properties of smoking. The Gum and Control Groups did not significantly differ in level of anxiety at any point in time. No significant differences in EAS-ANX were detected at Time 3, F (2,168) = 2.38; Time 4, F (2,168) = 1.24; or Time 5, F (2,168) = 2.30.

Discussion

General findings

The primary purpose of the present study was to investigate the anxiolytic properties of cigarette smoking compared to the use of chewing gum as an alternative coping mechanism in response to stress. Specifically, this study sought to examine the effects of cigarette smoking and chewing gum on urge to smoke, withdrawal, and anxiety in the presence of a laboratory stressor.

The basic predictions were partially confirmed. Smoking helped manage urge to smoke and withdrawal symptoms, but provided little benefit, if any, in managing levels of anxiety. Although chewing gum did not reduce urge to smoke, it did seem to help

manage withdrawal symptoms. Additionally, gum appeared to be more "anxiolytic" than cigarette smoking in reducing anxiety.

Urge to smoke and withdrawal symptoms

Since smoking availability differed among the three groups, it was predicted that groups would differ in urge to smoke at assessment points beyond baseline. As predicted, smoking clearly helped manage the urge to smoke. Subjects with access to smoking reported significantly fewer urges to smoke both pre- and post-stressor as compared to the Gum and Control Groups, which did not have access to smoking. Gum provided no benefit in managing urge to smoke and was essentially no different than having access to nothing at all.

Smoking also appeared to better manage withdrawal symptoms, whereas not smoking was less helpful. We proposed that group differences in withdrawal symptoms would be detected as smoking availability differed among groups. Not surprisingly, subjects in the Smoke Group generally reported fewer withdrawal symptoms than subjects without access to smoking. No groups significantly differed in symptoms if withdrawal immediately following presentation of the stressor. This is not surprising given that subjects in all conditions had just smoked 1 hour prior to Time 2 assessment.

However, as the withdrawal period lengthened, differences in withdrawal symptoms among groups became more pronounced. At Time 3, just immediately prior to the speaking task, the Smoke Group reported significantly lower withdrawal distress than the Control Group. This is not surprising given that the Smoke Group had access to smoking prior to the speaking task. Once the stressor had ended (Times 4-5), the Smoke

Group reported significantly lower withdrawal symptoms than those in the Gum Group, which were significantly lower than withdrawal symptoms in the Control Group (See Figure 2). Smoking did help reduce symptoms of withdrawal, which should come as no surprise: continuation of smoking does not allow a chance for significant withdrawal symptoms to develop. However, results indicate that although not as effective in alleviating withdrawal, chewing gum may help manage current symptoms of withdrawal post-stressor.

These findings are generally consistent with recent studies conducted in our laboratory. Several recent studies have shown that chewing gum helps reduce nicotine withdrawal when a nicotine dependent person cannot smoke (Cohen, 1998; Cohen et al, 1997). Cohen (1998) recently demonstrated that when smokers were asked to chew gum, they reported significantly less withdrawal as compared to times when they were not allowed to chew gum. Additionally, as the withdrawal period lengthened, differences between the two experimental sessions (Gum and No-Gum) became more pronounced. In a follow-up study, smokers with access to gum waited longer to their first cigarette and took fewer puffs than those without access to chewing gum (Cohen et al., in press). The results from the current study, coupled with previous research conducted in our laboratory do not suggest that chewing gum will allow an individual to completely avoid withdrawal, rather chewing gum may help manage withdrawal in times when smoking is not permitted.

Anxiety

In contrast to the "beneficial" effects smoking had on urge to smoke and withdrawal, smoking was not as helpful with anxiety. Contrary to what smokers generally report, smoking did not reduce levels of stress as measured by two separate measures of anxiety (STAI-S, EAS-ANX). It was predicted that if smoking was truly anxiolytic, subjects in the Smoke Group would report less anxiety than the other two groups at all assessment point beyond baseline.

Findings from the STAI-S indicate that no groups differed in levels of anxiety pre-stressor (Times 2-3). The anxiety levels in the Smoke Group were virtually no different from anxiety in the groups without access to smoking (See Figure 3). These results suggest that smoking in the presence of an immediate stressor is not stress-reducing, as many smokers may believe.

Once the stressor had passed and the speaking task was over, the Smoke Group reported significantly lower levels of anxiety as compared to the Control Group. What was surprising, however, was that during the period following the stressor, the Smoke and Gum Groups' levels of anxiety appeared almost identical. Post-stressor, *both* the Smoke and Gum Groups reported significantly lower levels of anxiety as compared to the Control Group.

These findings indicate that in anticipation of a stressful situation (Times 2-3), smoking is virtually no better at managing levels of anxiety than not smoking. If smoking was truly anxiolytic, then the Smoke Group should have reported significantly lower anxiety scores pre-stressor as compared to the other two groups. Similar levels of anxiety among the three groups demonstrates that smoking is not stress-reducing in the

presence of an immediate stressor. These findings suggest that smokers may be better off in stressful situations delaying their next cigarette until the immediate stressor has passed. At that point in time, smokers can reduce stress levels even without smoking. Chewing gum may be as effective as smoking in reducing anxiety with none of the health risks associated with smoking.

Findings from the EAS-ANX subscale are generally consistent with findings based on the STAI-S: smoking does not help alleviate anxious emotional states in anticipation of a stressor. It was predicted that given the suggested anxiolytic properties of smoking, the Smoke Group would report less anxiety as assessed by the EAS-ANX than the Gum Group, which would report lower levels of anxiety compared to the Control Group. Interestingly, upon immediate introduction of the stressor, the Smoke Group reported significantly higher levels of anxiety as compared to Control Group (See Figure 5).

Taken together, results based on the STAI-S and EAS-ANX demonstrate that not only is smoking not helpful in alleviating anxious affect in anticipation of a stressful situation, but that doing something other than smoking (e.g., chewing gum, nothing at all) may be more anxiolytic than smoking in the presence of an imminent stressor. These findings suggest that smoking itself is not inherently stress-ameliorating or anxiolytic; rather, smoking may actually be stress-inducing. Smokers who are smoking to reduce negative affect, particularly anxiety, may actually be doing themselves a disfavor by smoking in stressful situations.

Findings based on EAS-ANX subscale may be more compelling than those from the STAI-S. Although groups did not significantly differ in anxiety in anticipation of the

stressor (Times 2-3) as measured by the STAI-S, group means were clearly in directions similar to those found on the EAS-ANX, where subjects in the Smoke Group reported higher levels of anxious emotion in the presence of an immediate stressor. It is possible that the STAI-S and EAS-ANX measure different, yet related, aspects of state anxiety. EAS-ANX assesses anxiousness, nervousness, and worry, whereas the STAI-S scale measures these concepts, plus various other related concepts (e.g., confusion, indecision, etc.). It is possible that the EAS-ANX provides a more direct measure of anxious emotion as compared to the broader STAI-S scale, which may be more of a composite negative affect or blended a measure of general distress rather than a true measure of anxiety.

Limitations and Clinical Implications

Although researchers went to great lengths to design a methodologically sound study, caution should be used in interpreting these findings. Data from the current study are based on self-report measures. Although confidentially was addressed and emphasized, it is possible that the nature of the questionnaire items may have influenced subjects' responses. However, all subjects were informed that they could withdraw from the study at any time without penalty. Thus, researchers feel that results of the current study are generally based on accurate information. Secondly, the current study utilized a public speaking task as the stressor. While this task may not be a perfect stressor for all study participants, previous studies have used similar tasks with good results (al'Absi et al., 1997; Kassel & Shiffman, 1997).

Additionally, the design of the current study did not ensure that all subjects continue speaking for the entire three-minute speaking task. While we were primarily interested in stress responses associated with the speaking task rather than the content or length of the speeches themselves, it is possible that some subjects did not speak for the entire three minute period, allowing some "escape" from anxiety...

Data from the current study were based on college students and thus, may not generalize to other populations. It has been noted that university students exhibit different smoking behavior as compared to their non-college peers, as educational level has been linked to smoking behavior (National Institute on Drug Abuse, 1994). Additionally, the mean number of cigarettes smoked in the current sample was 21.89 daily. The extent to which these findings apply to heavier, older smokers has yet to be determined. Additionally, participants in this study reported chewing gum at least occasionally; however, some people cannot or do not chew gum. In addition, chewing gum use declines with age (O'Connor et al., 1993), thus generalizability of the beneficial qualities of chewing gum in lieu of smoking has yet to be examined in other populations. Conclusions drawn from this study are limited to smokers who can chew gum as an alternative to smoking.

Finally, these results were based on smokers who were not trying to quit smoking. It is possible that the observed results may be limited to smokers who believe that once they leave a particular situation (e.g., a stressful situation), they will be able to resume their normal smoking behaviors, and may not apply to those trying to quit smoking. Future studies should examine the potential differences between abstaining volunteers and those wishing to quit smoking.

Despite the limitations noted above, results from the current study are worth mentioning. The current study is a methodologically sound study which corrects for some of the limitations of previous studies (i.e., Jarvik et al., 1989; Perkins et al., 1992b). Specifically, the present study utilized a more ecologically valid and personalized stressor, obtained subjective measurements of anxiety immediately after smoking and at various points throughout the study and utilized multiple measurements of anxiety.

Data from the current study do not support the stress-ameliorating effects of cigarette smoking in anticipation of stressful events. When smokers who normally smoke in response to stress encounter a stressful situation, they often turn to an easily accessible, well learned coping mechanism, smoking. However, if that particular coping mechanism is unavailable, coping and performance may adversely be affected. Perkins et al. (1991) demonstrated that when smokers were exposed to a stressor in the absence of smoking, diminished performance and greater distress were found. Results from the current study, however, demonstrate that only those smokers who actually smoked showed greater emotional distress. Although smoking appears to be better at reducing urge to smoke and withdrawal symptoms as compared to not smoking, chewing gum appears to be as good as smoking, if not better, at reducing feelings of anxiety, one of the most frequently reported reasons for smoking. The current findings suggest that if individuals have alternative means of coping with stressful situations rather than smoking, exposure to stressful situations may not necessarily lead to greater distress.

Examination of the circumstances surrounding relapse (Pomerleau et al., 1978) as well as retrospective analyses of factors related to craving (Myrsten, Elgerot, & Edgren, 1977) suggest that dysphoric states, specifically anxiety, frequently precede smoking.

Previous research has documented that negative affect influences urge to smoke and both are significant predictors of relapse (Doherty et al., 1995; Tiffany, 1990; Zinser et al., 1992). Results from the current study suggest that if smokers are smoking to reduce negative emotional states, such as anxiety, they are not achieving their goal. Smoking is clearly not beneficial in terms of managing one's anxiety in anticipation of stressful events, and cannot be considered truly "anxiolytic." Results from the current study demonstrate that smoking in response to stressful situations may actually increase smokers' negative affect (levels of anxiety) rather than decrease it. If researchers can convince smokers that not smoking in response to stress may actually be more anxiolytic than smoking, relapse rates may not be so high. Chewing gum appears to be a viable alternative to smoking in stressful situations, and may in fact be a better coping mechanism in stressful situations. Identification of alternative means of coping with stressful situations in lieu of cigarette smoking can reduce the number of smokers who relapse and help teach smokers more effective ways of coping with stressful situations in the absence of smoking.

Smokers retrospectively report that smoking reduces subjective distress and increases feelings of calm and relaxation. These perceived beneficial effects may be important in reinforcing tobacco use. As long as smokers perceive the positive benefits of smoking and view smoking as a valuable psychological resource, smokers will continue to face pressure to resume smoking after cessation attempts. If cessation interventions can dispel such myths and convince smokers of the false benefits of smoking, smokers may begin to recognize that smoking is of no advantage to them and be at less risk of relapse once the acute withdrawal effects of nicotine pass (West, 1993).

The current study does not suggest that chewing gum is a perfect substitute for smoking in times of stress. However, these results do demonstrate that chewing gum may be an effective alternative to smoking during brief periods of abstinence, especially in response to negative emotional states (i.e., stress and anxiety) and nicotine withdrawal. Researchers have been encouraged to examine innovative approaches to smoking cessation in attempts to reduce relapse rates. This study demonstrates that chewing gum may be such an innovative tool to help smokers cope with stressful situations. The current study, coupled with previous research, suggests that smoking does not better the lives of smokers or help them cope better with life's demands. Cessation interventions must train the smoker to identify alternative behavioral tools in response to stress and incorporate these tools into treatment programs.

References

al'Absi, M., Bongard, S., Buchanan, T., Pincomb, G. A., Licinio, J., & Lovallo, W. R. (1997). Cardiovascular and neuroendocrine adjustment to public speaking and mental arithmetic stressors. Psychophysiology, 34, 266-275.

American Cancer Society [ACS]. (1997). Cancer facts and figures – 1997. Atlanta, GA: Author.

American Psychiatric Association. (1994). Diagnostic and statistical manual of mental disorders (4th ed.). Washington, DC: Author.

Aneshensel, C. S., & Huba, G. J. (1983). Depression, alcohol use, and smoking over one year: A four-wave longitudinal causal model. Journal of Abnormal Psychology, 92, 134-150.

Ashton, H., & Stepney, R. (1982). Smoking psychology and pharmacology. London: Tavistock Publications.

Baer, J. S., & Lichtenstein, E. (1988). Classification of smoking relapse episodes: An exploration of individual differences. Journal of Consulting and Clinical Psychology, 56, 104-110.

Bartecchi, C. E., MacKenzie, T. D., & Schrier, R. W. (1994). The human costs of tobacco use (First of two parts). The New England Journal of Medicine, 330, 907-912.

Beman, D. S. (1995). Risk factors leading to adolescent substance abuse. Adolescence, 30, 201-208.

Bickel, W. K., DeGrandpre, R. J., Hughes, J. R., & Higgins, S. T. (1991). Behavioral economics of drug self-administration. II: A unit-price analysis of cigarette smoking. Journal of the Experimental Analysis of Behavior, 55, 145-154.

Billings, A. G., & Moos, R. H. (1983). Social-environmental factors among light and heavy cigarette smokers: A controlled comparison with nonsmokers. Addictive Behaviors, 8, 381-391.

Bliss, R. E., Garvey, A. J., Heinhold, J. W., & Hitchcock, J. L. (1989). The influence of situation and coping on relapse crisis: Outcomes after smoking cessation. Journal of Consulting and Clinical Psychology, 57, 443-449.

Britt, D. M. (1996). The development of a habits use questionnaire: relationship of cigarette smoking, alcohol, caffeine, and chewing gum use in a college population. Unpublished master's thesis, Oklahoma State University, Stillwater.

Britt, D. M., Collins, F. L., Jr., & Cohen, L. M. (in press). Cigarette smoking and chewing gum use among college students. Journal of Applied Biobehavioral Research.

Carlson, C. R., Collins, F. L., Stewart, J. F., Porzelius, J., Nitz, J. A., & Lind, C. O. (1989). The assessment of emotional reactivity: A scale development and validation study. Journal of Psychopathology and Behavioral Assessment, 11, 313-325.

Centers for Disease Control and Prevention [CDC]. (1993). Medical-Care Expenditures Attributable to Cigarette Smoking -- United States 1993, 1994. Morbidity and Mortality Weekly Report, 469-472.

Centers for Disease Control and Prevention [CDC], Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion. (1996). Cigarette smoking among adults -- United States, 1994. Morbidity and Mortality Weekly Report, 45 (27), 588-590.

Chaplin, W. E. (1985). State-Trait Anxiety Inventory. In D. J. Keyser & R. C. Sweetland (Eds.), Test Critiques (Vol. 1, pp. 626-632). Kansas City, MO: Test Corporation of America.

Coan, R. W. (1973). Personality variables associated with cigarette smoking. Journal of Personality and Social Psychology, 26, 86-104.

Cohen, L. M. (1998). A multimodal assessment of the effect of chewing gum on nicotine withdrawal. Unpublished doctoral dissertation, Oklahoma State University, Stillwater.

Cohen, L. M., Britt, D. M., Collins, F. L., Jr., Stott, H., & Carter, L. (in press). Chewing gum affects smoking topography. Experimental and Clinical Psychopharmacology.

Cohen, L. M., Collins, F., L., & Britt, D. M. (1997). The effect of chewing gum on tobacco withdrawal. Addictive Behaviors, 22 (6), 769-773.

Cohen, S., & Lichtenstein, E. (1990). Perceived stress, quitting smoking, and smoking relapse. Health Psychology, 9, 466-478.

Cohen, S., & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan & S. Oskamp (Eds.), The Social Psychology of Health (pp. 31-68). Newbury Park, CA: Sage.

Collins, F. L., Jr., Street, V. L., & Shields, T. (1996). A comparison of three methods for assessing self-reported emotion. Unpublished Manuscript.

Conger, J. J. (1956). Alcoholism: Theory, problem and challenge. II. Reinforcement theory and the dynamics of alcoholism. Quarterly Journal of Studies on Alcohol, 13, 296-305.

Conway, T. L., Vickers, R. R., Ward, H. W., & Rahe, R. H. (1981). Occupational stress and variation in cigarette, coffee, and alcohol consumption. Journal of Health and Social Behavior, 22, 155-165.

Corcoran, K., & Fischer, J. (1987). Measures for Clinical Practice: A Sourcebook. New York: The Free Press.

Dobbs, S. D., Strickler, D. P., & Maxwell, W. A. (1981). The effects of stress and relaxation in the presence of stress on urinary pH and smoking behaviors. Addictive Behaviors, 6, 345-353.

Doherty, K., Kinnunen, T., Militello, F. S., & Garvey, A. J. (1995). Urges to smoke during the first month of abstinence: relationship of relapse and predictors. Psychopharmacology, 119, 171-178.

Epstein, L. H., Bulik, C. M., Perkins, K. A., Caggiula, A. R., & Rodefer, J. (1991). Behavioral economic analysis of smoking: Money and food as alternatives. Pharmacology Biochemistry & Behavior, 38, 715-721.

Epstein, L. H., Dickson, B. E., McKenzie, S., & Russell, P. O. (1984). The effects of smoking on perception of muscle tension. Psychopharmacology, 83, 107-113.

Epstein, L. H., & Jennings, J. R. (1986). Smoking, stress, cardiovascular reactivity, and coronary heart disease. In K. A. Matthews, S. M. Weiss, T. Detre, T. M. Dembroski, B. Falkner, S. B. Manuck, & R. B. Williams, Jr. (Eds.), Handbook of stress, reactivity, and cardiovascular disease (pp. 291-309). New York: John Wiley & Sons.

Epstein, L. H., & Perkins, K. A. (1988). Smoking, stress, and coronary heart disease. Journal of Consulting and Clinical Psychology, 56, 342-349.

Fagerström, K.-O. (1978). Measuring degree of physical dependency to tobacco smoking with reference to individualization of treatment. Addictive Behaviors, 3, 235-241.

Fischer, J., & Corcoran, K. (1994). Measures for Clinical Practice: A Sourcebook (2nd ed., Vol. 2. Adults). New York: The Free Press.

Fleming, S. E., & Lombardo, T. W. (1987). Effects of cigarette smoking on phobic anxiety. Addictive Behaviors, 12, 195-198.

Gilbert, D. G., & Hagen, R. L. (1980). The effects of nicotine and extraversion on self-report, skin conductance, electromyographic, and heart responses to emotional stimuli. Addictive Behaviors, 5, 247-257.

Gilbert, D. G., & Spielberger, C. D. (1987). Effects of smoking on heart rate, anxiety, and feelings of success during social interaction. Journal of Behavioral Medicine, 10, 629-638.

Gilbert, D. G., & Wesler, R. (1989). Emotion, anxiety, and smoking. In T. Ney and A. Gale (Eds.), Smoking and human behavior (pp. 171-196). Chichester: Wiley.

Golding, J., & Mangan, G. L. (1982). Arousing and dearousing effects of cigarette smoking under conditions of stress and mild sensory isolation. Psychophysiology, 19, 449-456.

Hajek, P. (1994). Treatment for smokers. Addiction, 89, 1543-1549.

Hajek, P. (1996). Current issues in behavioral and pharmacological approaches to smoking cessation. Addictive Behaviors, 21, 699-707.

Hatch, J. P., Bierner, S. M., & Fisher, J. G. (1983). The effects of smoking and cigarette nicotine content on smokers' preparation and performance of a psychosocially stressful task. Journal of Behavioral Medicine, 6, 207-216.

Hatsukami, D. K., & Lando, H. (1993). Behavioral treatment for smoking cessation. Health Values, 17, 32-40.

Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerström, K.-O. (1991). The Fagerström Test for Nicotine Dependence: A revision of the Fagerström Tolerance Questionnaire. British Journal of Addiction, 86, 1119-1127.

Hendrickson, R. (1976). The great American chewing gum book. Radnor, PA: Chilton Book Company.

Hollingworth, H. L. (1939). Chewing as a technique of relaxation. Science, 385-387.

Hughes, J. R., & Hatsukami, D. (1986). Signs and symptoms of tobacco withdrawal. Archives of General Psychiatry, 43, 289-294.

Hughes, J. R., Higgins, S. T., & Hatsukami, D. (1990). Effects of abstinence from tobacco. In L. T. Kozlowski, H. M. Annis, H. D. Cappell, F. B. Glaser, M. S. Goodstat, Y. Israel, H. Kalant, E. M. Sellers, & E. R. Vingilis (Eds.), Research advances in alcohol and drug problems, (Vol. 10, pp. 317-398). New York: Plenum.

Jarvik, M. E., Caskey, N. H., Rose, J. E., Herskovic, J. E., & Sadeghpour, M. (1989). Anxiolytic effects of smoking associated with four stressors. Addictive Behaviors, 14, 379-386.

Jarvis, M. J. (1994). A profile of tobacco smoking. Addiction, 89, 1371-1376.

Kassel, J. D., & Shiffman, S. (1997). Attentional mediation of cigarette smoking's effect on anxiety. Health Psychology, 16, 359-368.

Kessler, D. A. (1994, March). Statement on nicotine-containing cigarettes. Paper presented to the Subcommittee on Health and the Environment, U.S. House of Representatives, Washington, DC.

Leary, M. R. (1983). Social anxiousness: The construct and its measurement. Journal of Personality Assessment, 47, 66-75.

Levenson, R. W., Sher, K. J., Grossman, L. M., Newman, J., Newlin, D. B. (1980). Alcohol and stress response dampening: Pharmacological effects, expectancy, and tension reduction. Journal of Abnormal Psychology, 89, 528-538.

Leventhal, H., & Cleary, P. D. (1980). The smoking problem: A review of the research and theory on behavioral risk modification Psychological Bulletin, 88, 370-405.

Lindenthal, J. J., Myers, J. K., & Pepper, M. P. (1972). Smoking, psychological status, and stress. Social Science and Medicine, 6, 583-591.

Maisto, S. A., Galizio, M., & Connors, G. J. (1995). Drug use and abuse (2nd ed.). Fort Worth, TX: Harcourt Press.

Mangan, G. L., & Golding, J. F. (1984). The psychopharmacology of smoking. Cambridge: Cambridge University Press.

McChargue, D., Cohen, L. M., Britt, D. M., & Collins, F. L., Jr. (1999). The development of a nicotine abstinence scale. Unpublished manuscript.

Myrsten, A. L., Elgerot, A., & Edgren, B. (1977). Effects of abstinence from tobacco smoking on physiological and psychological arousal levels in habitual smokers. Psychosomatic Medicine, 39, 25-38.

National Institute on Drug Abuse. (1994). National survey results on drug use from Monitoring the Future Study, 1975-1993, Volume II: College students and young adults (NIH Publication No. 94-3810). Washington, DC: U.S. Government Printing Office.

O'Connor, M. G., O'Mullane, D. M., & Whelton, H. P. (1993). A study of patterns of chewing gum consumption amongst the Irish population. Journal of the Irish Dental Association, 39 (4), 93-95.

Payne, T. J., Smith, P. O., McCracken, L. M., McSherry, W. C., & Antony, M. M. (1994). Assessing nicotine dependence: A comparison of the Fagerström Tolerance Questionnaire (FTQ) with the Fagerström Test for Nicotine Dependence (FTND) in a clinical sample. Addictive Behaviors, 19, 307-317.

Perkins, K. A., Epstein, L. H., Grobe, J., & Fonte, C. (1993). Tobacco abstinence, smoking cues, and the reinforcing value of smoking. Pharmacology Biochemistry and Behavior, 47, 107-112.

Perkins, K. A., Epstein, L. H., & Jennings, J. R. (1991). Smoking as a cue for subjective and behavioral response to a stressor. Journal of Substance Abuse, 3, 29-38.

Perkins, K. A., Grobe, J. E., Epstein, L. H., Caggiula, A. R., & Stiller, R. S. (1992a). Effects of nicotine on subjective arousal may be dependent on baseline subjective stress. Journal of Substance Abuse, 4, 131-141.

Perkins, K. A., Grobe, J. E., Fonte, C., & Breus, M. (1992b). "Paradoxical" effects of smoking on subjective stress versus cardiovascular arousal in males and females. Pharmacology Biochemistry and Behavior, 42, 310-311.

Peto, R., Lopez, A. D., Boreham, J., Thun, M., & Heath, C. (1992). Mortality from tobacco in developed countries: Indirect estimation from national vital statistics. Lancet, 339, 1268-1278.

Pomerleau, O. F., Adkins, D., & Pertschuk, M. (1978). Predictors of outcome and recidivism in smoking cessation treatment. Addictive Behaviors, 3, 65-70.

Pomerleau, C. S., Majchrzak, M. K., & Pomerleau, O. F. (1989). Nicotine dependence and the Fagerström Tolerance Questionnaire: A brief review. Journal of Substance Abuse, 1, 471-477.

Pomerleau, C. S., & Pomerleau, O. F. (1987). The effects of a psychological stressor on cigarette smoking and on subsequent behavioral and physiological responses. Psychophysiology, 24, 278-285.

Pomerleau, O. F., & Pomerleau, C. S. (1984). Neuroregulators and the reinforcement of smoking: Towards a biobehavioral explanation. Neuroscience and Biobehavioral Reviews, 8, 503-513.

Pomerleau, O. F., & Rosecrans, J. (1989). Neuroregulatory effects of nicotine. Psychoneuroendocrinology, 14, 407-423.

Rhodes, J. E., & Jason, L. A. (1990). A social stress model of substance abuse. Journal of Consulting and Clinical Psychology, 58, 395-401.

Rivenburg, R. (1993, September 19). Stuck on gum. L. A. Times, pp. E1, E7.

Rose, J. E., Ananda, S., & Jarvik, M. E. (1983). Cigarette smoking during anxiety-provoking and monotonous tasks. Addictive Behaviors, 8, 353-359.

Russell, M. A. H. (1976). Tobacco smoking and nicotine dependence. In R. J. Gibbins, Y. Israel, H. Kalant, R. E. Popham, W. Schmidt, & R. G. Smart (Eds.), Research advances in alcohol and drug problems (Vol. 3, pp. 1-48). New York: Wiley.

Russell, M. A. H., Peto, J., & Patel, V. A. (1974). The classification of smoking by a factorial structure of motives. Journal of the Royal Statistical Society, 137, 313-346.

Schachter, S., Silverstein, B., Kozlowski, L. T., Herman, C. P., & Liebling, B. (1977). Effects of stress on cigarette smoking and urinary pH. Journal of Experimental Psychology, General, 106, 24-30.

Shadel, W. G., & Mermelstein, R. J. (1993). Cigarette smoking under stress: The role of coping expectancies among smokers in a clinic-based smoking cessation program. Health Psychology, 12, 443-450.

Shiffman, S. (1982). Relapse following smoking cessation: A situational analysis. Journal of Consulting and Clinical Psychology, 50, 71-86.

Shiffman, S. (1993). Smoking cessation treatment: Any progress? Journal of Consulting and Clinical Psychology, 61, 718-722.

Shiffman, S., & Jarvik, M. E., (1984). Cigarette smoking, physiological arousal and emotional response: Nesbitt's paradox re-examined. Addictive Behaviors, 9, 95-98.

Shiffman, S. M., Shumaker, S. A., Abrams, D., Cohen, S., Garvey, J., Grunberg, N., & Swan, G. (1986). Models of smoking relapse. Health Psychology, 5 (Suppl. 1), 13-27.

Shor, R. E., Williams, D. C., Canon, L. K., Latta, M. R., & Shor, M. B. (1981). Beliefs of smokers and never smokers about the motives that underlie tobacco smoking. Addictive Behaviors, 6, 317-324.

Spielberger, C. D., Gorsuch, R. L., Lushene, R. E., Vagg, P. R., & Jacobs, G. A. (1983). Manual for the State-Trait Anxiety Inventory (Form Y). Palo Alto, CA: Consulting Psychologists Press.

Steele, C. M., & Josephs, R. A. (1988). Drinking your troubles away II: An attention-allocation model of alcohol's effect on psychological stress. Journal of Abnormal Psychology, 97, 196-205.

Tiffany, S. (1990). A cognitive model of drug urges and drug-use behavior: Role of automatic and nonautomatic processes. Psychological Review, 97, 147-168.

Tiffany, S. T., & Drobes, D. J. (1990). Imagery and smoking urges: The manipulation of affective content. Addictive Behaviors, 15, 531-539.

Tiffany, S. T., & Drobes, D. J. (1991). The development and initial validation of a questionnaire on smoking urges. British Journal of Addiction, 86, 1467-1476.

U.S. Department of Health and Human Services [USDHHS]. (1988). The health consequences of smoking: Nicotine addiction: A report of the Surgeon General (DHHS Publication No. CDC 88-8406). Washington, DC: U.S. Government Printing Office.

U.S. Department of Health and Human Services [USDHHS]. (1991, June). Environmental tobacco smoke in the workplace (DHHS (NIOSH) Publication No. 91-108). Cincinnati, OH: Centers for Disease Control, National Institute for Occupational Safety and Health.

Wesnes, K., & Warburton, D. M. (1983). Smoking, nicotine, and human performance. Pharmacology and Therapeutics, 21, 189-208.

West, R. (1993). Beneficial effects of nicotine: Fact or fiction? Addiction, 88, 589-590.

Wills, T. A., & Shiffman, S. (1985). Coping and substance use: A conceptual framework. In S. Shiffman, & T. A. Wills (Eds.), Coping and substance use (pp. 3-24). New York: Academic.

Zimmerman, M., & Coryell, W. (1987). The Inventory to Diagnose Depression: A self-report scale to diagnose major depressive disorder. Journal of Consulting and Clinical Psychology, 55, 55-59.

Zimmerman, M., & Coryell, W. (1988). The validity of a self-report questionnaire for diagnosing major depressive disorder. Archives of General Psychiatry, 45, 738-740.

Zimmerman, M., Coryell, W., Corenthal, C., & Wilson, S. (1986). A self-report scale to diagnose major depressive disorder. Archives of General Psychiatry, 43, 1076-1081.

Zinser, M. C., Baker, T. B., Sherman, J. E., & Cannon, D. S. (1992). Relation between self-reported affect and drug urges and cravings in continuing and withdrawing smokers. Journal of Abnormal Psychology, 101, 617-629.

APPENDIX

Psychosocial and Health Habits Questionnaire

Demographics

Your Age: _____ Sex: (1) _____ Male
(2) _____ Female

Are you currently in college? (1) _____ Yes
(2) _____ No

If yes, what is your class standing? (Check one answer only)

(1) _____ Freshman
(2) _____ Sophomore
(3) _____ Junior
(4) _____ Senior
(5) _____ Grad Student
(6) _____ Non-degree seeking

Which best describes your current marital status? (Check one answer only)

(1) _____ Single (Never Married)
(2) _____ Married
(3) _____ Divorced
(4) _____ Widowed
(5) _____ Separated
(6) _____ Co-habitating
(7) _____ Engaged

Which best describes your ethnic background? (Check one answer only)

(1) _____ Caucasian (White)
(2) _____ African American
(3) _____ Native American
(4) _____ Asian American
(5) _____ Arab American
(6) _____ Hispanic
(7) _____ International - not US born
(8) _____ Other: _____

Smoking Habits

At what age did you first begin to smoke? ____ years old

At what age did you begin smoking regularly, (e.g., almost daily) ____ years old

How long have you been a regular smoker?

(1) ____ less than 6 months
(2) ____ 6 months to 1 year
(3) ____ 1-2 years
(4) ____ over 2 years

On average, how many cigarettes do you typically smoke each day? ____ cigarettes

How often do you smoke cigarettes? (Check one answer only)

(1) ____ daily or almost daily
(2) ____ 1-3 times a week
(3) ____ 4-5 times a week
(4) ____ 1-3 times a month
(5) ____ only on occasions
(6) ____ never or almost never

Do you have a preferred brand of cigarettes?

(1) ____ Yes If yes, please list: _____
(2) ____ No

Does it bother you to abstain from smoking for 12 hours (circle): (1) _____ YES
(2) _____ NO

If YES, how bothered (please circle one):

EXTREMELY VERY MUCH MODERATELY SLIGHTLY

Do you use chewing tobacco, snuff, or other smokeless tobacco? (1) _____ YES
(2) _____ NO

When you are tense or stressed, do you tend to: (Check one answer only)

(1) ____smoke more?
(2) ____smoke less?
(3) ____smoke about the same number of cigarettes?

When do you typically have your first cigarette of the day? (Check the 1 best answer)

(1) ____ As soon as I wake up in the morning
(2) ____ With breakfast
(3) ____ At work or school in the morning (but not with a meal)
(4) ____ At lunch
(5) ____ Sometime during the afternoon
(6) ____ At dinner
(7) ____ At work or school in the afternoon (but not with a meal)
(8) ____ In the evening (e.g., after dinner time, but before bedtime)
(9) ____ Other (please specify, _____)

If you HAD to give up 1 cigarette, which would be the absolute hardest to give up? (Check the 1 best answer)

(1) ____ As soon as I wake up in the morning
(2) ____ With breakfast
(3) ____ At work or school in the morning (but not with a meal)
(4) ____ At lunch
(5) ____ Sometime during the afternoon
(6) ____ At dinner
(7) ____ At work or school in the afternoon (but not with a meal)
(8) ____ In the evening (e.g., after dinner time, but before bedtime)
(9) ____ Other (please specify, _____)

Please use the rating scale below for the following questions:

1	2	3	4	5	6	7
not at all			**somewhat**			**very much**

To what degree does smoking make you feel...

a)	relaxed	1	2	3	4	5	6	7
b)	tense	1	2	3	4	5	6	7
c)	energetic	1	2	3	4	5	6	7
d)	more sociable	1	2	3	4	5	6	7
e)	more in control	1	2	3	4	5	6	7
f)	better able to concentrate	1	2	3	4	5	6	7

To what degree do you smoke...

g)	when you are in a bad mood	1	2	3	4	5	6	7
h)	to relieve a craving	1	2	3	4	5	6	7
i)	to boost your mood	1	2	3	4	5	6	7
j)	when you see someone else smoking	1	2	3	4	5	6	7
k)	in social situations	1	2	3	4	5	6	7
l)	to increase your energy	1	2	3	4	5	6	7
m)	more or less depending on the situation	1	2	3	4	5	6	7
n)	just out of habit	1	2	3	4	5	6	7
o)	because you enjoy the taste	1	2	3	4	5	6	7
p)	to help control your hunger	1	2	3	4	5	6	7
q)	to help combat a bad taste or bad breath	1	2	3	4	5	6	7
r)	because you are bored	1	2	3	4	5	6	7
s)	to help you relax	1	2	3	4	5	6	7
t)	because you are anxious	1	2	3	4	5	6	7

Drinking Habits: Caffeine

On a typical day, how many cups of regular (caffeinated) **coffee** do you drink? _____

When you are tense or stressed, do you tend to: (Check one answer only)

(1) ____drink more caffeinated coffee?
(2) ____drink less caffeinated coffee?
(3) ____drink about the same amount of caffeinated coffee?

On a typical day, how many cups of regular (caffeinated) **soda** do you drink? _____

When you are tense or stressed, do you tend to: (Check one answer only)

(1) ____drink more caffeinated soda?
(2) ____drink less caffeinated soda?
(3) ____drink about the same amount of caffeinated soda?

On a typical day, how many cups of regular (caffeinated) **tea** do you drink? _____

When you are tense or stressed, do you tend to: (Check one answer only)

(1) ____drink more caffeinated tea?
(2) ____drink less caffeinated tea?
(3) ____drink about the same amount of caffeinated tea?

Does it bother you to abstain from drinking caffeinated beverages for 12 hours? (circle)

(1) ____ YES
(2) ____ NO

If YES, how bothered (please circle one):

EXTREMELY VERY MUCH MODERATELY SLIGHTLY

Drinking Habits: Alcohol

Do you currently drink alcohol? (1) ____ Yes (2) ____ No

How many beers do you have...

a) on an average day? ____
b) in a typical week? ____

How many other drinks (including wine [5 oz. Glasses] mixed drinks [1 oz alcohol], etc.) do you have...

a) on an average day? ____
b) in a typical week? ____

If you do drink alcohol, please record the total number of drinks you typically drink...

a) ____ drinks on an average day
b) ____ drinks in an average week:

How often do you drink alcohol? (Check one answer only)

(1) ____ daily or almost daily
(2) ____ 1-3 times a week
(3) ____ 4-5 times a week
(4) ____ 1-3 times a month
(5) ____ only on occasions
(6) ____ never or almost never

At what age did you first begin drinking alcohol? ____ years old

When you are tense or stressed, do you tend to: (Check one answer only)

(1) ____drink more alcohol?
(2) ____drink less alcohol?
(3) ____drink about the same amount of alcohol?

When do you typically have your first drink of the day? (Check the 1 best answer)

(1) ____ As soon as I wake up in the morning
(2) ____ With breakfast
(3) ____ At work or school in the morning (but not with a meal)
(4) ____ At lunch
(5) ____ Sometime during the afternoon
(6) ____ At dinner
(7) ____ At work or school in the afternoon (but not with a meal)
(8) ____ In the evening (e.g., after dinner time, but before bedtime)
(9) ____ Other (please specify, _____)

If you **HAD** to give up 1 drink, which would be the absolute hardest to give up? (Check the 1 best answer)

(1) ____ As soon as I wake up in the morning
(2) ____ With breakfast
(3) ____ At work or school in the morning (but not with a meal)
(4) ____ At lunch
(5) ____ Sometime during the afternoon
(6) ____ At dinner
(7) ____ At work or school in the afternoon (but not with a meal)
(8) ____ In the evening (e.g., after dinner time, but before bedtime)
(9) ____ Other (please specify, _____)

Please use the rating scale below for the following questions:

1	2	3	4	5	6	7
not at all			**somewhat**			**very much**

To what degree does alcohol make you feel...

a)	relaxed	1	2	3	4	5	6	7
b)	tense	1	2	3	4	5	6	7
c)	energetic	1	2	3	4	5	6	7
d)	more sociable	1	2	3	4	5	6	7
e)	more in control	1	2	3	4	5	6	7
f)	better able to concentrate	1	2	3	4	5	6	7

To what degree do you drink alcohol...

g)	when you are in a bad mood	1	2	3	4	5	6	7
h)	to relieve a craving	1	2	3	4	5	6	7
i)	to boost your mood	1	2	3	4	5	6	7
j)	when you see someone else drinking it	1	2	3	4	5	6	7
k)	in social situations	1	2	3	4	5	6	7
l)	to increase your energy	1	2	3	4	5	6	7
m)	more or less depending on the situation	1	2	3	4	5	6	7
n)	just out of habit	1	2	3	4	5	6	7
o)	because you enjoy the taste	1	2	3	4	5	6	7
p)	to help control your hunger	1	2	3	4	5	6	7
q)	to help combat a bad taste or bad breath	1	2	3	4	5	6	7
r)	because you are bored	1	2	3	4	5	6	7
s)	to help you relax	1	2	3	4	5	6	7
t)	because you are anxious	1	2	3	4	5	6	7

Chewing Gum

On average, how many pieces of gum do you typically chew each day: ____ pieces

How often do you chew gum? (Check one answer only)

(1) ____ daily or almost daily
(2) ____ 1-3 times a week
(3) ____ 4-5 times a week
(4) ____ 1-3 times a month
(5) ____ only on occasions
(6) ____ never or almost never

Do you have a preferred brand of gum?

(1) ____ Yes If yes, please list: _____
(2) ____ No

When you are tense or stressed, do you tend to: (Check one answer only)

(1) ____chew more gum?
(2) ____chew less gum?
(3) ____chew about the same amount of gum?

When do you typically have your first piece of gum of the day? (Choose the 1 best answer)

(1) ____ As soon as I wake up in the morning
(2) ____ With breakfast
(3) ____ At work or school in the morning (but not with a meal)
(4) ____ At lunch
(5) ____ Sometime during the afternoon
(6) ____ At dinner
(7) ____ At work or school in the afternoon (but not with a meal)
(8) ____ In the evening (e.g., after dinner time, but before bedtime)
(9) ____ Other (please specify, _____)

If you **HAD** to give up 1 piece of gum, which would be the absolute hardest to give up? (Choose the 1 best answer)

(1) ____ As soon as I wake up in the morning
(2) ____ With breakfast
(3) ____ At work or school in the morning (but not with a meal)
(4) ____ At lunch
(5) ____ Sometime during the afternoon
(6) ____ At dinner
(7) ____ At work or school in the afternoon (but not with a meal)
(8) ____ In the evening (e.g., after dinner time, but before bedtime)
(9) ____ Other (please specify, _____)

Please use the rating scale below for the following questions:

1	2	3	4	5	6	7
not at all			**somewhat**			**very much**

To what degree does gum make you feel...

a)	relaxed	1	2	3	4	5	6	7
b)	tense	1	2	3	4	5	6	7
c)	energetic	1	2	3	4	5	6	7
d)	more sociable	1	2	3	4	5	6	7
e)	more in control	1	2	3	4	5	6	7
f)	better able to concentrate	1	2	3	4	5	6	7

To what degree do you chew gum...

g)	when you are in a bad mood	1	2	3	4	5	6	7
h)	to relieve a craving	1	2	3	4	5	6	7
i)	to boost your mood	1	2	3	4	5	6	7
j)	when you see someone else chewing it	1	2	3	4	5	6	7
k)	in social situations	1	2	3	4	5	6	7
l)	to increase your energy	1	2	3	4	5	6	7
m)	more or less depending on the situation	1	2	3	4	5	6	7
n)	just out of habit	1	2	3	4	5	6	7
o)	because you enjoy the taste	1	2	3	4	5	6	7
p)	to help control your hunger	1	2	3	4	5	6	7
q)	to help combat a bad taste or bad breath	1	2	3	4	5	6	7
r)	because you are bored	1	2	3	4	5	6	7
s)	to help you relax	1	2	3	4	5	6	7
t)	because you are anxious	1	2	3	4	5	6	7

Medical Information

Please indicate whether or not you have had medical problems in the following areas:

a)	Cardiovascular (heart)	____ Yes	____ No
b)	Respiratory (lung)	____ Yes	____ No
c)	Gastrointestinal (stomach)	____ Yes	____ No
d)	Ulcers	____ Yes	____ No

e)	Jaw tension/soreness	____ Yes	____ No
f)	Cavities	____ Yes	____ No
g)	Gum disease	____ Yes	____ No
h)	Cold sores	____ Yes	____ No
i)	Mouth ulcers	____ Yes	____ No
j)	Excessive sore throat	____ Yes	____ No
k)	Cancer	____ Yes	____ No
l)	Other	____ Yes	____ No

(if yes, please specify: _____)

Have you ever received treatment for any of the following?

a)	Nervousness or anxiety	____ Yes	____ No
b)	Depression	____ Yes	____ No
c)	Alcohol abuse	____ Yes	____ No
d)	Drug abuse	____ Yes	____ No
e)	Eating disorder	____ Yes	____ No
f)	Other	____ Yes	____ No

(if yes, please specify: _____)

Are you currently taking any medication (circle): YES NO

If YES, what are you taking? _____

How would you rate your general health during the past 6 months?

(1) _____ Excellent
(2) _____ Very good
(3) _____ Good
(4) _____ Fair
(5) _____ Poor

Please answer the following items:

a) I never smoke marijuana.	____ True	____ False
b) I occasionally smoke marijuana.	____ True	____ False
c) I frequently smoke marijuana.	____ True	____ False
d) I never use illegal drugs (other than marijuana).	____ True	____ False
e) I occasionally use illegal drugs (other than marijuana).	____ True	____ False
f) I frequently use illegal drugs (other than marijuana).	____ True	____ False
g) I never engage in excessive use of prescription drugs.	____ True	____ False
h) I occasionally engage in excessive use of prescription drugs.	____ True	____ False
i) I frequently engage in excessive use of prescription drugs.	____ True	____ False

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS REVIEW

Date: 09-18-97 **IRB#:** AS-98-016

Proposal Title: CIGARETTE SMOKING AND CHEWING GUM: RESPONSE TO A LABORATORY-INDUCED STRESSOR

Principal Investigator(s): Frank L. Collins, Dana M. Britt

Reviewed and Processed as: Expedited

Approval Status Recommended by Reviewer(s): Approved

ALL APPROVALS MAY BE SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING, AS WELL AS ARE SUBJECT TO MONITORING AT ANY TIME DURING THE APPROVAL PERIOD.
APPROVAL STATUS PERIOD VALID FOR DATA COLLECTION FOR A ONE CALENDAR YEAR PERIOD AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL.
ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

==========

Comments, Modifications/Conditions for Approval or Disapproval are as follows:

Signature: John H. Wylie

Date: September 26, 1997

Chair of Institutional Review Board
cc: Dana M. Britt

Table 1

Timeline of Procedure and Activities

Time of procedure		Activity
Introduction		Subjects welcomed to the lab, project described, consent form signed.
Time 1		Subjects smoke 1 mandatory cigarette. Complete Time 1 (baseline) measures: demographics, smoking history, mood, fear of public speaking, urge to smoke (QSU) withdrawal symptoms (NAS), and anxiety (STAI-S, EAS-ANX) - 45 min.
Rest		Rest period - 15 min.
Time 2	Free access to smoking, gum, or nothing	Instructions for speaking task given. Smoke, chew gum, or do nothing depending on group assignment. Complete Time 2 measures (QSU, NAS, STAI-S, EAS-ANX).
Prepare for Speech	Free access to smoking, gum, or nothing	Mentally prepare for speech – 2 min. Smoke, chew gum, or do nothing depending on group assignment.

(Table 1 continues)

Time of procedure		Activity
Time 3	Free access to smoking, gum, or nothing	Complete Time 3 measures (QSU, NAS, STAI-S, EAS-ANX). Smoke, chew gum, or do nothing depending on group assignment.
Speech	NO smoking/gum	Give 3 minute speech.
Time 4	Free access to smoking, gum, or nothing	Complete Time 4 measures (QSU, NAS, STAI-S, EAS-ANX). Smoke, chew gum, or do nothing depending on group assignment.
Rest	Free access to smoking, gum, or nothing	10 min. rest. Smoke, chew gum, or do nothing depending on group assignment.
Time 5	Free access to smoking, gum, or nothing	Complete Time 5 measures (QSU, NAS, STAI-S, EAS-ANX). Smoke, chew gum, or do nothing depending on group assignment.
Debriefing		

Table 2

Subject Characteristics and Demographics

Subject Characteristics		Group			
		Sample	Smoke	Gum	Control
Gender					
	Male	27	9	9	9
	Female	18	6	6	6
Age					
	Mean	23.36	25.20	23.67	21.20
	SD	6.59	8.81	6.10	3.61
	Range	(18-47)	(18-47)	(19-39)	(18-32)
# Cigarettes Daily					
	Mean	21.89	22.87	20.67	22.13
	SD	4.93	5.67	4.01	5.04
	Range	(16-35)	(16-35)	(16-30)	(16-35)
FTND Score					
	Mean	4.67	4.73	4.33	4.93
	SD	2.28	2.66	2.06	2.19
	Range	(1-9)	(1-9)	(1-8)	(1-8)
STAI-S					
	Mean	33.73	32.33	32.27	36.60
	SD	8.80	8.80	6.78	10.33
	Range	(20-52)	(22-52)	(20-42)	(20-50)
STAI-T					
	Mean	38.71	40.07	35.87	40.20
	SD	11.01	11.33	10.11	11.72
	Range	(21-69)	(22.68)	(22-62)	(21-69)

(Table 2 continues)

Subject Characteristics		Group			
		Sample	Smoke	Gum	Control
IDD					
	Mean	10.02	9.80	10.07	10.20
	SD	7.64	8.87	6.87	7.59
	Range	(0-37)	(2-37)	(0-25)	(0-24)
AAS					
	Mean	38.69	38.93	42.80	34.33
	SD	11.98	13.55	8.71	12.37
	Range	(12-59)	(12-57)	(26-52)	(14-59)

Note. FTND = Fagerström Test for Nicotine Dependence. STAI-S = State-Trait Anxiety Inventory-State. STAI-T = State-Trait Anxiety Inventory-Trait. IDD = Inventory to Diagnose Depression. AAS = Audience Anxiousness Scale.

Table 3

Correlation Matrix Among Dependent Variables at Baseline

	QSU	NAS	STAI-S	EAS-ANX
QSU	1.00	.479**	.505**	.477**
		.001	.000	.001
	N=45	N=45	N=45	N=45
NAS		1.00	.498**	.421**
			.001	.004
		N=45	N=45	N=45
STAI-S			1.00	.552**
				.000
			N=45	N=45
EAS-ANX				1.00
				N=45

Note. ** is significant at the 0.01 level (2-tailed). QSU = Questionnaire of Smoking Urges. NAS = Nicotine Abstinence Scale. STAI-S = State-Trait Anxiety Inventory-State. EAS-ANX = Emotion Assessment Scale Anxiety Subscale.

Urge to Smoke

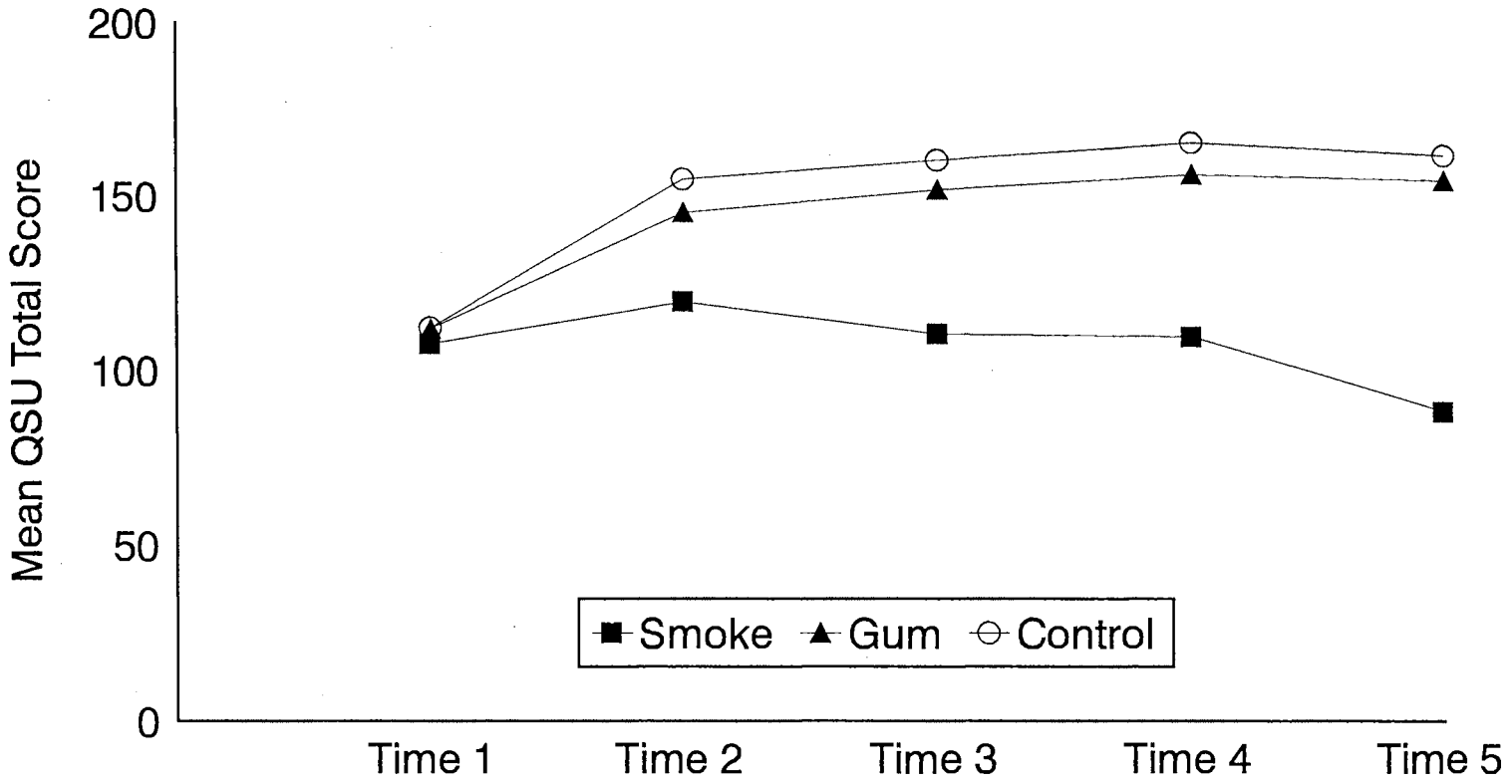

Figure 1

Withdrawal Symptoms

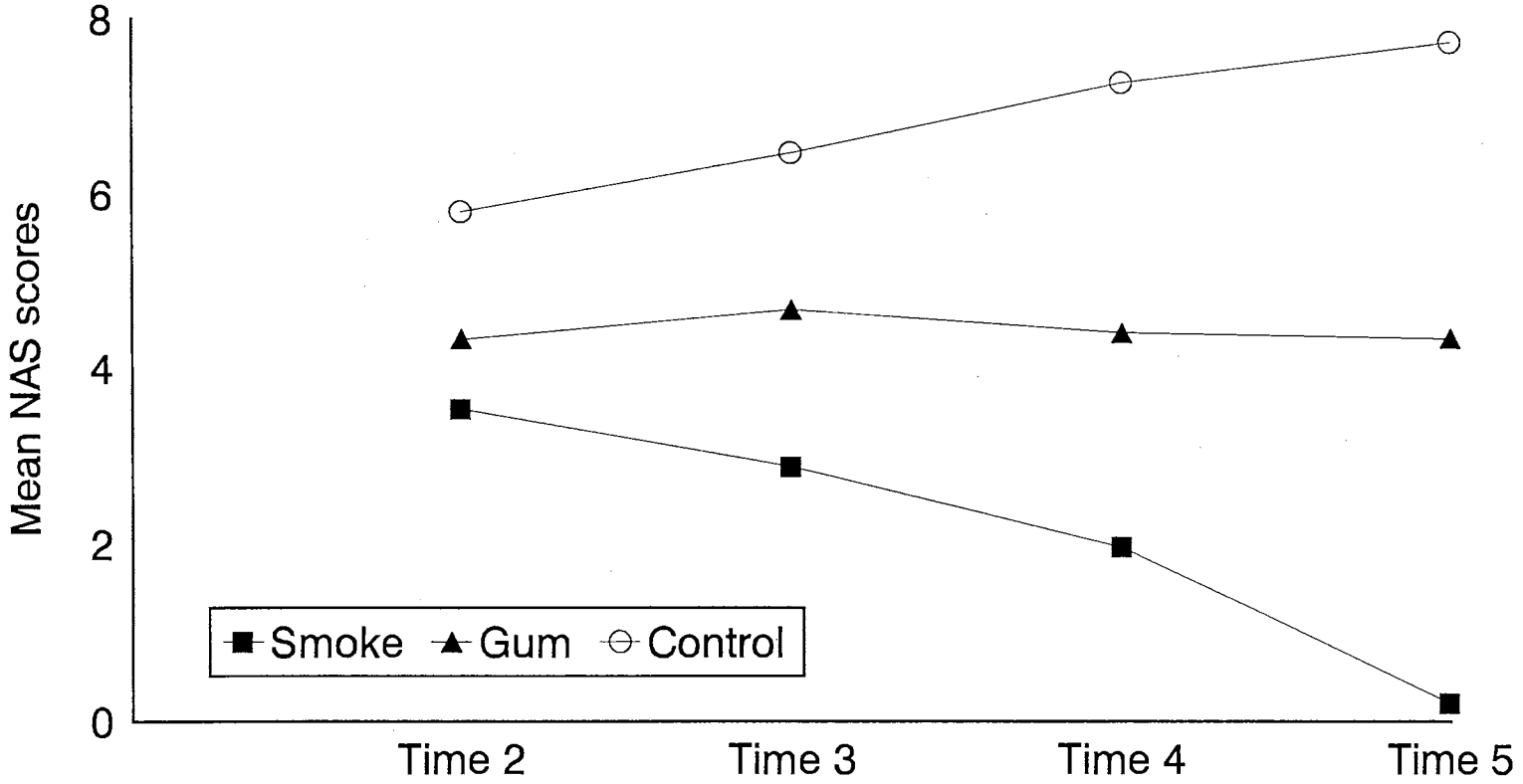

Figure 2

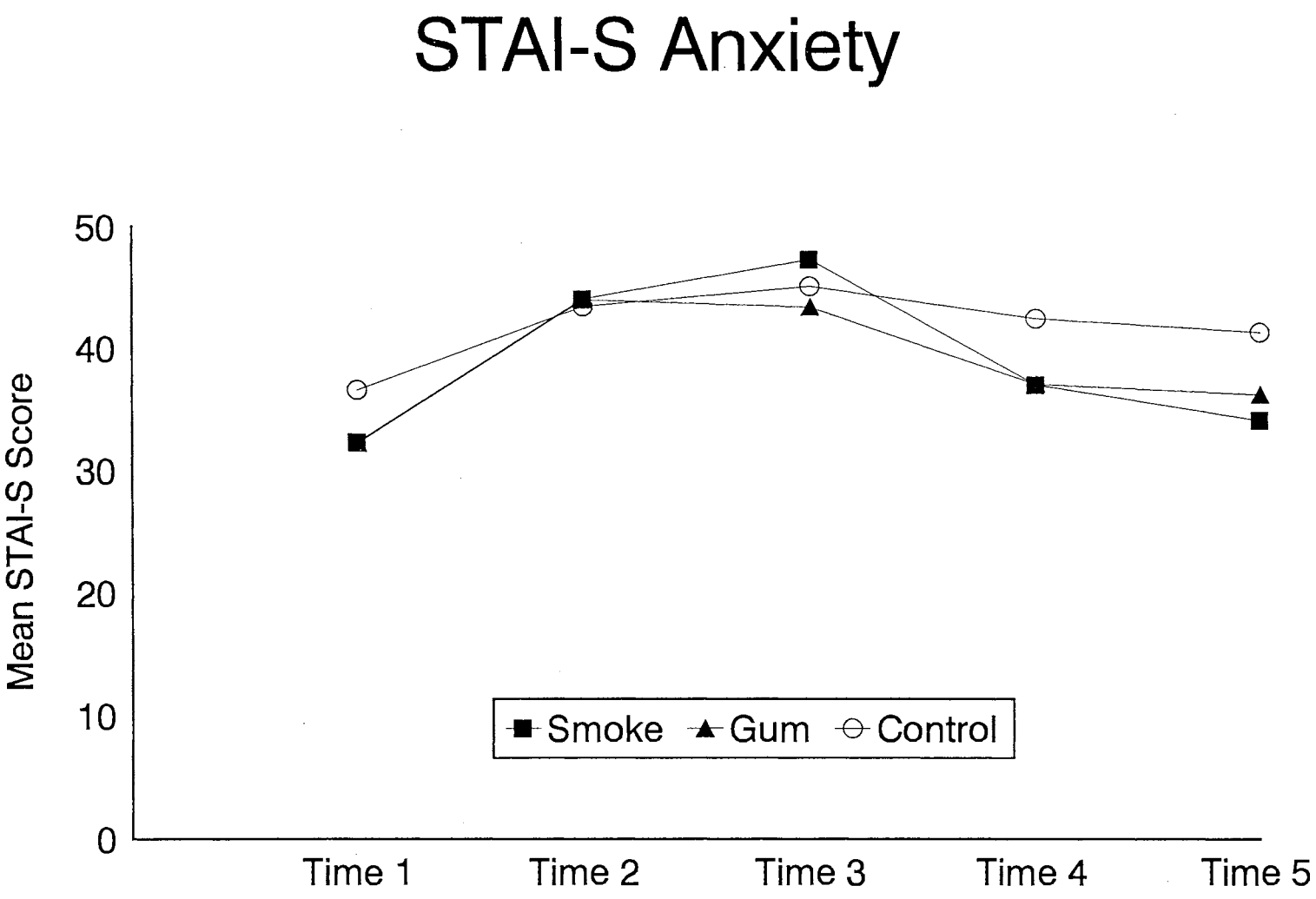
STAI-S Anxiety
Mean STAI-S Score
50
40
30
20
10
0
Time 1
Time 2
Time 3
Time 4
Time 5
Smoke
Gum
Control

Figure 3

Time Effects for Anxiety -- Smoking Group

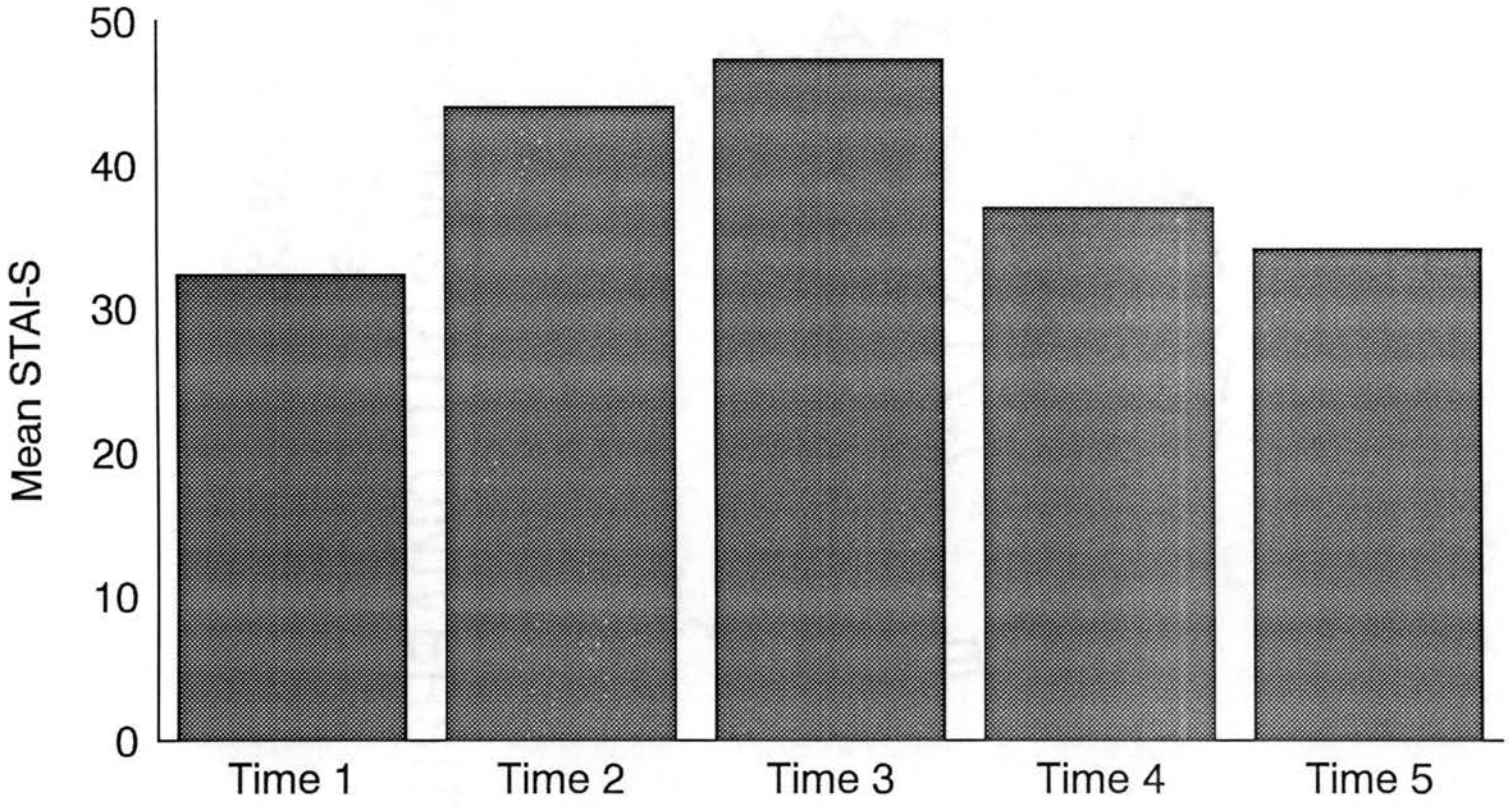

Figure 4

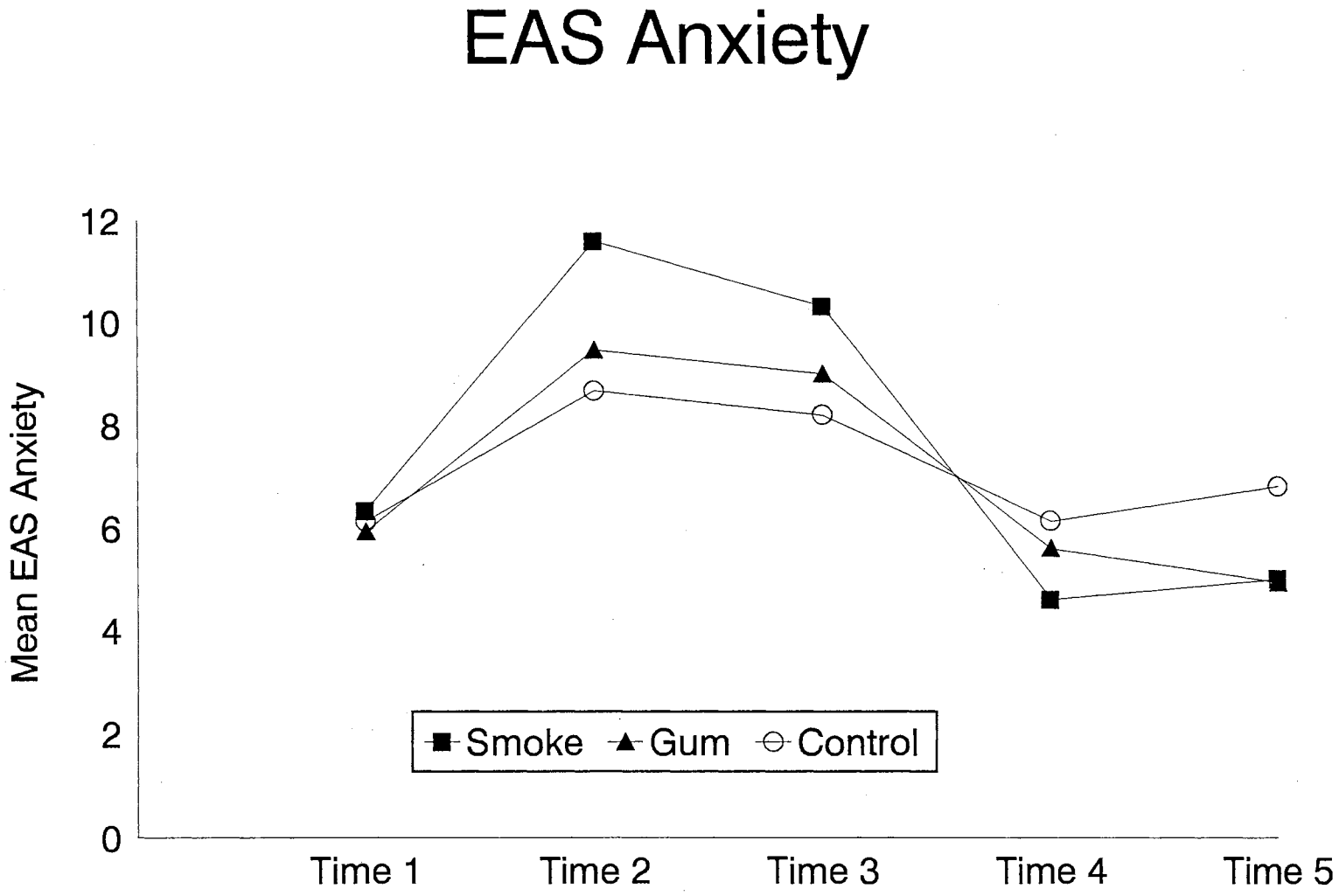
EAS Anxiety
Mean EAS Anxiety
12
10
8
6
4
2
0
Time 1
Time 2
Time 3
Time 4
Time 5
Smoke
Gum
Control

Figure 5

VITA

Dana M. Britt

Candidate for the Degree of

Doctor of Philosophy

Thesis: CIGARETTE SMOKING AND CHEWING GUM: RESPONSE TO A LABORATORY-INDUCED STRESSOR

Major Field: Psychology

Biographical:

Professional: Born and raised in New Orleans, LA.

Education: Graduated from Ursuline Academy, New Orleans, Louisiana in May, 1985. Received a Bachelor of Arts degree in Psychology from Millsaps College, Jackson, Mississippi in May, 1989. Received a Master of Science degree with a major in Psychology at Oklahoma State University in July, 1996. Completed pre-doctoral internship in Clinical Psychology at Brown University Clinical Psychology Training Consortium in Providence, RI in June 1999. Completed the requirements for the Doctor of Philosophy degree with a major in Clinical Psychology at Oklahoma State University in July, 1999.

Professional Memberships: American Psychological Association, Society of Behavioral Medicine, Society for Research on Nicotine and Tobacco, Association for Advancement of Behavior Therapy.