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The effect of chewing gum on self-reported nicotine withdrawal: Is it the flavor, the act of chewing, or both?

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ABSTRACT

A healthy alternative that has been shown to lessen the severity of nicotine withdrawal symptoms during brief periods of nicotine abstinence (e.g., 3–4 h) is confectionary chewing gum (Cohen and colleagues, 1997, 1999, & 2001). The current study sought to build upon this line of research by examining the impact of chewing gum on nicotine withdrawal severity over an extended period of nicotine abstinence (e.g., 24 h) while also identifying the specific attributes of chewing gum that may be responsible for the reported decreases in withdrawal. Specifically, the acts of chewing, flavor, as well as the combination of the two, were independently examined. Twenty-four dependent cigarette smokers participated in three experimental conditions (e.g., a flavorless gum base, flavor strips, and flavored chewing gum) as well as a no product control across four weeks while abstaining from smoking for 24 h each week. Using repeated measures ANOVAs, a significant difference in withdrawal severity was reported by participants across conditions, $F(3, 69) = 2.89$, $p < .05$. Follow-up analyses revealed that the flavored gum condition yielded significantly lower withdrawal scores than the flavorless gum base and no product control conditions. These findings indicate that chewing gum appears useful in lessening the severity of nicotine withdrawal symptoms over a 24-hour period of nicotine abstinence and that it is a combination of flavor and chewing that appears to lead to this effect.

1. Introduction

Cigarette smoking continues to be a major public health concern. The Substance Abuse and Mental Health Services Administration (SAMHSA) estimated that in 2006, 61.6 million individuals in the U.S. (25.0% of the population) reported being current cigarette smokers (SAMHSA, 2007). This choice will result in the death or disability of approximately half of these individuals (Centers for Disease Control [CDC], 2006). The CDC further estimated that over the past four decades smoking has contributed to 12 million deaths including 4.1 million from cancer, 5.5 million from cardiovascular diseases, 2.1 million from respiratory diseases, and 94,000 infant deaths related to smoking during pregnancy (CDC, 2006). As such, tobacco use continues to be the foremost preventable cause of death in the United States, claiming the lives of approximately 440,000 individuals each year (CDC, 2006). Despite these well-documented health risks, however, many individuals who smoke find it difficult to quit. In fact, it is estimated that 70% of all adult smokers in the United States are interested in quitting yet less than 5% are able to do so for 3 months or longer (CDC, 2002).

One of the main reasons that smoking cessation is difficult for individuals wishing to quit is the withdrawal syndrome associated with reduced use of nicotine (al'Absi, Hatsukami, Davis, & Wittmers, 2004). Manifestations of withdrawal are mostly affective and include: irritability, depressed mood, difficulty concentrating, insomnia, anxiety, restlessness, anger, and increased appetite (American Psychiatric Association [APA], 2000). Withdrawal symptoms can begin as quickly as 6–12 h after the last nicotine administration (Hughes, 1992). A recent review of the time course and symptomology of tobacco withdrawal showed that the majority of symptoms peak between 24 and 72 h and can last up to four weeks (Hughes, 2007). Complicating this picture even further is that individuals may experience different aspects of the withdrawal syndrome as being the most difficult. Since withdrawal appears to be a very individualized experience, optimally the treatment provided should also be tailored to the individual. One-way treatments have been tailored is by altering smoking behavior by replacing it with an acceptable substitute.

One healthy alternative to smoking that has received empirical attention is the use of confectionary chewing gum. Cohen, Collins, and Britt (1997) investigated the potential benefits of chewing gum on the effects of nicotine withdrawal and craving. This study examined 20

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cigarette smokers who were asked to abstain from smoking in the laboratory for approximately 3 h using a between subjects design. Results indicated that chewing gum reduced self-reported craving and withdrawal symptoms during abstinence. Encouraged by these findings, Cohen, Britt, Collins, Stott, and Carter (1999) expanded upon their previous work by examining the effects of chewing gum when participants were able to smoke. Results revealed that the presence of chewing gum was related to a significant decrease in the number of cigarette puffs taken and significantly increased the length of time until the first cigarette was smoked. Chewing gum was again shown to help manage nicotine withdrawal symptoms when compared to a control condition in a research study using a within-subjects design (Britt, Cohen, Collins, & Cohen, 2001). Chewing gum, therefore, appears to help decrease the severity of self-reported nicotine withdrawal symptoms during brief periods of abstinence in a laboratory setting. It remains unclear however, if chewing gum can help with withdrawal over extended periods of abstinence in a smoker's natural environment. It is also unclear which of the components of chewing gum (i.e., flavor, chewing, or both) plays the most significant role in the reported reductions in withdrawal. Such information may lead to a better understanding of which alternative reinforcers available in the environment may be the most effective in helping smokers to quit.

A review of the literature revealed that the act of chewing has long been shown to provide several benefits such as relief from tension, boredom, loneliness, and even be an outlet for anger (Hendrickson, 1976). Further, in terms of the subjective experience of relaxation, chewing gum has been investigated for its calming effect. Specifically, Hollingworth (1939) conducted an investigation in which individuals were followed at work under three different conditions: chewing flavored gum, having a flavored wafer dissolve in their mouth, or having nothing present in their mouth. Results indicated that workers reported feeling more relaxed when chewing gum compared to either of the other two conditions. Prior research has also examined the individual impact of both chewing and flavor although they have not been investigated together among a population of smokers. Some studies examining the impact of flavor have used brain activity and imagery. Specifically, Yagyu et al. (1997) compared blood flow to different areas of the brain when participants were given flavored gum and hard candy. Based on results from this study, it was concluded that there was no distinct difference in brain response in the gum or candy conditions. It was also noted that smell and taste properties appear to influence the brain more than chewing. Based on these findings it was concluded that chewing, in and of itself, was less important than the taste and olfactory properties of chewing gum.

The current study builds upon previous studies in this area in a number of ways. First, the previous studies have examined the utility of chewing gum during very brief periods of abstinence (i.e., 3–4 h) and in a simulated laboratory environment. This study extended the period of abstinence to 24 h and allowed for an examination of the utility of gum in participants' natural environment. Second, previous research has not examined what component of chewing gum (e.g., flavor, chewing or both) may be helpful to smokers who are experiencing nicotine withdrawal. This study evaluated which component(s) of confectionary chewing gum may be responsible for the reported decreases in self-reported nicotine withdrawal by utilizing three experimental conditions (peppermint gum, a flavorless gum base, and peppermint flavor strips).

It was hypothesized, therefore, that participants, while in the flavored gum condition, would report significantly lower withdrawal symptoms compared to the week they were placed in the no product control condition across the 24-hour period. It was also hypothesized that the flavored gum group would demonstrate significantly lower self-reported withdrawal across the 24-hour abstinence period compared to all other experimental conditions. Further, it was hypothesized that the gum base and flavor strip groups would show significantly lower nicotine withdrawal scores compared to the no product (control) condition.

2. Method

2.1. Participants

Participants for this study were cigarette smokers at least 18 years of age who reported smoking 16 or more cigarettes per day for the past 6 months. Potential participants were excluded if they had made a serious attempt to quit smoking within the last six months, reported any dental or jaw problems that would preclude the use of chewing gum, or reported current use of psychoactive medication. Participants were 12 male and 12 female undergraduate students recruited from Texas Tech University either through Introductory Psychology courses ($N=19$) or via flyers posted throughout campus ($N=5$). Participants were predominantly Caucasian (87.5%) with an average age of 21 years (range = 17 to 36 years). Overall, participants reported smoking 17 cigarettes per day (SD = 3.56), and had FTND scores averaging 3.95 (SD = 1.23). The 19 students recruited through Introductory Psychology classes received course credit in exchange for taking part in the study, while the 5 other students were entered in a raffle for a gift certificate. The five participants entered in the raffle did not significantly differ from the 19 participants who received course credit with respect to gender, race, smoking rate, or level of nicotine dependence. However, a one-way analysis of variance (ANOVA) detected a significant difference across groups with regard to age, $F(1, 23)=5.930$, $p<.05$, with those in the raffle group being slightly older.

2.2. Measures

General Habits Questionnaire (GHQ). The GHQ was designed specifically for this study in order to obtain demographic data and information regarding number of cigarettes smoked and chewing gum habits (e.g., reasons for using, time of day, amount).

Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991). The FTND is a 6-item self-report measure designed to assess physical dependence to nicotine. Questions focus on various aspects of individuals' smoking practices (e.g., How many cigarettes per day do you smoke?). Total scores range from 0 to 10, where higher scores are indicative of greater physical dependence. A five-level categorization has been developed to identify dependence levels: very low (0–2), low (3–4), medium (5), high (6–7), and very high (8–10) (Fagerström, Heatherton, & Kozlowski, 1990). The FTND has a test–retest reliability of .882 and a Cronbach's alpha of .64 among a non-clinical sample of smokers (Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994).

Withdrawal Symptom Checklist (WSC; Hughes & Hatsukami, 1986). The WSC is a 12-item self-report measure that is designed to assess the presence of tobacco withdrawal symptoms and the severity of each symptom. The severity scores are based on a 4-point Likert scale, ranging from 0 (not present) to 3 (severe). For purposes of this study, the total score on the WSC was calculated by taking the sum of all the items on the measure minus the "craving" item. We omitted the "craving" item from the total score given it is not currently listed as a nicotine withdrawal symptom in the DSM-IV-TR (APA, 2000).

CO measures (Vitalograph, Lenexa, KS., USA). Carbon monoxide (CO) measures provide a biological marker to validate smoking status as well as to corroborate self-reported smoking abstinence. According to the guidelines set forth by the Society for Research on Nicotine and Tobacco's Subcommittee on Biochemical Verification (2002) abstinent participants must have CO levels below 10 parts per million (ppm). Due to the fact that some participants may have very high levels at baseline, a second criterion for the verification of abstinence will be considered. Individuals with initial CO levels above 20 ppm must demonstrate a drop in CO level by at least 50%. This criterion has been used in other studies (Bickel, DeGrandpre, Hughes, & Higgins, 1991; Tidey, Higgins, Bickel, & Steingard, 1999). Participant's CO level ($\geq$10 ppm) was also used to determine eligibility to complete the