

BRIEF REPORT

Menthol Cigarette and Marijuana Use Among Adolescents

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ABSTRACT

Introduction: Menthol cigarette and marijuana use among adolescents is high; however, little is known about dual use in this age. Thus, we examined these rates among 2 samples of adolescents in Connecticut.

Methods: Study 1 examined a school-wide survey assessing variables related to cigarettes and marijuana among high school students ($N = 837$ [13% smokers]), and Study 2 examined these factors using baseline data of high school-aged, treatment-seeking, daily cigarette smokers prior to quitting ($N = 132$).

Results: In Study 1, lifetime marijuana use among all adolescents was 33% and past 30-day marijuana use was 21%. Among cigarette smokers, 55% reported smoking menthol cigarettes, 84% reported lifetime marijuana use, and 66% reported past 30-day marijuana use. Multivariate-adjusted logistic regression models indicated that cigarette smokers, when compared with nonsmokers, had greater rates of lifetime (odds ratio [OR] = 10.91) and past 30-day marijuana use (OR = 10.44). Among smokers, use of menthol cigarettes, when compared with use of nonmenthol cigarettes, was associated with greater lifetime (OR = 5.05) but not past 30-day marijuana use. In Study 2 with daily smokers, 59% of adolescents reported use of menthol cigarettes and 66% reported past 30-day marijuana use. Compared with nonmenthol cigarette smokers, menthol cigarette smokers were more likely to report past 30-day marijuana use (OR = 2.44).

Conclusions: Cigarette smoking is associated with marijuana use, and among smokers, menthol cigarette smoking further increased the odds of marijuana use. More research on the dual use of marijuana and tobacco is needed to inform prevention and treatment of substance use.

INTRODUCTION

Menthol cigarettes represent about 27% of the cigarettes sold in the United States (Federal Trade Commission, 2011). The rate of menthol cigarette use is highest among young people (Substance Abuse and Mental Health Services Administration, 2011a), and national survey data indicate a trend of increase in menthol cigarette smoking among adolescents (Substance Abuse and Mental Health Services Administration, 2009). Young adults who smoke menthol cigarettes are more likely to perceive it as being safer than regular cigarettes (Richter, Pederson, & O'Hegarty, 2006). The increasing popularity of menthol cigarettes among youth is problematic from tobacco prevention perspectives because menthol cigarette use can facilitate cigarette experimentation by serving as a starter product for younger adolescents (Hersey et al., 2006; Nonnemaker et al., 2012; Villanti et al., 2012). Numerous studies (Collins & Moolchan, 2006; Hersey et al., 2006; Muscat et al., 2009; Wackowski & Delnevo, 2007) and a recent report by the

Tobacco Product Scientific Advisory Committee (Benowitz & Samet, 2011; Tobacco Products Scientific Advisory Committee, 2011) have concluded that menthol cigarette smoking is a risk factor for the development of nicotine dependence.

Marijuana is one of the most commonly used illicit substances by adolescents. By 12th grade, 36.4% report using marijuana in the past year and 22.6% report using it in the past 30 days (Johnston, O'Malley, Bachman, & Schulenberg, 2012). National survey data indicate an increase in the prevalence of marijuana use among high school students while showing a decrease in the perception of risk (Substance Abuse and Mental Health Services Administration, 2011b).

Existing epidemiological evidence also suggests that initiation of tobacco use is one of the greatest risk factors for developing later substance addictions (Palmer et al., 2009). The rate of use of marijuana and cigarettes is striking (Jackson, Sher, & Schulenberg, 2008). About 50% of adolescent cigarette smokers reported marijuana use (Duhig, Cavallo, McKee, George, & Krishnan-Sarin, 2005; Everett, Giovino, Warren,

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Crossett, & Kann, 1998). Much of the increase in marijuana use among youth has been shown to coincide with the increase of popularity of “blunts” (tobacco cigars mixed with marijuana) (Giovino et al., 2004; Golub & Dunlap, 2005; Richter et al., 2006). Existing evidence from adult smokers also suggests that use of menthol cigarettes is associated with greater marijuana use among Blacks (Okuyemi, Ebersole-Robinson, Nazir, & Ahulwalia, 2004). However, the association between menthol cigarette and marijuana use among adolescents had not been studied. Thus, this study attempts (a) to examine the association between cigarette and marijuana use and (b) among cigarette smokers, examine the relationship between menthol cigarette and marijuana use. We hypothesized that cigarette smokers would report more marijuana use than nonsmokers. Among cigarette smokers, menthol cigarette smokers would report more marijuana use compared with nonmenthol cigarette smokers even after controlling for demographic factors and the quantity of cigarettes smoked.

METHODS

Participants

We analyzed two datasets with complete data on study variables. See Table 1 for the study variables for the total sample

and separated by smoking status and smoking type (menthol vs. nonmenthol cigarettes) for each study.

Procedures

Study 1

This is a secondary data analysis of a survey assessing attitudes and behaviors toward cigarette smoking and other drug use administered to the entire student body at a high school in Connecticut in 2010, as part of a larger study to develop a tobacco prevention/intervention program. Passive parental permission was obtained through letters mailed home to parents. Assent was required for participants younger than 18 years old and consent was required from participants who were 18 years or older. Research staff informed the students about confidentiality and the voluntary and anonymous nature of the study before administering the survey in an assembly setting.

Study 2

Data for this study derived from the baseline data of adolescent smokers prior to quitting in a high school-based smoking cessation intervention across multiple schools in New Haven County, CT. Smokers who smoked over 5 cigarettes/day in the past 6 months, and wanted to quit, were recruited for this study. Parental permission, assent, and consent were obtained similarly to Study 1. Both study procedures were approved by the

Table 1. Characteristics of Adolescents by Smoking Type

	Study 1					Study 2			
	Total sample (N = 837)	Nonsmoker (n = 726)	Menthol (n = 61)	Nonmenthol (n = 50)	χ^2	Total (N = 132)	Menthol (n = 78)	Nonmenthol (n = 54)	χ^2
Gender (%)									
Female	58.3	59.1	55.7	50.0	1.77	47.7	53.8	38.9	2.86
Age, y (%)					6.53				3.71
≤13–14	13.5	13.9	6.6	16.0		6.8	10.3	1.9	
15–16	55.1	55.8	49.2	52.0		33.3	30.8	37.0	
≥17	31.4	30.3	44.3	32.0		59.8	59.0	61.1	
Race (%)					7.95				7.49
White	76.8	77.5	67.2	78.0		92.4	87.2	100.0	
Black	2.3	1.9	3.3	6.0		1.5	2.6	0.0	
Hispanic	9.9	9.6	13.1	10.0		3.0	5.1	0.0	
Other	11.0	10.9	16.4	6.0		3.0	5.1	0.0	
Smoking status (%)					850.71*				
Nonsmoker	86.7	100.0	0.0	0.0			–	–	–
Sporadic	8.0	0.0	55.0	68.0			–	–	–
Daily	5.1	0.0	45.0	32.0		100	59.1	40.9	–
Lifetime marijuana use (%)	33.1	25.3	88.5	78.0	149.88*	–	–	–	–
Past 30-day marijuana use (%)	20.7	13.8	65.6	66.0	158.73*	65.9	75.6	51.9	8.04*
Number of cigarettes smoked in the past 30 days (%)					261.78*				3.10
Up to 5 cigs/day	95.5	99.6	62.3	76.0		5.3	2.6	9.3	
6–10 cigs/day	2.0	0.0	23.0	6.0		62.1	65.4	57.4	
1–1.5 pack/day	1.1	0.0	8.2	8.0		31.1	30.8	31.5	
2 or more packs/day	1.4	0.0	6.6	10.0		1.5	1.3	1.9	

Note. Cigs = cigarettes.

**p* ≤ .01.

Menthol cigarettes, marijuana, adolescents

Yale Institutional Review Board and the participating schools and school boards.

Measures

In both studies, demographic questions assessed gender, age, and ethnicity/race. In Study 1, smokers were defined as those who smoked at least one cigarette in the past month.

Study 1

Cigarette smoking. Number of cigarette smoked per day in the past 30 days were assessed using response options: no cigarettes, less than 1 cigarette, 1–5 cigarettes, 6–9 cigarettes, about 0.5 pack, about 1 pack, about 1.5 packs, and 2 or more packs. These responses were grouped to four categories: up to 5 cigarettes, 6–10 cigarettes, 1–1.5 packs, and 2 or more packs. Menthol cigarette smoking was assessed by asking participants what cigarettes they usually smoke: regular, light, ultra-light, menthol regular, menthol light, and menthol ultra light. All menthol cigarette responses were coded as 1 and nonmenthol cigarettes as 0.

Marijuana use. Two variables assessed marijuana use: history of ever trying marijuana or hashish (yes/no) and number of days of marijuana/hashish use in the past month (0 days to 30 days). Endorsement of any use of marijuana/hashish in the past month was coded as 1 and no use as 0.

Study 2

Cigarette smoking. Open-ended question assessed current number of cigarettes smoked per day. These responses were categorized to four smoking groups: up to 5 cigarettes, 6–10 cigarettes, 1–1.5 packs, and 2 or more packs. Menthol cigarette smoking was assessed by asking the adolescent whether they usually smoked menthol (coded as 1) or nonmenthol cigarettes (coded as 0).

Marijuana use. Marijuana smoked in the past 30 days was assessed through the timeline followback interview (Sobell & Sobell, 1992). Endorsement of any use of marijuana/hashish in the past month was coded as 1 and no use as 0.

Data Analysis

We conducted data analyses using PASW version 19. Descriptive analyses examined the demographic information and cigarette and marijuana use among all participants. Chi-square tests assessed the differences between menthol cigarette smokers and nonmenthol cigarette smokers and between cigarette smokers and nonsmokers (Study 1) on all study variables. Then, to assess the association between cigarette smoking and marijuana use, we conducted logistic regression models with lifetime and past 30-day marijuana use as separate dependent variables and cigarette smoking status (nonsmoking vs. cigarette smoking [combined menthol and nonmenthol cigarettes]), gender, age, race, and number of cigarettes smoked in the past 30 days as the independent variables.

To assess the effect of menthol cigarettes on marijuana use, we selected smokers in both studies and conducted separate logistic regression models with lifetime (Study 1 only) and past 30-day use of marijuana as dependent variables and menthol cigarette (vs. nonmenthol cigarette), gender, age, race, and the number of cigarettes smoked in the past 30 days as independent variables.

RESULTS

Study 1

Of the 837 high school students surveyed, 13% ($n = 111$) reported smoking cigarettes in the past 30 days and 55% ($n = 61$) of the smokers reported smoking menthol cigarettes. Among smokers, 39% were daily smokers and 61% were sporadic smokers (reported smoking at least one cigarette in the past 30 days but not daily).

Demographic variables, such as gender, age, and race did not differ between cigarette smokers (menthol and nonmenthol cigarette smokers combined) and nonsmokers. Smoking type (nonsmokers, menthol, nonmenthol cigarette smoking) was associated with smoking status (sporadic, daily smoking), lifetime, and past 30-day marijuana use (Table 1). Specifically, a larger proportion of cigarette smokers reported lifetime (83.8% vs. 25.3%, $\chi^2 = 148.50$, $p < .0001$) and past 30-day marijuana use than nonsmokers (65.8% vs. 13.8%, $\chi^2 = 158.72$, $p < .0001$). Pairwise comparisons showed that menthol and nonmenthol cigarette smokers did not differ on smoking status (sporadic vs. daily), quantity of cigarettes smoked, lifetime marijuana, and past 30-day use of marijuana.

See Table 2 for the odds ratios and confidence interval for all multivariate logistic regression models for both studies. Multivariate-adjusted logistic regression analysis using the complete sample indicated that female gender and 15 years of age or older were associated with lifetime marijuana use but not with past 30-day use of marijuana. Smoking 2 or more packs/day and smoking status (vs. not smoking) and being 17 years or older were associated with lifetime and past 30-day use of marijuana. Multivariate-adjusted logistic regression models with only smokers showed that compared with nonmenthol cigarette smoking, menthol cigarette smoking was associated with lifetime marijuana use but not with past 30-day use of marijuana.

Study 2

Of the 132 daily cigarette smokers, 59% ($n = 78$) reported smoking menthol cigarettes. Gender, age, race, and number of cigarettes smoking did not differ between menthol cigarette and nonmenthol cigarette smokers, but a larger proportion of menthol cigarette smokers compared with nonmenthol cigarette smokers reported past 30-day use of marijuana (Table 1). Multivariate-adjusted logistic regression model showed that compared with nonmenthol cigarette smoking, menthol cigarette smoking was associated with past 30-day marijuana use (Table 2).

DISCUSSION

We analyzed the data from two samples of high school students and found that cigarette smoking status, smoking 2 or more packs/day, and older age were associated with lifetime and past 30-day marijuana use. When examining cigarette smokers only, menthol cigarette use increased the odds of marijuana use.

Although we cannot determine whether smoking cigarettes leads to marijuana use or vice versa, we can postulate several reasons for concomitant use of the two substances. First, adolescents who are high sensation seeking may be drawn to

Table 2. Multivariate-Adjusted Logistic Regression Model Examining Marijuana Use Among Adolescents

Variable	Marijuana use					
	Lifetime		Past 30 days		Study 2	
	Study 1 Smokers (n = 111) and nonsmokers (n = 726)	Smokers only (n = 111)	Study 1 Smokers (n = 111) and nonsmokers (n = 726)	Smokers only (n = 111)	Study 1 Smokers only (n = 111)	Study 2 Smokers only (n = 132)
	OR (95% CI)					
Gender						
Male (reference group)	–	–	–	–	–	–
Female	0.67 (0.48, 0.93)	0.49 (0.13, 1.89)	0.72 (0.49, 1.06)	1.86 (0.73, 4.74)	1.02 (0.45, 2.30)	–
Age						
≤13–14 (reference group)	–	–	–	–	–	–
15–16	1.96 (1.08, 3.53)	1.08 (0.17, 6.91)	1.54 (0.78, 3.05)	0.42 (0.07, 2.36)	1.63 (0.31, 8.45)	–
≥17	3.24 (1.76, 5.97)	0.84 (0.12, 6.147)	2.53 (1.26, 5.11)	0.33 (0.06, 2.01)	1.42 (0.29, 6.97)	–
Race (%)						
White (reference group)	–	–	–	–	–	–
Black	2.18 (0.73, 6.52)	–	1.69 (0.47, 6.15)	–	–	–
Hispanic	0.57 (0.31, 1.06)	0.50 (0.07, 3.36)	0.83 (0.43, 1.61)	0.95 (0.20, 4.46)	–	–
Other	1.17 (0.70, 1.96)	0.39 (0.05, 2.95)	0.89 (0.47, 1.67)	0.43 (0.10, 1.73)	–	–
Smoker type (sporadic vs. daily, smokers only)	–	9.21 (0.42, 203.37)	–	1.16 (0.29, 4.65)	–	–
Smoker (vs. nonsmoker)	10.91 (6.11, 19.47)	–	10.44 (6.22, 17.51)	–	–	–
Number of cigarettes smoked in the past 30 days (%)						
Up to 5 cigs/day (reference group)	–	–	–	–	–	–
6–10 cigs/day	4.59 (0.56, 37.56)	0.30 (0.01, 8.13)	1.15 (0.38, 3.48)	0.47 (0.09, 2.49)	1.36 (0.05, 40.47)	–
1–1.5 pack/day	–	–	1.31 (0.30, 5.78)	2.39 (0.18, 31.59)	1.85 (0.09, 34.82)	–
2 or more packs/day	11.99 (1.18, 122.15)	0.06 (0.01, 3.41)	24.81 (2.52, 244.17)	1.61 (0.10, 25.52)	1.65 (0.09, 31.96)	–
Menthol cigarette use (smokers only)	–	5.05 (1.05, 24.25)	–	1.60 (0.58, 4.42)	2.44 (1.10, 5.42)	–

Note. OR = odds ratio; CI = confidence intervals. Bold values indicate statistically significant values, $p < .05$

Menthol cigarettes, marijuana, adolescents

both substances. Sensation seeking in adolescents is associated with marijuana (Brook, Zhang, & Brook, 2011) and flavored cigarette use, including menthol (Manning, Kelly, & Comello, 2009). Second, cigarette and marijuana smoking employ similar drug delivery methods and may even potentially reinforce the use of the two substances (Simon, Sussman, & Dent, 1993). This is supported by the increase use of blunts among adolescents (Golub & Dunlap, 2005). Pharmacological evidence using animal models also suggests that the reinforcing and anxiolytic effects of nicotine and cannabis are enhanced when they are used together (Viveros, Marco, & File, 2006). Even a Philip Morris memo indicated that Kool cigarettes are the best cigarettes to smoke with and after marijuana to maintain the high (Udow, 1972).

A significant body of literature indicates that menthol cigarettes may reinforce nicotine addiction potential in youth (Tobacco Products Scientific Advisory Committee, 2011). This addiction potential may also apply to other substances such as marijuana through several potential pathways. Menthol cigarette smoking affects drug absorption and the central nervous system (Ahijevych & Garrett, 2004), thus potentially increasing pleasurable and addictive properties of marijuana. Moreover, menthol stimulates the cold receptors and decreases irritation of smoke inhalation, which may also influence the drug effects on the central nervous system (Matthias, Tashkin, Marques-Magallanes, Wilkins, & Simmons, 1997). Future research should determine if there is a synergistic effect of the substances on the dopaminergic pathways.

The findings support the importance of examining menthol cigarette smoking and its correlates in youth. Understanding the trajectories of concomitant use as well as the biological and social influences on dual use is important to inform substance use prevention and cessation interventions for adolescents because of adverse health concerns. Tobacco use is well known to be associated with many adverse health outcomes (Doll, Boreham, & Sutherland, 2005; Doll, Peto, Boreham, & Sutherland, 2004), and the pulmonary and respiratory harm from smoking marijuana and cigarettes has been shown to be greater than smoking either substance alone (Sherrill, Krzyanowski, Bloom, & Lebowitz, 1991).

Several limitations should be noted: the relative small sample size of the cigarette smoking groups, self-selected nature of daily smokers in Study 2, geographical restriction (Connecticut only), and a possible response bias in Study 1 due to survey administration in a large assembly setting. Contrary to the well-documented findings of the high rates of menthol cigarette smoking among Black adult smokers (Okuyemi et al., 2004), we did not find this in our study, possibly due to the small number of minority participants. Future studies examining menthol cigarette and marijuana use should include representative sample of ethnically and racially, socioeconomically, and geographically diverse group of adolescents,

Another limitation is not assessing the method of marijuana delivery such as blunt, joint, or pipe/hookah. Previous research has shown that blunt use among adolescents is common and it may reinforce the use of both cigarettes and marijuana (Golub & Dunlap, 2005). It is also possible that marijuana use may be occurring with other types of tobacco other than menthol cigarettes, such as cigars/cigarillos. Although tobacco, marijuana, and alcohol are known to occur concurrently and simultaneously (Martin, Clifford, & Clapper, 1992), we did not directly

assess whether menthol cigarette is being smoked concurrently or separately with marijuana; such distinctions should be made in future studies.

Finally, misclassification of menthol cigarette may be possible, particularly among sporadic and newer smokers (Hersey, Nonnemaker, & Homsy, 2010; Hersey et al., 2006). Such misclassification may partially explain the lack of association between menthol cigarette smoking and past 30-day marijuana use in Study 1. Smokers in Study 2 were daily smoking adolescents who smoked more cigarettes than smokers in Study 1; hence, it is possible that misclassification of menthol cigarettes may have attenuated the relationship between menthol cigarette and past 30-day marijuana use (Hersey et al., 2006). Future studies should assess the brand of cigarettes smoked and compare it with adolescent's report of menthol cigarette use to reduce misclassification. Despite these limitations, strength of this study is the examination of an important and understudied area of dual marijuana and cigarette use in adolescents and sampling daily smokers who may be at greater risk for marijuana use.

In conclusion, cigarette smoking is associated with marijuana use, and among smokers, smoking menthol cigarettes further increased the odds of marijuana use. These findings suggest that more research on the dual use of marijuana and menthol cigarettes is needed to inform the development of prevention and treatment of substance use, as well as public health policy in targeting these substances.

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DECLARATION OF INTERESTS

None declared.

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