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Kratom Use Among U.S. Adolescents: Analyses of the 2019 National Survey on Drug Use and Health

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Abstract

Background: Kratom (*Mitragyna speciosa*) is an opioid-like psychoactive substance not approved by the U.S. Food and Drug Administration that could be used due to its euphoric, stimulant, and analgesic effects. Kratom is gaining popularity in the U.S. and becoming a reason of concern among pediatricians.

Methods: Data from the 2019 National Survey on Drug Use and Health were analyzed to estimate the prevalence and identify correlates of lifetime and past 12-month kratom use among 13,397 U.S. adolescents. Multivariable logistic regression models were conducted to assess the associations of interest.

Results: Lifetime and past 12-month prevalence of kratom use was .44% (95% confidence interval [CI] .32–.60) and .27% (95% CI .18–.40), respectively. Past 12-month cigarette use was associated with lifetime kratom use (adjusted odds ratio 2.60, 95% CI 1.07–6.35). Past 12-month cannabis use was associated with past 12-month kratom use (adjusted odds ratio 2.48, 95% CI 1.15–5.35).

Conclusions: This first report on the epidemiology of adolescent kratom use provides a baseline to assess kratom use trends in future years and identify potential correlates of use among adolescents.

Keywords

Adolescents; kratom; NSDUH; Opioids

Mitragyna speciosa (Korth) or kratom is a botanical species reported to contain alkaloids that modulate mu, kappa, and delta-opioid receptors [1]. Although use of kratom was initially limited to Southeast Asian countries [2], it has gained popularity and became a reason of concern in Europe and the United States (U.S.). Kratom is primarily consumed for recreational or medical purposes due to its euphoric, analgesic, anorectic, antispasmodic, or antidepressant effects [3,4]. Regular use of kratom might lead to dependence, withdrawal

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symptom development, and craving [4]. Most deaths among people who ingested kratom have also involved the use of other substances [5,6]. Kratom is not scheduled under the U.S. Controlled Substances Act; however, the Drug Enforcement Administration considers kratom a drug of concern and as of September 2019 was under active review by the U.S. Food and Drug Administration [7-9].

The majority of the available estimates of kratom use have been based on nonprobabilistic adult samples [10,11]. For instance, a study among 59,714 adults in the U.S. estimated a lifetime prevalence of 1.3% (95% confidence interval [CI] 1.2–1.4) and past 12-month prevalence of .8% (95% CI .7–.9) for kratom use. Additionally, compared to those who did not use kratom, individuals who used kratom were more likely to be younger, male, students, and healthcare professionals and less likely to have a college degree [11]. Results from another study analyzing kratom exposures based on calls reported to poison centers and uploaded to the National Poison Data System between 2011 and 2017 included exposure data among adolescents (13- to 19-year-olds) and reported that the majority of adolescent exposures (84.7%) were among 17- to 19-year-olds [12].

Currently in the U.S, kratom can be purchased via multiple locations, including the Internet, vape shops, and some tea/coffee shops [13], which are frequented by youths. Kratom is an attractive substance because it is perceived as safe, easy to obtain [10], and is not being currently regulated [4]. Kratom in the U.S. is primarily used for self-treatment of pain, mood disorders, and the mitigation of opioid withdrawal symptoms [10,14]. Although kratom is gaining popularity in the U.S. [15], it is also becoming a reason of concern among pediatricians, because of a potential increase in consumption among adolescents [16] and in the number of newborns exhibiting neonatal withdrawal symptoms [17]. Although it is essential to know whether individuals with opioid use disorders self-medicate with kratom to minimize the negative effects resulting from opioid withdrawal (i.e., harm reduction strategy), it is also important to explore its role in facilitating the onset of other drugs, including opioids, and to understand patterns of co-use with other drugs that might exacerbate the risk of experiencing negative consequences. In this report, we estimated the lifetime and past 12-month prevalence and identified drug use correlates of kratom use among a nationally representative sample of U.S. adolescents, which can help recognize appropriate points of intervention.

Methods

We analyzed the 2019 National Survey on Drug Use and Health (NSDUH), a series of yearly cross-sectional surveys designated to yield a representative sample of all U.S. noninstitutionalized individuals aged 12 years and above. The first time that the NSDUH survey included questions about kratom use was in 2019. Our nationally representative sample consisted of 13,397 adolescents aged 12–17 years. Approximately 1.9% of the total adolescent respondents had missing data on kratom use. A more detailed description of the survey methodology is provided elsewhere [18].

Assessments

The NSDUH surveys are completed by participants using confidential audio computer-assisted self-interviews. Informed consent from both the participating youth and their parent (or guardian) is obtained.

Measures

The two outcome variables (lifetime and past 12-month kratom use) were defined based on the answer to binary (yes/no) questions on whether individuals reported having used kratom ever in their lifetime or in the past 12 months.

Covariates of interest included sex (male, female), self-identified/reported race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other), county status (large metropolitan, small metropolitan, nonmetropolitan), poverty level (low, middle, or highest), and independent variables assessing past 12-month use of alcohol, cigarette, cannabis, nonmedical use of prescription pain relievers (yes/no), and use of any stimulants (yes/no). Non-Hispanic other was a combination of the following race/ethnicity categories: non-Hispanic American Indian or Alaska Native; non-Hispanic Native Hawaiian or Other Pacific Islander; non-Hispanic Asian; and non-Hispanic two or more races. A detailed description of the variables is shown in Table 1.

Analyses

Descriptive statistics and chi-squared tests were conducted to characterize the study population and assess differences in use. Logistic regression models were conducted to assess the relationship between lifetime and past 12-month kratom use with potential correlates. Analyses were conducted using Stata 14 (StataCorp LP, College Station, TX). Survey weights were applied to accommodate for the complex sampling design.

Ethical review

The study was considered “exempt” by the University of Florida Institutional Review Board.

Results

Sample description

Approximately half (50.9%) of the sample were males (Table 1). Almost a quarter (21.6%) had used alcohol in the past 12 months, 5.5% had used cigarette in the past 12 months, 13.5% had used cannabis in the past 12 months, 2.3% reported nonmedical use of pain relievers in the past 12 months, and 1.8% reported use of any stimulants in the past 12 months.

Kratom use and correlates

The lifetime prevalence of kratom use among this adolescent sample was .44% (95% CI .32–.60). Compared to adolescents who did not use cigarettes in the past 12 months, those who did were 2.5 times (adjusted odds ratio [aOR] 2.54, 95% CI 1.03–6.25) as likely to ever have used kratom (Table 2). Compared with adolescents whose families had the highest

income, those with family incomes in the middle range were more likely (aOR 2.73, 95% CI 1.06–7.01) to ever use kratom. There were no associations between kratom use and past 12-month cannabis use, nonmedical use of prescription pain relievers, and past 12-month use of any stimulant.

The past 12-month prevalence of kratom was .27% (95% CI .18–.40). Compared to adolescents who did not use cannabis in the past 12 months, those who did were 2.5 times (aOR 2.48, 95% CI 1.15–5.35) as likely to ever have used kratom in the past 12 months. Compared to non-Hispanic white participants, non-Hispanic other participants were less likely (aOR .11, 95% CI .02–.64) to use kratom in the past 12 months. There were no associations with past 12-month nonmedical use of prescription pain relievers and past 12-month use of any stimulant.

Discussion

In 2019, approximately 68,000 adolescents in the U.S. used kratom. Prevalence estimates of lifetime and past 12-month kratom use among this representative sample of U.S. adolescents were about a third the prevalence observed among a nonprobabilistic sample of U.S. adults [11], and substantially lower than comparable estimates for lifetime kratom use (3.4%) among adolescents in Thailand, where kratom has been used historically [19]. In relation to use of other drugs for the same age group, in 2019 the past 12-month prevalence of kratom use (.27%) was found to be lower than the prevalence of extra-medical use of prescription pain relievers (2.30%) or cocaine (.43%) [20], but higher than the prevalence of heroin use (<.05%) [18]. The increased “popularity” of kratom, based on the results from adults and other surveys, might be explained by its multiple easy-to-use presentations, ease of purchase via the Internet by individuals of all ages, perception that this substance provides a “legal high,” and its easy availability, as it is increasingly being used by middle-aged people in their home environments [10], potentially facilitating access for adolescents at home. Additionally, perceptions of safety of kratom use might be changing as new studies reveal low rates of negative side effects among individuals using kratom to reduce withdrawal symptoms for opioid use disorders [6] and lower kratom-related death rates compared to opioid-related death rates in the U.S. [5].

Past 12-month cannabis use was correlated with kratom use in the past 12 months. Prevention scientists in the U.S. consider both cannabis use and kratom use as issues that are urgent and emerging [21]. Both kratom use and cannabis use have inconsistent or nonexistent regulations across jurisdictions [4] that might facilitate use of both products. Based on NSDUH data from 2002 to 2019, prevalence of cannabis use among 12- to 17-year-olds has remained fairly consistent [18], and the inclusion of kratom in the NSDUH will allow for continuously monitoring its use over time and co-use with other existing and emerging drugs. Similarly, lifetime kratom use was associated with past 12-month cigarette use. The availability of kratom in tobacco and vape shops might explain this association and highlight the importance of investigating kratom use among adolescent who smoke cigarettes. Finally, it is important to note that there is no information to support whether kratom was simultaneously used with cannabis or cigarettes. The consequences of kratom use and co-use with other drugs are poorly understood [21], and additional epidemiological

and pharmacological research is needed to investigate patterns of co-use, its effects, and pharmacological interactions.

Unlike patterns of use among adults, kratom use among adolescents was not associated with past 12-month nonmedical use of pain relievers. The observed finding in adolescents might indicate that kratom use in this age group might not always be motivated by the need to treat or mitigate prescription pain reliever's withdrawal symptoms [10], but rather for its euphoric effects [4]. The extent to which kratom use might lead to other drug use, including stimulants and opioids, requires further investigation.

Because kratom is relatively new in the U.S. and healthcare providers might not be aware of it, the results of this study might motivate the healthcare providers to become familiarized with kratom, its pharmacology, and potential side effects [16]. As a result, healthcare providers can be better equipped to counsel adolescent patients and their parents who have been exposed to kratom, with particular emphasis on adolescent patients who use cannabis or smoke cigarettes. Exposure to adulterated or contaminated products available in the U.S. unregulated market [14] highlights the importance of continuous surveillance in poison control centers, emergency departments, and substance use treatment facilities. New evidence on neurocognitive impairments among chronic kratom users [22] represents another area of concern that requires additional investigation.

The results of this report might be interpreted in light of the following limitations. The cross-sectional nature of the survey and the items available hinders any assumptions of temporality with regards to kratom use as a risk factor for use of other drugs, or vice versa [23]. Assessment of simultaneous use of substances was not conducted. Finally, drug use might be underreported because it is a non-normative behavior.

This first report on the epidemiology of kratom use among adolescents will serve as a baseline to compare the prevalence of kratom use in future years. Kratom use has become a reason of concern for pediatricians, both in terms of potential effects among prenatally exposed newborns and adolescents who use kratom [16,17], and the potential co-use with cannabis and cigarettes which might involve pharmacological interactions that are not yet well-understood. Further research should examine kratom's potential in facilitating the use of other drugs, a therapeutic resource, and the possible interactions when used simultaneously with other drugs. Resulting evidence will be crucial to address any potential threats associated with its use [8] and develop appropriate behavioral and pharmacological interventions for individuals experiencing problematic use.

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IMPLICATIONS AND CONTRIBUTION

Estimating the prevalence and identifying correlates of lifetime and past 12-month kratom use in a nationally representative sample of U.S. adolescents could help in the monitoring of future trends of use and recognizing potential points of intervention.

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Sociodemographic and drug use-related characteristics of the study sample from the 2019 National Survey of Drug Use and Health

Table 1

	Total (n = 13,397)		Lifetime kratom use		Past 12-month kratom use	
	% (CI)	Yes (n = 58)	No (n = 13,339)	Yes (n = 35)	No (n = 13,362)	
Sex						
Female	.49 (.48-.50)	.48 (.32-.65)	.49 (.48-.50)	.41 (.24-.61)	.49 (.48-.50)	
Male	.51 (.50-.52)	.52 (.35-.68)	.51 (.50-.52)	.59 (.39-.76)	.51 (.50-.52)	
Race						
NH white	.52 (.50-.53)	.61 (.42-.77)	.51 (.50-.53)	.50 (.28-.72)	.52 (.50-.53)	
NH black	.13 (.12-.15)	.14 (.06-.31)	.13 (.12-.15)	.18 (.07-.40)	.13 (.12-.15)	
Hispanic	.25 (.09-.41)	.20 (.09-.41)	.25 (.24-.26)	.31 (.12-.59)	.25 (.24-.26)	
NH other	.10 (.09-.11)	.05 (.01-.16)	.10 (.09-.11)	.01 (.002-.05)	.10 (.09-.11)	
County status						
Large metropolitan	.55 (.52-.56)	.45 (.28-.63)	.54 (.53-.56)	.44 (.26-.64)	.55 (.53-.56)	
Small metropolitan	.31 (.30-.33)	.41 (.26-.59)	.31 (.29-.33)	.43 (.24-.64)	.31 (.29-.33)	
Nonmetropolitan	.15 (.14-.15)	.14 (.07-.25)	.15 (.14-.15)	.15 (.03-.29)	.15 (.14-.15)	
Poverty						
Low income	.21 (.19-.22)	.15 (.07-.30)	.21 (.19-.22)	.15 (.05-.35)	.21 (.19-.22)	
Middle income	.21 (.20-.22)	.41 (.24-.60)	.21 (.20-.22)	.31 (.15-.53)	.21 (.20-.22)	
Highest income	.58 (.56-.60)	.44 (.28-.60)	.58 (.57-.60)	.54 (.35-.72)	.58 (.57-.60)	
Past 12-month cannabis use						
No	.87 (.86-.87)	.67 (.53-.78)	.87 (.86-.87)	.61 (.40-.76)	.87 (.86-.87)	
Yes	.13 (.13-.14)	.33 (.22-.47)	.13 (.13-.14)	.40 (.24-.60)	.13 (.12-.14)	
Past 12-month alcohol use						
No	.78 (.77-.79)	.62 (.46-.76)	.79 (.77-.80)	.54 (.32-.75)	.79 (.77-.80)	
Yes	.21 (.21-.23)	.38 (.24-.54)	.21 (.21-.22)	.46 (.25-.68)	.22 (.21-.23)	
Past 12-month cigarette use						
No	.94 (.94-.95)	.78 (.64-.87)	.95 (.94-.95)	.78 (.59-.89)	.95 (.94-.95)	
Yes	.06 (.05-.06)	.22 (.13-.36)	.05 (.05-.06)	.22 (.11-.41)	.05 (.05-.06)	
Past 12-month prescription pain medication nonmedical use						
No	.98 (.97-.98)	.98 (.97-.98)	.91 (.79-.97)	.98 (.97-.98)	.98 (.97-.98)	

	Total (n = 13,397)		Lifetime kratom use		Past 12-month kratom use	
	% (CI)	.02 (.02-.03)	Yes (n = 58)	No (n = 13,339)	Yes (n = 35)	No (n = 13,362)
Yes		.08 (.04-.19)	.02 (.02-.03)	.09 (.03-.21)	.02 (.02-.03)	
Past 12-month stimulant use						
No		.96 (.88-.99)	.98 (.98-.99)	.96 (.88-.99)	.98 (.98-.99)	
Yes		.04 (.01-.02)	.02 (.01-.02)	.04 (.01-.12)	.02 (.01-.02)	

Numbers represent weighted percentages. Covariates included are: sex (male, female), self-identified race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other), county status (large metropolitan, small metropolitan, and nonmetropolitan), poverty level (determined by age, family size, number of children in the household, and total family income and categorized into living in poverty called “low” in this manuscript, income up to 2× FPT called “middle,” and income more than 2× FPT called “highest”), past 12-month alcohol use (yes, no), past 12-month cannabis use (yes, no), past 12-month nonmedical use of pain relievers (yes, no), and past 12-month use of stimulant (yes, no).

CI = confidence interval; FPT = Federal Poverty Threshold; NH = non-Hispanic.

Table 2
 Characteristics of the study sample by lifetime and past 12-month kratom use, and factors associated with lifetime and past 12-month kratom use among the selected sample from the 2019 National Survey of Drug Use and Health

	Lifetime kratom use			Past 12-month kratom use		
	OR (CI)	p value	aOR (CI)	OR (CI)	p value	aOR (CI)
Sex						
Female	1		1	1		1
Male	1.04 (.51–2.11)	.91	1.05 (.51–2.15)	1.37 (.62–3.04)	.43	1.41 (.63–3.20)
Race						
NH white	1		1	1		1
NH black	.88 (.31–2.44)	.80	.92 (.25–3.35)	1.37 (.44–4.27)	.58	1.79 (.50–6.34)
Hispanic	.69 (.24–2.01)	.49	.63 (.19–2.05)	1.27 (.37–4.35)	.69	1.38 (.39–4.90)
NH other	.38 (.10–1.52)	.17	.44 (.10–1.83)	.09 (.02–.49)	.007	.11 (.02–.64)
County status						
Nonmetropolitan	1		1	1		1
Large metropolitan	.88 (.36–2.14)	.77	1.12 (.40–3.15)	.92 (.32–2.62)	.88	.91 (.32–2.60)
Small metropolitan	1.42	.40	1.57 (.69–3.57)	1.57 (.50–4.98)	.43	1.48 (.48–4.55)
Poverty						
Highest income	1		1	1		1
Low income	.98 (.40–2.39)	.96	1.07 (.37–3.06)	.77 (.24–2.44)	.65	.65 (.20–2.18)
Top income	2.60 (1.17–5.78)	.20	2.73 (1.06–7.01)	1.57 (.62–4.00)	.34	1.37 (.50–3.74)
Past 12-month alcohol use						
No	1		1	1		1
Yes	2.22 (1.13–4.37)	.02	1.08 (.49–2.40)	3.07 (1.20–7.87)	.02	1.50 (.53–4.24)
Past 12-month cigarette use						
No	1		1	1		1
Yes	4.93 (2.51–9.71)	<.001	2.54 (1.03–6.25)	4.88 (2.0–11.93)	.001	2.19 (.72–6.66)
Past 12-month cannabis use						
No	1		1	1		1
Yes	3.25 (1.80–5.87)	<.001	1.82 (.99–3.56)	4.39 (1.98–9.74)	<.001	2.48 (1.15–5.35)
Past 12-month prescription pain medication nonmedical use						
No	1		1	1		1
Yes	3.25 (1.80–5.87)	<.001	1.82 (.99–3.56)	4.39 (1.98–9.74)	<.001	2.48 (1.15–5.35)

	Lifetime kratom use			Past 12-month kratom use			p value
	OR (CI)	p value	aOR (CI)	OR (CI)	p value	aOR (CI)	
No	1	1	1	1	1	1	
Yes	3.90 (1.55–9.82)	.01	1.82 (.53–6.22)	4.02 (1.43–11.35)	.01	2.20 (.74–6.66)	.16
Past 12-month stimulant use							
No	1	1	1	1	1	1	
Yes	4.24 (1.62–11.09)	.004	1.33 (.30–5.86)	2.31 (.71–7.55)	.16	.47 (.13–1.69)	.24

aOR = adjusted odds ratio; CI = confidence interval; NH = non-Hispanic; OR = odds ratio.