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J Addict Med. Author manuscript; available in PMC 2023 January 01.

Published in final edited form as:

J Addict Med. 2022 ; 16(6): 666–670. doi:10.1097/ADM.0000000000000986.

Assessment of Kratom Use Disorder and Withdrawal Among an Online Convenience Sample of US Adults

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Abstract

Introduction: Since 2007, kratom use in the United States has increased, centered around nonmedical self-treatment of pain, psychiatric, and substance use disorder (SUD) symptoms. Reports of kratom withdrawal have emerged amidst description of therapeutic effects, yet we know little about disordered use. Our objective was to assess DSM-5 SUD for kratom ("kratom use disorder", KUD) and examine kratom withdrawal symptoms among those who ever used regularly. We also sought to identify clinical characteristics of respondents who qualified for current, remitted, or never KUD.

Methods: Between April-May 2021, we re-recruited online respondents who reported lifetime kratom use on an unrelated survey into our cross-sectional kratom survey study, permitting a diverse sample of current and former kratom-using persons.

Results: A total of 129/289 (44.6%) evaluable surveys were obtained. Over half (52.7%) of respondents never met KUD diagnostic criteria; 17.8% were assessed remitted, and 29.5% met current (past-year) KUD threshold. For past-year KUD, severity was: 14.0% mild, 7.0% moderate, and 8.5% severe. Pain, psychiatric symptoms, and polydrug use were found across all groups. KUD symptoms reflected increased use, tolerance, withdrawal, unsuccessful quit attempts, and craving; 9.3% reported decreases in important social, occupational, or recreational activities because of use. Withdrawal symptoms were moderate and included gastrointestinal upset, restlessness, anxiety, irritability, fatigue/low energy, and craving.

Conclusions: As assessed here, tolerance and withdrawal are primary KUD features rather than psychosocial impairments. As kratom is often used among persons with a myriad of health conditions, clinicians should be aware of and assess for kratom use and withdrawal.

Keywords

Kratom; Mitragyna Speciosa; Kratom Use Disorder; Assessment; Opioids

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Conflicts of Interest: None

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Introduction

Kratom is a tree indigenous to Southeast Asia whose leaves contain over 40 bioactive alkaloids. These include four (mitgragynine, 7-hydroxymitragynine, corynoxine, and speciociliatine) that act as partial agonists at mu opioid receptors, but which, along with other alkaloids, have non-opioid actions at serotonin, dopamine, and andrenergic receptors.[1–5] Many who use kratom report doing so to nonmedically self-treat chronic pain, psychiatric, and substance use disorder (SUD) symptoms, as well as to mitigate opioid withdrawal symptoms.[6–9] Kratom use is not routinely assessed in clinical settings and few data elucidate problematic use or withdrawal. There remains little clinical guidance on what would constitute disordered use. Our objective was to assess DSM-5 SUD for kratom ("kratom use disorder", KUD) and to examine kratom withdrawal symptoms among persons with a history of kratom use. We also sought to identify clinical characteristics of respondents who qualified for current, remitted (12 months without diagnostic criteria being met), or never KUD.

Methods

Between April 15 through May 15, 2021 (N=129/289) respondents who reported lifetime kratom use on a separate, larger online survey unrelated to kratom were successfully re-recruited. Amazon Mechanical Turk (mTurk), an online crowdsourcing platform increasingly used in the in addiction and psychological sciences for engagement of research participants, was utilized for recruitment in both of our cross-sectional survey studies to obtain national convenience samples (see Smith et al., 2021 for detailed methodological description)[10]. For our kratom survey we recontacted only respondents who reported ever using kratom on the larger parent survey to answer additional questions about their kratom use. Because people with mTurk accounts do not always stay active or may deactivate their accounts, our goal was not to achieve a 100% recontact rate (which would be practically impossible). Rather, during this one-month recontact period, we sent out two emails to eligible respondents with the aim of gathering formative data.

Here, we report preliminary findings pertaining to assessment of KUD using the DSM-5 SUD checklist adapted for kratom. Specifically, the DSM-5 SUD symptom list was modified by inserting "kratom" as the drug specifier (e.g., "I spent a great deal of time on activities necessary to get kratom, use kratom, or recovery from kratom's effects"; "I experienced cravings, strong desires, or urges for kratom"). See Table 2 for modified symptom list. Comorbidities were also examined. These included chronic pain (past 3-month period), measured using the Brief Pain Inventory, and past-month depressive and anxiety symptoms measured using the Center for Epidemiologic Studies Sort Depression Scale and the Generalized Anxiety Disorder Scale 7-item, respectively. Past-month use was also determined. Where sample size permitted, differences between KUD groups (current, remitted, never) were examined using one-way analysis of variance for continuous variables and chi-square for categorical variables. Respondents who considered themselves to have ever been a "regular kratom user" (N=104), defined as ever having used kratom >4 times per week, were given a checklist to report kratom withdrawal symptoms and rate

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severity using visual analogue scales (0–100). Checklist items (shown in Table 2) were locally developed based on kratom case report, survey, and social media data. Because no personally identifiable information was collected, this study was given exempt status by the National Institutes of Health Institutional Review Board.

Results

Table 1 shows demographics, comorbidities, KUD prevalence and severity, kratom quit attempts, and proportion of KUD symptoms endorsed. The sample (N=129) was 34.8 years old on average, 51.9% female, and 69.0% White. Average age for kratom use initiation was 29.9 years. Over half (52.7%) of respondents never met KUD diagnostic criteria; 17.8% were assessed remitted (based on DSM-5 remission criterion of 12 months without meeting diagnostic threshold), and 29.5% met diagnostic threshold for current (past-year) KUD. Pain and psychiatric symptoms of moderate severity for past-month anxiety and depression were found across groups. Those who never qualified for KUD had higher rates of pain and slightly lower rates of depression compared to those with current or remitted KUD, but with no statistically significant differences. Slightly fewer females than males were assessed has having current or remitted KUD (p=0.007). Respondents assessed with current KUD had higher rates of ever having received or sought SUD treatment (p=0.017). History of drug overdose was found across all groups, with 22.5% of the full sample having ever experienced an overdose. Polysubstance use was endemic, particularly for alcohol, cannabis, cannabidiol, opioids, and benzodiazepines. Still, no statistically significant differences were found across KUD groups for past-month substance use except for kratom, which was used by a greater proportion of respondents in the current KUD group (65.8%), compared to the remitted (17.4%) and never (39.7%) KUD groups (p<.0001).

Among those who met past-year current KUD criteria, severity (assessed by symptom count) was: 14.0% mild (2–3 symptoms), 7.0% moderate (4–5 symptoms), and 8.5% severe (>6 symptoms). When the experience of individual KUD symptoms were examined in the full sample (irrespective of KUD status), they predominantly reflected increased use, tolerance, withdrawal, unsuccessful quit attempts, and craving; 8.5% of respondents reported having “repeatedly used kratom in situations where it was physically hazardous” and 10% endorsed the symptom “gave up or reduced some important social, occupational, or recreational activities because of my kratom use”. Relatedly, 9.3% reported that “kratom use repeatedly interfered with my major role obligations (at work, school, or home)”. Table 2 in supplementary materials shows statistically significant differences between KUD groups (p<.0001 for all items with sufficient cell count to analyze), with the current KUD group showing the highest counts for each symptom followed by the remitted group, meaning the current KUD group also had highest rates of meeting criteria for severe KUD, rather than moderate or mild.

Table 2 shows withdrawal symptoms endorsed by respondents who ever regularly (>4 more times weekly) used kratom (61.9 weeks regular use on average). The most common withdrawal symptoms were gastrointestinal upset, restlessness, anxiety, irritability, fatigue, low energy, kratom craving, and desire to use another substance to relieve kratom withdrawal. Symptom severity ranged from the lowest average of 22.4/100 for emesis

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(reported by 6.2%) to the highest average of 89.9/100 for intense kratom craving (reported by 5.4%).

Discussion

Of respondents with at least one lifetime use of kratom, approximately one-third currently met DSM-derived criteria for KUD. Although this group endorsed more total symptoms than the never or remitted KUD groups, symptoms primarily reflected continued use due to tolerance and withdrawal. Most reported having experienced a kratom-withdrawal syndrome of mild-moderate severity, similar to prior reports, that in many respects resembled opioid withdrawal.[6–9] Few reported that kratom use was impairing their psychosocial or occupational functioning. However, lower endorsement of psychosocial items could be due to symptom minimization, discounting, or underreporting. Taken together, preliminary findings indicate that kratom use may present differently than traditional addictive drugs, including full opioid agonists. Still, over one-third reported at least one kratom quit attempt and evidenced symptoms of use disorder, meaning that problems related to kratom use can develop.

Although our study is limited by small sample size and potential recall bias, it is differentiated and strengthened by the inclusion of respondents who had discontinued use and who may therefore not hold overly favorable attitudes toward kratom. Although only 129/289 (44.6%) of the eligible parent survey respondents (those who reported lifetime kratom use) completed our kratom survey after we sent out invitations, we believe this is an artifact of mTurk (a platform that does not guarantee continued activity among registered users over time) and our short 1-month data collection window, rather than substantive differences between completers and non-completers. As shown in Table 1 of supplementary materials, no statistically significant differences on demographic, pain, and psychiatric factors were found between persons eligible to take the kratom survey and those who completed it. However, like any voluntary survey study reliant on convenience sampling, self-selection bias is possible. To date, only one large survey study has assessed KUD using DSM-5 diagnostic criteria; 12.3% of that sample met past-year KUD, with 1.8% assessed moderate and 0.6% assessed severe.[7] Here, 29.5% of respondents were assessed as having current (past-year) KUD with severity primarily mild-moderate. Although comparisons cannot be drawn across surveys due to sampling differences, one provisional take-away is that KUD rates are lower than might be expected given that kratom has bioactive alkaloids which can produce stimulatory and analgesic effects and that some report using kratom for recreation or pleasure, rather than purely for “self-treatment”, which could result in different dosing patterns.[6,9] More work is needed to understand where kratom use fits in clinical assessment and where misuse fits into clinical nosology. This begins with increased clinical awareness about kratom use.

Conclusions

Our preliminary findings from a national convenience sample that current KUD was detected among one-third of respondents and that a similar number reported ever experiencing kratom withdrawal suggests that clinicians should discuss kratom use with

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their patients and should assess for KUD and kratom withdrawal when clinically indicated (e.g., when kratom use is self-reported; when symptoms typically attributed to opioids are observed but opioid use cannot be verified; when prescribing medication). This is particularly important because of the high rates of polysubstance use and comorbidities among this population, the overlap between kratom and the opioid system, and reports that persons use kratom to self-treat pain and attenuate opioid withdrawal[6–9]. Clinical guidance on KUD is lacking, however case reports indicate buprenorphine induction may be appropriate for patients with severe presentations.[11–13] Even in the absence of KUD, kratom use that is not discussed with prescribing clinicians could confer risk in the form of interactions with other substances, particularly benzodiazepines, alcohol, and opioids.[14,15] Accordingly, we recommend all clinicians openly engage patients on the topic of kratom use and assess for KUD when considered medically appropriate.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

Support for KES, JMR, and DHS was provided by the Intramural Research Program of the NIH NIDA. Support for JCS was provided by NIDA T32DA07209.

Funding:

Support was provided by the Intramural Research Program of the NIH NIDA for KES, JMR, DHE. Support was provided by NIDA T32DA07209 for JCS.

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Table 1.

Full sample and KUD group characteristics, past 30-day drug use, KUD lifetime and current severity, kratom quit attempts, and specific KUD symptoms endorsed

	Current KUD (N=38) 29.5%		Remitted± KUD (N=23) 17.8%		Never KUD (N=68) 52.7%		Full Sample (N=129)		
	%	M ± SD	%	M ± SD	%	M ± SD	%	M ± SD	p value
Age (years)	100.0	33.7 ± 6.9	100.0	33.5 ± 8.7	100.0	35.9 ± 9	100.0	34.8 ± 8.4	0.291
Age of kratom use initiation (years)	100.0	28.9 ± 8	100.0	27.4 ± 8.8	100.0	31.5 ± 9	100.0	29.9 ± 8.8	0.091
Female	34.2		43.5		64.7		51.9		**0.007**
White	65.8		60.9		73.5		79.1		0.328
High School graduate	42.1		39.1		38.2		40.3		0.763
Past-year full or part-time employment	57.9		78.3		64.7		68.2		0.532
History of drug overdose, excluding alcohol	26.3		17.4		22.1		22.5		0.568
Ever received or sought treatment for a substance use disorder, including alcohol	47.4		30.4		23.5		31.8		**0.017**
Chronic pain cutoff of ≥3 months of pain**, BPI**	34.2		43.5		38.2		38.0		0.924
Past-month depression**, CES-D-R-10 (0–30)** [1]		15.2 ± 6.2		14.5 ± 5.8		12.8 ± 7.4		13.8 ± 6.9	0.210
Past-month anxiety, **GAD-7 (0–21)** [2]		9.5 ± 5.4		10.3 ± 5.3		9.4 ± 6.3		9.6 ± 5.8	0.829
Substance use, past 30 days									
Kratom	65.8	17.8 ± 12.5	17.4	6.1 ± 10.3	39.7	7.5 ± 10.9	43.4	11.1 ± 12.4	**< 0.001**
E-cigarettes	42.1	18.7 ± 13.5	34.8	6.9 ± 10.9	29.4	13.1 ± 13.8	34.1	13.5 ± 13.6	0.172
Alcohol	73.7	8.8 ± 9.1	73.9	8.8 ± 8.9	76.5	9.6 ± 9.6	75.2	9.2 ± 9.3	0.808
Cannabis	60.5	12.6 ± 11.2	65.2	18.1 ± 11.8	50.0	11.3 ± 12.3	55.8	12.9 ± 12	0.234
Medicinal cannabis	10.5	26.8 ± 3.4	17.4	27.5 ± 5	8.8	29.7 ± 0.8	10.9	28.2 ± 3.2	0.591
Cannabidiol	34.2	11.2 ± 11.8	47.8	12 ± 10.5	42.6	10 ± 11.1	41.1	10.7 ± 11.1	0.939
Nonmedical prescription opioids	15.8	3.9 ± 5.6	26.1	6 ± 8.8	13.2	3.1 ± 7	16.3	3.9 ± 6.8	0.585
Prescription opioids	13.2	14.9 ± 13.8	0.0	0 ± 0	2.9	5.2 ± 12.2	5.4	9.6 ± 13.3	NA
Nonmedical buprenorphine	5.3)	1.7 ± 3.6	4.3	0.5 ± 0.7	1.5	0 ± 0	3.1	2 ± 3.5	NA
Prescription buprenorphine	7.9)	30 ± 0	4.3	0 ± 0	1.5	15 ± 21.2	3.9	25 ± 12.2	NA
Fentanyl	0.0	0 ± 0	4.3	0 ± 0	2.9	0.8 ± 1	2.3	5.5 ± 12	NA
Powder Cocaine	5.3	1.8 ± 4	4.3	0.5 ± 0.7	0.0	0 ± 0	2.3	0.8 ± 2.6	NA

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	Current KUD (N=38) 29.5%		Remitted± KUD (N=23) 17.8%		Never KUD (N=68) 52.7%		Full Sample (N=129)		
	%	M ± SD	%	M ± SD	%	M ± SD	%	M ± SD	p value
Crack Cocaine	0.0	0 ± 0	4.3	2 ± 2.8	0.0	0 ± 0	0.8	1.3 ± 2.3	NA
Methamphetamine	7.9	9.5 ± 13.8	8.7	17 ± 18.4	1.5	7.5 ± 15	4.7	10.2 ± 13.8	NA
Nonmedical prescription amphetamine	13.2	4.9 ± 5.8	4.3	1 ± 1.4	5.9	3.5 ± 9.3	7.8	3.8 ± 7.4	NA
Nonmedical benzodiazepines	21.1	8.4 ± 7.9	26.1	9.2 ± 11.6	14.7	1.6 ± 2.3	18.6	4.9 ± 7.3	NA
Prescription benzodiazepines	21.1	13.6 ± 14.3	13.0	23 ± 12.1	11.8	12.4 ± 13.9	14.7	14.2 ± 13.7	NA
Psychedelics	10.5	0.7 ± 1.1	8.7	1 ± 1	7.4	0.6 ± 1.1	8.5	0.7 ± 1	NA

	Full Sample (N=129)
Severity criteria met for ever *lifetime* Kratom Use Disorder based on DSM-5 checklist.	**%**
None (<2 symptoms)	69.0
Mild (2–3 symptoms)	21.7
Moderate (4–5 symptoms)	0.5
Severe (6 symptoms)	0.5
Severity criteria met for *current* (past year) Kratom Use Disorder diagnostic criteria based on DSM-5 checklist	
None (<2 symptoms)	70.5
Mild (2–3 symptoms)	14.0
Moderate (4–5 symptoms)	7.0
Severe (6 symptoms)	8.5
Has quit using kratom after a regular period of time	
Never	48.1
At least once	27.9
2–5 times	16.3
5 times	7.8
Specific DSM-5 SUD symptom items endorsed among persons meeting criteria for lifetime or current KUD	
I used kratom in larger amounts and/or over a longer period than I had intended to.	45.7
I kept using the same amount of kratom, but didn’t feel it as much.	38.8
I needed to use larger amounts of kratom just to feel the same effect.	33.3
I had physical or psychological withdrawal symptoms during times I stopped using kratom.	33.3
I made at least one unsuccessful attempt to cut down or control my kratom use.	32.6
I experienced cravings, strong desires, or urges for the kratom.	31.8

	Current KUD (N=38) 29.5%		Remitted± KUD (N=23) 17.8%		Never KUD (N=68) 52.7%		Full Sample (N=129)		
	%	M ± SD	%	M ± SD	%	M ± SD	%	M ± SD	p value
I kept using kratom in order to avoid withdrawal symptoms.							28.7		
I kept using kratom despite knowing it was causing or worsening physical or psychological problems for me.							15.5		
I spent a great deal of time on activities necessary to get kratom, use the kratom, or recover from kratom's effects.							15.5		
I kept using kratom despite knowing it was causing or worsening social or interpersonal problems for me.							14.0		
I gave up or reduced some important social, occupational, or recreational activities because of my kratom use.							10.9		
My kratom use repeatedly interfered with my major role obligations (at work, school, or home).							9.3		
I repeatedly used kratom in situations where it was physically hazardous.							8.5		

BPI= Brief Pain Inventory; CES-D-R= Center for Epidemiologic Studies Short Depression Scale; GAD-7= Generalized Anxiety Disorder Scale-7 item.

[1] For the CES-D- R-10, a score of 10/30 indicates presence of moderate-severe depressive symptoms.

[2] For the GAD-7 total score, cutoffs for clinically significant anxiety are: 5=mild, 10=moderate, and 15=severe.

±"Remitted"= DSM-5 specifier of 12 month continuous period without diagnostic criteria being met.

N/A=Not applicable due to insufficient group size to calculate statistical difference.

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Table 2.

Withdrawal-like symptoms among those with any regular kratom use (>4 days of use per week) history (N=104)[a]

When kratom was stopped for *one day or longer….*	Current KUD (N=38)		Remitted± KUD (N=23)		Never KUD (N=68)		Total (N=129)	
	%	M ± SD	%	M ± SD	%	M ± SD	%	M ± SD
Anxiety	50.0	73.1 ± 19.5	43.5	70.9 ± 16.8	19.1	42.8 ± 23.7	32.6	63.2 ± 24.2
Irritability	55.3	74.1 ± 18.5	34.8	76.6 ± 13.1	19.1	38.4 ± 23.5	32.6	63.5 ± 25.5
Desire to use another substance	52.6	75.3 ± 22	26.1	73 ± 17.6	16.2	48.8 ± 32.3	28.7	67.1 ± 27.1
Low energy	50.0	82.6 ± 18.6	26.1	71.3 ± 27.5	17.6	46 ± 28	28.7	68.9 ± 28.2
Difficulty Sleeping	42.1	71.8 ± 24.2	26.1	82.5 ± 20	10.3	73.1 ± 19	22.5	74.3 ± 21.9
Restlessness	44.7	58.8 ± 24.3	21.7	65 ± 19.2	10.3	43.9 ± 36.9	22.5	56.2 ± 27.1
Nausea	36.8	52.5 ± 24	34.8	48.1 ± 25.3	8.8	32.8 ± 27.1	21.7	47.0 ± 25.3
Body aches	44.7	68.4 ± 27.3	21.7	51.2 ± 18.4	8.8	57.8 ± 29	21.7	63.1 ± 26.4
No energy	36.8	88.4 ± 10.5	26.1	69.3 ± 28.3	10.3	55 ± 22.3	20.9	75.5 ± 23.1
Upset stomach	36.8	58.9 ± 25.5	21.7	56.8 ± 10.1	10.3	34.9 ± 28.5	20.2	52.0 ± 25.8
Depressed mood	39.5	75.5 ± 19.3	17.4	69 ± 34.9	10.3	44.4 ± 29.4	20.2	66.1 ± 27.4
Mild to moderate kratom craving	36.8	69 ± 26.3	17.4	81.8 ± 15.5	10.3	57.6 ± 28.8	19.4	67.8 ± 26
Daytime sleepiness	23.7	84 ± 16.7	21.7	81 ± 12.1	14.7	48.8 ± 29.7	18.6	68.7 ± 27.7
Hot flashes	36.8	51.4 ± 34.7	8.7	81.5 ± 4.9	5.9	49.8 ± 11	15.5	54.0 ± 30.5
Runny nose	34.2	68.4 ± 21.5	17.4	24.3 ± 10.7	2.9	38 ± 36.8	14.7	55.9 ± 27.8
Restless legs	21.1	82.6 ± 19.6	21.7	57.8 ± 16.1	5.9	40.8 ± 42.5	13.2	65.5 ± 29.8
Craving for another substance	36.8	76.6 ± 22.6	8.7	68 ± 17	1.5	100 ± 0	13.2	77.0 ± 21.9
Cold flashes	18.4	63.4 ± 27.6	4.3	68 ± 0	2.9	54 ± 5.7	17.8	62.0 ± 23
Watery eyes	18.4	73.1 ± 20.7	8.7	33 ± 19.8	0.0	0 ± 0	7.0	64.2 ± 26.2
Vomiting/emesis	10.5	35.3 ± 43.2	4.3	36 ± 0	4.4	0.7 ± 1.2	6.2	22.4 ± 33.5
Intense kratom craving	15.8	94.2 ± 8.4	4.3	64 ± 0	0.0	0 ± 0	5.4	89.9 ± 13.7

[a]Withdrawal severity ratings were made by respondents using visual analogue scales (0–100; 0="almost nothing",100="severe or unbearable discomfort").

Checklist items were locally developed based on prior kratom case report, survey, and social media data describing kratom withdrawal.

±"Remitted"= DSM-5 specifier of 12 month continuous period without diagnostic criterion being met.