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Exploring the association between khat use and psychiatric symptoms: a systematic review

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ABSTRACT

Objectives Consumption of the drug khat is high across East Africa and the South-Western Arabian Peninsula despite evidence for its adverse psychiatric effects. This systematic review aims to explore cross-sectional research in the field to determine the strength of the association between khat use and psychiatric symptoms

Methods Six databases were searched in October 2021—Ovid Medline, Embase, APA PsycINFO, CINAHL, Scopus and Proquest—using the following search terms: "khat" OR "qat" OR "qaad" OR "catha" OR "miraa" OR "mairungi" AND "depression" OR "anxiety" OR "mania" OR "psych*" OR "schiz*" OR "mental" OR "hallucinations" OR "delusions" OR "bipolar". Eligible studies were cross-sectional studies of any population or setting comparing the prevalence of psychiatric symptoms in long term or dependent khat users with non-users. The quality of each study was appraised by the Newcastle-Ottawa scale. A meta-analysis was planned using a random effects model to produce an OR with 95% CIs—using the Mantel-Haenszel method—alongside an I^2 statistic to represent heterogeneity. The quality of this meta-analysis was appraised using the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) scoring system.

Results 35 studies were eligible for inclusion (total participants=31 893), spanning 5 countries (Ethiopia, Somalia, Kenya, Saudi Arabia, UK). Meta-analysis suggests that khat use is associated with an 122% increased prevalence of psychiatric symptoms (OR 2.22, 95% CIs 1.76 to 2.79, p<0.00001, GRADE score: 'very low').

Conclusions The high heterogeneity of the meta-analysis is likely due to the wide variation between the studies within the evidence base. To perform a more accurate systematic review, further primary studies are needed with standardised measurements of variables, particularly khat consumption.

PROSPERO registration number CRD42020224510.

INTRODUCTION

The stimulant drug khat consists of the buds and leaves of the plant *Catha edulis*, an evergreen shrub highly prevalent in East Africa and the South-Western Arabian Peninsula.[1 2] Ethiopia is the world's largest exporter of khat, however, its consumption is highest in Yemen where up to 90% of adult males and 50% of adult females chew khat for 3–4 hours per

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Follows all guidelines listed in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 Checklist for systematic reviews.
⇒ Searches published and unpublished literature using search terms that include all commonly-used variations of 'khat' from around the world.
⇒ Includes both dependent and non-dependent khat use due to poor definitions of khat usage in primary research studies.
⇒ Includes both psychiatric symptoms and psychiatric disorders.

day.[3–5] Within its local regions, khat chewing has been a cultural tradition for many generations and is thought to increase sociability, concentration, energy and spirituality.[2 6 7]

Psychiatric symptoms have been recognised as a consequence of khat use for several decades.[8 9] Milder psychological consequences related to its use include anxiety, restlessness, insomnia and dysphoric mood, all of which can reduce quality of life.[2 8–11] More severe psychological harms associated with its use include psychosis and depression, which in some cases have resulted in acts of suicide and homocide.[8–11] Users most at risk of these sequelae are those abusing larger amounts of khat—some studies have provided evidence for a dose-dependent relationship—and those with pre-existing psychiatric disorders.[8–10]

The evidence base exploring the association between khat use and psychiatric symptoms—which consists mostly of cross-sectional studies—is currently small and insufficient.[12] Studies often vary in terms of populations and regions studied, measurement of khat use, symptoms explored and quality of methodology. Hence, results can be inconsistent, making it difficult for academics, policymakers and the public to understand the psychiatric risks of khat consumption. This systematic review aims to investigate the strength of the association between khat use

and psychiatric symptoms by collating the evidence we have so far, in order to guide further research in the field and to evaluate the need for any potential interventions for khat users, for example, increased education about potential psychiatric side effects.

METHODS

The protocol for this systematic review can be found on Prospero, with registration number CRD42020224510.[13] Originally, this systematic review had two objectives: to investigate the strength of the association between khat use and psychiatric symptoms, and secondly to investigate the role of trauma within this relationship. Due to the vast amount of literature in the field, the second objective was removed from the protocol to ensure that the findings would be suitable for one single review. It is recommended that a follow-up review should be conducted exploring the role of trauma.

This review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines at all times.[14]

Patient and public involvement

No members of the public or patients were involved in the design of this systematic review.

Literature search

A literature search was carried out independently by authors BE and NA in October 2021 using the following search terms:

"khat" OR "qat" OR "qaad" OR "catha" OR "miraa" OR "mairungi"

AND

"depression" OR "anxiety" OR "mania" OR "psych*" OR "schiz*" OR "mental" OR "hallucinations" OR "delusions" OR "bipolar"

These search terms encompassed all previously reported psychiatric symptoms associated with khat, and included all predominant cultural variations of the term 'khat' as identified by the Medical Subject Headings Thesaurus.[15] Advice was provided by the library team at the University of Birmingham. Note that studies surrounding suicidality were excluded, as suicidality is often but not always associated with psychiatric dysfunction.[16] Disagreements between the authors were discussed in person. Removal of duplicates was automated for the databases Ovid MEDLINE, Embase and APA PsycINFO, and was performed manually for the remaining databases.

Six electronic databases were searched. Five of these were databases of published literature: Ovid MEDLINE, Embase, APA PsycINFO, CINAHL and Scopus. Additionally, Proquest was searched to obtain any relevant grey or unpublished literature. The full search strategy for each database can be found in online supplemental material 1.

Study eligibility

The literature search used the following inclusion criteria:

- ▶ Population: adults (aged 18+).
- ▶ Exposure: long-term or dependent khat use.
- ▶ Comparator: no khat use or non-dependent khat use*.
- ▶ Outcome: prevalence of psychiatric symptoms in khat users and prevalence of psychiatric symptoms in non-users.
- ▶ Study design: cross-sectional studies; note that mixed-method studies are considered eligible but only the cross-sectional data will be considered for the review.
- ▶ Language: all.
- ▶ Publication type: must be a complete study but no restriction on publication status.
- ▶ Setting: all.
- ▶ Date of publication: all.

Each potentially eligible study was compared with a checklist of the above criteria to determine whether or not it should be included within the review.

*Note that non-dependent khat use was only considered a suitable comparator for studies where the exposure group were dependent khat-users, where both dependence and non-dependence were validated by a recognised tool such as the Severity of Dependence Scale.

The literature search used the following exclusion criteria:

- ▶ Population: children, animals.
- ▶ Exposure: substance abuse other than khat.
- ▶ Comparator: 'substance users' where khat use is not specifically described.
- ▶ Outcome: neurobehavioural processes, withdrawal symptoms, suicide, substance use disorders.
- ▶ Study design: any study design other than cross-sectional, for example, case control, randomised controlled trial, case report, review.
- ▶ Language: no exclusion criteria.
- ▶ Publication type: unfinished studies including abstract only, conference abstracts, letters, retracted articles, book chapters.
- ▶ Setting: no exclusion criteria.

Data collection and quality assessment

A summary of findings table—see online supplemental material 2—was created to present the following study features: population, sample, criteria for 'khat user', psychiatric measure, effect estimate. In addition, the quality of each primary study (e.g., risk of bias due to inadequate reporting methods or missing data) was assessed using the Newcastle-Ottawa Scale (see online supplemental material 3).[17 18] Data were collected manually by both authors independently, with any disagreements between the independent assessments resolved by discussion.

Synthesis of findings

The prevalence of khat-users and non-users with psychiatric symptoms from each study was entered into a meta-analysis using the software Revman, provided by the Cochrane organisation. After inputting all dichotomous
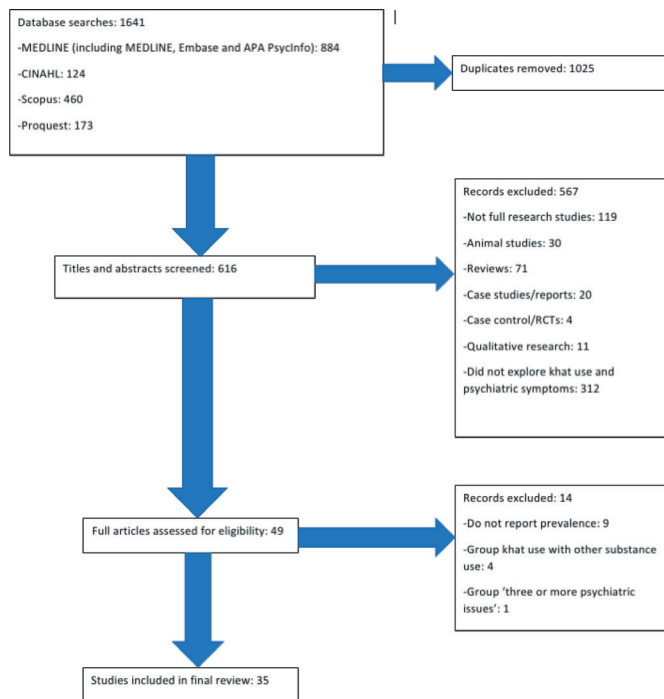
Figure 1 PRISMA flow chart of included and excluded studies. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

values, this software created a forest plot of ORs, each with 95% CIs, using the Mantel-Haenszel method.[19] A random effects model was used as this assumes that the outcome is normally distributed, hence attributing the differences between studies to both chance and genuine variation.[19] An I^2 statistic was given to indicate variability between studies, as this is again recommended by the Cochrane organisation.[20]

A subgroup analysis was also included, grouping studies investigating similar symptoms. An OR and I^2 statistic was provided for each subgroup, as well as a χ^2 test and p value for overall subgroup differences.

A sensitivity analysis was conducted to look for any studies that are prominent outliers. Each study was removed from the meta-analysis one at a time, and the OR, 95% CIs, I^2 value and p value reported within a table.

The quality of the meta-analysis was evaluated using the GRADE (Grading of Recommendations, Assessment, Development and Evaluations) framework.[21]

RESULTS
Included and excluded studies
The PRISMA flow chart in figure 1 shows the number of studies included and excluded at each stage of the literature search.[14] When searching the relevant databases, 1641 results were found that included the relevant terms within their title or abstract. After removing duplicates, this number was reduced to 616.

Each title and abstract were screened, and 567 results were removed for the following reasons:

- One hundred and nineteen were not research studies, for example, these included conference abstracts, letters, and newspaper/magazine articles.
- Thirty were animal studies.
- Seventy-one were reviews, including systematic reviews and meta-analyses.
- Twenty were case studies or case reports.
- Four were case–control studies or randomised controlled trials.
- Eleven were qualitative studies.
- A total of 312 did not explore the relationship between khat use and psychiatric symptoms.

Forty-nine studies were read in full in order to determine their eligibility. Of these, 14 were excluded for the following reasons:
- Nine explored both khat use and psychiatric symptoms but not their prevalence.[22–30]
- Four did not report khat-use alone, and instead reported substance use or equivalent.[31–34]
- One only reported the prevalence of khat use alongside 'three or more psychiatric issues'.[10]

Thirty-five studies were included in the final review.[7 35–68]

Summary of included studies
The summary of findings table—online supplemental material 2—contains the effect estimates of each individual study, alongside each study's characteristics (ie, target population, sample and methods of measuring khat use and psychiatric symptoms).

A subsequent table—online supplemental material 3—provides information regarding the quality of each primary study, assessed using the Newcastle-Ottawa Scale.[17 18] According to Mekuriaw *et al*, a score of 5/10 indicates a medium-quality study while a score of 6/10 indicates a high-quality study.[69] In this systematic review, the average quality score was 6.8, with a range of 4–8. No issues due to missing data arose.

Symptoms explored within included studies
The included studies explored a range of symptoms in association with khat usage. These have been grouped into the following subgroups:
- Twelve studies explored symptoms of 'depression'; this subgroup includes 'depressive symptoms', 'feeling depressed', diagnoses of depression, and the presence of 'depressive episodes' within the last month.
- Six studies explored symptoms of' anxiety'; this subgroup includes 'feeling anxious', 'obsession–compulsion', 'phobic anxiety' and diagnoses of anxiety disorders.
- Sixteen studies explored symptoms of 'psychological distress'; this subgroup includes 'psychological stress', 'psychological distress', 'mental distress' and 'stress'.
- Six studies explored symptoms of psychotic disorders; this subgroup includes 'psychotic symptoms', 'psychosis', 'paranoid ideation', 'psychoticism' and diagnoses of 'schizophrenia'.
- One study explored psychopathy.

► Five studies explored unspecified psychiatric symptoms and disorders; this subgroup includes 'common mental disorders', 'psychiatric dysfunction', 'mental illness' and 'mental problems that prevent employment or household tasks'.

► No studies explored bipolar disorder or mania.

Meta-analysis

The meta-analysis of the 35 included studies can be seen in figure 2. This meta-analysis suggests that khat use is associated with an 122% increased prevalence of psychiatric symptoms (OR 2.22, 95% CIs 1.76 to 2.79, p<0.00001). All but one of the 35 studies were scored as at least medium or high-quality when assessed using the Newcastle-Ottawa Scale; the remaining study scored 4/10—where 5/10 is medium quality—and had a very small weighting within the meta-analysis of 1.5%. The heterogeneity of this meta-analysis is 92%, which is classified as high.[20 21]

Subgroup analysis

The accompanying subgroup analysis—grouping studies investigating similar symptoms—shows that there is a statistically significant subgroup effect of p=0.04; usually, a p value of less than 0.1 is regarded as a statistically significant subgroup effect.[70] This means that khat use has a varying association with the symptoms investigated.

The largest association found is between khat use and symptoms of psychological distress (OR 2.56, 95% CIs 1.82 to 3.61, p<0.00001). A higher OR can be found in the psychopathology category (OR 6.10, 95% CIs 2.81 to 13.28), but as this is only composed of one single study this has not been considered as a subgroup.

The two subgroups of symptoms with the lowest ORs are anxiety (OR 1.68, 95% CIs 0.93 to 3.04) and psychotic symptoms/disorders (OR 1.47, 95% CIs 0.93 to 2.30). As the CIs cross the null value in both of these subgroups, this meta-analysis suggests that neither anxiety nor psychotic symptoms are associated with khat use.

Every subgroup has at least five studies to support it, a reasonable amount of supporting evidence. Most of these subgroups have a high level of heterogeneity, apart from the subgroup of unspecified psychiatric symptoms/disorders, which has a heterogeneity of 0%. Note that while psychopathology has been listed as a separate symptom, it is not to be considered as a subgroup as only one study investigated this.

Sensitivity analysis

A sensitivity analysis of the meta-analysis data was conducted and can be seen in online supplemental material 4. Each study was removed in turn and the OR, confidence intervals, I^2 value and p value recorded. Removing the depression data from Wondemagegn *et al*[55] caused the largest change in OR, from 2.22 to 2.11. The I^2 value for heterogeneity remained at 91% or 92% regardless of which study was removed, and the p value was always <0.00001.

GRADE analysis

The meta-analysis shown in figure 2 received a GRADE score of 'very low'.[21] As per guidance in the GRADE handbook, the score automatically started as 'low', because the meta-analysis focuses on observational studies.[21] The score was then downgraded for the following two reasons: 'inconsistency of results' demonstrated by the high I^2 statistic, and 'indirectness of evidence' due to the differences between studies including populations investigated and methods of measuring khat use.[21] The score was not downgraded for publication bias, as despite occasional outliers, overall the funnel plot for the included studies was fairly symmetrical (see figure 3).

DISCUSSION

Our findings suggest that khat use is associated with a 122% increased prevalence in overall psychiatric symptoms (OR 2.22, 95% CIs 1.76 to 2.79, p<0.00001). Subgroup analyses suggest thats suggests that the strongest relationship is between khat use and psychological distress (OR 2.56, 95% CIs 1.82 to 3.61, p<0.00001). Subgroup analyses also found that the associations between khat use and anxiety, and khat use and psychotic symptoms/disorders is statistically insignificant (OR 1.68, 95% CIs 0.93 to 3.04 and OR=1.47, 95% CIs 0.93 to 2.30, respectively).

The overall prevalence of psychiatric symptoms and disorders within this systematic review is 29%. Most of the included studies were conducted in Africa, which the WHO estimates has a 5.5% prevalence of common mental disorders.[71] The prevalence of symptoms is higher in this review than expected, as many of the studies focus on populations with an increased risk of mental illness, for example, students, migrants, combatants, refugees, prisoners and psychiatric outpatients.[72–76]

This review has a strong, high-quality methodology, following all of the PRISMA guidelines for systematic reviews.[14] However, it can be argued that the evidence base surrounding khat use and psychiatric symptoms is too small to merit the pooling of data. This is reflected in the high heterogeneity of the meta-analysis conducted (I^2=92%), which suggests that the studies analysed may be too different to meaningfully compare[20]; these differences are likely to include the wide variety of populations and regions studies, the differences in khat consumption measurement, and the differences in psychiatric symptom explored. It is also reflected in the low GRADE score of the meta-analysis, however, this scoring system favours experimental rather than observational data, which would be both pragmatically and ethically inappropriate when investigating substance use.[77]

Despite these concerns, this review is important as it is currently the largest systematic review of khat usage and psychiatric symptoms. A 122% increase in psychiatric symptoms is easy for laypersons to understand, eliminating their need to evaluate various studies of varying quality against each other. Furthermore, the issues highlighted by this review are important for guiding further research.
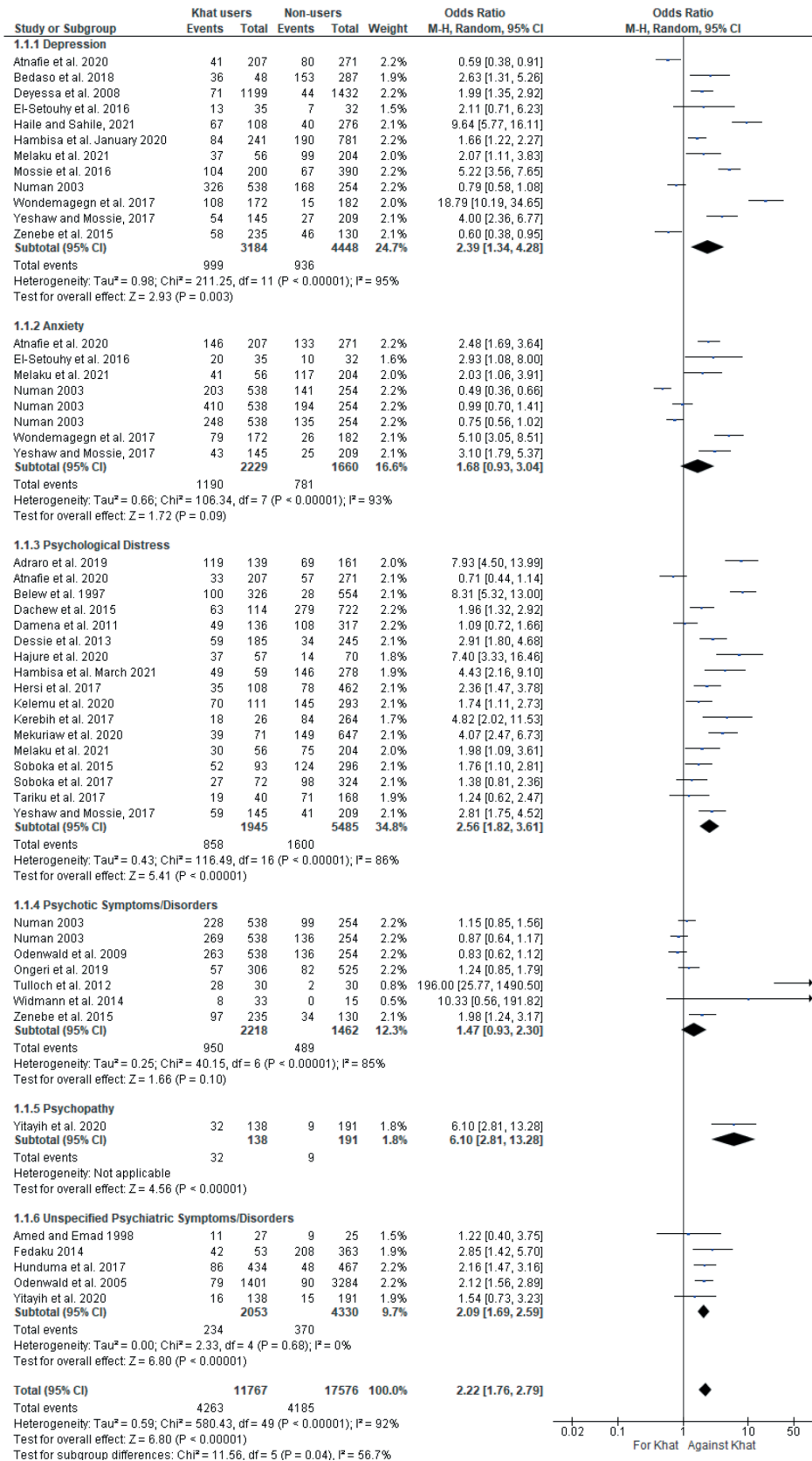
Study or Subgroup	Khat users Events	Total	Non-users Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
1.1.1 Depression						
Atnafie et al. 2020	41	207	80	271	2.2%	0.59 [0.38, 0.91]
Bedaso et al. 2018	36	48	153	287	1.9%	2.63 [1.31, 5.26]
Deyessa et al. 2008	71	1199	44	1432	2.2%	1.99 [1.35, 2.92]
El-Setouhy et al. 2016	13	35	7	32	1.5%	2.11 [0.71, 6.23]
Haile and Sahile, 2021	67	108	40	276	2.1%	9.64 [5.77, 16.11]
Hambisa et al. January 2020	84	241	190	781	2.2%	1.66 [1.22, 2.27]
Melaku et al. 2021	37	56	99	204	2.0%	2.07 [1.11, 3.83]
Mossie et al. 2016	104	200	67	390	2.2%	5.22 [3.56, 7.65]
Numan 2003	326	538	168	254	2.2%	0.79 [0.58, 1.08]
Wondemagegn et al. 2017	108	172	15	182	2.0%	18.79 [10.19, 34.65]
Yeshaw and Mossie, 2017	54	145	27	209	2.1%	4.00 [2.36, 6.77]
Zenebe et al. 2015	58	235	46	130	2.1%	0.60 [0.38, 0.95]
Subtotal (95% CI)		3184		4448	24.7%	2.39 [1.34, 4.28]
Total events	999		936			
Heterogeneity: Tau² = 0.98; Chi² = 211.25, df = 11 (P < 0.00001); I² = 95%						
Test for overall effect: Z = 2.93 (P = 0.003)						
1.1.2 Anxiety						
Atnafie et al. 2020	146	207	133	271	2.2%	2.48 [1.69, 3.64]
El-Setouhy et al. 2016	20	35	10	32	1.6%	2.93 [1.08, 8.00]
Melaku et al. 2021	41	56	117	204	2.0%	2.03 [1.06, 3.91]
Numan 2003	203	538	141	254	2.2%	0.49 [0.36, 0.66]
Numan 2003	410	538	194	254	2.2%	0.99 [0.70, 1.41]
Numan 2003	248	538	135	254	2.2%	0.75 [0.56, 1.02]
Wondemagegn et al. 2017	79	172	26	182	2.1%	5.10 [3.05, 8.51]
Yeshaw and Mossie, 2017	43	145	25	209	2.1%	3.10 [1.79, 5.37]
Subtotal (95% CI)		2229		1660	16.6%	1.68 [0.93, 3.04]
Total events	1190		781			
Heterogeneity: Tau² = 0.66; Chi² = 106.34, df = 7 (P < 0.00001); I² = 93%						
Test for overall effect: Z = 1.72 (P = 0.09)						
1.1.3 Psychological Distress						
Adraro et al. 2019	119	139	69	161	2.0%	7.93 [4.50, 13.99]
Atnafie et al. 2020	33	207	57	271	2.1%	0.71 [0.44, 1.14]
Belew et al. 1997	100	326	28	554	2.1%	8.31 [5.32, 13.00]
Dachew et al. 2015	63	114	279	722	2.2%	1.96 [1.32, 2.92]
Damena et al. 2011	49	136	108	317	2.2%	1.09 [0.72, 1.66]
Dessie et al. 2013	59	185	34	245	2.1%	2.91 [1.80, 4.68]
Hajure et al. 2020	37	57	14	70	1.8%	7.40 [3.33, 16.46]
Hambisa et al. March 2021	49	59	146	278	1.9%	4.43 [2.16, 9.10]
Hersi et al. 2017	35	108	78	462	2.1%	2.36 [1.47, 3.78]
Kelemu et al. 2020	70	111	145	293	2.1%	1.74 [1.11, 2.73]
Kerebih et al. 2017	18	26	84	264	1.7%	4.82 [2.02, 11.53]
Mekuriaw et al. 2020	39	71	149	647	2.1%	4.07 [2.47, 6.73]
Melaku et al. 2021	30	56	75	204	2.0%	1.98 [1.09, 3.61]
Soboka et al. 2015	52	93	124	296	2.1%	1.76 [1.10, 2.81]
Soboka et al. 2017	27	72	98	324	2.1%	1.38 [0.81, 2.36]
Tariku et al. 2017	19	40	71	168	1.9%	1.24 [0.62, 2.47]
Yeshaw and Mossie, 2017	59	145	41	209	2.1%	2.81 [1.75, 4.52]
Subtotal (95% CI)		1945		5485	34.8%	2.56 [1.82, 3.61]
Total events	858		1600			
Heterogeneity: Tau² = 0.43; Chi² = 116.49, df = 16 (P < 0.00001); I² = 86%						
Test for overall effect: Z = 5.41 (P < 0.00001)						
1.1.4 Psychotic Symptoms/Disorders						
Numan 2003	228	538	99	254	2.2%	1.15 [0.85, 1.56]
Numan 2003	269	538	136	254	2.2%	0.87 [0.64, 1.17]
Odenwald et al. 2009	263	538	136	254	2.2%	0.83 [0.62, 1.12]
Ongeri et al. 2019	57	306	82	525	2.2%	1.24 [0.85, 1.79]
Tulloch et al. 2012	28	30	2	30	0.8%	196.00 [25.77, 1490.50]
Widmann et al. 2014	8	33	0	15	0.5%	10.33 [0.56, 191.82]
Zenebe et al. 2015	97	235	34	130	2.1%	1.98 [1.24, 3.17]
Subtotal (95% CI)		2218		1462	12.3%	1.47 [0.93, 2.30]
Total events	950		489			
Heterogeneity: Tau² = 0.25; Chi² = 40.15, df = 6 (P < 0.00001); I² = 85%						
Test for overall effect: Z = 1.66 (P = 0.10)						
1.1.5 Psychopathy						
Yitayih et al. 2020	32	138	9	191	1.8%	6.10 [2.81, 13.28]
Subtotal (95% CI)		138		191	1.8%	6.10 [2.81, 13.28]
Total events	32		9			
Heterogeneity: Not applicable						
Test for overall effect: Z = 4.56 (P < 0.00001)						
1.1.6 Unspecified Psychiatric Symptoms/Disorders						
Amed and Emad 1998	11	27	9	25	1.5%	1.22 [0.40, 3.75]
Fedaku 2014	42	53	208	363	1.9%	2.85 [1.42, 5.70]
Hunduma et al. 2017	86	434	48	467	2.2%	2.16 [1.47, 3.16]
Odenwald et al. 2005	79	1401	90	3284	2.2%	2.12 [1.56, 2.89]
Yitayih et al. 2020	16	138	15	191	1.9%	1.54 [0.73, 3.23]
Subtotal (95% CI)		2053		4330	9.7%	2.09 [1.69, 2.59]
Total events	234		370			
Heterogeneity: Tau² = 0.00; Chi² = 2.33, df = 4 (P = 0.68); I² = 0%						
Test for overall effect: Z = 6.80 (P < 0.00001)						
Total (95% CI)		11767		17576	100.0%	2.22 [1.76, 2.79]
Total events	4263		4185			
Heterogeneity: Tau² = 0.59; Chi² = 580.43, df = 49 (P < 0.00001); I² = 92%						
Test for overall effect: Z = 6.80 (P < 0.00001)						
Test for subgroup differences: Chi² = 11.56, df = 5 (P = 0.04), I² = 56.7%						

Odds Ratio scale: 0.02   0.1   1   10   50 — For Khat   Against Khat

Figure 2 Meta-analysis of included studies. M-H, Mantel-Haenszel.
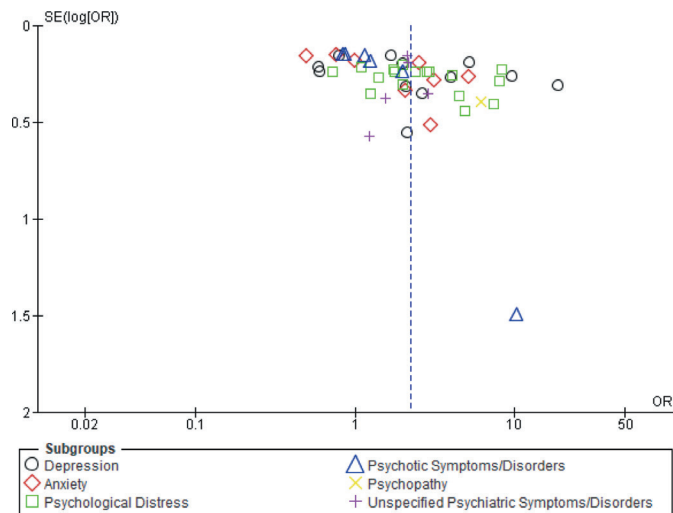
Figure 3 Funnel plot of included studies.

While the results provided by this review are unlikely to be entirely accurate, they can provide a valid estimate until the evidence base expands enough to provide a systematic review with much lower heterogeneity.

One issue in particular is the variation in measuring khat consumption between studies. This review is limited as it has included both non-dependent and dependent khat use, which are likely to have varying association with psychiatric symptoms. Many studies simply described khat users as those who had chewed within the previous week or previous month, hence it was often difficult to distinguish between current users, long-term users and dependent users. This likely contributes to the high heterogeneity of the meta-analysis of this review, and should be considered in future primary and secondary research within this field.

Another limitation of this review is that it includes both psychiatric symptoms and psychiatric disorders under the term 'psychiatric symptoms'. Out of the 35 included studies, 28 measured psychiatric symptoms using screening tools, 5 measured psychiatric disorders using diagnostic tools and 2 used a mixture of both screening and diagnostic tools. This may also have contributed to the high heterogeneity of the meta-analysis.

One final limitation of this review is that it cannot demonstrate causation between the two variables. It would be useful for future research to include cohort studies. Many researchers hypothesise that khat use is the cause of psychiatric symptoms, with its active ingredients distorting the brain's cytoarchitecture and, therefore, increasing one's vulnerability to mental illness.[78–80] Contrastingly, other researchers suggest that those with mental illness are more likely to chew khat as an attempt to self-medicate their symptoms.[81] Long-term cohort studies would be able to assess which variable predisposes the other, monitor psychiatric symptoms that take time to manifest, and investigate how the prevalence of psychiatric symptoms changes as the duration of khat use increases.

CONCLUSIONS

This review combines 35 cross-sectional studies in the field of khat use, and using meta-analysis suggests that khat use is associated with a 122% increase in the prevalence of psychiatric symptoms, particularly psychiatric distress. The high heterogeneity of the meta-analysis is likely due to the wide variation between the studies within the evidence base. To perform a more accurate systematic review, further primary studies are needed with standardised measurements of variables, particularly khat consumption. Furthermore, the evidence base is unclear about causality within this relationship, another important focus for future research.

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