

Over time prevalence of illicit substance use in Saudi Arabia

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Abstract

Illicit substance use disorder is a chronic brain disease. This disease can lead to many negative health outcomes or even death. Recently, Saudi Arabia's rank was among the top of the world in amphetamine seizures. Drug smuggling as well as conflicts and wars in the surrounding countries might play a role in that. The current paper aimed to review the over time prevalence of illicit substance use in Saudi Arabia. To achieve that, we searched through different databases. We also looked over the United Nations Office on Drugs and Crime (UN-ODC) reports. The current review found a few articles talking about illicit substance use prevalence in Saudi Arabia; much of that work was about Khat substance. In the end, we concluded that there is a considerable need for further research in this field.

Keywords: Khat, amphetamine, cannabis, drug abuse, illicit substance abuse

Introduction

Illicit substance use disorder is a complex brain disease. It is manifested by a compulsive desire to take the illicit substance despite its harmful effects (1). This disorder can lead to negative health effects which increase with duration (2,3).

Globally, there was an increase in illicit substance use by 30% last decade. In 2017, 5.3 percent of the global population was affected by these substances. The number of deaths related to them was 585,000 deaths. Moreover, 35 million people suffered from illicit substance use disorders that need treatment services (4).

Cannabis is the most abused substance worldwide (5). Unfortunately, Saudi Arabia suffers from many types of illicit substances, in particular the amphetamine (Captagon). It was ranked first globally for amphetamine seizures (6). These massive seizures emphasize the need for more research.

It is worth mentioning that Saudi Arabia is located in the southwest corner of Asia (7). By 2020, the total Saudi population was of 35,013,414 million, 38.79% of them were non-Saudi. The majority of the population is under the age of 65 years and those aged 65 years and more constitute only 3% of the total population (8).

Despite the huge efforts to face this problem, there is still a gap in illicit substance use research, and the large epidemiological studies that address the substance use prevalence in Saudi Arabia were sparse, (9,10) and the study that addresses the ability to monitor illicit substance use in Saudi Arabia is stated to be of high priority (10). Furthermore, enhancing the nation's immunity toward illicit substance use is a part of the 2030 vision (11). Therefore, this study aimed to know the overtime prevalence of illicit substance use in Saudi Arabia. At the end of the current review, we hope that we can end up with advice and recommendations which help to face this problem.

Methods

We conducted this review between June 2021 and May 2022. We aimed to identify all published articles and UNODC reports that address the topic of illicit substance use prevalence in Saudi Arabia. By synthesizing the previous works, we had a look at the overtime prevalence of illicit substance use in Saudi Arabia. We used the PubMed search engine. Also, we searched the SCFHS e-Library that had access to (Jama Network, ClinicalKey, DynaMed Plus, CINAHL, EBSCO Health, and American Academy of Pediatrics databases). Also, we went through the Cochrane library as well. Furthermore, we restricted the synthesis of the current review to the English articles published in Web of Science indexed journals. The following Mesh terms were placed in the PubMed's advanced search bar ("*Substance-Related Disorders*"[MeSH Terms] OR ("*Catha*"[MeSH Terms] OR "*cathinone*"[Supplementary Concept])) AND "*Saudi Arabia*"[MeSH Terms]. Also,

we searched the Saudi commission for health specialties electronic library (SCFHS e-Library) for substance abuse in Saudi Arabia. Then, we searched the Cochrane Library to find any article on this topic; (substance use disorder or substance abuse) in Saudi Arabia was placed in the advanced search bar. Moreover, we searched the reference lists of the eligible studies and Google Scholar to find more articles. The duplicated articles were identified and then deleted using the reference management software. Figure 1 shows the article selection process; 36 articles have been included in this review. Finally, we reviewed all United Nations Office on Drugs and Crime reports (UNODC) from 1997 to 2021, and all Global Illicit Drug Trends reports from 1999 to 2003 to collect more information related to the illicit substance use prevalence in Saudi Arabia.

Inclusion criteria

We included articles that showed substance use prevalence among the general population. Also, we added those that addressed the different substances, such as amphetamine, methamphetamine, Khat, cannabis (hashish and marijuana), alcohol, cocaine, opiates (e.g., heroin), or inhalants, to the current review. Moreover, we included the articles that presented the percentage of different substances used by drug abusers who sought treatment in health care facilities.

Exclusion criteria

We excluded articles on smartphone and/or video game addiction, smoking tobacco and/or electronic cigarette, postmortem studies, doping substances, research on animal, and plant studies. Also, we excluded, case reports, case series, case-control, abstracts, reviews, qualitative research, and experimental studies from this review. We ended up with 36 articles, which we used in the current review.

Results

This review included 36 articles and 4 UNODC reports. 31 articles were published after the year 2000, and about a third of all published articles was on Khat use percentage and/or prevalence (n=13). The rest of the published research was about other illicit substance use (n=23); 13 articles showed the rates of illicit substance use among the studied individuals, and 10 articles were about the percentages of different drugs used among those who sought treatment for substance use problems. Two articles from Saudi National Mental Health Survey (SNMHS) were included as well.

The qualities of the included studies

To find an answer to our research question "what is the overtime prevalence of illicit substance use in Saudi Arabia?", and not to miss any important article, we had to broaden our search to find all related articles in different databases. We only reviewed those published in Web of Science indexed journals to ensure the relative quality of the included studies.

Figure 1. Flow diagram of the literature review and study selection process

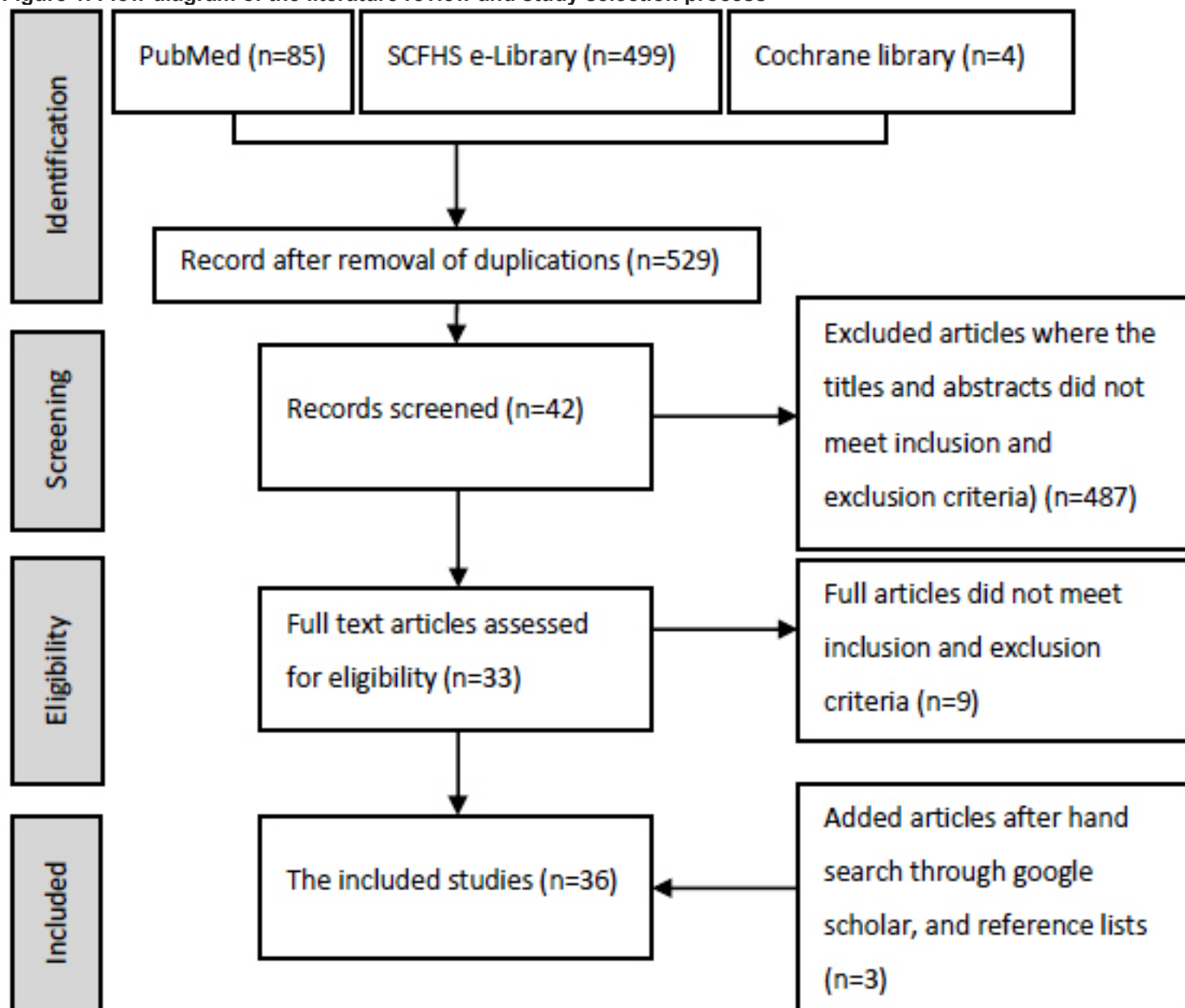


Figure 2. Primary substance abuse among persons treated for drug problems in Saudi Arabia in the years 2001 and 2006. Sources: World Drug Reports 2005 and 2009 (12,13)

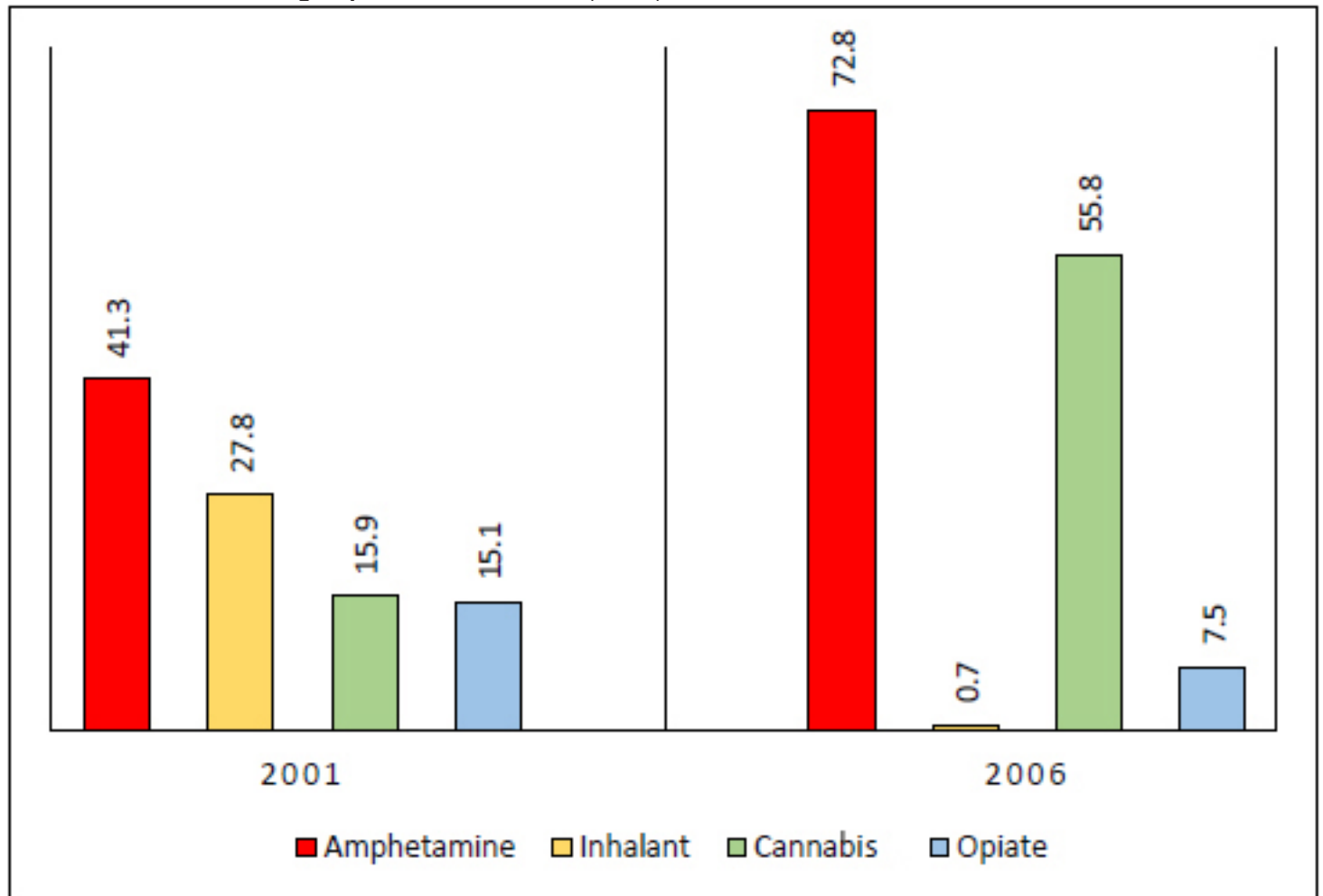


Table 1. Percentages of different drugs used among those seeking treatment for illicit substance use problem

Author(s)	No. (study year/s)	Amphetamine /stimulants (%)	Alcohol (%)	Cannabis (%)	Heroin (%)	Sedatives (%)	Volatile/ glue (%)	Notes
Osman ¹⁴	485 (1988-1989)	5.2	16.1	NA	43.5	NA	NA	NA
Hafeiz ¹⁵	116 (1995)**	10	31.2	26	83.6	1.8	0.9	One patient abused cocaine
Iqbal ¹⁶	799 (1995)	4	11	0.88	63	0.5	5	Two patients on Khat and one on cocaine
Iqbal ¹⁷	302 (1997)	4.30**	21.52	NA	68.21	NA	6.95*	** single substance dependence
Al-Nahedh ¹⁸	160 (1998)	NA	23.75	10.63	18.75	23.12	9.38	NA
Bassiony ¹⁹	101 (2002)	71.3	NA	60.4	24.8	7.8	NA	2% cocaine
AbuMadini et al. ²⁰	12,743 (1986-2006)	34.7	26.2	35.7	33.1	10.2	3.8	Overtime increase in amphetamine, alcohol, cannabis, and sedative use And decrease in heroin and volatile use
Alzahrani et al. ³	165 (2012-2013)	72.2	49.1	40	46.1	NA	55.8	Polysubstance abusers were 74.5%
Ibrahim et al. ²¹	612 (2016)	24	9	≈4	NA	NA	NA	Polysubstance abusers were 62%
Almarhabi et al. ²²	101 (2016)	38.6	6.9	24.8	7.9	NA	NA	NA

Abbreviation: NA, not available; No, number of study individuals.

Note: * we wrote the published date because we did not find the study date.

Table 2. Rates of illicit substance use among individuals in the reviewed studies

Author(s)	No. (study year/s)	Characteristics of study participants	Substance use (%)	Amphetamine/ stimulants (%)	Heroin (%)	Alcohol (%)	Cannabis (%)	Khat (%)	Volatile (%)
Al-Umran et al. ²³	27,916 (1988)	Male students	NA	NA	NA	NA	NA	NA	5.3
Elsayed et al. ²⁴	100 (2010)*	Mentally ill offenders	56	39	NA	9	4	4	NA
Ginawi. ²⁵	451 (2012)	Volunteers	NA	NA	NA	7.5	NA	NA	NA
Hafsa et al. ²⁶	225 (2012)*	Men (15–20 years)	8	NA	NA	NA	NA	NA	NA
Almuneef et al. ²⁷	10,156 (2013)	National study participants	8	NA	NA	8	NA	NA	NA
Alosaimi et al. ²⁸	406 (2013-2014)	Patients attending infertility clinics	3	NA	NA	NA	NA	NA	NA
Beaver et al. ²⁹	494 (2014)	School students	3	NA	NA	2.6	NA	NA	NA
Al Buhairan et al. ³⁰	11,361 (2015)*	School students	NA	1.5	NA	1.4	1	NA	16.2
Hakami. ³¹	746 (2013-2016)	Schizophrenic patients in the adult psychiatry clinic	NA	29.2	NA	NA	10.3	22.5	NA
Ahmad et al. ³²	157 (2015-2017)	Youth with repeated suicidal attempts	6.4	NA	NA	NA	NA	NA	NA
Alrakaf et al. ³³	1,177 (2019)	Medical students	2.46**	NA	NA	NA	NA	NA	NA

Abbreviations: NA, not available; No, number of study individuals.

Notes: * we wrote the published date because we did not find the study date; ** Illicit use.

Table 3. Percentages of Khat use in Jazan, Saudi Arabia

Author(s)	Study year	Study sitting	Sample size	Age	Percentages	Male (%)	Female (%)
Ageely. ³⁴	2006	Colleges and secondary schools	10000	15-25 years	21.4	37.7	3.8
Alsansoyet al. ³⁵	2011	Intermediate and upper secondary schools	3923	10-20+ years	20.5	33.1	4.3
Alsansoyet al. ³⁶	2011-2012	Higher education students	4100	20-24+ years	23.1	38.5	2.1
Mahfouz et al. ³⁷	2012	Primary health care centers	4,500	>12 years	28.7	36.9	8.7
Peeran et al. ³⁸	2013	Selected population around the university	1766	15-34 years	18.3	NA	NA
Awadalla et al. ³⁹	2015	Recruited drivers from transport stations	215	22-89 years	47.4	NA	NA
Quadri et al. ⁴⁰	2015	University colleges	500	NA	52	NA	NA
Hakami et al. ⁴¹	2016	Schizophrenia patients on antipsychotic monotherapy at psychiatric Hospital	1007	18-64 years	48	59.9	1.6
Darraj et al. ⁴²	2017-2018	Diabetic patients at primary health care centers	307	≥18 years	18.2	32.1	3.4
Albahawi et al. ⁴³	2018	University students	642	22.14±1.7 years	15.3	24.7	5.4
Badedi et al. ⁴⁴	2020	Type 2 diabetic patients at primary health care centers	472	Older than 18 years	14.19	NA	NA
Alkhormi et al. ⁴⁵	2022	Type 2 diabetic patients at diabetic center	375	18 years and above	20	NA	NA

Abbreviation: NA, not available.

Discussion

Illicit substance use in Saudi Arabia

Saudi Arabia is a higher income country located in southwest Asia (46). This country is near areas suffering from poverty, conflicts, and wars (47). Such surrounding problems in those areas creates an opportunity for the illegal drugs to be abused and produced without control (48). Hence, Saudi Arabia has a major problem, and many seizures of different substances have been recorded over the years (12,49,50).

Between 2011 and 2016, Saudi National Mental Health Survey (SNMHS) was conducted and showed that the 12-months prevalence of substance use disorders in Saudi Arabia was 1.9%; 0.2% were for alcohol abuse, 1.4% for drug abuse, and 0.5% for drug dependence (51). On the other hand, the same survey showed that the lifetime prevalence of substance use disorders was 4%; 0.6 for alcohol abuse, 2.7% for drug abuse, and 0.8% for drug dependence (52). This was lower than the median lifetime prevalence of substance use in 18 countries, of which it was 7%. Moreover, the alcohol abuse among the Saudi population was far lower than those who abused it in other countries (53). This could be due to the banning of Alcohol in Saudi Arabia (54,30).

Over time prevalence of different illicit substances in Saudi Arabia

Amphetamine is the most abused drug in Saudi Arabia. It is a stimulant drug that leads to higher levels of euphoria and an altered mental state for a while. This substance can lead to an addiction and negative physical, psychological, and social problems (55). Apart from UNODC reports, no study was found to know the prevalence of amphetamine use among the general population. UNODC reports showed that the prevalence of amphetamine use among the Saudi Arabian population has risen dramatically. This prevalence was 0.01%, 0.002%, and 0.4% in the years 1998, 2000, and 2006, respectively. At the same time, the prevalence of opiate use rose from 0.01% in 2000 to 0.06% in 2006 (56-58). One specialist hospital in the treatment of drug addiction problems in Saudi Arabia found that there was a nine fold increase in amphetamine use treatment admissions between 1998 and 2006. Also, it found a three times increase in the number of amphetamine treatment admissions as compared to other admissions (20). The second most abused substance in Saudi Arabia was cannabis. Its prevalence in 2006 was 0.3% among those between 15-64 years (6).

From the above, it is obvious that the most abused substances among the general population in 2006 were amphetamines followed by cannabis. This can be seen in the drug addictions treatment centers where amphetamine users present more frequently than others. Then, they were followed by cannabis users as seen in Figure 2. Moreover, this figure showed an overtime increase in amphetamine and cannabis use and a decrease in opiate and inhalant use. Similarly, Table 1 showed an over time increase in the percentage of amphetamine use and a

decrease in heroin use. One Saudi study found such a pattern (20). This was seen in Australia and Finland as well (59,60). The increasing trend of amphetamine use and seizures in Saudi Arabia over the last decade could be attributed to the geographical closeness to areas that produce amphetamine substances and the closeness to the drug trafficking routes (13,60). Another contributing factor to such an increase is the easiness of amphetamine production and abuse (61). Another possible contributing factor is drug relapse which is defined as the returning of the individual to the previous state of addictive behavior (62). One review in 2013 showed that the prevalence of substance use relapse in Saudi Arabia was around 50 percent or more (5).

Interestingly, an increase in amphetamine and cannabis use over time was seen in many studies (59,60,63-65). Our study also confirmed that. On the other hand, Table 2 shows the rate of substance use among different individuals. The rate was lowest (2.46%) among medical students and highest (56%) among mentally ill offenders. One report in Canada showed an association between offending and substance use. It stated that around 42% of crimes might not occur if the offender was not under the influence of the substances or seeking them (66). Moreover, different studies found a positive relationship between substance use prevalence and mental illness (59,67). This will raise our attention to the association between illicit substance use and psychological problems and give us a clue to the possibility of benefit from any preventive or treatment strategies that focus on this relationship.

Khat use

According to our research, an amphetamine-like substance named Khat was widely consumed in the southwest region of Saudi Arabia. This psychoactive drug contains cathinone (β -keto analog of amphetamine).

The Khat leaves are chewable and used in the southwest Arabian peninsula and east of Africa. Those who take Khat feel higher for a while (68). Many studies have been done in Saudi Arabia regarding this plant. In our research we found that this plant is socially acceptable among some populations despite its negative impact. The Kingdom of Saudi Arabia bans this plant and there were many efforts to decrease its use. An example of such an effort was the incentives given to those who replace it with any other crops and/or remove it from their lands (34-36,43,69).

In this review, we tried to collect all articles that address the topic of Khat use prevalence in Saudi Arabia and we found that most of the work was done in Jazan city. This city is the most affected by this plant. One reason is the smuggling from Yemen where the Khat is cultivated. Another reason is that some areas in the Jazan region cultivate this plant as well (70).

By reviewing all available articles that address the percentages of Khat use among the different populations in the Jazan region, we found that the Khat use percentages were widely varied and ranged from 14% to 52%. One of

the most affected groups by this plant was the students. As seen in Table 3, many researchers found that around one-quarter of the Jazan students were Khat users. A similar percentage was seen among the Ethiopian students as well (71). It is obvious that this phenomenon affects males mainly but does not exclude females (36). Table 3 shows that the trend of Khat use among the university students in the Jazan region tends to decrease over time from 23.1% in 2011 to 15.3% in 2018. Similarly, it showed an overtime decreasing trend among those attending primary health care and diabetic centers from 28.7% in 2012 to 20% in 2022. This decrease in the Khat use trend could be attributed to the efforts done by the Saudi government to control this substance (70). On the other hand, around half of schizophrenic patients, drivers, and students in 2015-2016 were using Khat. No explanations were found here as these results were far away from the other studies' results. Although, it was known that Khat could exacerbate a preexisting psychiatric problem, there is no clear evidence of the causal link between Khat use and the development of mental illness (72).

Furthermore, the war in Yemen may have a role in the fluctuating Khat prices that might affect its consumption. One study found that Khat substance is price elastic which means any price change will change the consumption amount, and the relationship was negative. This phenomenon may help the policymakers in the affected countries to control the Khat use habit (73). Similar findings happen when tobacco product prices increase. The WHO Framework Convention on Tobacco Control stated that the single and most effective strategy to encourage tobacco users to decrease consumption or even quit is to raise tobacco retail prices through increasing taxes(74).

Although Khat use is banned in the Kingdom of Saudi Arabia and other countries, it is still used. It is known that the addiction potential of Khat is low and the main problem of its use is social and financial (75). Hence, we proposed an MPOWER-like strategy for Khat control that might help to decrease its consumption rate in the future. The MPOWER package consists of a set of six keys which is the most effective strategy for fighting the global tobacco

epidemic(76). Table 4 illustrates the MPOWER strategy as well as the proposed one. Applying such a strategy to the affected regions around the world could be a helpful tool for controlling the Khat epidemic.

Recommendations

By the end of this study, we found that illicit substance use research in Saudi Arabia is still small, and there is a huge need to do more. Besides the other substances abused, special attention must be tailored to amphetamine, cannabis, and Khat as they were the most abused in Saudi Arabia. Moreover, we encourage applying more research regarding the proposed MPOWER-like strategy among the affected population around the world to evaluate its effectiveness in controlling the Khat use habit.

Limitations

This review included the published studies only. Therefore, searching gray literature could give us another view of the substance use prevalence in Saudi Arabia. Moreover, this work is a narrative review. The included studies were heterogeneous in their setting, aim, and sample. Hence, upon the availability of more and strong illicit substance use prevalence studies, a systematic review will give us a trusted result.

Conclusion

We conclude that there is an illicit substance use problem in Saudi Arabia. The most abused substance found in Saudi Arabia was amphetamine. Khat use was seen more frequently in the Jazan region. The number of articles that measure the prevalence of substance use inside the Kingdom of Saudi Arabia was low and many of them were about Khat prevalence. Finally, an MPOWER-like strategy for controlling Khat substance was proposed.

Table 4. Proposed MPOWER-like strategy for Khat control in comparison to the original strategy for tobacco control

MPOWER package for tobacco control	MPOWER-like package for Khat control
1) Monitoring tobacco consumption and the effectiveness of preventive measures	1) Monitoring Khat consumption and the effectiveness of preventive measures
2) Protect people from tobacco smoke	2) Protect people from Khat chewing
3) Offer help to quit tobacco use	3) Offer help to quit Khat chewing
4) Warn about the dangers of tobacco	4) Warn about the dangers of Khat chewing
5) Enforce bans on tobacco advertising, promotion, and sponsorship	5) Enforce bans on Khat advertising, promotion, and sponsorship*
6) Raise taxes on tobacco	6) Applying taxes on those who buy, sell, or cultivate Khat*

*Note: It might not be applicable in countries where Khat is completely banned.

References

1. Ranna Parekh MD, M.P.H. What Is Addiction? American Psychiatric Association. Available from <https://www.psychiatry.org/patients-families/addiction/what-is-addiction>. Accessed 12 Jun 2022.
2. Chen C-Y, Lin K-M. Health consequences of illegal drug use. *Current opinion in psychiatry*. 2009;22(3):287-292.
3. Alzahrani H, Barton P, Brijnath B. Self-reported depression and its associated factors among male inpatients admitted for substance use disorders in Saudi Arabia. *Journal of Substance Use*. 2015;20(5):347-353.
4. UNODC. World Drug Report 2019. Available from https://wdr.unodc.org/wdr2019/prelaunch/WDR19_Booklet_1_EXECUTIVE_SUMMARY.pdf. Accessed 27 Jun 2021.
5. Bassiony M. Substance use disorders in Saudi Arabia. *Journal of Substance use*. 2013;18(6):450-466.
6. UNODC. World Drug Report 2011. Available from https://www.unodc.org/documents/data-and-analysis/WDR2011/World_Drug_Report_2011_ebook.pdf. Accessed 27 Jun 2021.
7. General Authority for Statistics. Kingdom of Saudi Arabia. About Kingdom. Available from <https://www.stats.gov.sa/en/%D8%B5%D9%81%D8%AD%D8%A9/about-kingdom>. Accessed 29 June 2022.
8. MOH S. Statistical Yearbook 2020 Chapter 1 Health Indicators. Available from https://www.moh.gov.sa/en/Ministry/Statistics/book/Documents/Chapter_1_2020.xlsx. Published 2022. Accessed 29 Jun 2022.
9. AlMarri TS, Oei TP. Alcohol and substance use in the Arabian Gulf region: A review. *International journal of psychology*. 2009;44(3):222-233.
10. Makeen AM, Alanazi AM, AlAhmari MD, Murriky AA, Alfaraj M, Al-Zalabani AH. Delphi consensus on research priorities in tobacco use and substance abuse in Saudi Arabia. *Journal of Ethnicity in Substance Abuse*. 2020:1-12.
11. KSA Vision 2030 Strategic Objectives and Vision Realization Programs. Available from <https://vision2030.gov.sa/>. Accessed 27 Jun 2021
12. UNODC. World Drug Report 2005. Volum 2: statistics. Available from https://www.unodc.org/pdf/WDR_2005/volume_2_web.pdf. Accessed 24 May 2022.
13. UNODC. World Drug Report 2009. Available from https://www.unodc.org/documents/wdr/WDR_2009/WDR2009_eng_web.pdf. Accessed 24 May 2022.
14. Osman AA. Substance abuse among patients attending a psychiatric hospital in Jeddah: A descriptive study. *Medline Complete (Ebsco)*. 1992;12(3):289-293.
15. Hafeiz HB. Socio-demographic correlates and pattern of drug abuse in eastern Saudi Arabia. *Drug Alcohol Depend*. 1995;38(3):255-259.
16. Iqbal N. Substance dependence. A hospital based survey. *Medline Complete (Ebsco)*. 2000;21(1):51-57.
17. Iqbal N. Problems with inpatient drug users in Jeddah. *Ann Saudi Med*. 2001;21(3-4):196-200.
18. Al Nahedh N. Relapse among substance-abuse patients in Riyadh, Saudi Arabia. *EMHJ-Eastern Mediterranean Health Journal*, 5 (2), 241-246, 1999. 1999.
19. Bassiony MM. Stages of progression in drug abuse involvement across generations in Jeddah, Saudi Arabia. *Neurosciences (Riyadh, Saudi Arabia)*. 2008;13(1).
20. AbuMadini MS, Rahim SI, Al-Zahrani MA, Al-Johi AO. Two decades of treatment seeking for substance use disorders in Saudi Arabia: trends and patterns in a rehabilitation facility in Dammam. *Drug and alcohol dependence*. 2008;97(3):231-236.
21. Ibrahim Y, Alnasser S, Almohandes H, Sarhandi I. Patterns and sociodemographic characteristics of substance abuse in Al Qassim, Saudi Arabia: a retrospective study at a psychiatric rehabilitation center. *Annals of Saudi Medicine*. 2018;38(5):319-325.
22. Almarhabi Y, Mufti AI, Almaymuni AD, et al. Substance abuse at early age as a potential risk factor for driving under the influence of substance in Jeddah, Saudi Arabia: A cross-sectional study. *Traffic Inj Prev*. 2018;19(7):687-692.
23. Al-Umran K, Mahgoub OM, Qurashi NY. Volatile substance abuse among school students of eastern Saudi Arabia. *Annals of Saudi medicine*. 1993;13(6).
24. Elsayed YA, Al-Zahrani M, Rashad MM. Characteristics of mentally ill offenders from 100 psychiatric court reports. *Annals of general psychiatry*. 2010;9:4-4.
25. Ginawi IA. Perception on the Relationship between Cancer and Usage of Tobacco and Alcohol in Hail, Saudi Arabia. *Journal of Clinical and Diagnostic Research : JCDR*. 2013;7(10):2197-2199.
26. Raheel H, Mahmood MA, BinSaeed A. Sexual practices of young educated men: implications for further research and health education in Kingdom of Saudi Arabia (KSA). *J Public Health (Oxf)*. 2013;35(1):21-26.
27. Almuneef M, ElChoueiry N, Saleheen HN, Al-Eissa M. Gender-based disparities in the impact of adverse childhood experiences on adult health: findings from a national study in the Kingdom of Saudi Arabia. *International journal for equity in health*. 2017;16(1):1-9.
28. Altuwirqi MH, Bukhari M, Abotalib Z, BinSaleh S. Psychiatric disorders among infertile men and women attending three infertility clinics in Riyadh, Saudi Arabia. *Annals of Saudi Medicine*. 2015;35(5):359-367.
29. Beaver KM, Al-Ghamdi MS, Kobeisy AN, et al. The Effects of Low Self-Control and Delinquent Peers on Alcohol, Tobacco, and Drug Use in a Sample of Saudi Arabian Youth. *International journal of offender therapy and comparative criminology*. 2016;60(13).
30. AlBuhairan FSM, Tamim HPD, Al Dubayee MMD, et al. Time for an Adolescent Health Surveillance System in Saudi Arabia: Findings From "Jeeluna". *Journal of Adolescent Health*. 2015;57(3):263-269.
31. Hakami T. Clinical characteristics and treatment outcomes of patients with newly diagnosed schizophrenia: A 4-year single-center experience in Saudi Arabia. *Neuropsychopharmacology reports*. 2022.
32. Ahmed AE, Alaqeel M, Alasmari NA, et al. Risk Assessment of Repeated Suicide Attempts Among Youth in Saudi Arabia. *Risk management and healthcare policy*. 2020;13:1633-1638.
33. Alrakaf FA, Binyousef FH, Altammami AF, Alharbi AA, Shadid A, Alrahili N. Illicit Stimulant Use among Medical Students in Riyadh, Saudi Arabia. *Cureus*. 2020;12(1).

34. Ageely HM. Prevalence of Khat chewing in college and secondary (high) school students of Jazan region, Saudi Arabia. *Harm Reduction Journal*. 2009;6(1):11.
35. Alsanosy RM, Mahfouz MS, Gaffar AM. Khat Chewing Habit among School Students of Jazan Region, Saudi Arabia. *PLoS ONE*. 2013;8(6).
36. Alsanosy RM, Mahfouz MS, Gaffar AM. Khat Chewing among Students of Higher Education in Jazan Region, Saudi Arabia: Prevalence, Pattern, and Related Factors. *BioMed Research International*. 2013;2013.
37. Mahfouz MS, Rahim B-eE, Solan YM, Makeen AM, Alsanosy RM. Khat chewing habits in the population of the Jazan region, Saudi Arabia: prevalence and associated factors. *PloS one*. 2015;10(8).
38. Peeran SA, Peeran SW, Al Sanabani F, Almakramani B, Elham EI, Kumar PGN. "Education level" responsible for inequities in oral practices among 15–34-year-old individuals in Jizan, Saudi Arabia. *Journal of International Society of Preventive & Community Dentistry*. 2015;5(2):120.
39. Awadalla NJ, Suwaydi HA. Prevalence, determinants and impacts of khat chewing among professional drivers in Southwestern Saudi Arabia. *Eastern Mediterranean health journal*. 2017;23(3):189.
40. Quadri MFA, Mahnashi A, Al Almutahhir A, et al. Association of awake bruxism with khat, coffee, tobacco, and stress among Jazan university students. *International journal of dentistry*. 2015;2015.
41. Hakami T, Mahmoud M, Mohammed B, El-Setouhy M. Effects of khat use on response to antipsychotic medications in patients with newly diagnosed schizophrenia: a retrospective study. *Eastern Mediterranean Health Journal*. 2021;27(4).
42. Darraj A, Mahfouz MS, Alsabaani A, Sani M, Alameer A. Assessment of sleep quality and its predictors among patients with diabetes in Jazan, Saudi Arabia. *Diabetes, metabolic syndrome and obesity: targets and therapy*. 2018;11:523.
43. Al Bahhawi T, Albasheer OB, Makeen AM, et al. Depression, anxiety, and stress and their association with khat use: a cross-sectional study among Jazan University students, Saudi Arabia. *Neuropsychiatric disease and treatment*. 2018;14:2755.
44. Badedi M, Darraj H, Hummadi A, et al. Khat chewing and Type 2 diabetes mellitus. *Diabetes, metabolic syndrome and obesity: targets and therapy*. 2020;13:307.
45. Alkhormi AH, Mahfouz MS, Alshahrani NZ, et al. Psychological Health and Diabetes Self-Management among Patients with Type 2 Diabetes during COVID-19 in the Southwest of Saudi Arabia. *Medicina*. 2022;58(5):675.
46. The Royal Embassy of Saudi Arabia, Washington, DC. About Saudi Arabia. Available from https://web.archive.org/web/20120417231457/http://www.saudiembassy.net/about/country-information/facts_and_figures/. Published April 17, 2012. Accessed 27 June 2021.
47. Dimitry L. A systematic review on the mental health of children and adolescents in areas of armed conflict in the Middle East. *Child: care, health and development*. 2012;38(2):153-161.
48. Bergen-Cico DK. War and drugs: The role of military conflict in the development of substance abuse. Routledge; 2015.
49. Dabbagh R, Rawson R. Captagon Use in Saudi Arabia: What Do we Know. *Int Addict Rev*. 2019;2:22-30.
50. UNODC. World Drug Report 2014. Available from https://www.unodc.org/documents/wdr2014/World_Drug_Report_2014_web.pdf. Accessed 27 Jun 2021.
51. Al-Habeeb A, Al-Subaie AS, Bilal L, et al. Twelve-month prevalence and severity of mental disorders in the Saudi National Mental Health Survey. *International Journal of Methods in Psychiatric Research*. 2020;29(3).
52. Altwajiri YA, Al-Subaie AS, Al-Habeeb A, et al. Lifetime prevalence and age-of-onset distributions of mental disorders in the Saudi National Mental Health Survey. *International journal of methods in psychiatric research*. 2020;29(3).
53. Merikangas KR, McClair VL. Epidemiology of substance use disorders. *Hum Genet*. 2012;131(6):779-789.
54. Organization WH. Global status report on alcohol and health 2018. World Health Organization; 2019.
55. Heal DJ, Smith SL, Gosden J, Nutt DJ. Amphetamine, past and present—a pharmacological and clinical perspective. *Journal of psychopharmacology*. 2013;27(6):479-496.
56. UNODC. Global Illicit Drug Trends 2000. Available from https://www.unodc.org/pdf/report_2000-09-21_1.pdf. Accessed 24 May 2022.
57. UNODC. Global Illicit Drug Trends 2003. Available from https://www.unodc.org/pdf/trends2003_www_E.pdf. Accessed 24 May 2022.
58. UNODC. World Drug Report 2008. Available from https://www.unodc.org/documents/wdr/WDR_2008/WDR_2008_eng_web.pdf. Accessed 24 May 2022.
59. Baker A, Lee NK, Claire M, et al. Drug use patterns and mental health of regular amphetamine users during a reported 'heroin drought'. *Addiction*. 2004;99(7):875-884.
60. Kankaanpää A, Ariniemi K, Heinonen M, Kuoppasalmi K, Gunnar T. Current trends in Finnish drug abuse: Wastewater based epidemiology combined with other national indicators. *Science of the Total Environment*. 2016;568:864-874.
61. Verweij AM. Impurities in illicit drug preparations: amphetamine and methamphetamine. *Forensic Sci Rev*. 1989;1(1):1-11.
62. Witkiewitz K, Marlatt GA. Relapse prevention for alcohol and drug problems: that was Zen, this is Tao. *American psychologist*. 2004;59(4):224.
63. Piper BJ, Ogden CL, Simoyan OM, et al. Trends in use of prescription stimulants in the United States and Territories, 2006 to 2016. *PLoS One*. 2018;13(11):e0206100.
64. Seitz N-N, Lochbühler K, Atzendorf J, Rauschert C, Pfeiffer-Gerschel T, Kraus L. Trends In Substance Use And Related Disorders: Analysis of the Epidemiological Survey of Substance Abuse 1995 to 2018. *Dtsch Arztebl Int*. 2019;116(35-36):585-591.
65. Hasin DS. US epidemiology of cannabis use and associated problems. *Neuropsychopharmacology*. 2018;43(1):195-212.

66. Young MM, De Moor C, Kent P, et al. Attributable fractions for substance use in relation to crime. *Addiction*. 2021;116(11):3198-3205.
67. Chengappa KR, Levine J, Gershon S, Kupfer DJ. Lifetime prevalence of substance or alcohol abuse and dependence among subjects with bipolar I and II disorders in a voluntary registry. *Bipolar Disorders*. 2000;2(3):191-195.
68. Al-Hebshi N, Skaug N. Khat (*Catha edulis*)—an updated review. *Addiction biology*. 2005;10(4):299-307.
69. Mahmoud SS, Khamis KA, Mania KM, et al. Prevalence and predictors of khat chewing among students of Jazan University, Jazan, Kingdom of Saudi Arabia. *International Journal of Preventive and Public Health Sciences*. 2016;2(6):1-6.
70. Ageely HMA. Health and socio-economic hazards associated with khat consumption. *Journal of Family & Community Medicine*. 2008;15(1):3-11.
71. Roba HS, Beyene AS, Irenso AA, Gebremichael B. Prevalence of lifetime substance use among students in Ethiopia: a systematic review and meta-analysis. *Systematic Reviews*. 2019;8(1):326.
72. Warfa N, Klein A, Bhui K, Leavey G, Craig T, Alfred Stansfeld S. Khat use and mental illness: A critical review. *Social Science & Medicine*. 2007;65(2):309-318.
73. El-Setouhy M, Alsanosy R, Makeen AM, Ghailan KY, Alsharqi A, Sheikh KA. Impact of khat price increases on consumption behavior—price elasticity analysis. *Substance Abuse Treatment, Prevention, and Policy*. 2019;14(1):19.
74. Organization WH. MPOWER: a policy package to reverse the tobacco epidemic. Geneva: World Health Organization; 2008.
75. Pennings E, Opperhuizen A, Van Amsterdam J. Risk assessment of khat use in the Netherlands: a review based on adverse health effects, prevalence, criminal involvement and public order. *Regulatory Toxicology and Pharmacology*. 2008;52(3):199-207.