Review Article

Risks of khat chewing on the cardiovascular, nervous, gastrointestinal, and genitourinary systems: A narrative review

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Abstract

Khat is an evergreen plant and its fresh green leaves and buds are chewed for several hours a day for its psychostimulant response. This study aimed to review the effects of khat chewing on the body. PubMed was searched for literature on the different aspects of khat chewing to summarize its effects on different body systems. The major effects of khat chewing are those on the cardiovascular system including increased blood pressure, increased heart rate, and increased risk of myocardial infarction. It causes insomnia, stress, depression, hallucination, and increased risk of brain stroke. It causes dental caries, bad oral hygiene, periodontitis, increased oral mucosal ulcers, and increased gingival bleeding and recession. Khat chewing causes loss of appetite, gastritis, constipation, and hemorrhoids, and increased risk of hepatotoxicity and liver cirrhosis. Ultimately, it causes weak micturition, decreased sperm motility and count, and low birth-weight offspring in khat chewing mothers. The published articles about khat chewing in journals indexed in the PubMed was reviewed. Inclusion criteria involved each article available with English language and have a reported new effect of khat chewing.

Keywords: Effects of khat chewing on the cardiovascular system, effects of khat chewing on the gastrointestinal tract, effects of khat chewing on the genitourinary system, effects of khat chewing on the nervous system

Introduction

Khat (Catha edulis) is an evergreen plant cultured in some countries and its fresh green leaves and buds [Figure 1] are chewed for several hours a day for its psychostimulant response to relieve fatigue, stay alert, and increase work capacity. Khat leaves and buds contain cathine, cathinone, and methcathinone substances that are reported to have amphetamine-like structure and functions.[1-3] Natural S-(-)-cathinone has the same configuration as S-(+)-amphetamine. Cathinone is found in young leaves and buds. It metabolizes to cathine [(+)-norpseudoephedrine] and (-)-norephedrine in mature leaves.[4]

Khat chewing is a common habit among the people in many countries in east Africa and south Arabian Peninsula including Yemen, Ethiopia, Kenya, and Somalia. Most individuals start

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Received: 24-06-2021 **Revised:** 15-09-2021
Accepted: 06-10-2021 **Published:** 31-01-2022

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_1254_21

How to cite this article: Alshoabi SA, Hamid AM, Gameraddin MB, Suliman AG, Omer AM, Alsultan KD, *et al*. Risks of khat chewing on the cardiovascular, nervous, gastrointestinal, and genitourinary systems: A narrative review. J Family Med Prim Care 2022;11:32-6.

the habit of khat chewing for its stimulant and euphoric effect without awareness about its adverse health consequences. The knowledge gap contributes to the increase in the prevalence of khat chewing with increase of its farm and demand.[1,2,5]

Khat chewing cause a wide range of effects that include alertness, anxiety, stress, and depression.[6] It causes negative physical consequences including oral lesions, gastric cancers, duodenal ulcers, hepatotoxicity, hypertension (HTN), cardiovascular (CV) problems, and stroke. Prolonged excessive use of khat induces psychological dependence, depression, and even psychotic disorders.[7] The World Health Organization reported that khat has amphetamine-like stimulant, which causes euphoria and loss of appetite and it can also cause CV, gastrointestinal disorders and dental decay with long-term use.[8]

Khat chewing is a widespread social habit in the horn of Africa and south peninsula with bad personal and socioeconomic effects such as loss of working hours of the users and deprivation, family instability, and household poverty. Family doctors must do their role in educating the community about the risks of this habit. As this habit has been neglected in scientific researches, we introduce this literature review to provide an overview of the effects of khat chewing on the cardiovascular system, nervous system, digestive, and genitourinary systems.

Materials and Methods

A research of PubMed was performed upto August 2020 using the following words in different combinations: "Effects of khat chewing on the cardiovascular system," "Effects of khat chewing on the nervous system," "Effects of khat chewing on the gastrointestinal tract," and "Effects of khat chewing on the genitourinary system." There were no restrictions regarding publication date. The authors discussed and decided the selected articles. Papers were included or excluded based on the title and abstract. Inclusion criteria involved each article available in PubMed in English language and have a new effect of khat chewing. Exclusion criteria included case reports, articles with repeated information, articles with pre-clinical studies, and articles do not include in the PubMed. However, review articles were used in the introduction section. The majority of articles were observational studies.

Discussion

Khat effect on the cardiovascular system

In the literature [Table 1], we found that khat chewing causes hypertension.[9-12] Khat chewing increases heart rate.[11,13] This was explained by Wabe *et al.*[4] as a result of the vasoconstrictor activity of cathinone, which may be sustained in regular khat chewers.[11,12] In addition, Geta *et al.*[9] and Ali *et al.*[14] reported that cathinone has positive inotropic and chronotropic actions on isolated atria. Khat chewing increases risk of acute myocardial infarction (AMI).[13,15] This was explained by the coronary vasospasm effect of khat and thrombus formation due to catecholamine-mediated platelet aggregation.[14] The coronary vasospasm was explained by Ali *et al.*[14] and Al-Motarreb *et al.*[16] as amphetamine-like action of cathinone increases irritability and nervous tension after khat session that, in addition to increased heart rate it increases oxygen demand of the heart muscle and induces catecholamine-mediated platelet aggregation, which causes coronary vasospasm.

Khat effect on the nervous system

In the literature [Table 2], we found that khat chewing causes insomnia and sleep disturbances.[17,18] This may be explained by the irritability and the nervous tension effect of cathinone after khat session.[14,16] Khat chewing causes increased hallucination and stress.[19,20] This was explained by Wabe *et al.*[4] as khat chewing causes auditory hallucination and anxiety as same as amphetamine psychosis. El-Setouhy *et al.*[21] reported that khat chewing causes psychological dependence effect. Dependence effect was explained to be caused by the effect of catecholamine in the synaptic clefts of the nerve cells.[22] Furthermore, khat chewing increases incidence of brain stroke as reported by Kulkarni *et al.*[23] Ali *et al.*[14] explains this increase of cerebral stroke in khat chewers by increased cerebral vasospasm. Other study reported that longtime khat chewing causes increase intima-media thickness and plaque formation in the carotid artery and this may add another explanation of increased cerebral stroke in khat chewers.[24]

Table 1: Khat effects on the cardiovascular system

Author	Year	Effect
Geta *et al.*[9]	2019	(↑) blood pressure, both systolic and diastolic (SBP and DBP)
Sallam *et al.*[10]	2017	(↑) blood pressure, both systolic and diastolic (SBP and DBP)
El-Menyar *et al.*[11]	2015	(↑) catecholamine release (↑) heart rate (↑) blood pressure
Getahun *et al.*[12]	2010	(↑) mean blood pressure
Ali *et al.*[13]	2011	(↑) risk of STEMI and recurrent MI (↑) heart rate (↑) cardiogenic shock (↑) ventricular arrhythmia (↑) cardiogenic shock (↑) risk of death
Al-Motarreb *et al.*[15]	2013	(↑) acute myocardial infarction (AMI)

SBP: systolic blood pressure, DBP: diastolic blood pressure, ↑: increase, ↓: decrease, MI: myocardial infarction, AMI: acute MI, STEMI: ST-elevation MI.

Table 2: Khat effects on the nervous system

Author	Year	Effect
Alebachew *et al.*[17]	2019	(↑) insomnia (↑) depression
Teni *et al.*[18]	2015	(↑) sleep disturbance
Ongeri *et al.*[19]	2019	(↑) hallucination
al'Absi *et al.*[20]	2013	(↑) stress
El-Setouhy *et al.*[21]	2016	(↑) psychological dependence effect
Kulkarni *et al.*[23]	2012	(↑) brain stroke

↑: increase, ↓: decrease

Khat effect on the oral cavity

In the literature [Table 3], we found that khat chewing causes increased dental caries.[17,25,26] It causes increased incidence of oral mucosal ulcers, gingival bleeding, and recession.[27,28] It also causes decreased rate of saliva excretion and causes low salivary PH value.[29] It causes increase incidence of periodontitis and oral cancer.[26] Explanation was reported by Tarboush *et al.*[26] by the pro-oxidant effect of khat chewing that leads to dental caries, periodontitis, and increase oral cancer. In another study, Math *et al.*[30] introduced evidence that connected between khat chewing and oral mucosal genetic damage and cancer. Schmidt-Westhausen *et al.*[31] reported that khat chewing induces premalignant oral lesions those are dependent on site, dose, and time of khat chewing. Likewise, Lukandu *et al.*,[32] reported acanthosis, hyperkeratosis, and fibrosis as histological features of oral lesions induced by chronic khat chewing.

Khat effect on the digestive system

In the literature [Table 4], we found that khat chewing causes gastritis.[17,33] Gastritis was related to the astringent tannis in khat that irritates the gastric mucosa causing inflammation and gastritis.[33] It causes constipation.[18,33] Nigussie *et al.*[33] explained this as cathinone-stimulated release of noradrenaline from storage vesicles that stimulate CNS and causes sympathomimetic effect, which decrease gastrointestinal and colon motility and increase sphincter tone and as a consequence increases water absorption, which leads to formation of hard stool and consumption. Khat chewing causes hemorrhoids and the pathogenesis of hemorrhoids was explained by Nigussie as prolonged sitting during khat chewing sessions and constipation causes straining during defecation, which induces hemorrhoid formation.[33] Mahamoud *et al.*[34] reported that khat chewing increases risk of hepatotoxicity and liver cirrhosis, which may be related to the pesticides and herbicides that are used in khat farms. Furthermore, Abid *et al.*[35] reported that khat chewing triggers generation of intracellular reactive oxygen species that induces activation of c-Jun NH2-terminal kinase, which results in increased cell apoptosis and decreased cell viability. Khat chewing causes decreased appetite.[18] This explains the decrease of weight and body mass index, which is common in khat chewers.[36]

Khat effect on the genitourinary system

In the literature [Table 5], we found that khat chewing causes weak stream of micturition.[37] Urine retention was explained by the autonomic effect of cathinone on the peripheral nervous system.[4] As mentioned previously, other explanation was introduced by Nigussie *et al.*[33] who reported that the sympathomimetic effect of cathinone increases sphincter tone. Demelash *et al.*[38] reported that khat chewing causes low birth-weight of the newborns of khat-chewer mothers. This was explained by Wabe as khat chewing reduces placental blood flow and produces growth retardation.[4] Nyachieo *et al.*[39] reported that khat chewing causes decreased sperm count, motility, and plasma testosterone. This was explained by the toxic effect of cathinone which, in addition, causes increase in the number of sperms with morphological changes.[40]

Table 3: Khat effects on the oral cavity

Author	Year	Effect
Alebachew *et al.*[17]	2019	(↑) dental caries
Al-Alimi *et al.*[25]	2018	(↑) dental caries
Tarboush *et al.*[26]	2019	(↑) oral cancer (↑) periodontitis (↑) dental caries
Al-Kholani[27]	2010	(↓) oral hygiene (↑) incidence of gingival bleeding (↑) incidence of oral mucosal ulcers (↑) gingival recession
Al-Maweri *et al.*[28]	2017	(↑) gingival recession
Badulla *et al.*[29]	2019	(↓) baseline salivary PH (↓) flow rate of saliva
Math *et al.*[30]	2016	(↑) oral cancer

↑: increase, ↓: decrease

Table 4: Khat effects on the digestive system

Author	Year	Effect
Alebachew *et al.*[17]	2019	(↑) gastritis
Teni *et al.*[18]	2015	(↑) loss of appetite (↑) constipation
Math *et al.*[30]	2016	(↑) esophageal and gastric cancer
Nigussie *et al.*[33]	2013	(↑) dental problems (↑) gastritis (↑) constipation (↑) hemorrhoids
Mahamoud *et al.*[34]		(↑) hepatotoxicity (↑) liver cirrhosis

↑: increase, ↓: decrease

Table 5: Khat effects on the genitourinary system

Author	Year	Effect
Hassan *et al.*[37]	2002	(↓) stream of micturition (↑) urethral discharge post-chewing
Demelash *et al.*[38]	2015	(↑) low birth-weight
Nyachieo *et al.*[39]	2013	(↓) sperm motility (↓) sperm count (↓) testosterone level (↓) prolactin level

↑: increase, ↓: decrease

Conclusions

Several studies across the world reported that khat chewing has multiple harmful effects on the human body. It causes hypertension, increased heart rate and increased risk of acute myocardial infarction. Khat chewing causes insomnia and sleep disturbances, dependence, and increased risk of cerebral stroke. Oral problems including dental caries, oral mucosal ulcers, gingival bleeding and recession, and increased risk of oral cancer were reported in khat chewers. Khat chewing causes gastritis, anorexia, constipation, increased risk of hepatotoxicity, liver cirrhosis, and esophageal and gastric cancers. Weak stream of micturition, decreased sperm count and motility, and low

Figure 1: Khat tree (a), and khat herbs (b) ready for chewing session

birth-weight of siblings of khat chewing mothers were also reported. Although khat chewing is a widespread social habit in the horn of Africa and the southern Arabian Peninsula, it has been neglected by scientific researchers as a medical problem.

Key messages

1. Khat chewing has unfavorable personal outcomes and family deprivation and unfairness.
2. Khat chewing has serious medical problems on the cardiovascular problems, starting from increased heart beats to increased risk of myocardial infarction.
3. Khat chewing has many behavioral and nervous bad effects, starting from sleep disturbance to increased risk of brain stroke.
4. Khat chewing has a lot of gastrointestinal tract health problems, starting from dental caries to increased risk of hepatotoxicity and gastrointestinal tract cancers.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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