



Psychopharmacosocial Aspects of *Catha edulis* Forsk (Fam. Celastraceae)

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ABSTRACT

Khat [*Catha edulis* Forsk (Celastraceae)], is an ancient plant associated with psychological, health and socioeconomic issues on humans. Khat (the flower of paradise) is a plant vastly used on the African continent. The khat-chewing aspect of this plant in particular, is one of the most widespread, longstanding, age-old customs in Eastern and Southern Africa, as well as certain areas of the Arabian Peninsula. The chewing of khat leaves probably pre-dates the use of coffee. Since time immemorial, there have been numerous disputes and debates over khat-chewing practices with respect to its positive as well negative impact on society. In recent years, khat-chewing has been observed across all age groups, however its use has been observed to surge in teenagers. As a result of its major health implications and socioeconomic impact on society, there is an urgent need to effectively and efficiently address the use of this plant, not only in Africa and the Arabian Peninsula, but globally. Quite a number of studies have reported khat-chewing as a harmful custom on the basis of its negative impact on health, as well as the resultant and socioeconomic consequences of its use. In contrast, a few studies suggest it is an indispensable, indigenous tradition for social recreation. A number of khat-chewers strongly believe that khat-sessions preserve their identity as well as help unite their communities. Nevertheless, by taking cultural legitimacy into consideration, there is reason to appropriately design strategies which could result in the proper communication of the negative impact of this flower of paradise on health and socioeconomic status. Various education programs designed to demonstrate the negative effects of the routine social use of this plant could be developed and implemented, in order to create awareness in the khat-chewing community. Such ventures, which could be carried out via appropriate health education and mass media campaigns, could bring an end to the devastating consequences associated with the use of this product, and certainly, a constructive and positive outcome on this khat-chewing population in the future.

KEYWORDS: Khat; *Catha edulis*; Khat-chewing; Health impact; Tradition; Practice

INTRODUCTION

Khat is a natural stimulant derived from the *Catha edulis* plant, which is cultivated in the Republic of Yemen and most East African countries. Its young buds and tender leaves are chewed to attain a state of euphoria (1). Khat-chewing originated in Ethiopia and subsequently spread through Kenya, Somalia, Djibouti, Uganda, Tanzania, Zimbabwe, Zambia, South Africa, and Yemen. Although Khat can be freely obtained in these regions, its use in western countries, such as the United Kingdom, Canada, and the United States has recently become restricted, and is now classified as a controlled substance. Nonetheless, individuals from such regions as Somalia and Yemen, continue the habit even after immigration to the West (2).

Khat is grown extensively as a cash crop in Ethiopia, Yemen and the northern provinces of Kenya (Figs. 1 &2).



Figure 2
Interaction with Ethiopian khat plant cultivator about the cultivation practice and harvesting technique



Figure 1
Close examination of khat plant with cultivator

It is also of social and economic importance in the neighboring areas of Somalia and Djibouti. In Ethiopia, over 93,000 hectares is devoted to khat production, the second largest in terms of land area devoted to any crop (3). Prior to the expansion of the khat trade, coffee was the primary cash crop in Yemen (4). Currently, in Yemen, certain estimates suggest that one-half to two-thirds of their arable land is being used for khat cultivation largely because farmers earn five times as much from khat as compared to other cash crops, such as coffee. Though Khat cultivation has taken over arable land because of its value, as a crop however the agricultural and health benefits of this product are questionable (2).

Individuals in Eastern Africa and the Arabian Peninsula have for several centuries used khat mainly for its stimulant and socializing aspects. The majority of the users are followers of the Islamic faith, who are forbidden from smoking marijuana (cannabis) or drinking alcohol. Khat chewing however is not contraindicated on Islamic religious grounds, hence its popularity in African and Asian Muslim countries (5). Khat is also known to be used in Afghanistan and Turkestan (6).

Khat chewing is a common practice in countries of the horn of Africa, such as Ethiopia, Somalia, Somaliland, Kenya, Eritrea, Djibouti and Uganda, as well as across the Arabian Sea in areas such as Yemen and Saudi Arabia. Khat chewing is a legal pastime and woven into the social and cultural fabric of these countries (7). Thus far, this habit has remained confined to the areas where khat is cultivated, or grows, since only fresh leaves are known to be active. Nevertheless, in recent years the khat habit has become prevalent in regions remote from environments where the plant is cultivated. This has been achieved mainly via air-transportation of khat leaves (8). In the olden days, khat was pretty much used mainly on ceremonial occasions, predominantly by men however, with recent social upheavals and changes in lifestyles post independence, more young men seem to have taken to the khat chewing habit, Fig. 4, (5).



Figure 4
Chat with Ethiopian khat-chewer in relation to the mode of khat-chewing at khat parlor

Khat is a very popular hallucinogen and Khat chewing is deeply rooted in the sociocultural traditions of several countries, and is a one of the most widespread age-old

customs in Eastern Africa and the southern section of the Arabian Peninsula. Today, millions chew khat leaves on a daily basis. In recent years, the khat-chewing practice has been escalated enormously amongst all sections of these societies, particularly the pubescent. It certainly has major socioeconomic as well health related issues which need to be addressed urgently, in an effective and efficient manner. Numerous studies have been reported globally on khat-chewing, as well as its negative and positive impact on societies. Unfortunately it is extremely tricky and difficult to judge this time immemorial tradition. Thus, this review attempts to address the health and socioeconomic consequences of khat-chewing and looks at both sides of the controversy. It is possible that as this subject continues to be carefully tackled and appropriately addressed, some insights via research could be passed on to policy makers in order devise appropriate strategies and laws and regulations to shape the use of this product in society.

Origin of khat plant

The khat tree was first described by Peter Forskal (1736-1763), a Swedish botanist who had travelled with his friend the Geographer, Karsten Niebuhr (1736-1815) on an expedition to Egypt and Yemen, organized by King Frederick V of Denmark. Among other information collected, extensive data was collected on khat, which Forskal described as *Catha edulis* (Celastraceae family). Karsten Niebuhr was the only survivor of the five members of the expedition and in memory of his friend; he named khat *Catha edulis* Forskal (9). There are numerous disputes about the origin of the khat plant, but wherever it came from, it has unquestionably been a part of the cultural tradition of East Africa and the southern sections of the Arabian Peninsula for a very long period of time (Fig. 5).

Other common names for khat

Globally, khat is known by a variety of names, such as Mirra, Qat, Catha, Bushman's tea, Jaad, Herari, Tschat, Flower of paradise, Kaad, Chat, Tohai, Abyssinian tea, Qaat, Gat, African salad, and Tea of the Arabs.

Description of the khat plant

The khat tree is a perennial green plant which is grown by grafting, usually reaching 6–7 m in height. It grows at altitudes of 1500–2500 m. The first harvesting of chewable leaves is usually after the third or fourth year; although it usually requires another 6–7 years for the tree to fully mature. A healthy tree will continue to yield excellent products for another 50 years (9). The leaf odor is faintly aromatic and the taste is astringent and slightly sweet (12). The khat tree has a slender trunk with a smooth thin bark. The lancet-shaped leaves are between 0.5 and 10 cm long and 0.5 to 5 cm wide. Young leaves are a reddish-green, later turning to yellowish-green. In areas with frost, the shrub grows no more than 1.5 m; however, in environments with more rainfall, like the highlands of Ethiopia and areas near the equator, khat trees can attain a maximum height of 20 m (13, 14).

Therapeutic values of khat

The first report of khat as having any medicinal properties was by the Arabian physician Abu Al-Rihan Bin Ahmed Al-Baironi (973-1051 AD) in his book, *Pharmacy and Therapeutic Art* (15). Khat is also mentioned in an Arabic medical book, *The Complex Drugs*, which was written in 1237AD.



Figure 5
Tender leaves of Khat plant

One opinion however, is that khat was introduced to Yemen during the Ethiopian occupation of Yemen in 525 AD, when its use was limited to the invaders. This date however, is believed by others to be too early, as Abu Al-Hasan Al-Hamdani in the 10th century (945 AD) does not mention khat in his botanical treatise on the several plants he described.¹⁰ The view that khat came to Yemen at the beginning of the 13th century is supported by a letter written by a religious scholar, Ahmed Ben Alwan, asking the ruler at that time to legally ban its use, because prevented Yemenis from properly carrying out their prayers, especially during the afternoon (*Asr*) and sunset (*Maghreb*) prayer periods. In an Arabic manuscript preserved in the Bibliotheque National in Paris, reports indicate that reference made to Khat may be as early as 1332 AD.¹¹

The author, Najeeb Al-Deen Al-Samargandi, described khat as a treatment for depression, because it led to happiness and excitement (16).

The earliest written record of the medical use of khat appears to be in the New Testament. Khat is used in indigenous medical systems in northeastern, eastern, and southeastern Africa, as a remedy for such ailments as venereal disease, asthma and other lung conditions, colds, fevers, coughs and headaches. Occasionally it is used to prevent pest and malaria epidemics (13, 17, 18). Some believe it to be a dietary requirement.⁶ Yemeni khat chewers believe that it is beneficial for minor ailments such as headaches, colds, body pains, fevers, arthritis, as well as depression (19).

Mode of khat-chewing

Khat leaves are chewed just like tobacco. Khat-chewing sessions may last for several hours. During this time chewers drink copious amounts of non-alcoholic beverage such as colas, tea as well as cold water.⁶ This was found to be the case in Ethiopia, based on our personal observations and discussions with khat-chewers. During khat-chewing sessions we observed khat-chewers drinking tea, Coffee, and soft-drinks particularly coca-cola. Some of these individuals would smoke cigarettes while chewing khat. Additionally, we have on several occasions observed few chewers consuming sugar and groundnuts along with khat leaves in order to overcome the bitter taste of leaves of this product. We have observed elderly individuals who are unable to chew as a result of poor dental conditions, crush khat leaves then imbibe the khat-leave juice.

Importance of khat sessions

Khat sessions are frequently used for celebrations, as well a medium for the exchange of information. Participants can meet friends, exchange news, take part in discussions and debates, and make various plans and take decisions on several issues. The exchange of information is often highly personal and may be relevant to one's status within the community (20, 21). These khat sessions, known in Ethiopia as "barch'a", and in Yemen as "majlis al-qat" (literally "the council of khat"), are informal events (14, 20). There are also organized khat sessions, where the participants are carefully screened and receive invitations from their hosts, who also would provide khat. The socioeconomic status of the host frequently determines the amount and quality of the khat served at such gatherings. In return, those invited to such incidental khat parties are expected to reciprocate by organizing similar events. Both sessions define social differences, in class as well as in status, and the type and quality of khat used (14, 22).

Khat-chewing as a social event

Khat chewing usually takes place in groups in a social setting. Only a minority frequently chew alone. In a khat chewing session, initially there is an atmosphere of cheerfulness, optimism and a general sense of well-being. After about 2 hours, tension, emotional instability and irritability is observed, later leading to depressed mood and sluggishness. Chewers tend to leave these sessions feeling depleted (6). Overall, the khat-chewers experiences a sense of increased energy levels, increased alertness and ability to concentrate, improvement in self-esteem and an increase in libido (23).

Yemenis chew khat heavily on a daily basis. The habit of khat chewing is deeply rooted in the Yemeni society (24) and has sharply increased in recent years.

Air transportation has removed the main obstacle associated with its distribution in Yemen. This plant which is highly perishable, as a result of air transportation can be readily be available from areas where it is grown to individuals in Yemen, Somalia, and East African communities in the USA and UK. Seven tons of khat passes through Heathrow airport UK every week; smaller amounts are also imported through other airports. Some of these quantities are re-exported to other European countries (25). Yemenis consider khat sessions to represent important social occasions to meet other people and for the exchange of ideas and information. Although friends and individuals of similar social status gather together, these occasions are frequently open to anybody who wishes to attend, especially sessions which combine weddings, funerals, and political election campaigns. At such gatherings, social class distinctions are forgotten (9).

Khat-chewing as a gratification

Chewing khat is both a social and a culture-based activity. It is said to enhance the social interactions, in ceremonies such as weddings. Khat contains a number of chemicals, among which, are two controlled substances, namely cathinone (Schedule I) and cathine, (Schedule IV), (26). Cathinone is structurally and functionally closely similar to amphetamine and releases catecholamines from pre-synaptic storage sites resulting in CNS stimulation and a variety of peripheral sympathomimetic effects such as tachycardia and

hypertension. It has been reported that the effects of a portion of khat are very similar to that of approximately 5 mg of amphetamine (27). In Yemen, Muslims are the most avid chewers. Some believe that khat chewing facilitates a spiritual connection with Allah, during prayers. Many Christians and Yemenite Jews in Israel also practice khat-chewing. Khat is a stimulant as a result, it is used to stay alert, improve performance, thus increase work capacity (28). Workers on night shifts use it to stay awake and delay fatigue. Students have chewed khat in an attempt to improve mental performance before exams (19, 29, 30). Security guards and others who wish to stay awake and alert at night or work long hours without fatigue would frequently chew khat.

Modern users report that chewing khat boosts their energy levels, increases alertness confidence, sense of happiness, thought process, creativity and communication. Chewing khat is a method of increasing energy and elevating mood in order to improve work performance for some (31). In Ethiopia, khat is commonly used for social recreation. Occupational groups such as motor vehicle drivers, truck drivers, chew khat during long distance trips, in order to keep them awake, and for other different reasons. There is also specific usage of khat by the special sections of the community; craftsmen and farmers use khat to reduce physical fatigue and traditional healers, to heal ailments (29, 30).

Khat-chewing as a health risk

As a result of increasing evidence of the harmful effects of khat on general health and its associated social problems, it is essential to pay attention to prevalence of khat within the general population as well as its risk factors. There is fairly extensive literature on the potential adverse effects of habitual use of khat on mental, physical and social well-being (31).

Some khat chewers experience anxiety, tension, restlessness, hallucinations, hypomania and aggressive behavior or psychosis (32,33) Chronic consumption can lead to impairment of mental health, possibly contributing to personality disorders and mental deterioration (12, 33, 34).

Khat-chewing and the digestive system

While chewing khat leaves makes people feel more alert and talkative, it does suppresses appetite. Regular khat chewers go on to develop gingivitis and loose teeth, however, there appears to be no convincing evidence of any association with khat and oral cancer. Among khat users in Yemen there is, however, a higher incidence of esophageal cancer compared with gastric cancer (26).

Khat accounts for a number of gastrointestinal tract problems, such as oesophagitis, gastritis and delayed intestinal absorption, as well as the development of oral keratotic white lesions at the site of chewing. Gastritis and constipation are some of the main complaints of its users. Khat chewing may be associated with the development of periodontal and the brownish discoloration of the teeth (35, 36). Khat chewing has also been reported to be a risk factor for duodenal ulcer formation (37). A generalized brown pigmentation in the oral cavity has been associated with the habit of chewing the leaves of khat (38). Strong correlation between khat chewing and oral cancer has also been reported, which could be related to the effects of insecticides used on these plants (39).

Khat-chewing and the circulatory system

Chewing khat leaves releases cathinone, a stimulant that produces the feeling of euphoria. When cathinone is broken down in the body, it produces chemicals including cathine and norephedrine, which have a similar structure to amphetamine and adrenaline (epinephrine). Regular khat use is associated with increased arterial blood pressure and pulse rate, pharmacodynamically corresponding with levels of cathinone in the plasma (26).

A recent study reported that khat is very harmful in hypertensive patients because it associated with increased heart rate and blood pressure (40). A significant association between the habit of khat chewing and the development of haemorrhoidal disease has also been reported (41). Khat is also associated with increased incidence of acute coronary vasospasm and myocardial infarction (41). Khat chewing was observed to be significantly higher among the acute myocardial infarction (AMI) case group than the control group. A dose-response relationship was observed, with the heavy khat chewers having a 39-fold increased risk of AMI.

This study indicates that khat chewing is certainly associated with AMI and is an independent dose-related risk factor in the development of myocardial infarction in this population.⁴³ A recent study reported that long term khat use or abuse can result in insomnia, anorexia, gastric disorders, depression, liver damage and cardiac complications, including myocardial infarction (26).

Khat-chewing and neurological disorders

The chemically unstable alkaloid cathinone, S (-) alpha-aminopropiophenone, present in the fresh plant material, is the main psychoactive agent (44).

Numerous laboratory studies have confirmed that cathinone is similar to amphetamine in chemical structure, and affects the central and peripheral nervous systems and behavior (45, 46, 47). Khat has been associated with numerous somatic and psychiatric health sequelae (42, 48, 49).

Khat may be associated with Parkinson's disease. Jeladti reported that individuals of Yemenite origin who develop Parkinson's show the first symptoms at a younger age of 55 years, than Ashkenazi Jews (62 years), (50). The disease also develops faster and the symptoms are more severe among Yemenite than Jews of Ashkenazi origin. This study was conducted in 98 Ashkenazi Jews with Parkinson's disease and 63 similar patients of Yemenite origin between 2000 and 2008.

The progress of their disease from diagnosis until death took an average of eight to nine years. Jeladti found that Yemenites tended to develop Parkinson's disease at a much younger age and surprisingly, 35% of the Ashkenazi Jews had a positive family history for this ailment, as compared to only 22% Yemenites. This researcher suggested that the fact that many Jews of Yemenite origin chew the leaves of the khat plant for its psychedelic properties could also be a cause of these differences.

Khat-chewing and pregnancy

Khat chewing, which is a wide spread male social habit in countries around the southern shore of the Red Sea and Eastern Africa and is also a common practice in women, even during pregnancy and lactation. According to a recent report, khat chewing during pregnancy results in women

giving birth to low weight babies. Khat is also known to be excreted in breast milk, but no studies have been conducted so far on how this affects nursing babies (40). In pregnant women, khat consumption may have detrimental effects on utero-placental blood flow and as a consequence, impacts fetal growth and development (51). Khat affects pregnant women via reduction of their daily food intake, subsequently they give birth to malnourished infants (35,52-53). Low birth weight is a contributing risk factor in both prenatal and infant mortality among khat chewers during pregnancy. Khat can affect fetal development during pregnancy via placental insufficiency, which could be explained by the extremely high blood pressure observed in these women (54).

Lower mean birth weights have been reported in khat-chewing mothers compared to non-using mothers indicating an association between khat chewing and decreased birth weight (6).

Khat-chewing and impotence

Khat consumption is also known to cause spermatorrhea, and its chronic use may lead to spermatozoa, and in certain cases impotence (39). This effect was observed in a study in rabbits to be largely dose related (55). Overall, this effect appears to be associated with decreased semen output; sperm count, motility, and an increase in the number of abnormal sperms. It has been determined that khat decreases fertility via this mechanism, which is reversible once its use is stopped (56). Khat-chewing causes a high frequency of spermatorrhea and decreased libido and, at a later stage, impotence, as observed in Somalia and Djibouti, where up to 60% of the male chewers countries were reported to be impotent (1, 57, 58).

Khat-chewing and the excretory system

Khat affects the urinary system via relaxation of bladder wall muscles and closure of the internal sphincter. Urine retention has been observed, as well significant decreased urinary flow rate (59).

Khat-chewing and other detrimental practices

Another study on chewing khat and its associated habits demonstrated that cigarette smoking was very common amongst khat-chewers. This study, which was carried out in 1992 among medical students of different grades at the Faculty of Medicine, Aden University demonstrated that 42% of khat-chewers were also smokers. Of these, 9.3% smoked and chewed khat leaves concurrently (60). Yambo & Acuda established a strong link between khat and alcohol abuse among Kenyan youth in their 1983 study (61). Khat increases the desire for active tobacco smoking and is associated with passive smoking. Some khat chewers may also smoke a common water-pipe, which might increase the chances of spreading a disease such as tuberculosis. Recently most chewers have preferred cigarette smoking because it does not need to be put together, and it is easy to smoke everywhere (10).

Khat-chewing as a social issue

The social use of khat has more disadvantages than advantages. The family in particular has been adversely affected. Thus, the relationship of the family members is weakened and the children are the first victims of the khat habit. The father returns home at lunchtime in a hurry, has his lunch, which is the main meal in Yemen and then leaves the house without having

enough time to see either his children or wife. Thus children do not see their fathers in most cases and fathers tend not to positively and effectively influence their children (10).

A culture of hedonism that attaches a high value to leisure has prevailed in much of Uganda. Having in the past been associated only with Somali and Yemeni migrants, khat consumption has spread among all ethnic groups and to all parts of Uganda. Khat chewing, which takes several hours if the full sequence of effects is to be achieved, is viewed as “idling” by mainstream society, and as an affront to the core Ugandan values of hard work and education. There are two types of consumers: 1) the traditional users, “maqatna”, who chew khat accompanied with soft drinks and 2) the “mixers” who combine khat sessions with alcohol and/or cannabis. The “mixers (who chew khat accompanied by alcohol and/or cannabis use) have abandoned the rules and rituals of consumption observed in other khat-chewing settings (62).

Manic and delusional behavior, violence, suicidal depression, hallucinations, paranoia and khat-induced psychosis have also been reported (26). Women who use drugs often have sexual jobs as a means of raising money for further drug consumption. Similarly, in Kenya and Uganda, journalists, the general public, and aid agencies associate female consumption of the stimulant drug, khat as a route to prostitution.⁶³ There is also a social stigma which surrounds the use of khat by Somali women (64).

Recently, khat chewing among females has increased sharply, and this can be observed in their attitudes, frequently, as they plan and hurry to various khat parties organized by women. Husbands buy khat branches for their wives as part of their marital duties, for use at home, to prevent their wives from going out to these khat parties.

In the past, it was unacceptable for women to chew khat or smoke a water-pipe (except for older women). The effect on society of women going on khat-chewing sprees is frequently that their children are left playing on city streets, with other street children (65).

It is estimated that up to 90% of adult males chew khat three to four hours daily in Yemen. The number for females may be as high as 50% or even higher, as younger women take up the habit; a recent study for the World Bank estimated that 73% of women in Yemen chew the khat leaf (66). A staggering 15–20% of children under the age of 12 are also daily consumers of khat (40).

The end result of the khat-chewing is believed to lead to strained relations between spouses or married couples and most likely family fragmentation and sexual promiscuity. Khat chewing is a risky behavior which could fuel the spread of HIV. In this regard, a link has been shown to exist between khat usage and increased exposure to HIV/AIDS among prostitutes in Djibouti (67).

Khat-chewing as an economic burden

Besides its health related damaging effects, Khat also has adverse socioeconomic consequences which include the loss of thousands of acres of arable land and billions in hours of decreased work productivity stemming from laziness and perpetual absenteeism. Workers for example frequently go to lunch, engage in Khat sessions, and do not return to work (2).

Women were more likely than men to report difficulty in affording khat (38% to 20%) respectively, and were more likely to report wanting to stop using khat (50% to 27%). Furthermore one study found that women were more likely report spending over £150 per month on khat (7%) than men (2%), (68).

From an economical perspective, khat use is one of the reasons for diversion of household income which could be wisely used for nutritious food, home improvement, education or other desperately needed family items (54). It is estimated that 15.8% of the average family income is spent on khat (69). Khat has mostly replaced the famous Yemeni coffee and seriously damaged the coffee economy (19). On the basis of available scientific evidence it is quite clear that khat use has serious negative consequences on the economic development of a country and on the health aspects of a society (26).

The recent sharp increase in khat consumption may not only affect the health of individuals but could also have serious socioeconomic consequences within the countries involved. The potential adverse effects include diversion of income for the purchase of khat by family members, thus resulting in the neglect of family needs, leading to family discord and divorce. Furthermore, in countries where its use is substantial, it may negatively affect the economy since the quality and quantity of productivity is grossly diminished as a result of absenteeism secondary to the after-effects of the drug.³³

CONCLUSION

The present report helps in scrutinizing and exposing a strong freckled conclusion about khat-chewing tradition and practice. Several studies across the globe have reported khat-chewing as a harmful activity on the basis of health and socioeconomic consequences. In contrast, few studies suggest that it is an indispensable indigenous tradition for social recreation. A number of khat-chewers believe that khat-sessions preserve their identity as well as keep their communities together. Thus, khat-chewing is recognized as a legitimate practice among certain members of these societies. Apparently, the use of this Flower of paradise, African salad, Tea of the Arabs, (other names for khat) is controversial, and the manner to regulate its use continuous to be debated. The use of khat is interwoven with certain fundamental historic traditional values and religion, which need to be approached cautiously. This present review in an effort put in perspective its cultural legitimacy; to obtain a constructive outcome in the near future makes the following conclusive recommendations:

RECOMMENDATIONS:

1. Raising awareness with the general public in terms of the harmful effects of khat-chewing. This can be accomplished via appropriate communication strategies by using printed materials and electronic media.
2. Since this is a major social issue particularly in the East Africa and the Arabian Peninsula, the perilous effects of khat-chewing should be included in various academic curricula.
3. Posters and billboards portraying the harmful effects of khat should be placed at various strategic locations, including areas adjacent to khat parlors.
4. Suitable communication strategies should be developed to educate certain targeted populations about the harmful effects of khat.
5. At the village level, special community-based awareness groups should be formed which should include, former khat-chewers, village chiefs, community leaders and religious leaders. It is possible that such an elite village group could unite in an effort to eradicate this khat-chewing debacle.
6. Khat parlors should be regulated and closely monitored, by the local administration.
7. Special khat rehabilitation programs and units must be developed for avid khat-chewers to provide them timely as well as appropriate counseling and treatment.

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