

Use and abuse of khat (*Catha edulis*): a review of the distribution, pharmacology, side effects and a description of psychosis attributed to khat chewing

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SYNOPSIS There have been relatively few reported cases of psychosis due to khat usage despite its heavy consumption in certain East African and Arabian countries. Four cases have been reported in the UK. We report here on three further cases of psychotic reactions to this substance in Somalian males, and emphasize the need to be aware of khat as a potential substance of abuse, with both medical and psychiatric complications. The features of khat psychoses are described and the relationship to amphetamine and ephedrine psychoses is discussed. The forensic aspects of two of the cases which involved homicide and combined homicide and suicide are highlighted, as is the possible role of social dislocation from the culture of origin.

INTRODUCTION

Khat (*Catha edulis* Forsk., Celastraceae family) is an evergreen tree which grows at high altitudes extending from East to Southern Africa, as well as Afghanistan, Yemen and Madagascar (Krikorian, 1984; Kennedy, 1987). The earliest scientific report concerning khat was in the eighteenth century by the botanist Peter Forskal (Baasher, 1980).

The chewing of khat leaves is common in certain countries of East Africa and the Arabian peninsula. It is known by various names, for example 'miraa', and has many spellings (Margetts, 1967; Baasher, 1980; Elmi, 1983*a*). Historically, khat has been used for medicinal purposes (Kennedy *et al.* 1983) as well as an aphrodisiac (Margetts, 1967; Krikorian, 1984), though it was also used for recreational purposes (Kennedy, 1987). It is most valued for its stimulant effects (Baasher, 1980). Though chewing is the commonest mode of administration it has been taken as a tea and is occasionally smoked (Hodgkinson, 1962; Kennedy, 1987). Khat must be chewed while it is fresh, and is usually wrapped in banana leaves immediately after picking, to preserve its potency (Elmi, 1983*a*).

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The chewing of khat has a deep-rooted social and cultural tradition (Kalix & Braenden, 1985). It is usually chewed in company (Elmi, 1983*a, b*; Kennedy, 1987), but may be used by individuals to enhance their working capacity (Elmi, 1983*b*; Kalix & Braenden, 1985; Kennedy, 1987). The principal features of the 'khat experience' are described as increased levels of alertness, ability to concentrate, confidence, friendliness, contentment and flow of ideas (Kennedy, 1987).

DISTRIBUTION OF USE

Several million people are estimated to be frequent users of khat (Kalix & Braenden, 1985) and its consumption is increasing (Kennedy, 1987). The prevalence varies widely between the various khat-using countries (Mancioli & Parrinello, 1967; Omolo & Dhadphale, 1987*a*). In Somalia, Elmi (1983*a, b*) estimates that about 18% in the South and 55% of the population in the North are consumers. The 'khat party', which is described in detail by Baasher (1980) and others (Kennedy *et al.* 1983; Kalix, 1984*a*; Weir, 1985; Giannini *et al.* 1986; Kennedy, 1987) is a predominantly male pastime, though women are occasionally involved (Elmi, 1983*a*; Luqman & Danowski, 1976). Kennedy (1987) estimates that approximately 50-60% of women chew khat more than once a

week compared with 80–85% of men. In countries such as Yemen and Somalia many houses have a room specifically used for chewing khat (Baasher, 1980).

East Africa, South West Arabia and Madagascar are the areas of major production and consumption. Recently, the use of khat in Yemen has been reviewed by McKee (1987). While Muslims are the most avid chewers (Krikorian, 1984), many Christians and Yemenite Jews in Israel use khat (Kalix, 1987). In the past, more than one country has prohibited or restricted its use (Al-Thani, 1983; Kennedy, 1987; Kalix, 1987), although today khat circulates freely in all the above countries (Elmi, 1983*a*). In Yemen, khat is regarded as beneficial, though it was considered desirable to prevent the younger generation developing the habit (McKee, 1987). Such ambivalent attitudes have made it difficult to formulate a coherent policy for coping with the problems of khat consumption. Newspaper reports suggest that khat has only recently been introduced into the UK (Hogg & Rogers, 1985; Busby, 1987). Its use is largely confined to those ethnic communities accustomed to its use (Gough & Cookson, 1987), particularly in East London, the Somali community in Liverpool (Gough & Cookson, 1984, 1987) and the Yemeni community in South Wales (Mayberry *et al.* 1984). There are, presently, no legal restrictions to its sale.

THE PHARMACOLOGY AND PHARMACOKINETICS OF KHAT

The alkaloid fraction is the active constituent of khat and cathine (d-norpseudoephedrine) was initially isolated (WHO Advisory Group, 1980). The search for a more powerful stimulant (Halbach, 1972) led to the isolation of a new alkaloid (α -aminopropiophenone) from the fresh leaf (Braenden, 1979; Szendrei, 1980), designated cathinone (UN Document, 1975) which has the same basic configuration as amphetamine (Schorno & Steinegger 1979; see Fig. 1). Other constituents include tannins, amino-acids and a significant amount of ascorbic acid, magnesium and beta-carotene (Kalix, 1984*a*; Kalix & Braenden, 1985; Kennedy, 1987). The market value of the leaves correlates with the cathinone content (Kalix & Braenden, 1985).

Little is known about the pharmacokinetics of



FIG. 1. Structure of the active constituents of khat compared with amphetamine (see Zelger *et al.* 1980).

cathinone. It is rapidly absorbed after oral administration (WHO, 1985) and is metabolized in the liver with only a small fraction appearing in the urine (Kalix & Braenden, 1985). The more rapid and intense action of cathinone compared with cathine, is explained by its higher lipid solubility, facilitating access into the central nervous system (Zelger *et al.* 1980). In animal studies, cathinone has positive inotropic and chronotropic effects on the heart, a pressor effect on arteries, increased blood pressure and constriction of the vas deferens (Kalix & Braenden, 1985; Knoll, 1979) as well as producing excitation and increased activity (WHO, 1980; Kalix & Braenden, 1985). It increases metabolic rate and oxygen consumption, causes hyperthermia and has an analgesic effect via activation of monoaminergic pathways mediating nociception (Yanagita, 1979; WHO, 1980; Ahmed *et al.* 1983; Nencini *et al.* 1984*b, c*; Kalix & Braenden, 1985). Cross-tolerance has been demonstrated between d-amphetamine and d-cathinone (Schuster & Johanson, 1979), and both have similar stimulant effects (Rosecrans *et al.* 1979) with a self-administration pattern resembling cocaine (Yanagita, 1979). At the cellular level cathinone has a similar effect to amphetamine at central dopaminergic synapses

(Kalix, 1983*a,b*; Kalix & Braenden, 1985), as well as effects on other central and peripheral neurotransmitters (Knoll, 1979; Nencini *et al.* 1984*c*; Kalix & Braenden, 1985).

THE EFFECTS OF KHAT

El-Guindy (1971) demonstrated increases in temperature and pulse rate as well as mydriasis in 30 people chewing khat. Subsequent studies describe moderate increases in blood pressure, transient facial and conjunctival congestion, extra-systoles and increased respiratory rate. Inhibition of micurition, increased diuresis (due to intake of large amounts of fluids while chewing), increased libido, impotence and spermatorrhoea are also common (Halbach, 1979). Brownish staining of the teeth and mydriasis with a staring gaze are considered pathognomonic signs of khat use (Kalix, 1987).

Unwanted effects associated with khat are sleeplessness, nervousness, impotence and nightmares (Kennedy, 1987). Gastro-intestinal tract problems are common, such as anorexia and constipation (Giannini *et al.* 1986). The latter is most likely due to the astringent effects of the tannins in khat (Halbach, 1972), and laxative use is high in khat-chewing areas, the sale of laxatives decreasing markedly when khat is prohibited (Luqman & Danowski, 1976). Khat has been implicated in a number of other gastro-intestinal and cardiovascular conditions (Halbach, 1972; Gendron *et al.* 1977; Giannini *et al.* 1986). However, Kennedy *et al.* (1983; Kennedy, 1987) have questioned the extent of such associations. Anorexia leads to malnutrition and increased susceptibility to infectious diseases, especially tuberculosis (Kalix, 1987). There is also increased prevalence of respiratory problems in men, resulting from associated heavy smoking during khat sessions (Kennedy *et al.* 1983).

Endocrine effects are variable (Giannini *et al.* 1986). Hyperglycaemia may occur in diabetics (Luqman & Danowski, 1976). Reduced birth weight of babies (Kalix, 1987) and inhibition of lactation (Luqman & Danowski, 1976) have been reported in khat-chewing mothers, possibly resulting from increased dopamine production (Laurent, 1962*a*). Khat also causes an increase in adrenocorticotrophic hormone and growth hormone, as do amphetamines (Nencini *et al.*

1983). Chromosomal abnormalities, decreased mitosis and decreased synthesis of DNA, RNA and total protein have been reported in rat studies (De Hondt *et al.* 1984).

SOCIAL CONSEQUENCES OF KHAT CHEWING

Individuals commonly divert their income into khat chewing, neglecting their families' needs (Kalix, 1987). The average family income can sometimes be halved to support the habit (Baasher & Sadoun, 1983). Khat has furthermore been implicated as a causal factor for family instability (Elmi, 1983*b*), divorce (Baasher & Sadoun, 1983), encouragement of prostitution and criminal behaviour (Elmi 1983*b*).

Nationally, diversion of resources toward the production or importation and marketing of khat has a negative impact on the economies of khat consuming countries. Baasher (1980) estimates that in cities of Somalia and Yemen a consumer spends about 25% of his daily earnings on khat. The cultivation of khat results in the decreased production of other more essential crops like cereals, promoting malnutrition and disease (Murad, 1983). It also leads to low productivity due to absenteeism and the after-effects of its use (Halbach, 1972, 1979; Elmi, 1983*b*; Giannini *et al.* 1986; Kalix, 1987). At the same time it is a major source of revenue. The concomitant use of alcohol to counteract the stimulant and insomniac effects of khat (Kennedy, 1987; Omolo & Dadphale, 1987*b*) raises the risk of complications from both these drugs (Omolo & Dhadphale, 1987*b*).

The khat session also serves an important social function in Yemeni society (Weir, 1985; Kennedy, 1987). Despite the reduction in working hours spent on chewing khat (Eddy *et al.* 1965; Halbach, 1979), Kennedy (1987) describes how these sessions can provide an arena for communication where serious exchanges of ideas and information take place.

THE ISSUE OF DEPENDENCE

In 1973, the WHO Expert Committee on Drug Dependence included khat type preparations of *Catha edulis* Forsk. in their group of 'dependence-producing drugs'. In their 22nd

report in 1985 cathine was assessed as having a central stimulating action similar to amphetamine but about 7–10 times less potent. Similarly, cathinone was regarded as a CNS stimulant about half as potent as amphetamine. Both compounds were felt to meet the criteria for control under the Convention on Psychotropic Substances.

Eddy *et al.* (1965) assessed khat as causing a moderate but often persistent psychic dependence, but no physical dependence or tolerance in contrast to the marked tolerance observed with amphetamine abuse (Kennedy *et al.* 1980; Kennedy, 1987). This lack of an appreciable tolerance to khat may be due to the physical limits on the amount that can be chewed (Halbach, 1972). Tolerance may, however, develop to the sympathetic effects of khat (Nencini *et al.* 1984a).

Kennedy (1987) considers that heavy khat chewers experience true withdrawal symptoms, albeit relatively weak, of profound lassitude, anergia, difficulty in initiating their normal activities and a slight trembling several days after ceasing to chew. In addition, he reported extremely unpleasant dreams often of a paranoid nature of being attacked, strangled or followed (see also Halbach, 1972; Gough & Cookson, 1984). These he interpreted as rebound phenomena rather than a specific abstinence syndrome. It is considered that there are no physical symptoms on withdrawal from khat (Luqman & Danowski, 1976; Giannini *et al.* 1986). The effect on health of stopping khat is generally beneficial with improvement in sleep and appetite, fewer problems due to constipation and a decrease in alcohol consumption (Luqman & Danowski, 1976).

THE PSYCHOACTIVE EFFECTS OF KHAT ABUSE

Subjectively, the pleasurable effects of khat are considered as beneficial (Kalix, 1987). These effects are similar to those of amphetamine and include euphoria, increased alertness and excitement etc. (Giannini *et al.* 1986). The khat user believes he thinks more clearly and quickly and is more alert, though concentration and judgement are objectively impaired. There is a tendency to querulousness with lability of mood and increases in anxiety and tension (Margetts,

1967). Kennedy (1987) has described transient psychotic phenomena following a khat session. Confusion, disorientation, grandiose fantasies and a mildly depressed mood may occur. We report here on three cases of khat related psychoses occurring in Somalian males in the UK.

CASE HISTORIES

Case 1

Mr A. is a 31-year-old separated Somalian man who was admitted from prison to a medium secure unit under section 31 of the Mental Health Act of 1983. He had been convicted of grievous bodily harm following a knife attack on his landlord. He believed that the latter was using chemicals against him and was trying to kill him.

Mr A. comes from a family of nine children. His father was described as mistrustful of people. Both his parents died in 1982. A younger brother had been receiving treatment for a paranoid illness and recently committed suicide. It is uncertain whether he abused khat.

He arrived in the UK as a refugee, seeking political asylum as he had been involved in anti-government activities. He worked in the United Arab Emirates from 1976 until 1984 when he started a business in Tanzania which failed. Premorbidly, he is described by his cousin as a quiet, helpful, hard-working man with many friends. He had no prior involvement with the law nor received any prior psychiatric care. In 1985 he had several episodes of malaria. Concurrently, he had been chewing khat socially on a daily basis and drinking 2–4 litres of beer three times weekly. He describes becoming suspicious that doctors were maltreating him for financial gain. It has not been possible accurately to assess his mental state at that time.

Mr A. came to the UK six months prior to the offence. He continued to take khat but in lesser amounts due to his financial circumstances. He was also socially isolated, even from the Somali community. His alcohol consumption increased and within two months his mood had become depressed. He chewed khat and drank on his own in contrast to his previous consumption in a social setting. He slept badly, his self-care declined, his clothes became dirty and his appetite was poor. He was bad tempered and changed in his personality. He developed delusions of persecution that everybody was his enemy as well as nihilistic delusions that parts of his body were missing. He was having nightmares that people were chasing him and heard them calling him a failure. He developed delusions of reference relating to newspaper articles about him, he heard people talking indirectly

about his affairs and he thought that the Somali government was behind it all. He believed that his cousin was conspiring with others to use 'psychochemical warfare' against him and was passing on all his secrets. On the day prior to the offence he was chewing khat together with some Somalian friends for about eight hours. He was unable to sleep and described the somatic hallucination of something cold in his brain which was forcing itself out through his nostrils. He also experienced olfactory hallucinations of chemicals in his room. At this point he suddenly developed the belief that his landlord was drugging him and trying to kill him. He also realized that his cousin was like a robot as a result of these chemicals and he believed he also was being turned into a robot. He went downstairs and stabbed his landlord in the neck with a kitchen knife. While in prison his symptoms resolved rapidly on no medication. He presented no management problem either in prison or while in hospital and did not receive any medication. Investigations including EEG and urinalysis for drugs were negative.

Case 2

Mr B. is a 27-year-old single Somali man who had worked as a clerk in Saudi Arabia. He was first admitted informally to a psychiatric ward following three attempts to hang himself. He had been chewing khat heavily over the preceding year, sleeping poorly, feeling increasingly depressed and had become convinced that people were calling him gay. He decided impulsively that the only way to deal with this was by suicide.

A maternal uncle has had an unspecified mental illness for 10 years. There was no other relevant family history. He came to the UK as a political refugee in 1985 because of his involvement in an anti-government movement, and he believed that, were he to return to Somalia, he would be gaoled or killed. He described himself premorbidly as outgoing and sociable. His relationships had been exclusively heterosexual. While in this country he lived a solitary life and had little contact with other Somali people. There was no past medical or psychiatric history. He did not drink and denied drugs other than khat which he had begun to chew excessively soon after his arrival in the United Kingdom.

He had been chewing khat daily, usually while alone and often borrowed money to buy it. On a few occasions after chewing khat, Mr B. described severe anxiety with palpitations, feeling as though he were going to have a heart attack and a fear that he would die. He also described spermatorrhoea. During the two months prior to his admission, Mr B. had felt himself 'not normal' in some way and he seemed irritable to his friends. His concentration, sleep, libido

and appetite were poor and he had lost about 20 kg in weight, which he put down to khat. He had begun to feel increasingly depressed, felt he hated life and thought he would prefer to be dead. He worried constantly about his status as a refugee, and was fearful about the prospect of returning to his country. Three weeks prior to admission he developed ideas of reference that his friends were calling him a homosexual. He also believed that his friends were using double meanings and that they were jealous of him because his family were well known. He then stopped chewing khat for a period of one week as he thought he was becoming an addict, but resumed it on the night prior to his admission when he decided to end it all. There were no other psychotic features in his mental state. On physical examination he had marked brownish discolouration of his teeth, bilateral conjunctival haemorrhages and abrasions around his neck and to his leg (incurred during his suicide attempts). Investigations including urine drug screen were negative.

After admission his depressive symptoms rapidly resolved and he did not require any medication. His sleep, appetite and concentration improved and he was discharged after 8 days. He was re-admitted 2 weeks later, having recommenced khat. He was again depressed and believed that his family were conspiring against him as well as continuing to believe that his friends were calling him gay. His depressive symptoms resolved rapidly without medication. However, he complained of continuing to feel suspicious. He was commenced on chlorpromazine 50 mg nocte and discharged to out-patient follow-up. Nine days later, Mr B. committed suicide and homicide by pouring petrol over himself and a one-year-old child and setting himself alight. Over the preceding twenty-four hours he was unable to sleep and was making threats to kill himself. During this time his family remained awake with him and had called the police because of their concern, though they were unaware of his homicidal intentions. The family believe he had recommenced chewing khat.

Case 3

Mr C. is a 36-year-old Somali man who had been in England on a grant for further studies in accountancy. He has had a number of admissions to a psychiatric hospital with a hypomanic illness since 1983. Premorbidly he was described as a quiet, introverted, pleasant and hardworking man. There is no family history of psychiatric ill-health. Since the onset of his illness, Mr C. has been in trouble with the Somali Government and has become *persona non grata* and is apparently threatened with arrest should he return to Somalia.

He was first admitted to hospital in August 1983

after failing his exams when he was in a hyperactive state with grandiose ideas that he could summon power from heaven by running both taps in the sink. He quickly settled, but was readmitted 3 weeks after discharge with a 3-day history of sleeplessness and disinhibited, aggressive behaviour. He was treated with chlorpromazine and lithium and settled within six weeks. He remained well until August 1986, when he became violent at a friend's house. He had also left all the taps running in his flat and had been running naked in the street saying that, as he was born that way, he would go back to Djibouti to liberate his country in the same way. Prior to each admission he had been preparing for examinations and had been chewing increasing amounts of khat. Both the British Consulate and his family felt his relapses were related to his chewing of khat.

DISCUSSION

Features of the khat-induced psychoses

Psychoses due to khat are considered by many authors to be rare phenomena (Kalix, 1987; Baasher, 1980; Halbach, 1972). Halbach (1972) believes this is the result of the way in which khat is ingested, thereby not permitting high blood levels of its active ingredients. Luqman & Danowski (1976), however, make the point that in khat-using areas where health facilities are lacking, persons with psychosis are usually locked in their homes by their families until the episode subsides.

The first cases of khat-induced psychosis were reported by Carothers in 1945. Tables 1 & 2 summarize the features of the cases to date, including the three cases reported here. As can be seen, the ages range from 20 to 36 with a predominance of males, there being only one female case. In only two of the twelve cases was there a past psychiatric history and in one of these cases the onset of psychosis was probably related to khat abuse. A family history of psychiatric illness was present in two cases of the six cases where this information was recorded. Pre-morbid functioning was considered normal in the six cases where this was reported. Social isolation was a feature in only three cases, though the solitary use of khat was apparent in half of them.

In all twelve cases the psychosis developed after a recent heavy or increased use of khat. The episode rapidly resolved within one to two weeks of stopping khat in all but one case. There was a tendency for the psychosis to recur

with the recommencement of khat. Not enough information was available to draw any conclusions about level of functioning between episodes of psychosis, though in at least five cases they were considered to be normal. Neuroleptics were used in nearly all of the cases. However, the time course for symptom resolution suggests that it was the withdrawal of the drug which was important. This was notably seen in the case of Mr B., who also relapsed rapidly with reinstatement of khat chewing. Other authors have made similar observations (e.g. Luqman & Danowski, 1976). The concomitant use of alcohol or other drugs was only reported in one case despite the literature suggesting a high prevalence of associated alcohol use (Omolo & Dhadphale, 1987b).

Table 2 describes the phenomena observed in these psychotic patients. Interestingly, paranoid delusions were not a constant theme (cf. amphetamine psychosis, below) though when present they tended to dominate the picture. Two types of reaction seem most apparent. First, there is a paranoid psychosis with prominent delusions of persecution often associated with auditory hallucinations. This pattern most closely resembles the paranoid psychosis seen with amphetamines and is discussed further below. Other first rank symptoms, for example, thought broadcast and passivity experiences, were also present in this subgroup of khat psychotics. A second reaction seen in five cases was of a manic illness with grandiose delusions, usually without auditory hallucinations. A less common response is of a depressive illness, which occurred in two of our cases. This could have resulted from a relative decrease in khat intake preceding a further heavy khat session, at which time the paranoid delusions became prominent. No mention is made of depressed mood in any of the other cases, in particular, that reported by Critchlow & Seifert (1987) in which there was attempted suicide.

The case by McLaren (1987) is atypical in that a one-year history of progressively odd behaviour precedes the onset of a psychotic reaction which was precipitated by khat. Such an effect has been discussed by other authors (Halbach, 1972; Carothers, 1945; Laurent, 1962a,b). The issue of vulnerability of the individual to the effects of a particular drug have been considered by other authors reviewing

Table 1. *Khat-induced psychosis: clinical features of reported cases*

Authors Cases	Carothers		Dhadphale <i>et al.</i>			Giannini & Castellani	Gough & Cookson	Critchlow & Siefert	McLaren	Mr A.	Mr B.	Mr C.
	1	2	1	2	3							
Age (yrs)	20	30	30	29	22	23	27	34	22	31	27	36
Sex	M	M	M	M	M	M	M	F	M	M	M	M
Origin	Somali	Mnyam- wezi	Arab Kenyan	Kenyan Arab	Boran	N. African in USA	N. Yemen	Somalia	Ethiopia	Somalia	Somalia	Somalia
Past psychiatric history	NR	NR	Nil	Nil	Nil	Nil	Nil	Nil	1 year pro- gressively odd behaviour	Nil	Nil	Yes
Family history	NR	NR	Nil	NR	NR	NR	Nil	Nil	NR	Yes	Yes	NIL
Premorbid functioning	NR	NR	Normal	Normal	Normal	NR	NR	NR	NR	Normal	Normal	Normal
Social isolation	NR	NR	Nil	NR	Nil	Nil	Nil	Yes	NR	Yes	Yes	NIL
Solitary use of khat	NR	NR	Yes	Yes	Yes	Nil	NR	NR	NR	Yes	Yes	Yes
Onset of psychosis after recent increased use	Yes 3 admissions	Yes	Yes	Yes +++	Yes +++	Yes ++	Yes	Yes	Yes	Yes	Yes	Yes
Rapid resolution of psychosis with stopping khat	Yes 2-4 wks.	Yes 1-3 wks.	Yes 1 wk.	Yes 2 wks.	Yes	Yes 5 hrs.	Yes 1 wk.	Yes 12 days	Yes 48-72 hrs.	Yes	Yes 1 wk.	No 6 wks.
Recurrence of psychosis with khat reintroduced	Yes	Yes	Yes	Yes	NR	NR	NR	Yes	Yes	N/A	Yes	Yes
Well between episodes without deterioration	?	?	Yes	Yes	Yes	Yes	NR	No* (cont. khat)	No (?)	?Yes	?	?
Use of medication	Nil	Nil	Yes	Yes	Yes	Nil	Yes	Yes	Yes	Nil	Minimal	Yes
Use of alcohol	NR	NR	Nil	Nil	Nil	Nil	NR	NR	NR	Yes ++	Nil	NR

NR = Not recorded. NA = Not applicable.

* Continued khat between episodes.

+, present but not marked; ++, marked feature or association; +++, very prominent feature or association.

Table 2. *Khat-induced psychosis: phenomenology of reported cases*

Authors Cases	Carothers		Dhadphale <i>et al.</i>			Giannini & Castellani	Gough & Cookson	Critchlow & Siefert	McLaren	Mr A.	Mr B.	Mr C.
	1	2	1	2	3							
Clear consciousness	Yes	NR	Yes	Yes	NR	Yes	NR	NR	NR	Yes	Yes	Yes
Paranoid delusions	Nil	Nil	Yes	Yes	Yes	Nil	Yes	Yes	Nil	Yes	Yes	Nil
Other delusions	grandiose	Nil	+++	+++	+++	grandiose	? thought broadcast	thought broadcast	Nil	+++ ? passivity ? nihilistic	Nil	grandiose
Auditory hallucinations	? Yes	Nil	Nil	Yes	Yes	NR	NR	NR	Yes	Yes	Nil	Nil
Tactile hallucinations	NR	NR	NR	++	++	NR	NR	NR	NR	Yes	Nil	Nil
Olfactory hallucinations	NR	NR	NR	NR	NR	NR	NR	NR	NR	Yes	Nil	Nil
Visual hallucinations	NR	NR	Nil	NR	NR	NR	NR	NR	NR	Nil	Nil	Nil
Depression	Nil	Nil	Nil	Nil	Nil	Nil	Nil	NR	NR	Yes	Yes	Nil
Hypomania/mania	Yes	Yes	Nil	Nil	Nil	Yes	Yes	Nil	Nil	Nil	Nil	Yes
Anxiety/fear	++	++	++	++	++	++	++	? Yes	Nil	Yes	Yes	++
Sleeplessness	NR	NR	NR	Yes	Nil	NR	Yes	Yes	NR	Yes	Yes	Yes
Loss of appetite/weight	NR	NR	Nil	NR	Nil	Nil	Yes	Yes	NR	Yes	Yes	NR
Other symptoms	mannerisms, aggressive	aggressive	isolating self	aggressive, histrionic	isolating self	aggressive	aggressive	Nil	lethargy, withdrawal	Nil	Nil	Nil
Attempted suicide/suicide	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Yes	Nil	Nil	Yes	Nil
Attempted homicide/homicide	Nil	Nil	Nil	Nil	Nil	Nil	? (wielding knife)	Nil	Nil	Yes	+++ Yes suicide-homicide arson	Nil
Weapon	(throwing stones)	Nil	Nil	Nil	firearm	Nil	Yes	Nil	Nil	knife	Nil	Nil
Physical symptoms/signs	NR	NR	constipation	h'ache	NR	mydriasis increased blood pressure	Nil	N/A	No mydriasis	Nil	brown teeth spermatorrhoea	NR

NR = Not recorded. NA = Not applicable.

+, present but not marked; ++, marked feature or association; +++, very prominent feature or association.

amphetamine psychosis (Gold & Bowers, 1978). They postulate that in patients developing a psychotic reaction to low doses of amphetamine there exists a vulnerability which requires the drug to make the psychosis manifest. Large doses of amphetamine, however, will produce psychosis in individuals who do not necessarily have this susceptibility. This may be relevant for khat-induced psychosis, as khat has a lower potency than amphetamine and large increments in dose are limited by its mode of administration.

Confusional states following khat usage are considered rare by most authors (Halbach, 1979; Giannini *et al.* 1986; Kalix, 1987) and Dhadphale & Mengech (1987) and Dhadphale *et al.* (1981) make the point that the paranoid reactions observed occur in a setting of clear consciousness. Kennedy (1987), on the other hand, states that confusion and disorientation may occur as a transient phenomenon in the khat-user, even without psychosis.

Relationship to other psychostimulants

Lugman & Danowski (1976) draw parallels with psychosis due to amphetamines and this is also discussed by Ellinwood (1969). Connell (1958) states that the main distinguishing feature of amphetamine psychosis, compared with other organic psychoses, is the relative absence of disorientation and confusion. A number of other features of the psychiatric presentation of amphetamine use also bear a close resemblance to those of khat. Of particular interest is the well delineated, characteristic nature of amphetamine psychosis with a high proportion of paranoid delusions, auditory and visual hallucinations, although the tactile and olfactory modalities may also be involved. These symptoms worsen with acute increases in dosage of the drug. Those amphetamine abusers who developed psychosis differed from non-psychotic abusers by the presence of intense fear and terror (Ellinwood, 1969). Similar symptoms were prominent in six of the reported cases (see Table 2), all of whom were paranoid psychotics. This occasionally led to attempted suicide in amphetamine users (Ellinwood, 1969). However, suicide is also a danger during the withdrawal period (Connell, 1958). In the case of Mr B., his initial suicide attempts followed a heavy khat session after a week without the drug, during which his

depressive symptoms worsened. Similarly, Mr A. had decreased his consumption of khat to some extent since arriving in the UK and his paranoid symptoms were heightened by a heavy session of khat chewing. In the case reported by Critchlow & Seifert (1987), the relationship of the suicide attempt to either withdrawal of the drug or to symptoms related to its abuse is not made clear.

Amphetamine abusers who developed psychosis also differed from the non-psychotic abuser by the presence of olfactory and tactile hallucinations, as were evidenced in the case of Mr A. Delusions of infestation occurred in up to 50% of amphetamine abusers (both psychotic and non-psychotic) and Kennedy (1987) describes the most common hallucination amongst khat users as being 'the feeling of hundreds of insects crawling over the body'. Ellinwood (1969, 1971) also highlights the effect of the environment on the content of delusions. Thus, the real possibility of the addict being followed by the police became incorporated into their delusional system. A similar reaction is observed in the case of Mr A. who was a political refugee from Somalia, with his fears relating to the Somali government becoming part of his delusional system. Snyder (1973), in discussing amphetamine psychosis as a possible model for schizophrenia, postulates that it is the alerting effects, mediated by noradrenergic pathways, which lead to the development of a system of paranoid delusions. This author discusses the possible roles of dopamine and noradrenergic systems in the development of such a paranoid psychosis.

Ephedrine psychosis has been recently considered by Whitehouse & Duncan (1987), who have reviewed 20 reported cases as well as their own. The typical clinical picture was again of a paranoid psychosis with prominent delusions and hallucinations in a setting of clear consciousness. This is relevant to khat, which contains norpseudoephedrine, as well as the more potent cathinone. Thus, these sympathomimetics are more likely to induce psychosis by acting in combination than by acting alone. In the USA, ephedrine and other non-controlled sympathomimetics are freely available over the counter and have become some of the most commonly abused drugs (Siegel, 1980; Dougherty, 1982; Whitehouse, 1987). Concern

about ephedrine abuse has also been expressed in the UK as early as 1965 (Chapple).

The relationship of amphetamine abuse to assault and homicide are discussed at length by Ellinwood (1971). A number of important features are brought out in his investigation of 13 cases. In particular there seemed to be a relationship with recent increase in drug dosage in the context of a pre-morbid solitary lifestyle in persons with poor impulse control. Sleeplessness was often a factor, as was the associated use of sedative drugs including alcohol, which Ellinwood feels had a disinhibiting effect. The act itself was usually impulsive rather than planned, although a concealed weapon was a feature in all but one of the cases. Similarities can be seen with the cases of Mr A. and Mr B. who were both involved in violent acts and who both led rather solitary lives since arriving in the UK. In the case of Mr A., a heavy bout of khat consumption together with alcohol and a sleepless night preceded the attack on his landlord. In Mr B.'s case his suicide-homicide was preceded by insomnia and there was little warning of his homicidal intentions. Two other cases are reported, in the literature, in which the patients were carrying weapons (Dhadphale *et al.* 1981; Gough & Cookson, 1984), although there were no actual aggressive acts.

Cultural aspects of khat abuse

Jaffe (1980) makes the distinction between culturally integrated and culturally less-integrated drug use, believing this to be of greater importance to deviant behaviour related to drugs than is the nature of the drug itself. A parallel may be drawn to the use of khat in the UK as opposed to the country of origin, such dislocation setting the scene for a more deviant pattern of drug abuse. In the above cases, the pattern of khat and alcohol abuse was very different to the culturally accepted pattern, with the drug often being taken alone and thereby no longer functioning as a means of facilitating social interchange. This estrangement of these individuals from their home country, where the khat habit is subject to identifiable rules, may have placed this group at an increased risk from the detrimental effects of khat use. Giannini & Castellani (1982) reinforce this view, stating that, first, the customary patterns of usage in the culture of origin tend to limit the amount of

drug used daily and secondly, khat chewing is condoned in such countries and is thus done in a social context which gives positive reinforcement and meaning to the experience.

Legislation against khat usage?

The seriousness of the cases described has resulted in public concern regarding the need for legislation to limit the sale of khat in the UK (Busby, 1987). D'Orbán has reviewed this issue with regard to other drugs. He states that legislation to control the non-medical use of drugs through criminal law is usually a response to some form of change in the pattern of drug consumption (D'Orbán, 1986). Historically, these legislative controls have arisen piecemeal and in response to a series of crisis situations, initially with amphetamines and then heroin and cocaine. D'Orbán (1986) concludes that 'the history of drug control policies leads to the pessimistic view that they are relatively ineffective and that drug problems cannot be dealt with in isolation from the international context'.

The trade and usage of khat in Great Britain is presently not illegal, and it is known that there is a market and distribution network for the drug, with its substantial use in certain locations (Hogg & Rogers, 1985; Kalix, 1987). Critchlow & Seifert (1987) estimate that extremely large numbers of the Somali community in London (estimated at about 4000) use khat. Kalix (1987) states that European countries have relatively little to fear from khat owing to its unattractive 'goat-like' mode of consumption and its relatively low potency, as well as the difficulty involved in extracting cathinone (cf. cocaine from coca leaves). Mayberry *et al.* (1984), on the other hand, believe that its use will become more extensive as the second generation of those ethnic minorities accustomed to its use become integrated into Western society. They also point out that with the development of air travel, fresh khat leaves can be distributed rapidly, thereby making khat readily available in the West. There have already been some reports of the use of khat by Westerners in this country (Hogg & Rogers, 1985). The possible need for preventive scheduling needs to be considered before an increase in the habit, particularly in immigrant groups, leads to problems. Kalix (1987) concludes that 'a limitation of khat use is desirable as the spread of the habit in recent years is

worrying'. The International Council on Alcohol and Addiction (Shanhandeh *et al.* 1983) have advised that those countries involved with the problem of khat deal with it in their own specific context. The extent of the problem in the United Kingdom is limited. However, in view of the seriousness of two of the cases reported the present authors feel that the growing use of khat needs to be closely monitored.

CONCLUSIONS

1. Khat chewing has been widespread in various Middle Eastern countries and is increasing in frequency amongst immigrant groups in the West. There is evidence to suggest that the habit may be spreading beyond such ethnic groups.
2. The active ingredient in khat, cathinone, is closely related to amphetamine in structure and effects.
3. From a review of the literature and our own cases it appears that khat chewing can induce at least two kinds of psychotic reaction: a paranoid psychosis with prominent persecutory delusions associated with intense fear and anxiety, with or without auditory hallucinations, in a setting of clear consciousness, and a hypomanic illness with grandiose delusions. In both forms of presentation symptoms abated rapidly when khat was withdrawn.
4. Acts of violence were exhibited in recent cases in which paranoid delusions were prominent, these having similarities to amphetamine psychotics involved in violent acts.

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