

The assessment of khat-related deaths in the UK

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Abstract

Twenty million people use khat (*Catha edulis*). Previously confined to Eastern Africa and Arabia, consumption is spreading to other regions. Chewing khat leaves releases the stimulants cathinone and cathine. Khat consumption has adverse health consequences including myocardial infarction, liver failure, depression, psychoses, and dependence. Literature regarding khat-related mortality is scant: only one death (in 1945) due to physiological complications, and a small number of fatalities due to psychological problems associated with long-term khat use are reported. Twelve UK deaths occurring in 2004-9 associated with khat consumption are briefly described, as well as the sources of information used to identify them. Khat-consuming communities and health professionals need to be aware of the physiological and psychological effects of khat, together with the risks for mortality associated with its use. These need to be borne in mind when Governments consider regulation of the plant. The methodology of how to identify and monitor such deaths will be discussed, along with taxonomy for classifying deaths associated with khat. There is an urgent need to identify sources of data and statistics on khat-related mortality, map what information is currently available, and to establish mechanisms for monitoring such deaths, and devise processes for filling in the gaps in knowledge. A stronger evidence base is needed to better inform policy-making, service provision, and preventive education.

Introduction

Khat (*Catha edulis*) is a shrub that grows in eastern Africa and southern Arabia. Its leaves and twigs are chewed to release natural amphetamines (principally cathinone and cathine) which provide stimulating effects. In the past the use of this plant was geographically limited to these areas because it loses its efficacy after a few days. However, with developments in communications and transportation, especially by air, and the migration of khat-using communities to other continents, its use has spread over the last two decades. Shipments of khat now arrive several times a week at major airports in western Europe, including the British Isles, as well to North America and Australia. An estimated 20 million people globally use khat.

During the past 20 years or so, more has become known about the properties of khat, its pharmacology, physiological and psychological effects on humans. Khat consumption has adverse health consequences including myocardial infarction, liver failure, depression, psychoses, and dependence. However, its reputation of social and recreational use in traditional contexts has hindered the dissemination of knowledge about its detrimental effects in terms of mortality.

This paper focuses on this particular deficit, briefly outlining the types of mortality associated with the trade and use of khat. With khat being increasingly brought under domestic regulation in many countries, and its legal status being considered in others, it is important that both these dimensions need to be understood.

Taxonomy of khat-related deaths

There are no known published reviews of or statistics on khat-related mortality however defined. This is an important gap in the knowledge-base. A literature search of all relevant databases as well as the Internet to identify relevant reports and information on 'khat-related' mortality was undertaken by the author and colleagues. The search terms included the different names that khat is known by, as well as the terms for its principal psychoactive substances, and terms in relation to mortality. It was also necessary to draw on media reports to illustrate various types of deaths associated with khat trade and consumption since these are not included in academic databases.

This process identified a range of deaths that can be directly and indirectly associated with khat, some of which can overlap. In order to assist an understanding of the different dimensions of this phenomenon it is necessary to derive themes or 'motifs' emerging from the results. Table 1 summarises these categories. The contribution of khat to deaths is varied; and in some cases can be difficult to categorise. Deaths associated with trade, marketing, wholesale and retail, can equally occur with any other illicit substance. Their inclusion here is deliberate: they are part of the wider pattern of mortality associated with the consumption of khat. The association of khat with psychiatric disorders or psychopathological factors is evident in some cases, contributing to suicide and even homicide. The physiological effects of khat consumption are quite clear in a number of cases.

Table 1: Taxonomy of 'khat-related' mortality

Directness	Type of association	Mechanism	Example
Trade-related			
	Cultivation/production	Poisoning	Fertiliser/Pesticide not washed before consumption
		Disputes between actors	Disagreement over wages => homicide
	Transportation	Fatigue	Long hours and driving at high speed => loss of concentration (can be in association with khat use to keep awake) leading to accidents
		Loss of concentration	Distraction whilst preparing khat for chewing whilst driving => accidents
		External factors	Bad weather conditions/mechanical failure => plane crashes
	Distribution/marketing/wholesale	Disputes between actors	Fighting over 'turf' => violence and homicide
		Disputes between actors	Refusal to do business => violence and homicide
	Retail	Disputes over price	Homicide
Consumption-related (medical)			
	Physiological	Mechanical	Choking on leaves/twigs or airway obstruction => asphyxia or cardiac arrest
		Toxicity	Myocardial infarction => fatal heart attack
			Liver failure
	Neurological	Lack of motor co-ordination, shaking	Reduces control => accidents
		Eye-sight problems	Impairs sight and focus => accidents
	Psychopathological	Causing and/or exacerbating psychosis and/or depression	Suicide and/or homicide, accidental overdose
		Impaired judgement/assessment of risk => accidents	Road traffic accident
			Fall from height
	Other medical contributory factors	Used with other psychoactive substances and/or positive toxicology	Role may not be clear

National Programme on Substance Abuse Deaths (np-SAD)

np-SAD receives information from coroners on a voluntary basis on deaths related to drugs in both addicts and non-addicts in England and Wales, Northern Ireland, the Channel Islands and the Isle of Man. Since 2004, information has also been received from the Scottish Crime and Drug Enforcement Agency (SCDEA) and the General Register Office for Northern Ireland (GRONI). Since 1997 details of some 20,000 deaths have been received. The average annual response rate from coroners in England and Wales to np-SAD has been as high as 95% (Ghodse et al., 2009). To be recorded in the np-SAD database as a drug-related death, at least one of the following criteria must be met: (a) presence of one or more psychoactive substances directly implicated in death; (b) history of dependence or abuse of drugs; and (c) presence of controlled drugs at post-mortem.

Method and data sources

We defined deaths related to khat as the inclusion of the words 'qat', 'khat', cathine, cathinone, norephedrine or (nor)pseudoephedrine in the cause of death, post-mortem drugs, verdict, and incident description sections of the coroner's report. The presence of such compounds in the toxicology results was used in conjunction with other information to define a khat-related death, since

norpseudoephedrine is also a metabolite of pseudoephedrine which is a precursor for methylamphetamine and can therefore be derived from a substance that is not cathinone.

Case identification was achieved through a quasi 'snow-ball' cluster sampling approach. Five cases were notified as part of the normal surveillance programme. The toxicological investigations for 2 cases were conducted by the Forensic Toxicology Service at St George's, University of London. An examination of their records revealed 3 further deaths involving khat. Members of the London Toxicology Group were also canvassed to see if they were aware of any cases; this resulted in further information on a case. Four cases were identifiable through press reports; contact was made with the relevant coroners to obtain the appropriate information using the Programme's standard data collection form. Details of the individual's background, medical and psychiatric history, post mortem and toxicology reports were also obtained or scrutinised at the coroner's office by the author. Enquiries were also made of the General Register Offices across the UK and the SCDEA to ascertain if there were any cases known to these data sources; there were none.

Results

The results of the np-SAD study are summarised in Tables 2 and 3.

Table 2: Main characteristics of 12 khat-related fatalities, UK, 2004-9

<i>Characteristics</i>	<i>Frequencies</i>
Year of death	2004 = 2; 2005 = 3; 2006 = 4; 2007 = 0; 2008 = 2; 2009 = 1
Geographical area	East London = 1; West London = 2; North London = 7; Hampshire = 1, Cardiff = 1
Gender	All male
Marital status	Married = 3; with partner = 1; divorced = 1; separated = 1; single = 1; not known = 5
Age at death (years)	Mean = 36, range = 22 to 47
Ethnicity/Nationality	Somali = 10; Eritrean = 1; Polish = 1
Length of UK residence (years)	3 = 1; 5 = 1; 11 = 2; 15 = 1; Not known = 7
Occupation	Unemployed = 5; manual employed = 4; student = 1; invalidity benefit = 2
Living arrangements	Alone = 3; partner & children = 3; self & children = 1; with partner = 1; with sibling = 1; with friends = 1; psychiatric in-patient = 1; not known = 1
Significant medical history	No = 5; yes = 3; not known = 4
Known psychiatric history	Yes = 3;
Known khat using history	Yes = 8
Evidence of using khat	Yes = 9; no = 3
Place of death	Home = 4; hospital = 4 (inc. 1 following traffic accident); railway station = 2; street = 1; outside flats = 1
Coroner's verdict	Self-harm = 2; suicide = 1; open = 1; accidental = 3; misadventure = 1; non-dependent abuse of drugs = 1; narrative = 2 (inc. 1 natural causes); abuse of drugs and natural causes = 1

Table 3: Role of khat in death for 12 khat-related fatalities, UK, 2004-9

<i>Case</i>	<i>Role/association</i>
1	Paranoid psychosis associated with history of khat use => traumatic suicide (none in body at death)
2	Possible suicide/accidental fall whilst judgement impaired (found in body)
3	Possible history of excessive use => traumatic murder and traumatic suicide
4	Paranoid schizophrenia exacerbated by khatting => accidental overdose
5	Ingestion of khat => high norephedrine levels => left ventricular failure => pulmonary oedema
6	Long term khat use => hepatic necrosis => sub-fulminant liver failure
7	Drug-induced psychosis/psychosis exacerbated by use of 'skunk' and khat over long period => traumatic suicide
8	Ingestion of khat (possibly no longer active), alcohol consumption => intoxication, impaired judgement/lack of co-ordination => traumatic road traffic accident (pedestrian)
9	Alcohol and khat in system => impaired judgement/co-ordination => loss of control of vehicle => traumatic road traffic accident (driver)
10	Overdose of injected heroin, but khat also in system
11	Abused khat => jaundice, night sweats, pyrexia => sub-acute liver failure
12	Excessive use of khat => fulminant hepatic necrosis => required liver transplant (failed)

The contribution of khat to these deaths was varied. It is notable that half of the deaths were traumatic in nature with external causes of death. In one case, khat was found in the mouth, oesophagus and stomach but it is unclear as to its role, although it is possible that the decedent's khat-induced psychosis may have contributed to or influenced his fall from a height. Alternatively, his judgement may have been impaired. Similarly, impaired judgement due to the use of khat and alcohol appear to have been instrumental in two cases

where the decedents were fatally injured by contact with motor vehicles. A lack of motor co-ordination, impaired vision (Le Bras and Frétilière, 1965) or ability to judge speed properly (Khattab and Amer, 1995) may also have contributed to these accidents. The use of 'skunk' in addition to khat contributed to the problems experienced by one case. In another case khat was present along with fatal levels of heroin.

The association of khat with psychiatric conditions is evident in four cases which resulted in 3 suicides (and one murder), and one accidental overdose. These echo the earlier UK cases reported by Busby (1987) and Pantelis et al. (1989).

The physiological effects of khat consumption are very clear in four cases. These are thought to be the first reported cases of death due to khat toxicity since the case reported by Heisch (1945). In one case the role of norephedrine/ norpseudoephedrine producing adrenaline-like actions led to an increased likelihood of myocardial infarction, leading to left ventricular failure and pulmonary oedema (Al-Motarreb et al. 1997, 2002, 2005; Croles et al., 2009; Health Canada, 2007).

In three cases khat consumption ultimately led to liver failure and death. Khat toxicity was responsible in two cases for hepatic necrosis and sub-fulminant liver failure; and in the third case to sub-acute liver failure, in the presence of auto-immune hepatitis. These presentations of "Khat-induced" liver failure [the Corkery khat liver condition] are consistent with recent findings in respect of hepatitis (Brostoff et al., 2006; D'Souza et al., 2006) and liver disease (McCune et al., 2007).

All of the decedents were male, aged between 22 and 47 (mean = 36) years at death and thus comparatively young. All but one were of East African descent (one was born in Russia), ten being Somali nationals and one Eritrean. However, one of the deceased was Polish; this suggests the possibility of the spread of khat use outside the traditional ethnic khat-using populations to other communities and substance-using groups in society. The deceased lived in areas associated with long-standing immigrant communities from the Horn of Africa and eastern Europe. Where the information was available, length of residence in the UK ranged from 3 to 16 years. At least two of the cases had been domiciled in the UK because of the civil war in Somalia.

The demographics of these 12 cases are typical of khat users in the UK, relatively young, unemployed, Somali males, living with significant others. However, it is perhaps surprising that there are no reported fatalities involving people of Yemeni origin resident in the UK. It is possible that this may be due, in part, to the fact that UK Somalis tend to prefer miraa from Kenya, whilst other groups opt for weaker varieties from Ethiopia or Yemen.

Review of khat in the UK

Khat is currently imported and used legally in the UK. Cathinone and cathine are controlled substances under Class C of the UK Misuse of Drugs Act 1971 by virtue of Schedules 1 and 3 respectively of the Misuse of Drugs (Amendment) Regulations Act 1986. An offence is committed if these substances are extracted from the plant. However, there have been no successful prosecutions to date. Khat is licensed under the Medicines Act 1968 as a medicinal product but has never been imported in that way. The plant is imported legally when declared as a vegetable, and it is even liable to Value Added Tax!

In 1988 the independent Advisory Council on the Misuse of Drugs (ACMD) considered the issue of khat at the Government's request and concluded that, based on the available evidence, the plant did not warrant control under this legislation. In February 2005 the Minister responsible for drugs asked the ACMD to advise the government as to the current situation in the UK and the risks associated with khat use. The report reviewing the scientific evidence concerning levels of khat use, risks, and current treatment options was published in January 2006 (ACMD, 2006). The Council recommended that khat should not be controlled under the 1971 Act. Use of the substance is limited to specific communities within the UK, and has not, nor does it appear likely to, spread to the wider community. However, the ACMD recognised that use of khat has detrimental effects and that its use should be discouraged.

Since that time, the Home Office has kept a "watching brief" on khat. The author understands that a further assessment will be undertaken shortly and that, in the meantime, more up-to-date evidence is being collected. It is intended that the np-SAD will provide the results of its research on khat-related mortality, and other aspects of khat use, to the Home Office so as to help inform the decision-making process. The Programme has contributed information and data analysis to a number of Home Office and ACMD reviews on a range of psychoactive substances, both licit and illegal, including MDMA, ketamine, GHB, GBL, and piperazines.

Discussion and Conclusions

Death can occur at any stage from the cultivation of khat to its consumption. Some of the factors can occur in combination, and it can be difficult sometimes to disentangle them. Apart from poisoning from insecticide, traumatic deaths can be a feature of the cultivation, transportation, and trading activities undertaken by distributors and sellers. Violence can also occur in other settings. For example, psychopathological effects – (i) impaired judgement leading to accidents and violence, (ii) causing or exacerbating psychoses or causing depression leading to suicide and even homicide. Physiological effects encompass (a) mechanical problems e.g. choking on pieces of the plant.; and (b) toxicity (i) causing heart problems leading to fatal heart attacks, and (ii) liver failure.

The UK cases of khat-related fatalities presented here illustrate some of the key issues related to the consumption of khat. These include: (a) psychological effects – (i) impaired judgement leading to accidents and violence, (ii) causing or exacerbating psychoses or causing depression leading to suicide and even homicide; (b) physiological effects – toxicity is the primary concern here (i) causing

heart problems leading to fatal heart attacks, and (ii) liver failure; (c) mechanical problems e.g. choking on pieces of the plant; life-style aspects - part of the culture and thus being found in post-mortem toxicology. We know that there other deaths have occurred in the past and yet others which may be currently happening but that are not identified as being related to the use of khat.

This brief review of the UK experience and exploration of international research has demonstrated a lack of documented cases in the literature, as well as nothing by way of quantitative data. These gaps in knowledge need to be filled. This will lead to a much better understanding of the potential risks of death associated with the use of khat, based on empirical observation. There is an urgent need for a mapping exercise to identify sources of information on khat-related mortality, collate what is currently known in terms of statistics, and identify what gaps exist and how they might be filled. With an improved information-base it will be possible to estimate the possible numbers at risk of dying from the trade and use of khat.

Furthermore, there is need for routine and systematic research of khat-using populations in respect of morbidity and mortality arising from khat. Only then can the best methods of supplying preventative and therapeutic interventions be considered in an informed way. In the meantime, the dangers arising from the use of khat and its psychoactive constituents need to be brought to the attention of those in producing/growing countries, and those countries/regions that have become hosts to ever-increasing communities from these countries. This will need to be specifically focused on target groups using a variety of media, including a variety of languages.

The lack of negative health results for khat in the literature should not lead to complacency or an assumption that khat use is free from toxic consequences. This absence of negative reports is due to a lack of population-based studies. Whilst anecdotal reports are informative, systematic investigations using surveillance methodologies are needed to determine the incidence and prevalence of ill-effects of khat use. The fatal case studies detailed above need to be borne in mind in future reviews of khat – but at the national and international levels - and the physiological and mental health risks associated with its use. These risks appear to be greater than previously realised. Something for policy-makers to chew on?

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