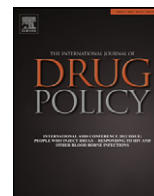




Contents lists available at [SciVerse ScienceDirect](http://SciVerse.Sciencedirect.com)

International Journal of Drug Policy

journal homepage: www.elsevier.com/locate/drugpo



Research paper

Pattern and consequences of krathom (*Mitragyna speciosa* Korth.) use among male villagers in southern Thailand: A qualitative study

Darika Saingam^a, Sawitri Assanangkornchai^{a,*}, Alan F. Geater^a, Quantar Balthip^b

^a Epidemiology Unit, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla 90112, Thailand

^b Faculty of Nursing, Prince of Songkla University, Hat Yai, Songkhla 90112, Thailand

ARTICLE INFO

Article history:

Received 3 May 2012

Received in revised form 3 September 2012

Accepted 10 September 2012

Keywords:

Krathom

Mitragyna speciosa Korth.

Qualitative study

ABSTRACT

Background: Krathom is currently the most popular illicit substance in use in southern Thailand. Research regarding its effects and health impacts is scarce. This study explored the pattern of krathom use and users' perceptions of the consequences of its use.

Methods: An in-depth qualitative interview. A group of 34 self-identified regular users, occasional users, non-users and ex-users of krathom was used in this study. Health volunteer as a key-contact person helped the researcher to invite villagers to participate in the study using snowballing technique. The process of data analysis was guided by Strauss and Corbin's grounded theory.

Results: The core category, 'Understanding krathom use', was generated from three inter-related categories: (i) reasons for continuing krathom use, (ii) the way of applying krathom, and (iii) perceiving positive and realizing the negative effects of krathom use and their 18 subcategories.

Conclusions: The study findings reveal the importance of considering krathom use from the perspective and belief of the villagers. Krathom is addictive with its own characteristic symptoms and signs. The results provide support for policy interventions to control the availability of krathom according to the community context. In addition, krathom misuse by adolescents must be considered.

© 2012 Elsevier B.V. All rights reserved.

Introduction

Krathom (*Mitragyna speciosa*, Korth.) is a tree which is native to Southeast Asia, especially common in southern Thailand and northern Malaysia. Krathom constituents act on the central nervous system as both a psycho-stimulant and depressant. They comprise over 25 alkaloids with mitragynine being dominant and acting as a stimulant, and 7-hydroxymitragynine having sedating effects (Chittrakarn, Keawpradub, Sawangjaroen, Kansanalak, & Janchawee, 2010; Matsumoto et al., 2005).

Krathom leaves have been traditionally chewed by the native people in Thailand and Malaysia to reduce the strain and fatigue of physical labor, to be able to work harder and longer, to better tolerate heat and sunlight, and also as a traditional medicine (Sirivongs Na Ayudhya & Assanangkornchai, 2005; Vicknasingam, Narayanan, Beng, & Mansor, 2010). Krathom is known to suppress opiate withdrawal symptoms, reduce fever, and act as an analgesic (Burkill & Haniff, 1930). There have been a number of studies in recent years

reporting the use of krathom and its effects on health, psychological, cognitive behavioural and social impact (Ahmad & Aziz, 2012; Apriyani, Hidayat, Moklas, Fakurazi, & Idayu, 2010). This reflects the growing interest in krathom globally.

Krathom was first placed under regulatory control in 1943 under the Krathom Act in Thailand. At that time, the Thai Government was levying taxes from the opium trade among users and opium houses. Because of the increasing opium costs, many users switched to krathom to solve their withdrawal symptoms. The declining revenues from the opium trade had an impact on the Thai government's income. In order to exclude krathom as a competitor, the Thai government had to control krathom by making it become an illicit substance. In 1979, krathom was classified in Category V of a 5-category classification of narcotics by the Thai government in the Narcotics Act, in the same enforcement class as cannabis, opium, and hallucinogenic mushrooms (the least restrictive and punitive level). This has made it illegal to buy, sell, import, or grow and harvest krathom and required existing trees to be cut down (Charoenrat, 2005). Apart from Thailand, krathom use is illegal in other neighbouring countries in the region such as Malaysia, Myanmar and Australia (EMCDDA, 2012).

There have been some controversial issues regarding the effects of pure krathom use and the legal control of krathom in Thailand in the past decades. Most traditional users do not see the

* Corresponding author at: Epidemiology Unit, Faculty of Medicine, Prince of Songkla University, 15 Kanchanavanich Road, Hat Yai, Songkhla 90110, Thailand. Tel.: +66 74451165; fax: +66 74429754.

E-mail address: savitree.a@psu.ac.th (S. Assanangkornchai).

serious adverse consequences of using it. Since kratom has been controlled for nearly 70 years, the evidence regarding its effect on mental and physical health is scarce; severe problems related to pure kratom use have never been reported and biomedical studies on kratom are difficult to conduct because of the limited availability, difficult transportation of the kratom leaves, and its use being hidden. While the eradication of kratom trees has been actively applied in recent years, there are some movements towards the decriminalization of traditional kratom use in Thai society. Furthermore, the scientific community worldwide is also actively studying this leaf and its compounds to determine if it can be used as a treatment option for users of drugs such as opioid and alcohol, as well as for other therapeutic purposes (Boyer, Babu, Adkins, McCurdy, & Halpern, 2008; Boyer, Babu, Macalino, & Compton, 2007; Kumarnsit, Keawpradub, & Nuankaew, 2007).

The most recent National Household Survey of Substance Use in 2007 found that kratom was the most prevalent substance used by the Thai population aged 12–65 years in the past 12 months and 30 days. Of the estimated 405.1 thousand people (0.87% of the population aged 12–65 years) who used at least one substance in the past 30 days prior to the survey, 388.6 thousand reported the use of kratom while only 7.9 thousand used cannabis and the rest used inhalants, methamphetamine and opium. The highest rate of kratom use was reported in the southern region with 9.29% of the adult population in the South being kratom lifetime users (Assanangkornchai et al., 2008).

Despite its being the most popular substance in Thailand at present and its gaining popularity globally as evidenced by more recent international literature and a number of advertisements on its sale in the internet (Schmidt, Sharma, Schifano, & Feinmann, 2011), knowledge about kratom health impacts is limited. This qualitative study was thus initiated to explore the pattern of kratom use and users' perception of the consequences of its use and to describe the characteristic symptoms and signs of kratom dependence and withdrawal.

Methods

Sample

Our study site was three rural villages in southern Thailand in a region which is hilly to mountainous, with dense virgin forests. This region is the centre for production of rubber and palm and cultivation of other tropical crops. The climate is that of a warm and humid tropical area, where kratom trees can grow easily. These villages were chosen as they were an area where traditional kratom use was most common and accepted and because the village leaders, villagers and the health personnel were willing to participate in the study and help the researchers in data collection.

A group of 34 self-identified regular users (22), occasional users (6), non users (3) and ex-users (3) of kratom living in the three villages was recruited into the study. Only male villagers were included as the prevalence of kratom use was much higher in males than in females and accepted as a rural phenomenon. A regular user was defined as an individual who had been using kratom daily for a period of at least one year. An occasional user referred to an individual who used kratom at certain times for a specific purpose (e.g. for a medicinal purpose or in social situations). A non-user was defined as an individual who had never used kratom in his/her entire life. Ex-user was an individual who used to chew kratom, could quit and did not use it within 3 months. Individuals with major psychiatric or physical illness, cognitive impairment or impaired sensorium, which could prevent quality data collection, were not recruited. Those who actively co-used kratom with other psychoactive substance(s) (e.g. cannabis,

methamphetamine, heroin or inhalants) were also excluded to ascertain that the responses especially regarding withdrawal and dependence were due only to kratom use and not to concomitant use of other drugs.

Data collection

Data collection was conducted during September 2010–March 2011, using the in-depth interview method with both local and official dialects as appropriate. Interviews were conducted consecutively with the villagers and continued until data saturation was obtained. The village health volunteer helped in translating some local dialect words and sentences which were not understood by the researcher. The interview was audiotape recorded with prior permission of the respondents and the researcher took notes of the important points to facilitate recorded voice transcription and data analysis. A health volunteer as a key-contact person helped the researcher to invite villagers to participate in the study using snowballing technique. Six issues were discussed: (1) patterns of kratom use, (2) reasons for using kratom, (3) definitions and symptoms and signs of kratom dependence and withdrawal by the users, (4) health impacts of kratom use, (5) intoxication symptoms, and (6) attitude towards use. Open-ended questions related to each issue were asked of all users. The interview guide was developed based on previous literature review regarding patterns of kratom use and the roles of kratom in Thai society and the internationally standard criteria, DSM-IV and ICD-10 of symptoms and signs of kratom dependence and withdrawal. These include six main themes: a strong desire or sense of compulsion to take kratom; difficulties in controlling kratom use; a physiological withdrawal state; tolerance; progressive neglect of alternative pleasures or interests because of kratom use; persisting with kratom use despite clear evidence of overtly harmful consequence. Furthermore, information obtained from discussion with some users, village leaders, villagers and health personnel and observation of the village context were integrated to form the guide.

The interview was done in privacy with each respondent at his home or work place, e.g. garden, rice field or garage, and took 50 min to one hour. All potential respondents were willing to be interviewed, there were thus no non-respondents. The villagers in rural areas in Thailand are usually friendly and well cooperative and the researcher (DS) had spent some time in the village to make friends with people there before actual data collection took place. Three non-users (one village head and two villagers) were interviewed about their opinion towards kratom use in the village, for example, their relationship with kratom users, what they thought of a user, why they did not use kratom, and the effects of kratom use on the village as a whole. This information is not, however, reported in this paper. Apart from self-report of the respondent, collateral information from village health volunteers and respondents' family members were obtained to verify the non-use of other drug where necessary. Institutional ethical approval was obtained from the Faculty of Medicine, Prince of Songkla University, where all authors were working. Verbal consent was obtained from all participants.

Data analysis

The qualitative data analysis was guided by grounded theory approach, using constant comparative process and three types of coding; open, axial, and selective coding (Strauss & Corbin, 1998). The open-ended interviews were transcribed into a word document. The data were coded and indexed by re-reading and repeating each step to bring out comprehensive sense, the main ideas, beliefs and opinions expressed in the three groups of

individuals. The technique of reading and highlighting approach was followed to get a sense of the whole of the essential words or ideas. The essential words or ideas were organized into categories and re-sorted using tables for developing a system to extract the contents and facts. Selective coding aims to identify a core category, establish links between the core category and other categories, integrate the categories along the dimensional level to form a domain and validate the statements of relationship among concepts.

Results

All 34 male participants were included in this study. Their age ranged from 31 to 75 years with 31 being married. All were Buddhists and had completed primary school. The majority worked as agriculturists in rubber and palm plantation or rice farm while some were industry employees and construction workers. The regular users had been using krathom continuously for 3–50 years while the occasional users reported using krathom for 1–6 years. The quantity of krathom used was 0.5–4 leaves per dose or 10–80 leaves per day for regular users and 0.5–1 leaf per dose or 1 to 20 leaves per day for occasional users. Three ex-users had used krathom for 25, 20 and 7 years and stopped using for 5 months, 3 and 10 years, respectively. All users chewed fresh leaves. Two regular users not only chewed fresh leaves but also drank tea made from dried leaves. When there was an abundance of krathom, these users would dry it and keep it for using as a tea when there was a shortage. The effect of dried krathom was the same as that of fresh leaves. Six regular users and one ex-user used to use amphetamine, alcohol or cannabis but they had stopped such use for many years before the interview. Two occasional users drank alcohol 2–3 times a week with 2–3 drinks per occasion.

From the informants' description, a core theme emerged: 'Understanding krathom use', covering the findings-related to a story of 'Why and how krathom was used' and 'Negative impacts of krathom use'.

Why and how krathom is used

It is available and accessible

Krathom trees can be easily grown and thrive in tropical swampy areas. Most regular krathom users had their own 1–2 krathom tree(s) hidden in some places such as rubber plantation, rice field, fruit garden, house-yard, ditch or fishing pond. There are two types of krathom distinguished by the colour of veins in the leaf; red and green (Fig. 1). Local people preferred the red to the green. The taste of the red vein krathom is more bitter than that of the green vein, and the effects last around 30 min longer. In the past krathom could be bought from a fresh market in the village. Currently, krathom was difficult to find and could not be sold in the market because the seller would be arrested and fined. Therefore, a new occupation emerged in the village as "krathom salesman", who typically rode a motorcycle to deliver krathom to acquainted users. Moreover, users could secretly buy krathom from someone who had krathom trees, a tea shop or from other nearby villages or sub-districts.

Apart from their own use at their own or a friend's home, users often used krathom with friends in a tea bar or workplace and when gathering together in a bull fighting, cock fighting or bird-cooing competition event held every weekend and on festivals and local ceremonies. Bull fighting has been past the cultural heritage of people in the south for more than a century. On Sunday the bullfight arena was crowded with audiences who took their own krathom for chewing while watching the competition and distributed it to

each other. In the past krathom was prepared by the owner of the bullfight arena for everyone and served free of charge.

It enhances my working energy

Rice farming and rubber plantation are old occupations of the villagers which have been passed down from generation to generation. The agriculturalist families work hard every day from dawn to dusk under the heat and sunlight.

Generally krathom was used in the daytime for working and in the evening for recreation. After chewing krathom, men became strong, diligent and tolerant, had the power to work harder and longer, were not sleepy while working, and could work under the heat and strong sunlight for the whole day. Those in some other occupations such as trucker, bus driver and rubber tapper would chew krathom in the night time. When they felt tired, krathom was used to recover from the fatigue. Krathom is a source of energy to stimulate and increase work efficiency. There is a folk song with lyrics concerning krathom use: "Popeye who is Olive's boyfriend likes to eat spinach and becomes a strong man. Popeye Thailand chews krathom for increasing his energy." 22 participants also elaborated that krathom use was necessary to enable them to work hard and increase their income and well being and could not be separated from their daily lives and the local society. A blacksmith aged 70 stated:

I can forge iron, make a big knife and axe all day because of chewing krathom. If I don't chew it, I cannot raise the hammer. Krathom helps me work in a hurry when I need to finish my work on time.

A farmer aged 75 explained:

In the morning I have to walk 6–7 km to my rice-field from my house, I usually bring krathom to the field, and when I get tired or hungry I chew it. I could work enjoyably the whole day without any need to eat food. When I feel hungry I chew krathom and drink water and resume working. I don't need food. I want to eat krathom in order to work. Krathom helps me become energetic, more active, and tolerant to heat and sunlight, so I could plough my field for the whole day without getting tired.

As the researchers followed some participants to their workplace they found that there were two types of krathom grown in a grove behind a garage. The owner explained that these krathom trees were planted four years ago by a senior worker. Every morning krathom leaves were picked and prepared for workers by including them with a set of coffee, tea and thermos bottle. At a construction site, the contractor had to find krathom for his workers every day. Agriculturalists who worked at rubber and palm plantations, vegetable gardens or rice fields always had krathom in their pockets. They used it before going to work, while working and while taking a rest. Six out of 22 regular users chewed it almost all the time, when its bitter taste finished they started chewing again immediately. A worker aged 31 explained:

I chew krathom and drink coffee with my colleagues in the morning, and during daytime when I feel tired and sleepy.

It is a traditional medicine, which is equally or more effective than western medicine

Krathom has been used as a 'traditional medicine' for century by local people. The qualification of the traditional healers and knowledge of the regimens and methods was passed from ancestors



Fig. 1. Type of krathom.

to their descendants, keeping such treatment available. Krathom could be used for treatment of both acute and chronic diseases such as coughing, diarrhea, pains, stomachache, common cold, herpes zoster, diabetes and hypertension, enabling villagers to treat themselves. Sixteen users reported that they used krathom for reducing their anxiety and moodiness and krathom could not only treat many diseases and have more efficacy than western medicine but also prevent some chronic diseases such as diabetes, hypertension, HIV and cancer. Moreover, three diabetics believed that krathom could reduce their blood sugar and help decrease cholesterol level.

A gardener aged 56 illustrated:

Krathom is a herbal medicine, which does not have bad effect like other drugs. Previously I had used 40 leaves per day for more than 10 years and stopped using it for a while because of a sickness. The doctor told me that I had diabetes then I decided to resume chewing it again. I thought krathom addiction is better than medicine addiction. Now I chew only 10 leaves per day because it is difficult to find, I feel good and my blood sugar is normal.

Almost all regular krathom users did not drink alcohol although some used to drink it before being krathom chewers. Krathom was believed to be an aid to those who wanted to stop drinking. An ex-drinker explained:

After I use krathom, I can't stand the alcohol strong smell. If I drink even a bit, I would have an extreme headache and vomit, get sick and have a hangover. I cannot work and have to take a rest.

To use as a medicine some sugar or salt was added before chewing a fresh leaf and the whole leaf was swallowed with or without splitting out its fibre. The other methods included drinking boiled fresh leaves as a tea or crushing the leaves and applying them to the painful organ. A gardener aged 42 expressed:

I had diarrhea for the whole night. At 2 a.m. I got up to pick krathom leaves and chewed them with red lime. After that I got well. Sometimes I was coughing for a month, I took several kinds of drugs but they were useless. My grandfather advised me to use krathom with sugar or salt and drink rain water. I used it only twice and I felt better.

Krathom has been used as a medication not only for human but also for animals such as cow, buffalo and pig. When the animal got diarrhea the owner would pick krathom leaves to treat them by mixing krathom leaves with food. After feeding them for only 2–3 meals they recovered. There was no need to buy medicine, thus saving money.

It is socially accepted, a custom and a precious gift to god

Twenty participants indicated that using krathom was not only harmless but also socially accepted. People who chewed krathom were better than those who drank alcohol or smoked tobacco. Krathom users did not bully, hurt, quarrel or fight with others. Krathom chewers were diligent and hard working, while cannabis users were lazy. Alcohol made drinkers to be bad men and tobacco smoking annoyed people. The elderly often said that they preferred a krathom user to be a son-in-law to a drunkard or a smoker. Additionally, krathom use could represent culture, custom and a symbol of welcome. In this village when someone visited a friend or neighbour, the host would welcome him by offering krathom. This has been a custom in the village since ancient times. It was placed with betel nut in a wicker basket and served with water, tea or coffee. A minibus driver aged 43 explained:

I think that krathom serves well in the informal social function and bonds the relationship among villagers. It's common when we visit someone's home that he makes us feel welcome by serving betel nut for women and krathom for men.

In addition, krathom was used as a precious gift to a god or spirit. When villagers lost something valuable or wanted to accomplish something special, they would pray to a god to help them and vow that if it was successful they would give the god krathom leaves. This practice has been traditionally performed since ancient time, indicating that krathom was valued as a precious thing, deserved by the god.

It is a channel linking users to happiness and friendship

'Happiness' was a feeling expressed by users after chewing krathom. They responded cheerfully that every time when chewing krathom they felt lively/sprightly, fresh, active with an urge to work. Six users felt healthy because they chewed krathom with warm water. The others felt joyful and not tense. In the evening, after finishing their work, villagers usually went to a house that acted like a club. They gathered in a group, told funny stories, discussed their work, lives and politics, exchanged their experiences, both happiness and sufferings, while they were chewing krathom and drinking tea or coffee. A krathom-chewing group was perceived as far better than an alcohol-drinking group, as alcohol often destroyed friendship. Krathom chewers never stayed up later than 1–2 a.m. unlike drinkers. Krathom use cost less money and did not cause accidents, quarrels or fighting but could create harmony in a group of friends, a strong community and unity. In the annual rice harvest farmers in the same village usually pool together to work on each rice field until it is finished and move to the next one until all are harvested. The host farmer usually

entertains the helpers with food, tea, coffee, betel nut and krathom leaves. A farmer aged 65 said:

In the evening after work I go to my friend's house, which is a recreational center of the village. We take krathom together and discuss, talk and share opinions about our work, our lives and politics. Because of chewing krathom I've got a lot of friends and we get along well. When I need some help I can ask them to help me.

Negative impacts of krathom use

Although users saw a lot of benefits from krathom use, some accepted that there were some negative consequences as well. These could be associated with long-term use and depended on the pattern of use, which was distinct between regular and occasional users.

I am dependent on krathom

Twenty regular users admitted that they became krathom dependents and needed to use krathom continually. They also felt a strong desire and thought of krathom all the time with its being the first thought after getting up. Nowadays with limited availability of krathom, they wasted time to find krathom and it was a preoccupation in their life. They felt it difficult to control the use. Eleven had tried to quit but could not stop using it. Moreover, fourteen tried to prevent withdrawal symptoms by chewing it at the usual times. A regular user told us that he had to have krathom in his mouth almost all the time while he was awake. His mouth would be krathom free only when he brushed his teeth or ate food.

Fourteen users tried to minimize withdrawal symptoms by always taking krathom with them wherever they travelled. One user told us that he rarely went out of his village and almost never spent a night elsewhere as he was afraid he could not live without krathom. Most users realized krathom was a narcotic and had health effects yet they still had to use it. A worker aged 45 described:

My heart desires for only krathom. After chewing krathom I feel happy, fresh and relieved, if I do not chew krathom my heart would be moody and also body would be fatigued like a man who did not sleep for two nights, my head would not be clear, and I would feel dull....If not use krathom I would not go to work, I must find krathom first....I would yield to death rather than not chew krathom. . . I'm pleased to be fined and arrested by a policeman.

I cannot tolerate withdrawal symptoms if stop using

Most users attempt to stop using krathom for a number of reasons. First, the cost of krathom has risen over the last three years. Currently krathom is difficult to find and the price is very high. In the past, 40 leaves of krathom cost only 2.50–7.00 Baht (USD 0.08–0.22), it has increased to 10–15 Baht (USD 0.31–0.47), 20–25 Baht (USD 0.63–0.78), and currently is 40–50 Baht (USD 1.25–1.56). Second, the law enforcement is now very strict. Third, the villagers are worried about krathom misuse by adolescents. As a result some have decided to cut down their krathom trees, making krathom available only with difficulty. Eighteen users realized the negative impacts of krathom use and tried to stop it by various methods but they faced withdrawal symptoms and were unsuccessful. They reported that whenever they stopped, "withdrawal symptoms" would occur within an hour and lasted for more than a day. Eighteen felt pains all over the body, their muscles/bones/back/joints ached and they suffered cramps. Fifteen felt anxious, depressed, moody,

Table 1

Example of the krathom dependence and withdrawal symptoms from users.

Dependence	Findings from krathom users
1. Strong desire/compulsion	Have to chew krathom every day
2. Impaired control	It is difficult to stop or cut down using krathom
3. Withdrawal	Want to quit but cannot stop using it
4. Tolerance	Have to chew it all the time, otherwise, feel sleepy and have muscle pain
5. Preoccupation	If chew it less than normal do, can only work slowly
6. Continued use despite harmful effects	Without krathom, do not want to go anywhere
	Worried and always keep on thinking of how to get krathom, if no krathom, try to find it
	Continue to use krathom even knowing that it has effects on health such as constipation, anorexia and weight loss
Withdrawal	
1. Musculoskeletal system	Feel pain over whole body
	Muscle/bone/back/joint aches, cramps/numbness
2. Mood symptoms	Anxiety, depressed mood, dysphoria
	Moodiness, annoyance, restlessness, irritability
3. Autonomic nervous system hyper/hypoactivity	Chills, sneeze, cough, illness/catch cold
	Sleepy, yawning, watering eyes, runny nose
	Sticky mouth, craving to eat krathom
4. Disturbances of behaviours and cognitive functions	Fatigue, no power to work
	Do not want to do anything

annoyed, restless and irritable. Moreover, 18 experienced chills, sneezing, coughing, general malaise like catching a cold, sleepy, yawning, watering eyes, runny nose, having sticky mouth, and craving to take krathom. They felt fatigue, were sleepless at night, had no power to work, felt as if something was missing in their life, and did not want to do anything.

Ten regular users reported that they had tried to stop using krathom many times and finally they turned back to it again because they could not work and were unhappy with their life. Five went to see a doctor at a hospital and got analgesic. However, withdrawal symptoms came back when the medicine was finished. It usually took 1 month to 3 years to stop using krathom completely. However, most users gave up and returned to use it when they saw their friends using it.

Three successful quitters reported that it was up to their mind and patience. During the quit time, they had to stay with the sufferings for 2 weeks to 4 months. They had to take approximately 10 tablets of analgesics per day to relieve body pains, muscle aches and cramps. An ex-user had to immerse himself in water to relax his muscles, which were twitching and extremely painful. Furthermore, they vomited in the morning as if having morning sickness, had diarrhea and defecated the whole day. They tried to avoid drinking hot or warm water otherwise they would have craving for krathom. One ex-user became a fat man because he had eaten a lot of food as soon as he thought of krathom. Two had become alcoholic because of sleeplessness and muscle spasm at night time, which made them use beer or rice whisky to substitute for krathom. Some tried using other herbs, which also have bitter taste but they appeared to be not effective in terms of activating the users as did krathom. The findings related to symptoms and signs of krathom dependence and withdrawal following the DSM-IV/ICD10 criteria are shown in Table 1.

Intoxication symptoms

The krathom intoxication often occurred with people who used a large amount at the first time, especially with an empty stomach, or who used an inedible kind of krathom. The symptoms included

fatigue, feeling of stretching, numbness, and flushing of face and ears, drowsiness, numb tongue, dizziness and giddiness, headache, nausea and vomiting, trembling hands, inability to breathe, having an impulse for urination or defecation but could not pass it out, feeling hot and perspiring. Those symptoms might last for 5 min to 1 day depending on the user's health. The symptoms could be self-treated or relieved spontaneously through activities such as physical exertion to the point of heavy sweating, drinking cold water or ice, taking a cold bath, taking a nap, or eating food, including sour fruit and candy. The symptoms were not severe and disappeared when users became accustomed to krathom.

Health impacts

Negative health impacts reported by the villagers included constipation, being thin, having dark skin, oral cavity problems, low sexual drive, rain panic and krathom intoxication.

'Constipation' reportedly occurred among those who ate the whole krathom leaf without spitting out its fibers. Some people believed that taking the whole leaf made them work longer and filled up their stomach so they took less food. They also told that krathom fibre could be accumulated in the stomach and cause gut obstruction or so-called phytobezoar, leading to stomachache, which could be so severe to need a surgery. A regular user who took two krathom leaves 10 times a day reported that the period of constipation lasted not more than three days and the stool looked like goat-dung. However, most krathom users knew how to use krathom safely and prevent constipation by spitting out the fibers and drinking a lot of water or buffalo milk to help digestion.

Malnutrition

Most regular users were 'thin' because they usually took only 1–2 meals per day. They did not feel hungry as krathom decreased their appetite and water filled up their stomach. Some long-term users were anorexic. Although most were aware that this might be the krathom effect and tried to improve their eating habit they did not take it as a serious problem. In contrast, the occasional users reported that they ate more after taking krathom as it helped them work hard and they became hungry afterward.

Poor oral hygiene

Long-term regular users who chewed krathom all the time without discarding the leaf veins before chewing might have cracked molars, toothache and gum pain because the sliver of krathom veins stabbed their gum. Furthermore, regular heavy users usually had strong mouth and body smell. Again they did not regard it a big problem although they sometimes had toothache, tooth hypersensitivity, and dental carries and found the food less tasty. On the contrary, chewing krathom was perceived to help them protect decayed teeth and was used for dental treatment.

Rain panic

The symptom of greatest concern for regular krathom users was the 'rain panic'. When it rained they would feel frozen into the bone, have muscle pains and joint aches, cough, sneezing, and trembling. On a rainy day they could not work outside but just sat and covered themselves with a thick blanket, and chewed krathom with warm water. This seemed to be a disturbing problem for them as farmers still had to work in the rainy season. Some believed it was related to the individual's physical strength and behaviour. A farmer aged 63 expressed:

...krathom use has affected me with the rain panic. When raining, I feel frozen and trembling, bone pains and numb. As soon

as the sky turns grey I stop working and go back home quickly before it rains to protect myself from getting wet.

Low sexual drive

The effect of krathom on the 'sexual drive' was controversially perceived. Some users said it heightened their sexual drive while some reported the opposite. Most users said sexual ability was not related to krathom use but depended on individual health, age and co-use of krathom with other substances such as tea, coffee and tobacco. A user told us that he and his friends used to discuss about this and all agreed that their sexual desire increased during the first ten years of use but declined after that.

Dark skin

We found that most regular users had 'dark skin', probably because they had worked under the strong sunlight for a long time. Male villagers were not concerned about their body image, and never found any users with a disease caused by sunlight such as skin cancer. Some told us that if they swallowed krathom fibers, their face would become dark green. They elaborated that most krathom users looked older than their actual age because they worked hard and exceeded their power over a long time, and their skin became wrinkled and black.

Krathom misuse by adolescents

In the villages, krathom trees were cut down not only because of the law but also to prevent krathom 'misuse by adolescents'. The adolescents have developed a new method called krathom cocktail or 4 × 100 (sii koon roi), which is quite harmful to the users. Basically krathom cocktail includes water boiled with krathom leaves, codeine cough syrup and cola soft drinks and served with ice. The participants reported that adolescents used it for fun or relaxation among friends after school. After they drank krathom cocktail they felt happy, clear-headed and relaxed but were too lazy to work and study. It was also rumored that some other toxic or addictive substances were put in the cocktail recipe, e.g. benzodiazepines, sleeping pills, toxic substances such as mosquito repellent stick, inner lining of fluorescent light bulbs or bleaching liquid, road paint, cow dung, and ashes from dead bodies. As this issue has gained a lot of attention from politicians and media, traditional krathom use has also been controlled. However, we did not find any evidence of the use of these toxic cocktails in our study area.

Discussion

This study illustrates the meaning of krathom use among local traditional users based on their experience and perception. The findings contribute to the understanding of the nature of the use patterns and give further evidence based on the community context for policy implication.

Krathom plant obviously acts as a representative of social and local culture in southern Thailand. Villagers and their ancestors have used it for a long time until it has become a part of their lives, which evolves from generation to generation. It has been used as a power enhancement for increasing work efficiency, a herbal medicine, and a recreational and entertaining tool among friends. Moreover, folk performances, songs, sports, and income earning activities of villagers are all concerned with krathom use. Therefore, krathom is not only an ordinary leaf to satisfy the user, but it has also been blended to culture development, lifestyle and living in the village.

The findings are limited to the data collected and based on the respondents' ability to recall and report their experiences. Careful in-depth interviews were undertaken with a relatively large

group of respondents to ensure saturation of information. However, the generalizability of these findings is limited inevitably to the samples and settings selected, with the focus of analyses being participants' personal accounts of lived experience. As traditional krathom use is quite accepted in the study area, the villagers were confident and willing to participate in the study. However, krathom is a hot issue in Thailand at present with a lot of debate regarding the eradication of krathom trees and total ban of use on one side and the decriminalization of krathom use on the other; this may affect their responses to the study. Although we had tried to include only pure krathom users, most of them chewed it with other substances, e.g. tobacco, coffee, tea, energizing drinks, and betel nut. It is thus difficult to ascertain with certainty the effects of krathom, either the positive ones in activating the users and enhancing work performance or the negative such as constipation and poor appetite. Our study thus warrants further epidemiological studies of the extent and distribution of health impacts of krathom use in different samples and settings.

The study reveals a number of aspects regarding krathom use and supports evidence reported in previous studies, including the reasons and ways of use and perceived positive and negative consequences of use (Ahmad & Aziz, 2012; Assanangkornchai, Muekthong, Sam-Angsri, & Pattanasattayawong, 2007; Vicknasingam et al., 2010). Nevertheless, it presents a more detailed picture.

Krathom use was seen as both beneficial to the users and accepted by the society. Although most regular users in our study viewed themselves as dependent users, they regarded their use as responsible, well-adjusted and purposive with regard to the patterns of use and the main reason of use for enhancing work performance and endurance. The priorities in lives of these rural villagers are involved with work, which is usually an outdoor, hard labor type, and social relationship with their folk peers. Our respondents appeared to frame their krathom use around these activities and believed it was an activity that fitted well into their daily lives and mainstream society.

Krathom has both advantages and disadvantages. On the positive side, krathom is actually a herbal medicine and makes users feel energetic. The pharmacological effects of krathom have been supported by some previous studies, demonstrating the morphine-like action on gastric acid secretion (Tsuchiya et al., 2002), the analgesic activity partly acting at opioids receptors in the supraspinal opioids system (Reanmongkol, Keawpradub, & Sawangjaroen, 2007), its effects on glucose transport in muscle cells (Purintrapiban et al., 2008) and the reduction of the ethanol withdrawal symptoms in mice (for example, Kumarnsit et al., 2007). Our study thus highlights some folk wisdom, which should have been compiled and documented for further use and development.

Nevertheless, our study obviously reveals that krathom is addictive. The strongest symptoms were those of the withdrawal state, which made users take all possible means to prevent them and which affected their lives and daily activities, making krathom the most important thing in their lives. These findings were in keeping with a recent paper from Malaysia which reports the experiences of the users when stopping using krathom (Ahmad & Aziz, 2012). The krathom symptoms and signs of dependence are compatible with the DSM-IV and ICD-10 criteria but may be less harmful than those associated with other substance dependence and were not considered to be a problem by the users. The current study was initially aimed to be a formative data collection in advance of a larger study to develop screening and rating instruments for krathom dependence and withdrawal. Our findings thus throw light on this issue.

The other negative impact of krathom, which is now the issue of greatest concern in our study area and in Thailand, is krathom misuse by adolescents by using it in a form of cocktail with other

addictive or toxic substances, which is indeed harmful to health. Actually, krathom misuse has also become an international concern as krathom is found to be one of the agents to obtain legal highs wide-spread in Europe (Schmidt et al., 2011). The control of this problem by eradication of krathom trees has pros and cons. On one hand, it may be an effective measure to limit the availability of krathom; on the other hand, the shortage of krathom makes it become highly valuable and affect traditional users, who may turn to use other substituted substances, including alcohol. Furthermore, it limits the feasibility for biomedical studies on krathom, delaying progress of science on the pharmacological properties of krathom. The policy intervention for this situation should be considered carefully. Within the context of traditional use, a clear message should be given to the public that, despite some benefits, krathom is addictive, and its use has disadvantages and side effects. Nevertheless, any control efforts should be sensitive to village culture.

The evidence-based findings of this study still need to be supported by in-depth laboratory studies and in human to elucidate the mechanism of ailment, physical change and neurological effect. There is also a need to investigate the advantages and disadvantages to physical and mental health of krathom use both short-term and long-term in order to advise and disseminate this information on krathom use to the users and other people.

This study is the first to qualitatively explore patterns of krathom use in a traditional context. The results reveal both advantages and disadvantages of krathom use, as well as its dependence and withdrawal symptoms. Krathom is addictive with characteristic symptoms and signs. However, the study also highlights the role of krathom in the Thai local society – providing users a means of relaxation and entertainment, having a social function, and serving as a medicine and a source of energy. This information can form the basis for policy planning and intervention aimed at control or reduction of krathom use in its different settings.

Acknowledgements

This study was supported by the Research Chair Grant from the National Science and Technology Development Agency, Ministry of Science and Technology, Thailand. The Epidemiology Unit, Prince of Songkla University is partially supported by the National Science and Technology Development Agency, Ministry of Science and Technology, Thailand. The authors wish to thank all of the villagers who gave the information, village health volunteers for contacting the participants and Ms. Kanlaya Nukong for coordinating the field work.

Conflict of interest

All authors declare that they have no conflicts of interest.

References

- Ahmad, K., & Aziz, K. (2012). *Mitragyna speciosa* use in the northern states of Malaysia: A cross-sectional study. *Journal of Ethnopharmacology*, 141, 446–450.
- Apryani, E., Hidayat, M. T., Moklas, M. A. A., Fakurazi, S., & Idayu, N. F. (2010). Effects of mitragynine from *Mitragyna speciosa* Korth. leaves on working memory. *Journal of Ethnopharmacology*, 129, 357–360.
- Assanangkornchai, S., Muekthong, A., Sam-Angsri, N., & Pattanasattayawong, U. (2007). The use of *Mitragynine speciosa* ("Krathom"), an addictive plant, in Thailand. *Substance Use and Misuse*, 42, 2145–2157.
- Assanangkornchai, S., Aramrattana, A., Perngpan, U., Kanato, M., Kanika, N., & Sirivongs Na Ayudhya, A. (2008). Current situation of substance-related problems in Thailand. *Journal of the Psychiatric Association of Thailand*, 53(Suppl. 1), S24–S36.

- Boyer, E. W., Babu, K. M., Adkins, J. E., McCurdy, C. R., & Halpern, J. H. (2008). Self-treatment of opioid withdrawal using kratom (*Mitragyna speciosa* Korth.). *Addiction*, *103*, 1048–1050.
- Boyer, E. W., Babu, K. M., Macalino, G. E., & Compton, W. (2007). Self-treatment of opioid withdrawal with a dietary supplement, Kratom. *The American Journal on Addictions*, *16*, 352–356.
- Burkill, I. H., & Haniff, M. (1930). Malay village medicine. *The Garden's Bulletin Straits Settlement*, *6*, 165–207.
- Charoenrat, S. (2005). Krathom law development in Thailand (compiled from Sumyai, v). In S. Assanangkornchai, & A. Sirivongs Na Ayudhya (Eds.), *Kratom plant in Thai society: Culture, behavior, health, science, laws* (pp. 146–156). Bangkok: Ministry of Justice.
- Chittrakarn, S., Keawpradub, N., Sawangjaroen, K., Kansanalak, S., & Janchawee, B. (2010). The neuromuscular blockade produced by pure alkaloid, mitragynine and methanol extract of kratom leaves (*Mitragyna speciosa* Korth.). *Journal of Ethnopharmacology*, *129*, 344–349.
- European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). (2012, February). <<http://www.emcdda.europa.eu/drug-profiles/kratom>> Accessed 13.07.12.
- Kumarnsit, E., Keawpradub, N., & Nuankaew, W. (2007). Effect of *Mitragyna speciosa* aqueous extract on ethanol withdrawal symptoms in mice. *Fitoterapia*, *78*, 182–185.
- Matsumoto, K., Yamamoto, L. T., Watanabe, K., Yano, S., Shan, J., Pang, P. K. T., et al. (2005). Inhibitory effect of mitragynine, an analgesic alkaloid from Thai herbal medicine, on neurogenic contraction of the vas deferens. *Life Sciences*, *78*, 187–194.
- Purintrapiban, J., Keawpradub, N., Kansanalak, S., Chittrakarn, S., Janchawee, B., & Sawangjaroen, K. (2008). Study on glucose transport in muscle cells by extracts from *Mitragyna speciosa* (Korth.) and mitragynine. *Natural Product Research*, *1*, 1–9.
- Reanmongkol, W., Keawpradub, N., & Sawangjaroen, K. (2007). Effects of the extracts from *Mitragyna speciosa* Korth. leaves on analgesic and behavioral activities in experimental animals. *Songklanakarin Journal of Science and Technology*, *29*, 39–48.
- Schmidt, M. M., Sharma, A., Schifano, F., & Feinmann, C. (2011). "Legal highs" on the net-evaluation of UK-based websites, products and product information. *Forensic Science International*, *206*, 92–97.
- Sirivongs Na Ayudhya, A., & Assanangkornchai, S. (Eds.). (2005). *Kratom plant in Thai society: Culture, behavior, health, science, laws*. Bangkok: Ministry of Justice.
- Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage Publications Inc.
- Tsuchiya, S., Miyashita, S., Yamamoto, M., Horie, S., Sakai, S. I., Aimi, N., et al. (2002). Effect of mitragynine, derived from Thai folk medicine, on gastric acid secretion through opioid receptor in anesthetized rats. *European Journal of Pharmacology*, *443*, 185–188.
- Vicknasingam, B., Narayanan, S., Beng, G. T., & Mansor, S. M. (2010). The informal use of ketum (*Mitragyna speciosa*) for opioid withdrawal in the northern states of peninsular Malaysia and implications for drug substitution therapy. *International Journal of Drug Policy*, *21*, 283–288.