

ARECA NUT SYMPOSIUM

Global epidemiology of areca nut usage

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Abstract

A substantial proportion of the world's population is engaged in chewing areca nut and the habit is endemic throughout the Indian subcontinent, large parts of south Asia and Melanesia. A large variety of ingredients, including tobacco, may be used along with areca nut constituting a betel quid. The composition and method of chewing can vary widely from country to country and these population variations are described in this review. Some populations are known to use areca nut without tobacco providing good opportunities to further research the carcinogenicity of areca nut. Some interesting trends on chewing patterns have emerged from recent data, suggesting a decline in the habit in some countries such as Thailand while the prevalence of areca nut use is rising in India and Taiwan.

Introduction

The usage of areca nut is indigenous to India, Sri Lanka, Maldives, Bangladesh, Myanmar, Taiwan and numerous islands in South Pacific. It is also popular in parts of Thailand, Indonesia, Malaysia, Cambodia, Vietnam, Philippines, Laos, China and in migrant communities from these countries. In populations resident in south and East Asia the use of areca nut is strongly interwoven into local art and craft, folklore, social customs, religious practices and cultural rituals. In this supplement historical and anthropological aspects of areca nut usage are described by Strickland.¹ This paper presents a global perspective of the current usage of areca nut by reviewing available information on its widespread use by population groups to allow an appreciation of the numerous public health problems associated with the use and abuse of this substance.

There are several palms under the genus *Areca* native to South, South-East Asia and Pacific islands. This tropical palm tree bears fruit all year. Areca nut for chewing is obtained from *Areca catechu* (Fig. 1). It is believed that *Areca catechu* may be native to Ceylon (Sri Lanka), West Malaysia and Melanesia.² Areca nut is consumed in large variety of ways and can be used by itself. When ripe it is orange-yellow in colour and the seed (endosperm) is separated from fibrous pericarp (Fig. 2). The nut may be used fresh, or dried and cured before use, by boiling, baking or roasting. In some areas, especially Eastern India and southern Sri Lanka, fermented areca nut is also popular. In Taiwan, areca nut is often used in the unripe stage when it is green, like a small olive (Fig. 3). Areca nut is known colloquially in the Indian subcontinent in Hindi and Bengali as *supari*, in Sri Lanka it is called *puwak*, in Sylheti

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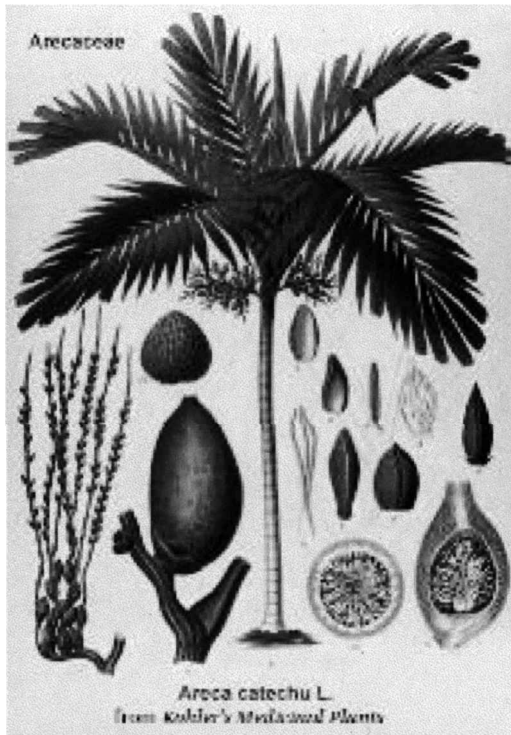


Figure 1. A diagrammatic illustration of areca palm. *Areca* nut is obtained from the *Areca catechu* tree. Source: 1995–2001 Missouri Botanical Garden Library <http://ridgwaydb.mobot.org/mobot/rarebooks/>

as *gua*, in Thailand as *mak*, in Sarawak as *pinang* and in Papua New Guinea as *daka*.

Areca nut chewing is practiced in several different ways in various countries and often mixed with several ingredients to make up a betel quid known as *pan* in Hindi. The most popular



Figure 2. *Areca* nut.



Figure 3. Unripe nut as consumed in Taiwan.

accompaniments are the leaf of *Piper betle* (betel leaf), lime, catechu and tobacco. The practice of areca nut chewing in the form of a betel quid is described explicitly in a monograph published by the International Agency for Research on Cancer.³ The major components of betel quid are illustrated in Fig. 4 and are listed in Table 1.

The most common accompaniment globally is the leaf of *Piper betle*. This has led to areca nut being labelled erroneously as betel nut in the English literature. Apart from the leaf other parts of the betel vine such as stem, inflorescence (flower; pods) or catkins are also consumed with



Figure 4. A betel quid prepared in the traditional way using betel leaves, sliced areca nut, cut tobacco and slaked lime.

Table 1. *Constituents of betel quid*

Consituent	Preparation
Areca nut	Sliced fresh ripe nut
	Roasted
	Dried/baked
	Boiled
	Fermented
Piper betle	Immature
	Fresh leaf
Lime	Inflorescence
	From coral
	From shell fish
Tobacco	From lime stone
	Fermented
	Sun dried
Catechu	Powdered with molasses with lime
	Extract of <i>Acacia catechu</i>
	Extract of <i>Acacia suma</i>
Spices	Cloves
	Cardamom
	Aniseed
Sweetners	Coconut

Modified from Ref 28

the nut. Consumption of the inflorescence (Fig. 5) is common in Melanesia and in parts of Taiwan.

Lime (calcium hydroxide) is often used with areca nut in combination. Lime is obtained in coastal areas by heating the covering of shellfish (sea shells) or harvested from corals. In central areas of a country it is quarried from limestone. In the Asian markets lime is sold as a paste mixed with water (Fig. 6) which is white or pink. In Papua New Guinea lime is available in the powdered form.



Figure 5. *Inflorescence (flower) of Piper betle mostly used in Taiwan and Melanesia.*

Catechu is an extract of the Acacia tree *A. catechu* or *A. suma*. Catechu is often smeared on the betel leaf that is used to wrap areca nut flakes.

Cut tobacco is consumed with areca nut often in the quid mixture. This type of chewing tobacco is made from sun-dried and partly fermented coarsely cut leaves without further processing. Sometimes tobacco is powdered and combined with molasses or boiled before use.

Pan Masala is the generic term used for areca nut-containing products that are manufactured industrially and marketed commercially. These are available in small convenient sachets for individual use. Several trade brands are illustrated in Fig. 7. Pan masalas containing tobacco are referred to as Gutka.

Global epidemiology

Areca nut is used as a masticatory substance by approximately 600 million people worldwide. It is estimated that 10–20% of the world's population chew areca nut in some form, often mixed in betel quid (pan). A challenge facing researchers documenting the prevalence of areca nut use in populations is the difficulty in documenting patterns of areca nut use as separate from betel quid chewing which often contain a variety of ingredients, including tobacco. Thus estimating the population frequency of areca use by itself is often frustrating, as some authors do not record this explicitly in their publications. As areca is often the primary ingredient in betel quid any studies describing population data for betel quid chewing is taken as a valid reference value. While there are no nationwide surveys reported on the prevalence of this habit, data from several

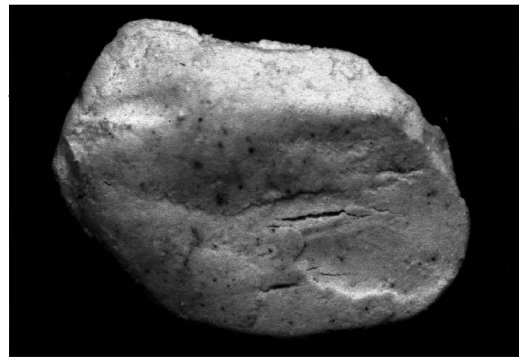


Figure 6. *Slaked lime in paste form.*

Table 2. Prevalence of areca and/or betel quid chewing among adults in selected populations

Country	Men		Women		All		Chewing practice		Reference
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	Nut only	Quid	
India, Bombay	40071	34.5	50527	27.2	99598	32.1		x	6
Pakistan, Karachi	2661	3.2	2093	8.2	4754	5.4		x	8
Sri Lanka	316	54	817	42	1133	45.2		x	13
Thailand	986	16	880	19	1816	17		x	15
Taiwan, Kaohsiung	511	28.3	651	1.4	1162	13.3	x		24
Sarawak	195	30	263	63	458	49.3	x		28
Cambodia	366	6.8	953	40.6	1319	31.2			30
China, Xiangtang city	6057	39.3	4989	30.5	11406	35.3	x		32

countries obtained in hospital-based, population-based and school-based surveys are reviewed here.

Data from several published studies arising from a number of population groups studied since 1970 are listed in Table 2. While the range of point prevalence for areca chewing is wide (< 1–54%) some important demographic differences are noted. Strickland¹ has considered these ethnographic differences in detail and the salient points are that in these countries more women than men chew and the prevalence of chewing increases with age. Some particular characteristics relevant to each local population are outlined below.

India

India has the largest areca-consuming population in the world. Much of the data arise from extensive population studies conducted by the TIFR group⁴ in the 1960s and 1970s. Data were collected in a series of house-to-house surveys

conducted in rural areas from individuals aged 15 years or over with approximately equal proportions of males and females. Interviews were conducted in five districts in India, Gujarat, Andhra Pradesh, Bihar and Kerala, involving 50915 people. The proportion chewing betel quid varied from 3.3% in Sirikakulam in Andhra Pradesh to 37% in Ernakulam in Kerala. Among 50915 people surveyed in five districts, 0.6% of those chewed areca nut alone (supari), compared with 11.6% who chewed betel quid with tobacco. The other large-scale study conducted in India by Malaowalla *et al.*⁵ on 57 518 industrial workers in Ahmedabad, Gujarat—a population different to the above studies in that these were mostly urban male textile workers—reported pan and supari chewing by 26% of 85% who admitted to an oral habit. In a study of 99 598 adults (> 35 years) in Mumbai, some 32.1% reported chewing betel quid with tobacco, whereas only 0.5% reported chewing areca nut or betel-quid without tobacco.⁶

Pakistan

Mahmood *et al.*⁷ questioned 10 749 apparently healthy subjects living in Karachi. He recorded pan use without tobacco in 7.5% and pan with tobacco in 15% of this population. A subcohort of 3562 individuals from this group were re-examined by Jafarey & Zaidi.⁸ They reported that at least 30% of these healthy individuals had a pan habit compared with a hospital group of 1192 oral carcinoma patients, among whom 66% had a pan habit. Their description of a pan habit is not explicit, but as tobacco chewers are listed separately the assumption is that this group



Figure 7. Packaged areca nut products referred to as *pan masala*. Those containing tobacco are referred to as *gutka*.

reporting pan use chewed predominantly areca nut and betel. Maher,⁹ in a recent house-to-house study in a periurban area in Sindh, recorded 35 different items that are consumed as part of betel quid chewing by this population.

Sri Lanka

In Sri Lanka the habit of areca chewing stems from ancient times, and traditionally the nut is chewed with a betel leaf sprinkled with lime (Fig. 4). Tobacco may be added to the quid. Hirayama's early studies in the 1960s¹⁰ indicated that, among a group of healthy control subjects, at least one in five men did not add tobacco to their betel/areca recipe. A higher proportion of women (who did not smoke) were reported to be adding tobacco to the areca/betel quid mixture. Other studies in the 1960s and 1970s confirmed these patterns of chewing.^{11,12} Warnakulasuriya,¹³ in a large-scale epidemiological study in rural villages in the Central Province of Sri Lanka, reported around 50% of men and women to be chewing betel quid.

In a nationwide survey¹⁴ conducted between 1994 and 1995 approximately 4000 adults over 35 years of age were interviewed on their betel quid chewing habits. The reported prevalence of betel quid chewing was 33.7% among 35–44-year-olds and 47.7% among 65–74-year-olds.

Thailand

The constituents of a betel quid which includes fresh or fermented parts of areca nut as used in Northern Thailand are very similar to those illustrated in Fig. 4. Tobacco is almost always added. A detailed study of several hill tribes (Lahu, Karen, Lisu and Thai) living in Northern Thailand by Reichart *et al.*¹⁵ carried out in 1979–84 suggested a prevalence ranging from 5 to 44% in men and 9 to 46% in women. In the Thai tribe the habit was less predominant and the Meo tribe was the exception, preferring to chew miang—fermented wild tea leaves.

The habit of betel quid chewing in Thailand is declining, the only country in south Asia to record such a trend. In 1955, Young¹⁶ commented on this and Reichart's group¹⁷ substantiated this falling trend by observing that very few villagers below the age of 35 chewed betel, once a universal custom among Thai peasants.

The habit of betel chewing in cities such as Bangkok and Chaing Mai has almost vanished.¹⁵ Axell *et al.*¹⁸ reported that only three of 234 subjects (1.3%) attending a hospital unit reported any form of betel or areca use. A decline in frequency and mortality from oral cancer in Thailand is linked to the continuously declining chewing habit among Thais.¹⁹

Guam

Guamians chew mainly the nut, without the addition of tobacco or lime. Either the fresh immature green areca nut with its husk and skin or areca nut together with a betel leaf is chewed.²⁰ This practice seems to be ancient and has not changed, but the prevalence data for the chewing habit have not been examined in any systematic survey.

Papua New Guinea (PNG)

In PNG the quid is formed by chewing the kernel of the areca nut, and by adding slaked lime using the inflorescence of betel piper vine (Fig. 5) moistened with saliva, dipped in powdered lime.²¹ Together these three form the basis of the quid habit and betel leaf or tobacco are traditionally not consumed.²² Although several descriptive papers refer to the habit of areca chewing among Papuans, mainly from lowland and island areas,²³ no detailed epidemiological studies on the use of areca are available.

Taiwan

Betel quid chewing behaviour is viewed as a predominantly male habit in Taiwan with 21:1 ratio of relative prevalence rates between men (28.3%) and women (1.4%) among Kaohsiung residents.²⁴ Patterns of chewing among aborigines and Chinese were also reported to be different;²⁵ an aborigine would wrap a fresh areca nut in a betel leaf while Chinese would sandwich the betel inflorescence (fruit) between two halves of the areca nut smeared with lime (Fig. 3). Among the general population in Taiwan, 6% were reported to be current chewers (9.8% for men; 1.6% for women) while among the aborigine people the prevalence was 42.1% (46.5% for men; 38% for women). Analysis of sociodemographic factors suggested that men, older people, less educated people, blue-collar workers, aborig-

ines, smokers and drinkers were more likely to chew areca nut.²⁵ Lu *et al.*²⁶ estimated that the age of beginning areca nut chewing in Changhua county was around 12 years, corresponding to the last year in the primary school. During school years from junior high school to vocational school prevalence rates rise from 2% to 10%.²⁷ Stich *et al.*,²⁰ examining chewing patterns in the Hualien district in Taiwan, reported that on average a Taiwanese uses 44 areca nuts a day and a significant number of chewers may chew up to 120 nuts a day.

Sarawak and Malaysia

In rural Sarawak, areca nut is essentially an item of local produce. Following a field study Strickland & Duffield²⁸ reported that 22% of men and 47% of women interviewed in 1996 used areca daily. The habit tended to begin in young adulthood and women were more regular chewers than men. Among indigenous people of Sarawak living in Malaysia, Zain *et al.*²⁹ reported 37 of 164 (22.5%) were current chewers. Again, the habit was more prevalent in women. However, compared with Sarawak people among Indians working on estates in the same region the habit of quid chewing was more popular and 91 of 147 (62%) were identified as habitués. Malay quid chewers are noted not to use tobacco in their quid mixture.

Cambodia

Few epidemiological studies on chewing habits are reported in selected Cambodian populations. Ikeda *et al.*,³⁰ in the early 1990s, interviewed 1319 individuals in nine villages in Cambodia. Chewing betel quid was reported by 408 subjects (31%). Among these Cambodian chewers 28% reported use of the nut only. Reichart also reported on the popularity of the areca chewing habit among elderly Cambodian women.³¹

China

Zhang *et al.*,³² in a large-scale epidemiological study, interviewed 11 406 subjects in Xiangtan city in Hunan Province in China. The people in Xiangtang were reported to often chew areca nut without tobacco, while bitter and hot pepper were usual additives. Thirty-five per cent of the subjects chewed areca nut. In a pilot study of 100

subjects in Hainan island of the People's Republic of China 95% of the study population chewed areca nut.³³

Conclusions

There are clearly many differences in the way areca nut is consumed, on its own or often in combination with many other ingredients, including tobacco. In India alone, Pindborg *et al.*,³⁴ in the 1960s, described 38 different combinations of areca nut and tobacco use according to each person's recipe. In some populations the chewing of areca nut begins at a young age and their first experience of areca use is during elementary school years.³⁵ During the last two decades, with the availability of commercially available products, the pattern of use of areca has changed rapidly and the practice of chewing areca nut has received a boost. More precision is required in defining what is chewed³⁶ and the risk of carcinogenicity of the betel quid may well relate to the type, duration and frequency of the habit. This review identifies some ethnic groups, mainly in Melanesia, that do not use tobacco in areca/betel quid chewing and there are thus good opportunities for further research into the carcinogenicity of areca nut in these populations. While in some countries such as Thailand areca chewing is declining, there is new evidence that areca usage is increasing in other countries, notably in India and Taiwan, thus increasing the risk of these populations to develop oral sub-mucous fibrosis and oral cancer.

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