

## UPPER ALIMENTARY TRACT CANCER IN NATAL INDIANS WITH SPECIAL REFERENCE TO THE BETEL-CHEWING HABIT

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THE 1960 Population Census for South Africa indicated that there were 477,125 Indians in South Africa. The Durban region contained 237,344 of these (approximately 50%). The remainder are scattered through the province of Natal and, to a lesser extent, the provinces of Transvaal and the Cape. The growth rate for Indians is regarded by the S.A. Bureau of Statistics as being 2.87% per annum, and the 1969 S.A. Indian population is therefore approximately 600,000, of whom about half live in the Durban region (see Table I).

### *General features*

Indians have participated in South African life for 110 years. Between 1860 and 1866 over 6000 Indians were brought to Natal as indentured labourers to work on sugar-cane farms, and for the ensuing 50 years they were predominantly engaged in agriculture. In the last 50 years Indians have become increasingly urbanised and there has been a relative decline in their engagement in agriculture, as the fields of commerce and industry were entered. In 1960, 80% of those who were gainfully employed were engaged in manufacturing, services or commerce, while only 12% worked in the agricultural sphere (McCrystal and Maasdorp, 1967).

The Indian population is largely urban dwelling. Only 17% were resident in rural areas in 1960. Indian household incomes are relatively low, and a substantial amount of poverty exists in the community. In Natal, in 1960, 82.7% of Indian workers earned less than 800 Rand per annum\* (McCrystal and Maasdorp, 1967).

The two main religions practised by Indians are Hinduism and the Islamic religion. A small proportion of Hindus have turned to Christianity. The regional variation of religious denominations is shown in Table I. Hindus predominate in Durban, in Natal, and in the whole Indian population, and studies based on Durban Indians are representative for Natal province. There are relatively more Moslems in the Cape and Transvaal provinces, and Christians form a larger proportion of the group in the Cape than elsewhere.

### *Cancer Incidence*

A survey designed to estimate the cancer incidence in South African Indians was initiated in Durban in 1964. The results of the first three years were published in 1968 (Schonland and Bradshaw, 1968). As the total number of cases was small,

\* In 1960, R2 = £1.

TABLE I.—*Population Distribution and Religious Groups of South African Indians, 1960\**

	Durban region	Provinces			South Africa
		Natal	Cape	Transvaal	
Population . . . . .	237,344	394,854	18,477	63,787	477,125**
% Total population . . . . .	50	83	4	13	100
Moslem % . . . . .	15.0	15.7	47.8	54.9	22.2
Hindu % . . . . .	77.4	77.1	28.0	38.8	70.1
Christian % . . . . .	7.6	7.2	24.2	6.3	7.7

\* 1960 Population Census.

\*\* Seven Indians live in the Orange Free State.

the investigation was continued for two further years, but further calculations based on the 5 year investigation produced very little variation from the findings of the 3 year study.

There are considerable differences between male and female Indians with regard to upper alimentary tract cancer. The incidence is much greater in Indian females than males and than that in English of both sexes. A discussion of this difference now follows, and for convenience, the relevant specific sites are shown in Table II.

TABLE II.—*Age-adjusted Cancer Incidence Rates for Sites of Mouth, Pharynx and Alimentary Tract: Indian and English\**

	Females		Males	
	Indian	English	Indian	English
A. Upper alimentary tract . . . . .	56.1	17.1	34.5	34.6
B. Lower alimentary tract . . . . .	28.2	29.6	20.6	37.6
C. Rest of mouth . . . . .	0.4	1.7	1.5	3.6
A. Tongue . . . . .	3.0	0.6	1.5	1.5
Buccal cavity . . . . .	8.1	0.6	4.4	1.7
Oral pharynx . . . . .	2.1	1.1	1.0	2.1
Oesophagus . . . . .	12.9	2.4	5.5	4.5
Stomach . . . . .	30.0	12.4	22.1	24.8
	56.1	17.1	34.5	34.6
B. Small and large bowel . . . . .	7.6	14.9	3.6	14.5
Rectum . . . . .	10.4	7.8	3.5	13.1
Liver, biliary tract . . . . .	6.9	2.0	11.4	2.2
Pancreas and other . . . . .	3.3	4.9	2.1	7.8
	28.2	29.6	20.6	37.6
C. Lip . . . . .	0.0	0.3	0.8	2.0
Salivary glands . . . . .	0.4	1.2	0.7	1.1
Nasopharynx . . . . .	0.0	0.2	0.0	0.5
	0.4	1.7	1.5	3.6

\* Annual Incidence per 100,000 population, standardised to Standard World Population. Durban Indians, 1964-66; England, 4 regions, 1960-62.

The term "Upper Alimentary Tract" as used here may be defined as including cancers of the tongue, buccal cavity, oral pharynx, oesophagus and stomach. The "Lower Alimentary Tract" may be defined as including cancers of the small bowel, colon, rectum, liver, biliary system and pancreas. The "Rest of Mouth" may be defined as including cancers of the lip, salivary glands and nasopharynx.

In the sites grouped under "Upper Alimentary Tract", English and Indian males have roughly the same incidence at all specific sites but when comparing Indian and English females a great difference is observed, the Indian female having higher rates at all sites. The Indian female develops tongue cancer five times as often, buccal cancer thirteen times as often, oesophageal cancer six times as often, and stomach cancer more than twice as often as the English female.

There is little difference between the sexes and the races in the sites grouped under the title "Rest of Mouth", English males having the highest rate, due mainly to lip cancer. In the sites grouped under "Lower Alimentary Tract", the English have higher rates for colonic and rectal carcinomas and lower rates for liver cancers than Indians do.

The undue frequency of cancer of the upper alimentary tract in Indian females has led us to study the habit of betel-chewing in Durban Indians.

A hospital survey indicated that the habit of betel-chewing was much more prevalent among Indian females than males. A more comprehensive survey of the habit among the general Indian population was therefore undertaken with the assistance of the Institute of Social Research. Correct sociological sampling techniques were used to define a representative distribution of households throughout Durban which were studied. A considerable amount of data was acquired, the findings of which are given below.

#### *The Betel-Chewing Habit Among Durban Indians*

*Method of survey.*—500 households were studied, which contained 659 families, or 3678 people. Although the representative distribution of households was maintained throughout, there was an adjustment in relation to Moslem households, in an effort to increase the numbers of Moslems interviewed above the statistical figure of 15%, in order to produce a numerically larger sample of Moslems. Therefore of the 500 households, 377 were Hindu (2802 people with an average of 5.57 members per family) and 123 were Moslem (876 people, with an average of 5.62 members per family). The findings of the Survey follow.

#### *General Incidence of Chewing in the Indian Population*

##### *(a) Age and sex*

More female Indians chewed betel than male Indians and this difference was significant. Of 1842 females of all ages, 30.7% were chewers, while of 1836 males, 5.5% were chewers. The percentage of chewers increased with age in both male and female groups. Thus 10.3% of males and 71.9% of females, in the age-group 60 years or more, chewed betel.

Table A of the Appendix shows that the percentage of male and female chewers in each age-group increases with age, and also that there are far more female chewers than male chewers at each age level.

##### *(b) Schooling and ability to speak English*

Male Indians were better schooled and more fluent in English than female Indians, and the younger age-groups were better schooled and more fluent in English than the older age-groups. This is shown in Table B of the Appendix. If schooling attainments and ability to speak English are regarded as indices of

westernisation, then Indian males are more westernised than Indian females. These differences were significant.

Attendance at school and fluency in English was associated with less chewing, and the converse was also true. Comparisons of schooling and English fluency were made on those who were 20 or more years old (Appendix Table A). In females, after age-adjustment to exclude the influence of age *per se*, schooling and English fluency produced a significant difference in that there were fewer chewers in those who had higher schooling attainment and were more fluent in English. In males no significant difference was obtained for schooling and English fluency once age had been adjusted.

The tendency towards greater westernisation in Indian males may be one of the main factors why betel-chewing is less common in males than females in Durban. It is possible that betel-chewing is a habit which is dying slowly in a community that is separated from its Asian origin, and becoming westernised, and that the process of westernisation in the Indian male sex has been accelerated by entrance into the sphere of western economic activity. Very few Indian females are economically active.

(c) *Moslem and Hindu comparisons*

Comparisons between Moslems and Hindus showed no differences as to age, schooling, or fluency in English, in either sex. Slightly more Moslems were found to be betel-chewers but there was no significance except in the case of males under 20 years old. As comparisons between chewers were made on adults age 20 years or more, it was possible to group Moslems and Hindus together for further analyses.

*Betel-Chewers: Factors Relating to the Habit in Chewers Aged 20 Years or More*

There were 77 male betel-chewers aged 20 years or more (54 Hindu and 23 Moslem males), and 479 female betel-chewers aged 20 years or more (363 Hindu and 116 Moslem females). There was no significant difference between the age distributions of Hindu and Moslem male chewers over 20 years old, nor between the age distribution of Hindu and Moslem female chewers over 20 years old. There was also no significant difference between the age distributions of all male chewers when compared with all female chewers. Therefore no age adjustments were required when testing for differences within the sexes, or between the sexes, in the over 20 years old groups.

*Age first started*

The age at which chewing of betel was adopted in male and female Moslems and Hindus is given in Table III(a).

Although the mean age at which chewing started was between 20 and 24 years in all four groups, more Moslem male and female chewers began the habit under the age of 20 years than did Hindu males and females. Female chewers started earlier than male chewers in each religious group. These differences are not significant. It can be seen from Table III(b) that about two fifths of Indian chewers commence before the age of 20 years, and a negligible number commence after 40 years.

TABLE III.—*Age at which Betel-Chewing Began—Chewers Aged 20+ Years*

Years	Males		Females	
	Hindu	Moslem	Hindu	Moslem
	%	%	%	%
0-9 . . .	7.4	—	2.5	5.2
10-19 . . .	26.0	43.5	32.5	48.3
20-29 . . .	33.3	47.9	46.5	31.9
30-39 . . .	25.9	4.3	11.9	11.2
40-49 . . .	3.7	—	4.1	2.6
50-59 . . .	3.7	4.3	1.7	0.9
60+ . . .	—	—	0.8	—
All ages—total .	54	23	363	116
Mean age (years)	23.9	21.7	23.8	20.2

  

Years	All Indian	All Indian	All Indians
	males	females	
	%	%	
0-19 . . .	36.4	39.4	39.0
20-39 . . .	57.1	54.7	55.1
40+ . . .	6.5	5.9	5.9
Mean age (years)	23.3	22.95	—

*Frequency of betel-chewing*

The number of times betel was chewed varied, some taking it very occasionally, and others four or more times a day. This distribution has been simplified into those who chew less than once a week (occasional chewers), those who chew between 1 and 6 times a week (light chewers), those who chew between 1-3 times a day (moderate chewers) and those who chew betel 4 or more times a day (heavy chewers).

When Hindu and Moslem males and females were analysed separately there were no significant differences within the sex divisions as to chewing. When these four groups were analysed by age there were no significant differences as to frequency of chewing between older and younger members, and no tendency for older chewers to chew oftener than younger chewers. When all male chewers and all female chewers are compared there is a significant difference as to the frequency of chewing betel. Table IV shows that the difference lies in the fact that more females are heavy chewers and more males are light or occasional chewers.

TABLE IV.—*Frequency of Chewing—Chewers Aged 20+ Years*

	Indian males		Indian females	
	No.	%	No.	%
	Occasional . . .	20	26.0	59
Light . . .	21	27.3	75	15.7
Moderate . . .	30	39.0	221	46.1
Heavy . . .	6	7.8	124	25.9
All chewers . . .	77		479	
Chi-Square: . . .	$X^2: 24.06; P < .01$ Significant			

*Duration of the betel-chewing habit*

The duration of the habit depends on the age of the chewers, but as the various groups of chewers aged 20 years or more showed no significant differences in age distributions, and were therefore matched groups, comparisons of the duration of the habit can be undertaken. There were no differences between Hindu and Moslem men or women. They are therefore grouped together and a comparison is made between all Indian males and all Indian females in Table V. This table indicates that, among chewers, there are no significant sex differences in the duration of habit.

TABLE V.—*Duration of Betel-Chewing Habit—Chewers Aged 20+ Years*

Years of chewing	Indian males		Indian females	
	No.	%	No.	%
Less than 10 years . . . . .	28	36.3	185	38.6
10–19 years . . . . .	18	23.4	126	26.3
20–29 years . . . . .	15	19.5	83	17.3
30–39 years . . . . .	12	15.6	45	9.4
40+ years . . . . .	4	5.2	40	8.4
All chewers . . . . .	77		479	
Mean duration of chewing .	17.6 years		17.09 years	
Chi-square . . . . .	$X^2: 3.77; 0.50 > P > 0.30$ Not significant			

*Total consumption of betel quids*

The total or life-time consumption of betel-quids is the product of the years of chewing and the number of quids chewed per day. Values were calculated which varied from less than one to over 100. Hindus and Moslems were grouped together, as neither the totals nor separate analyses in decennial age groups indicated that there were significant differences between Moslems and Hindus. The total consumption of betel-quids by Indian males and females is shown in Table VI. The differences between Indian male and female chewers were significant, there being fewer male chewers in the higher consumption scores and fewer females in the lower consumption scores. As the duration of chewing was not different between the sexes, this difference was due mainly to the greater daily frequency of chewing in the female group.

TABLE VI.—*Total Consumption of Betel-Quids: Chewers Aged 20+ Years*

Lifetime consumption	Indian males		Indian females	
	No.	%	No.	%
<1 . . . . .	20	26.0	50	10.4
1–9 . . . . .	25	32.4	136	28.4
10–19 . . . . .	7	9.1	48	10.0
20–49 . . . . .	12	15.6	99	20.7
50–99 . . . . .	6	7.8	64	13.4
100+ . . . . .	7	9.1	82	17.1
No. of chewers . . . . .	77		479	
Chi-square . . . . .	$X^2: 18.30; P < 0.01$ Significant			

*Preparations in use*

The most usual way to prepare the betel-quid is to wrap various ingredients, most important of which is the nut, into a fresh betel-leaf and then to place it in the mouth and chew it. The nut is often chewed alone, and red, white or black nuts were stated to be preferred by various chewers. By definition all betel-chewers chewed either the leaf or the nut or both. Table VII indicates this.

There were no significant differences between males and females, or between Moslems and Hindus as to the types of preparations in use, and there were only slight differences in preferences for ingredients. These will be mentioned at relevant points.

TABLE VII.—*The Use of Betel-leaf and Areca Nut by Chewers Aged 20+ Years*

	Males			Females		
	Moslem %	Hindu %	Both %	Moslem %	Hindu %	Both %
Leaf, but not nut	—	7.4	5.2	5.2	2.2	2.9
Nut alone . . .	17.4	35.2	29.9	26.7	29.5	28.8
Leaf and nut . . .	82.6	57.4	64.9	68.1	68.3	68.3
Number of chewers	23	54	77	116	363	479

Female chewers differ little in their leaf and nut preferences; male Moslems chew the nut alone less frequently than other groups. The differences were not significant. It is interesting to observe that almost 30% of males and females prefer to chew the nut only. Age breakdowns indicate that younger people prefer the nut only.

Innocuous ingredients which are sometimes added for the purpose of flavouring the quid include spices, seeds, flavourings and nuts, including cocoanut.

Three other ingredients (lime, tobacco, and catechu) are also added to the basic leaf/nut choice, and these may not be innocuous:

*Lime* is a white creamy substance, which is strongly alkaline, and a small smear of this is added to the nut or the leaf package. Lime is added by 63.4% of females and 64.9% of males, Moslems and Hindus differing little.

*Tobacco* is added as a small quantity of coarse shreds. Although frequently added in India, in Durban only 7.8% of male chewers and 2.8% of female chewers add tobacco. Although the number of tobacco-users was small, it appeared to be used more often by Hindu males and Moslem females.

*Catechu* is a coarsely powdered plant gum, imported from India. It is added by 32.5% of male chewers and in 14.2% of female chewers, being used much oftener by Moslems and Hindus.

Both tobacco and catechu were more frequently used by the older chewers than the younger chewers, and the habit of adding these ingredients may be dying out in Durban. A full list of the various combinations used by betel-chewers is given in the Appendix Table C and the ingredients commonly used are dealt with in the discussion.

Evidence suggests that the betel-chewing habit is addictive, in the same way that tobacco-smoking is. Abstinence, for whatever reason, may cause anxiety, and in some people withdrawal symptoms similar to those seen at times with tobacco addicts.

*Reasons for chewing betel*

Chewers over 20 years old gave their reasons for chewing the betel package. These were not very well formulated by the chewers and some replies (e.g. "to pass the time", "when I have nothing else to do") were difficult to classify. Reasons fell into 4 main groups: *Social* ("I chew at weddings", "I take it when offered"), *Habit* ("I learnt to chew from my parents", "If I don't I feel odd", "I cannot stay without it"), *Health* ("It helps my digestion", "if I don't I feel giddy", "it helps me when I am pregnant not to feel bilious") and *Pleasure* ("I like the taste", "I do it for fun"). Many chewers gave two or more reasons. Health reasons were given by 43% of women and 31% of men, Social reasons by 18% of women and 27% of men, Habit was given as the reason by 40% of women and 22% of men, and Pleasure was given by 26% of women and 35% of men. Every chewer proffered some sort of reason for chewing, and it is interesting to note that a larger number of female chewers considered it to be good for health than considered it to be pleasurable.

Twenty per cent of chewers (16 men and 105 women) had abandoned the habit or cut down on it. Economy and inaccessibility were given as reasons by 16% of these, reasons of health, including adverse physical and psychiatric effects were given by 60%, and dislike of the habit by 11%. Thus health reasons were also frequently used to explain cessation or diminution of the habit.

*Effects on chewers, pleasant and unpleasant*

In an attempt to ascertain whether the betel habit had any pleasant effect on mood, questions as to soothing and stimulating effects were asked: 39% of men and 32% of women said it had no effect; 40% of men and 30% of women said it had a soothing, calming effect; 9% of men and 12% of women said it had a stimulating effect; 12% of men and 25% of women said it had both a soothing and stimulating effect. Thus the effects, if felt, were tranquillising on the whole.

Many chewers reported that there were unpleasant effects relating to the habit. Complaints were given in detail by the chewers, and there were often several complaints by one chewer.

Staining of mouth or teeth, the commonest complaint, is caused by juices of the areca nut; the sialogogic effect of the betel package is very marked, but the authors are not certain whether the nut, leaf or lime is responsible. A diaphoretic effect and a feeling of being giddy or drugged noted by some chewers suggests that elements of the betel package have some systemic effect after absorption. Although not many chewers complained of discomfort felt in the mouth, betel-chewing has been implicated in the causation of submucous fibrosis of the buccal cavity and elements of the quid may have a direct local effect on the buccal mucosa, either chemical or traumatic (Shear *et al.*, 1966; Pindborg, 1965).

## DISCUSSION

It has been established that Indian females in Natal have higher cancer incidence rates for the mouth, pharynx, oesophagus and stomach than men, and that these rates are higher than those for English people. It has also been established that a far greater percentage of Natal Indian women chew betel than men and that among chewers, women chew more heavily than men. These differences are significant.

An association between poor oral hygiene, oral submucous fibrosis, leukoplakia



and oropharyngeal cancer has been noted by workers in Asia (Paymaster, 1956 and 1962; Pindborg, 1965; Pindborg *et al.*, 1967; Wahi *et al.*, 1965). Oral submucous fibrosis, first described by Joshi in 1953, was considered to be caused by the betel chewing habit by some observers (Shear *et al.*, 1966; Paymaster, 1962; Pindborg, 1965; Pindborg *et al.*, 1967) but not by others (Tennekoon and Bartlett, 1969; Balendra, 1949; Khanolkar, 1944). All workers agree that oropharyngeal cancers are common in countries where betel-chewing is a habit. This habit has been well described by Muir and Kirk (1960) and others (Orr, 1933; Davidson, 1923; Hirayama, 1966). Most workers have noted that tobacco is the important ingredient in the betel-chewing habit, and many have observed that dietary deficiencies, in particular Vitamin A deficiencies, are also present in the betel-chewing population (Paymaster, 1956; Wahi *et al.*, 1965; Orr, 1933). Most workers suspect tobacco as being causative both of submucous fibrosis and oropharyngeal cancer. Hirayama (1966) and Orr (1933) regard the lime component as being important in liberating carcinogenic alkaloids from tobacco. Hitherto almost all workers have disregarded the leaf and the areca nut as carcinogenic hazards.

As there is an association in Natal Indians between betel-chewing and upper alimentary tract cancer, but very little usage of tobacco in the quid, it becomes apparent that the leaf, the nut and the lime components must be reconsidered as possible carcinogens.

It is unlikely that poor oral hygiene, deficient diets, and curry or chilli consumption, which have been suggested to be cancer-promoting by several workers (Paymaster, 1956; Pindborg *et al.*, 1967; Wahi *et al.*, 1965; Balendra, 1949) are relevant, because these elements are equally present between males and females in Natal, and yet the incidence of upper alimentary tract cancer is not.

Muir and Kirk (1960), Orr (1933) and Davidson (1923) have given careful descriptions of the leaf, the nut and lime, as follows:

(a) *The leaf*: Mature leaves of the betel vine (piper betle) contains volatile oils (eugenol, an unsaturated aromatic phenol, and terpenes) potassium nitrate, and small quantities of sugar, starch and tannin. It has a carminative effect, sweetens the breath, and is a gentle stimulant. Natal chewers use betel leaves grown on special farms to the north of Durban. (Indian name: paan.)

(b) *The nut*: The dried areca nut contains many alkaloids (arecoline, arecaine, guvacaine, arecolidine, guvacoline, iso-guvacine and choline) chief among which is arecoline, which has a muscarinic (cholinergic) effect (Pfeiffer *et al.*, 1967) which is glandular secreting, gut-stimulating, vasodepressant, and has a direct cortical arousal effect. Muir and Kirk (1960) state that it is sialogogic and diaphoretic, and that very large amounts depress the central nervous system. It has been used in Malaya as a vermifuge and as a cure for diarrhoea. Pfeiffer *et al.* (1967) state that it may be used to counteract schizophrenia, and inhibits conditioned responses in laboratory animals. It is likely that the soothing, stimulating, and diaphoretic effects reported by Natal chewers are due to the nut alkaloids, and the frequently made claims by chewers that it is good for digestion may be an expression of the carminative effect. Arecoline is probably absorbed in quite large amounts by regular chewers as 0.1% of the dried nut is arecoline. In addition the nut also contains tannin, fatty acid glycerides and sugar. Natal users import the nut, which has three main varieties, the red, the white and the black. These are probably different species of the areca nut, the black being the driest and hardest. (Indian name: supari.)

(c) *Lime*: In India two types of lime may be used. The commoner type is prepared from limestone, but near the coast, lime is made from shells and is finer in consistency. Orr (1933) considered lime to be an injurious ingredient in betel-chewing, and shell-lime more so than stone-lime. He stated that lime catalysed the liberation of carcinogenic alkaloids from tobacco of the quid. Hirayama (1966) found that oral cancer occurred where tobacco and lime were chewed together, but not when tobacco was chewed alone, and felt that very strong suspicion should be attached to lime either as a carcinogen or as carcinogen-liberator from tobacco. Muir and Kirk (1960) felt that lime, in the small quantities used, served merely to neutralise the acid taste of the nut. Tennekoon and Bartlett (1969) felt that it might have an irritant action, but was used in such small quantities, that dilution by saliva rendered it innocuous. In Natal, the action of lime on tobacco is not in question, and the quantity added to the quid is very small. It is therefore difficult to say whether the lime is a suspect ingredient, either by its own action, or as a catalyst for releasing possibly carcinogenic alkaloids from the areca nut. Natal chewers obtain the lime from limestone, from a local supply source. (Indian name: chunam.)

(d) *Catechu*: This substance is extracted from the leaves of the shrub *uncaria gambir*. The leaves are bound, steamed, and steeped in boiling water. On cooling, catechin crystallises out, leaving the more soluble catechu-tannic acid in solution. Bran is added to catechin, and then made into little cakes. In Malaya, gums from acacia species are used instead. Natal users import the catechu cakes. (Indian name: gettah gambir, or katta kambu.)

(e) *Tobacco*: In Natal a dried leaf grown in the Transvaal is used. It is coarsely shredded and a few flakes are added by the small proportion of chewers who use it. In India, various types of tobacco are used, and various methods of curing have been described which differ from the local practice.

The authors feel that the areca nut, and possibly the leaf and lime, being so commonly used in Natal, are the most suspect ingredients of the betel-chewing habit in Natal. We do not consider catechu or tobacco to be hazards, as so few people add these and because their use is losing popularity among younger chewers.

Very little experimental work has been carried out on areca nut, betel-leaf or lime, as potential carcinogens. Muir and Kirk (1960) and Tennekoon and Bartlett (1969) have summarised the evidence, most of which has been based on betel ingredients plus tobacco.

Shear *et al.* (1966) observed that betel-chewing was more prevalent among patients with submucous fibrosis than among the general South African Indian population. They also observed that oral submucous fibrosis was very rare in Indian males; the condition was not observed at all in non-Indian South Africans.

#### SUMMARY

The general features of the South African Indian community are outlined. A recent survey of cancer morbidity incidence in Durban Indians indicates that cancers of the mouth, throat, oesophagus and stomach are commoner in Indian females than males, and that the combined incidence of these neoplasms is high. Realisation that the habit of betel-chewing in Durban Indians was also predominantly a female habit promoted an intensive study of the habit among Durban Indians. Analysis of this study shows that 8.3% of Indian males and 54.2% of

Indian females aged 20 years or more are addicted to betel-chewing, and this difference is significant. Schooling attainments and ability to speak English, when regarded as indices of westernisation, showed that younger people of both sexes were more westernised, and that males at all ages were more westernised than females. Differences between Moslems and Hindus (age-adjusted) were not significant. The tendency towards greater westernisation in Indian males may be the main reason for less betel-chewing in the male group, and it is likely that the habit in both sexes may be dying out.

Among chewers, comparisons between males and females (age-matched groups) showed that the betel-quid is chewed significantly more frequently by females, and that the lifetime consumption of the female group was significantly higher than that of the males. Duration of the habit, and age of adoption of the habit did not differ between the sexes. Moslem and Hindu differences were not significant, but there was a tendency for Moslems to adopt the habit at an earlier age.

The commonest ingredients used in the betel-quid are the leaf, the areca nut and the slaked lime. Tobacco is used very rarely. Reasons for adoption of the habit are most commonly given as being for social or health reasons. Unpleasant effects include a diaphoretic effect. Pleasant effects seem to be predominantly tranquillising.

This study differs from previous studies made by workers in India and the East in that tobacco is seldom added as an ingredient in Natal, and in that sex-differences in cancer of the upper alimentary tract and in the prevalence of the betel-chewing habit are marked, both being commoner in females. This observation must direct our attention to a possible association between betel-chewing and upper alimentary tract cancer, and to elements other than tobacco in the betel-quid which may be cancer promoting. The leaf, nut, and the lime component should in the first instance be investigated.

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## APPENDIX

TABLE A.—*Betel-Chewing in Durban Indians: Age, Schooling, and Ability to Speak English Allied to Sex*

Age	Males			Females		
	No. of people	No. of chewers	Chewers %	No. of people	No. of chewers	Chewers %
0-9 . . .	406	10	2.5	425	19	4.5
10-19 . . .	497	14	2.8	534	67	12.5
20-29 . . .	401	16	4.0	359	125	34.8
30-39 . . .	194	21	10.8	219	139	63.5
40-49 . . .	154	15	9.7	154	107	69.5
50-59 . . .	106	17	16.0	94	67	71.3
60+ . . .	78	8	10.3	57	41	71.9
Total . . .	1836	101	5.5	1842	565	30.7
Under 20 . . .	903	24	2.7	959	86	9.0
20 and over . . .	933	77	8.3	883	479	54.2
<i>Schooling: 20 years and over</i>						
Nil . . .	67	10	14.9	328	231	70.4
Up to Std. 2 . . .	75	9	12.0	114	80	70.2
Stds. 3-6 . . .	531	43	8.1	352	146	41.5
Std. 7 and over . . .	260	15	5.8	89	22	24.7
Total . . .	933	77	8.3	883	479	54.2
<i>English spoken: 20 years and over</i>						
Nil } . . .	78	12	15.3	70	52	74.3
Little }						
Fluent . . .	855	65	7.6	573	246	42.9
Total . . .	933	77	8.3	883	479	54.2

TABLE B.—*Education and Ability to Speak English Allied to Age and Sex: Indians Aged 20+ Years, Expressed as Percentages*

MALES	20-29	30-39	40-49	50-59	60+	Total 20-60+
<i>Education</i>	*%	%	%	%	%	%
Nil . . .	1	3	6	17	41	7
Up to Std. 2 . . .	2	8	12	22	15	8
Stds. 3-6 . . .	58	59	63	53	39	57
Std. 7 or more . . .	39	30	19	8	5	28
	100	100	100	100	100	100
<i>English spoken</i>						
Nil or little . . .	2	5	10	17	36	8
Fluent . . .	89	95	90	83	64	92
	100	100	100	100	100	100
FEMALES						
<i>Education</i>						
Nil . . .	12	35	52	83	91	37
Up to Std. 2 . . .	10	17	21	5	5	13
Std. 3-6 . . .	59	40	25	12	4	40
Std. 7 or more . . .	19	8	2	—	—	10
	100	100	100	100	100	100
<i>English spoken</i>						
Nil or little . . .	10	35	50	79	82	35
Fluent . . .	90	65	50	21	18	65
	100	100	100	100	100	100

\* Percentages correct to nearest unit.

TABLE C.—*Ingredients Used in Betel-Quid (Male and Female Chewers Aged 20+ Years)*

	All male chewers		All female chewers	
	No.	%	No.	%
Nut only . . . . .	23	29.9	131	27.3
Nut + lime . . . . .	—	—	7	1.5
Leaf only . . . . .	1	1.3	7	1.5
Leaf + catechu . . . . .	1	1.3	—	—
Leaf + lime . . . . .	2	2.6	6	1.3
Leaf + nut . . . . .	3	3.9	30	6.3
Leaf, nut, lime . . . . .	23	29.9	228	47.6
Leaf, nut, catechu . . . . .	3	3.9	7	1.5
Leaf, nut, lime, catechu . . . . .	15	19.5	49	10.2
Leaf, nut, lime, tobacco . . . . .	2	2.6	3	0.6
Leaf, nut catechu, tobacco . . . . .	—	—	1	0.2
Leaf, nut, lime, catechu, tobacco . . . . .	4	5.2	10	2.0
Total . . . . .	77	100.1	479	100.0
	No.	% of 77	No.	% of 479
Leaf, (ever) . . . . .	54	70.1	341	71.2
Nut, (ever) . . . . .	73	94.8	465	97.1
Lime (ever) . . . . .	46	59.7	304	63.5
Catechu, (ever) . . . . .	23	29.9	68	14.2
Tobacco, (ever) . . . . .	6	7.8	14	2.9
Seeds, spices, nuts, honey, (ever) . . . . .	10	13.0	54	11.3