Increased waist size and weight in relation to consumption of *Areca catechu* (betel-nut); a risk factor for increased glycaemia in Asians in East London

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Type 2 diabetes is commoner in Asians than Caucasians. Many nitrosamines are diabetogenic, causing both type 2 and type 1 diabetes. Of CD1 mice fed with betel-nut or associated nitrosamines 8·5 % develop glucose intolerance with marked obesity. Glycaemia and anthropometric risk markers for type 2 diabetes were therefore examined in relation to betel usage in 993 'healthy' Bangladeshis by one bilingual research-worker (N.M.). Of these, 12 % had known diabetes. A further 145 of 187 subjects 'at-risk' of diabetes (spot glucose $>6·5$ mmol/l <2 h after food, or $>4·5$ mmol/l >2 h after food) had a second blood glucose sample taken; sixty-one were confirmed as 'at-risk', and had an oral glucose tolerance test; nine new diabetics were identified. Multiple regression analysis showed that spot blood glucose values decreased with time after eating ($P = 0·0005$) and increased independently with waist size ($P = 0·0005$) and age ($P = 0·0005$) without relationships to other aspects of the diet, season or smoking. Waist size was strongly related to betel usage independent of other factors such as age. Betel use interacted with sex, relating to increasing glycaemia only in females. Since waist and age were the major markers of increasing glycaemia we suggest that betel chewing, a habit common to about 10 % of the world population (more than 200 million people) may contribute to the risk of developing type 2 diabetes mellitus.

Central obesity: Betel-nut: Diabetes: Asians

British Asians have a 4–5-fold greater prevalence of type 2 (non-insulin-dependent) diabetes mellitus and develop the disease earlier than British Caucasians (Mather & Keen, 1985; World Health Organization, 1985; McKeigue *et al*. 1992). The causes of the greater numbers of foregut cancers, tumours of the oro- and nasopharynx, oesophagus and tongue seen in Asians compared with Caucasians include the chewing of betel-nut, fruit of the *Areca catechu* palm imported by expatriate Asian communities and eaten by 10 % of the world population (Prokopczk *et al*. 1987; Johnson, 1991; Encyclopaedia Britannica, 1996;). Active carcinogens include specific arecal nitrosamines formed during curing and drying of the nut and *in vivo*, after acidification of arecal alkaloids by gastric juices (International Agency for Research on Cancer, 1992; Nishikawa *et al*. 1992). Many nitroso-compounds, including those previously found in smoked cured Icelandic mutton (Helgason *et al*. 1984) and toxins such as the rat poison Vacor and streptozotocin, are diabetogenic both experimentally and in man (Karam *et al*. 1980; Okamoto *et al*. 1988). *N*-nitroso compounds are commonly thought of as inducing type 1 diabetes. However, whilst Vacor produced type 1 diabetes in thirty human survivors of toxic doses, only 20 % of 250 survivors of smaller doses developed type 1 diabetes, 50 % developing type 2 diabetes (Karam *et al*. 1980). Low-dose streptozotocin early in life can also induce a non-insulin-requiring form of diabetes (Portha *et al*. 1989). We have shown that diabetes develops in 8·5 % of adult mice fed with betel-nut. The diabetes is non-insulin-dependent, associated with marked intra-abdominal fat deposition and enlarged and vacuolated islets as seen in human type 2 diabetes (Boucher *et al*. 1991, 1994). We suggested that betel-nut consumption might contribute to the development of diabetes in man either directly or by an effect on body build. The present study, a cross-sectional survey of adult British Asians of Bangladeshi origin, was

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Abbreviation: OGTT, oral glucose tolerance test.

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carried out to determine whether there was a relationship between glycaemia or central obesity (as a marker of risk for type 2 diabetes; McKeigue *et al*. 1992) and betel-nut consumption. Since vitamin D is required for normal insulin secretion and release, vitamin D deficiency is still seen in UK Asians and vitamin D status affects insulin response to glucose both experimentally and in man (Bansal *et al*. 1975; Gedik & Akalan, 1986; Boucher *et al*. 1995), the consumption of foods on which this population depends for vitamin D was also investigated as a possible confounder.

Methods

The study was approved by the District Ethical Committee and details were agreed with participating family practitioners. British Asian adults of Bangladeshi extraction (*n* 1000), resident in Tower Hamlets, East London, were contacted randomly as 'well' attenders at their family practitioners' surgeries. Of these, 993 subjects giving informed consent were interviewed by a single worker (N.M.). A questionnaire was administered on dietary habits, including the use of betel-nut (plain or wrapped in piper betel vine leaves as pan-quids), age of first usage and whether either parent had chewed betel (see Appendix). A personal and parental history of diabetes was taken and measurements made of height (with a single fixed scale), weight (with a single weighing scale) and waist and hip size using standard techniques (McKeigue *et al*. 1992). Blood glucose concentration was measured on a spot fingertip capillary blood sample using BM 1-44 stix and a Reflolux meter (Boehringer Mannheim UK, Lewes, Sussex, UK; CV $<10\,\%$), validated using glucose-oxidase specific spectrometry (Beckman Technical Institute, Palo Alto, CA, USA; CV $<3\,\%$). A total of 116 subjects (12 %) reported known diabetes. Subjects (*n* 187) not previously known to have diabetes, and defined as 'at-risk' of diabetes by capillary blood glucose concentrations of $>6{\cdot}5$ mmol/l less than 2 h after food, or $>4{\cdot}5$ mmol/l more than 2 h after food (screening levels found to be effective for detection of diabetes in other UK Asians; Simmonds *et al*. 1991), were invited to reattend for repeat spot sampling. Sixty-one of the 145 reattenders were still 'at-risk' and forty-four agreed to undergo a standard oral glucose tolerance test (OGTT), which revealed nine of these subjects to have diabetes (World Health Organization, 1985). One test was abandoned because of vomiting. Forty-two of the forty-four 'at-risk' subjects undergoing an OGTT were vitamin D deficient (serum 25-hydroxycholecalciferol <11 ng/l). Twenty-two of these subjects accepted treatment with vitamin D, and were re-studied as reported elsewhere (Boucher *et al*. 1995). Statistical analyses included examination of means and their differences by *t* tests, and the use of multiple regression (to $P<0{\cdot}05$). The skewed distribution of spot blood glucose concentration was corrected by inverse transformation (100–100/glucose, mmol/l) for analysis, reducing the dependency of the findings on values at the extremes of observation (see Fig. 2). This method achieved normalization of the distribution of the data more effectively than log transformation and resulted in regressions in the same direction as those produced by analyses made with the untransformed data. The computer program STATA, version 4.0, (Stata Corporation, College Station, TX, USA) was used for the analyses on an IBM-compatible computer.

Questionnaire evidence of betel-nut usage and of dietary vitamin D intake was validated as follows: (1) by measurement of urinary arecal nitrosamines (carried out by Dr J. Pollock, Pollock & Pool plc, Reading, Berks., UK) in twenty 'pan-chewers' and twenty 'non-chewers' as identified from responses to the questionnaire; (2) by examination of serum 25-hydroxycholecalciferol concentration (measured by radioimmunoassay; Incstar, Seattle, MN, USA) at OGTT in relation to stated dietary intake of fish and eggs; and (3) by examination of circulating serum fish-oil components at OGTT in relation to vitamin D status and to stated fish consumption on questionnaire as reported elsewhere (Mannan, 1992).

Results

Table 1 shows the overall findings for age, height, weight, waist, hip, BMI, waist:hip ratio and spot blood glucose concentration in the 988 men and women who completed the questionnaire, had screening blood test(s) and underwent anthropometric measurements. Specific arecal nitrosamines were detected in nine of twenty spot urine samples

Table 1. Age, weight, height, waist circumference, hip circumference, body mass index, waist:hip ratio, spot blood glucose concentration and blood glucose concentration corrected to 2 h after food in men and women surveyed in the present study

(Mean values, standard deviations and ranges)

Variable	Men (*n* 466)			Women (*n* 522)		
	Mean	SD	Range	Mean	SD	Range
Age (years)	44·8	14·9	15–83	37·0	12·4	15–70
Weight (kg)	66·0	10·8	35·5–112·0	56·4	10·6	21·5–95·0
Height (m)	1·648	0·061	1·46–1·83	1·514	0·049	1·35–1·67
Waist circumference (cm)	87·0	10·5	61–118	80·0	10·9	51–113
Hip circumference (cm)	91·1	6·7	72–116	91·4	8·3	69–122
BMI (kg/m^2)	24·3	3·6	16·4–35·3	24·6	4·4	10·8–42·9
Waist:hip ratio	0·95	0·07	0·70–1·18	0·87	0·07	0·70–1·10
Spot blood glucose (mmol/l)	6·3	3·2	2·1–27·1	5·7	2·5	2·3–22·8
Blood glucose (corrected to 2 h after food) (mmol/l)	6·4	3·2	2·1–27·1	5·8	2·4	2·3–22·8

from stated pan or betel chewers and in none of twenty samples from stated non-chewers. Both serum 25-hydroxycholecalciferol and serum 4,7,10,13,16,19-decanoic hexaenoic acid of fish origin had earlier been shown to be related to stated fish intake in the subjects undergoing a full OGTT in the present study (Mannan, 1992). Spot blood glucose concentration (corrected to 2 h after food) correlated significantly with 2 h OGTT plasma glucose in the forty-four 'at-risk' subjects (r 0·55, $P = 0·01$). Pan consumption was reported in 75·2 % of subjects at 1–22 quids/d and plain betel was used by a further 2 % of subjects. Fig. 1 shows the prevalence of consumption of areca (betel-nut) and of previously known diabetes in relation to age and sex.

Analyses of waist size and weight *v.* pan consumption showed its usage to be independently associated with increases in waist circumference of 23 mm in men and women and with increases of weight averaging 2·8 kg in both men and women (0·8 kg after correction for increases in waist size) as shown in Tables 2 and 3. There was no seasonal variation in corrected screening blood glucose concentration before or after correction for age, waist, weight, sex and height. Reported pan usage was greater for parents of men than of women (95 % of mothers and 90 % of fathers *v.* 84 % of mothers and 71 % of fathers respectively). These differences could be accounted for by the fact that the men surveyed were 7·8 years older than the women and betel-nut usage increases up to the age of about 55 years (see Fig. 1). There was no independent effect of parental pan usage on the presence of diabetes, on waist or hip size, waist:hip ratio, weight or height.

Multiple regression was also used to examine the association of spot blood glucose concentration with pan usage adjusting for recognized confounding variables. Regression models which allowed for time from last meal, height, weight, waist size, age and sex as well as pan consumption

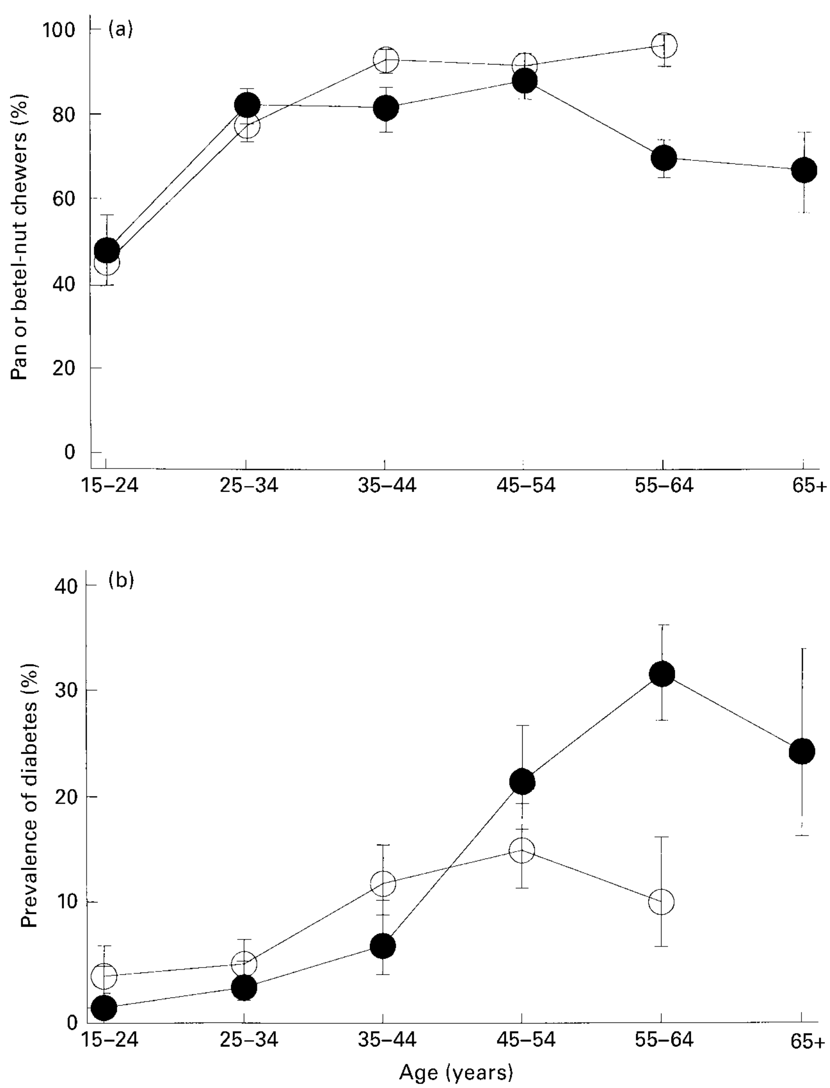

Fig. 1. (a) Prevalence of betel-nut or pan usage and (b) prevalence of previously known diabetes in groups of men (●) and women (○) of different ages. Subjects were of Bangladeshi origin and lived in Tower Hamlets, London. Values are shown with binomial exact 68 % confidence limits.

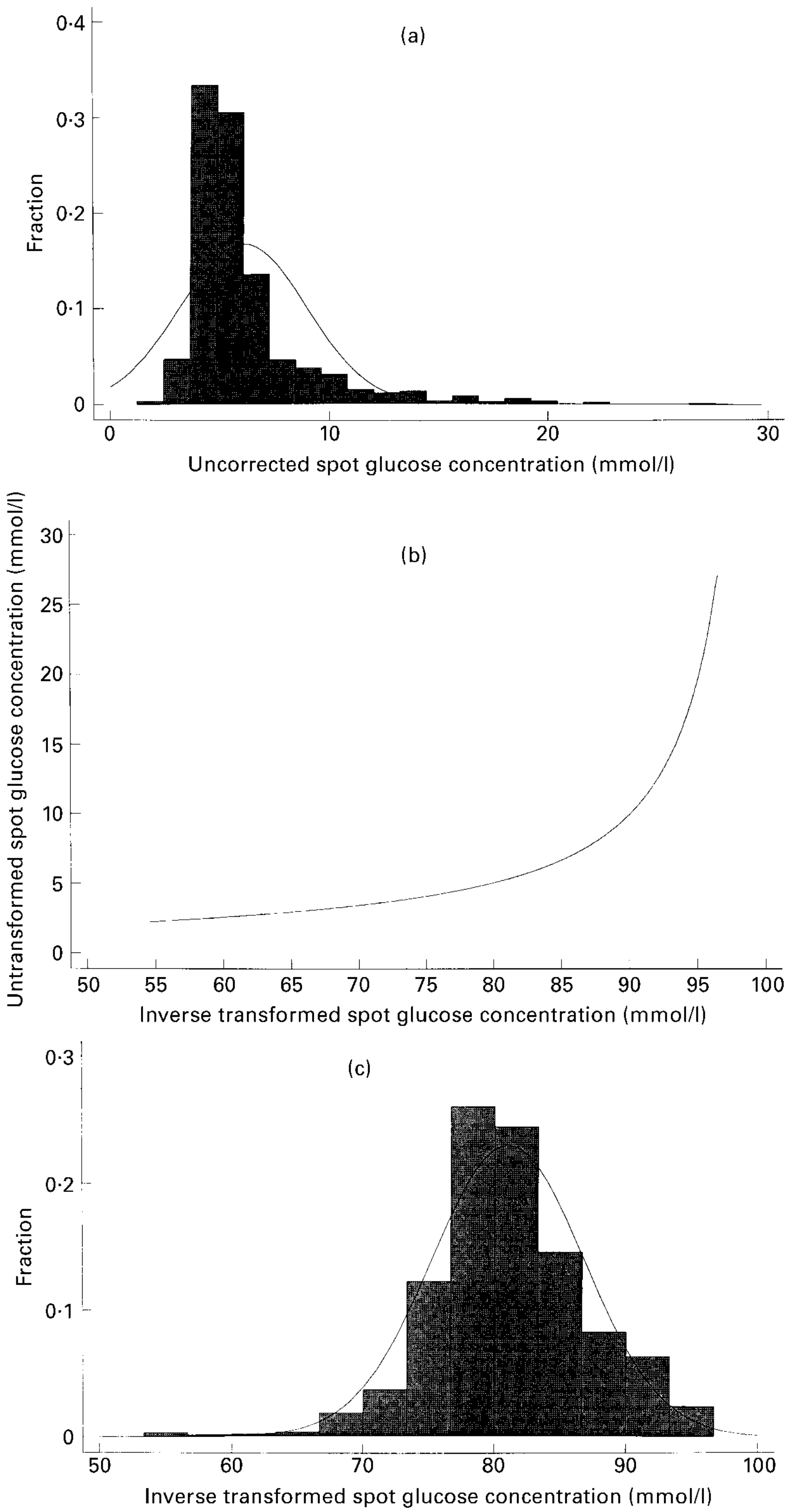

Fig. 2. (a) Skewed distribution of spot blood glucose concentration (mmol/l) in 988 subjects of Bangladeshi origin living in Tower Hamlets, London. (b) Relationship between untransformed spot blood glucose concentration and 'inverse' or transformed spot blood glucose concentration (100–100/blood glucose; mmol/l) in the same subjects. (c) Normalized distribution of the 'inverse' or transformed blood glucose concentration values.

Table 2. Multiple regression analysis of transformed (inverse) spot blood glucose concentrations* *v.* weight, waist circumference, interval after eating, age, sex, pan or betel consumption and sex × pan interaction in 988 subjects of Bangladeshi origin

(Coefficients with their standard errors, *t* and *P* values and 95 % confidence intervals)

	Change in inverse glucose per unit variable				
	Coefficient	SE	*t*	*P*	95 % CI
Weight (per kg)	–0·081	0·029	2·76	0·006	–0·14, –0·023
Waist (per cm)	0·174	0·03	5·59	0·0005	0·11, 0·24
Interval after meal (per h)	–0·38	0·07	–5·26	0·0005	–0·52, –0·24
Age (per year)	0·08	0·15	5·44	0·0005	0·05, 0·11
Sex (female *v.* male)	–1·23	0·73	–1·69	0·091	–2·66, 0·19
Pan (yes *v.* no)	–1·69	0·57	–2·98	0·003	–2·8, –0·58
Sex × pan interaction†	2·11	0·8	2·63	0·009	0·53, 3·67
Constant	70·29	1·5	47·86	0·0005	67·4, 73·15

* Inverse glucose concentration = 100 – 100/blood glucose (mmol/l).
† See p. 268.

(yes or no) or for numbers of pan quids used per day (0–22) were used. Linearity was checked and interactions of sex and other variables were tested. The best fitting model (see Tables 2 and 3) included interval after eating, waist size and age. Spot blood glucose concentrations were independently reduced with time after eating ($P = 0{\cdot}0005$) but increased with age ($P = 0{\cdot}0005$) and waist size ($P = 0{\cdot}0005$). No additional contribution was made by height, hip size, waist:hip ratio, fish and egg intake or smoking in men or women. Spot glucose concentration was found to be somewhat lower with increasing weight, but where waist and weight are highly correlated as in this population, then, for a given waist size, the higher the weight the lower the glucose. These findings were not altered by the exclusion of all subjects with diabetes (i.e. known diabetics plus those diagnosed in the study). Neither sex nor pan consumption had a significant effect on blood glucose on its own. There was, however, a significant interaction between the effects of pan usage and sex, with some reduction in glucose concentrations in male pan chewers but significant increases in glucose concentrations in female pan chewers, analyses having been made after adjustment for all other variables under consideration (see Table 2). Table 3 shows the same findings using untransformed blood glucose values. In order to demonstrate that variation of magnitude of this effect becomes more marked at increasing levels of glycaemia (see Fig. 2b).

Discussion

The number of subjects studied represented 2·7 % of Asians resident in Tower Hamlets as estimated by the 1991 census (Office of Population Censuses and Surveys, 1991). Since 50 % of this community is under 16 years old and our subjects were all older than 16 years, approximately 4·5 % of local adult Asians were surveyed. The 12 % prevalence of known diabetes (which together with the 2 % newly found diabetics gave a minimum prevalence of diabetes of 14 %) was similar to that found in other British Asian communities. The survey sample was therefore likely to be representative of the local Bangladeshi community (Mather & Keen, 1985; World Health Organization, 1985; McKeigue *et al*. 1992). The 2 % prevalence of undiagnosed diabetes was a smaller

Table 3. Multiple regression analysis of untransformed spot blood glucose concentrations (mmol/l) *v.* weight, waist circumference, interval after eating, age, sex, pan or betel consumption and sex × pan interaction in 988 subjects of Bangladeshi origin

(Coefficients with their standard errors, *t* and *P* values and 95 % confidence intervals)

	Change in inverse glucose per unit variable				
	Coefficient	SE	*t*	*P*	95 % CI
Weight (per kg)	–0·47	0·15	–3·24	0·001	–0·076, –0·19
Waist (per cm)	0·087	0·15	5·61	0·0005	0·06, 0·12
Interval after meal (per h)	–0·13	0·04	–3·72	0·0005	–0·2, –0·06
Age (per year)	0·04	0·007	5·46	0·0005	0·03, 0·05
Sex (female *v.* male)	–0·66	0·36	–1·83	0·068	–1·34, –0·05
Pan (yes *v.* no)	–0·71	0·28	–2·51	0·012	–1·26, –0·15
Sex × pan interaction*	0·73	0·39	1·83	0·068	–0·05, 1·51
Constant	0·98	0·73	1·35	0·178	–0·45, 2·42

* See p. 268.

proportion of total diabetes prevalence than that found on screening white populations in the UK (averaging 50 %). It is, however, comparable with earlier findings in Asians (Mather & Keen, 1985; Simmonds *et al*. 1991), who may be more symptomatic, attend their doctors earlier or attract earlier screening as a known high-risk group.

Confidence in the questionnaire data is enhanced by the fact that it was obtained by a Sylheti-speaking member of the local community and by the quantitative assessments made. The negative relationship of ‘spot’ blood glucose measurements to questionnaire-derived interval after eating provides useful confirmation of the validity of these findings, as does the positive relationship of the ‘spot’ blood glucose values with 2 h venous plasma glucose at OGTT.

The prevalence of pan usage increased with age. More women than men chewed pan at all ages and women ate more quids daily than men, which could account for the finding that pan consumption relates to increases in glycaemia in women but not in men. The lesser pan usage reported for parents of the women studied compared with those of the men reflects the fact that the women surveyed were younger than the men, since usage in younger Asians is believed to be falling in the UK (Bedi *et al*. 1995). The reduction in pan usage in men over 55 years was modest but raises the possibility that betel usage, known to be carcinogenic (International Agency for Research on Cancer, 1992; Nishikawa *et al*. 1992), may be associated with the increased death rates seen in this population which are largely from IHD, a well-recognized problem in people with diabetes (Balarajan, 1991). Alternatively older betel-nut users may be more likely than non-users to return to Bangladesh, or the prevalence could be falling with calendar year of birth at all ages, a cohort effect that cannot be studied in a single cross-sectional study. The fall in prevalence of diabetes in men over 64 years and women over 54 years was not significant but is in keeping with the generally accepted view that diabetes is associated with early death in Asians even more markedly than in whites, although again, this could reflect a tendency for older people with diabetes to leave Britain.

Our findings confirm that increased waist size is a better risk marker for hyperglycaemia than hip circumference, height or waist:hip ratio in Bangladeshi Asians. The reduction in glycaemia with increasing weight must be interpreted with caution since, as in any analysis using multiple regression, this relationship is calculated for constant values of the other factors (such as waist, age and time after eating) used in the analyses, and heavier people are likely to be taller for a given waist than lighter people. Height is generally regarded as a protective factor for diabetes although it was not independently related to glycaemia in the present study.

The specific and independent relationships found for pan consumption with anthropometric markers of diabetes risk, and with glycaemia, are of interest since the non-betel-fed F1–F4 descendants of short-term betel-fed CD1 mice that develop glucose intolerance are markedly obese. This is especially obvious intra-abdominally, with enlarged islets showing abnormalities similar in appearance to those found in human type 2 diabetes (Boucher *et al.* 1994). Since experimental betel feeding is associated with obvious damage to sperm heads and to the ova of betel-fed animals on light microscopy, it is clear that arecal agents target the gametes (Dave *et al.* 1992; Muhkerjee *et al*. 1993). These findings suggest that neither cross-sectional nor single generational studies would be capable of detecting any genetic effect of betel use in increasing susceptibility to type 2 diabetes in man, betel-nut having been in widespread use in many communities for over 5000 years. The impact of as yet unknown betel-induced genetic changes will therefore require elucidation for this aspect of the proposed hypothesis of the diabetogenicity of betel-nut consumption to be pursued. The situation is further complicated by the possibility that susceptibility to betel-nut diabetogenicity could itself be genetically determined in man as is the case for the diabetogenic nitroso-compound streptozotocin in the mouse where susceptibility depends on the H2 region of the major histocompatability complex (Kiesel *et al*. 1989; Tanaka *et al*. 1990).

There are several possible confounding factors that require further study. For example the leaves used as wraps for pan quids contain β-carotene (Dr J. Pollock, personal communication) which inhibits nitroso-compound carcinogenicity and diabetogenicity in animals. These leaves also contain hydroxy-chavicol, which, like the betel-nut alkaloid arecaine, is a hypoglycaemic agent (Stitch *et al*. 1991). It is also impossible to allow for any unidentified maternal diabetes, or gestational diabetes, for early death in those with diabetes (and perhaps also of those who chew betel-nut) or for the inability to identify normoglycaemic subjects who will later develop diabetes.

Whilst we have reported effects of vitamin D status on insulin secretion and glycaemia in a subset of our subjects, both in those ‘at-risk’ and ‘not-at-risk’ of diabetes, the absence of independent effects of season or of fish and egg intake on glycaemia (other than in the vitamin D-deficient subgroup already reported; Boucher *et al*. 1995), suggests that vitamin D status was not likely to be contributing to determination of glycaemia (or to be confounding the findings) in the group as a whole. The major confounder is of course likely to be pan usage in parents and earlier progenitors which could have increased susceptibility to diabetes by as yet unidentified genetic mechanisms. Cross-sectional studies should prove more powerful for the investigation of the diabetogenicity of recently introduced dietary nitroso-compounds than for those used over generations in man such as betel-nut.

The direct association between waist size and pan usage is, however, of special interest since we found waist size to be the best predictor of hyperglycaemia after age and sex in the present study, as in previous studies (Sheligar *et al*. 1991). The pan $\times$ sex interaction with an association between betel usage and increased glycaemia in women but with reduced glycaemia in men, whilst associated with greater pan usage in women, could reflect differences in susceptibility to diabetogenic nitroso-compounds between the sexes. We suggest that the use of betel-nut in pan quids adds to the risk of type 2 diabetes through increased central obesity. In addition it is clear that studies on the possible diabetogenicity of nitroso-compounds used in the diet are less likely to reveal any associations where the mechanisms involved may be genetic, and the agent has been in use for generations, than are studies on compounds recently introduced into the diet.

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Appendix

Name
নাম .... Hospital record no.
হাসপাতাল নং: ....

Age
বয়স .... Date of birth
জন্ম তারিখ .... Parity
সন্তানের সংখ্যা ....

Weight (kg)
ওজন .... Height (cm)
উচ্চতা .... Waist (cm)
পেট .... Hips (cm)
কোমর ....

1. Which type of cooking oil do you use?
১· আপনি রান্নায় কোন তৈল ব্যাবহার করেন ?

corn	কর্ন	☐
vegetable	ভেজিটেবিল	☐
sunflower	সানফ্লাওয়ার	☐
mustard	শরিসা	☐
other	অন্য	

2. Do you use ghee in cooking ?
২· আপনি কি রান্নায় ঘি ব্যাবহার করেন ?
yes হ্যাঁ ☐ no না ☐

3. Do you eat eggs ?
৩· আপনি কি ডিম খান ?
yes হ্যাঁ ☐ no না ☐
How many do you eat/week?
সপ্তাহে কয়টা ডিম খান ? ....

4. Are you vegetarian ?
৪· আপনি কি শুধু নিরামিষ খান ?
yes হ্যাঁ ☐ no না ☐

5. Do you eat fish ?
৫· আপনি কি মাছ খান ?
yes হ্যাঁ ☐ no না ☐

Which type of fish do you eat ?
কি কি মাছ খান ?

fabia	পাবদা	☐	hilsa	ইলিশ	☐
roi	রুই	☐	chitol	চিতল	☐
bual	বোয়াল	☐	fangash	পাঙ্গাস	☐
ayr	আইর	☐	basa	বাছা	☐
koi	কৈ	☐	sardine	সার্ডিন	☐
small fish	ছোট মাছ	☐	other	অন্য	☐

How many times /week do you eat fish?
সপ্তাহে কত দিন মাছ খান ? ....

What is your favourite fish?
আপনার প্রিয় মাছ কোন টি ? ....

6. Do you eat meat ?
৬· আপনি কি মাংস খান ?
yes হ্যাঁ ☐ no না ☐

If yes, which type of meat ?
যদি খান, কি রকম মাংস খান ?

mutton
ভেড়ি
yes হ্যাঁ ☐ no না ☐
How many times/week ?
সপ্তাহে কত দিন খান ? ....

chicken with skin
মোরুগ চামড়া সহ
yes হ্যাঁ ☐ no না ☐
How many times/week ?
সপ্তাহে কত দিন খান ? ....

chicken without skin
মোরুগ চামড়া ছাড়া
yes হ্যাঁ ☐ no না ☐
How many times/week ?
সপ্তাহে কত দিন খান ? ....

7. Do you eat pan ?
৭· আপনি কি পান খান ?
yes হ্যাঁ ☐ no না ☐

If no, do you eat plain betel ? yes ☐ no ☐
যদি পান খান না, আপনি কি শুধু সুপারি খান ? হ্যাঁ ☐ না ☐

If yes, age of first use ?
যদি পান/ সুপারি খান, কত বয়স থেকে খেতে শুরু করছেন ? ....

How many times /day do you chew betel ?
দিনে কত বার সুপারি খান ? ....

How long do you keep it in your mouth ?
কত সময় সুপারি চিবান ? ....

Which side of your mouth do you keep it on ? Right ☐ Left ☐ Same on both sides ☐
মুখের কোন পাশে সুপারি বেশীক্ষন রাখেন ? ডান ☐ বাঁ ☐ দুই দিকে সমান ☐

8. Do/did either of your parents use pan/betel ? yes ☐ no ☐
৮˙ আপনার মা বাবা কি পান সুপারি খান/খেতেন ? হ্যাঁ ☐ না ☐

If yes, / যদি হ্যাঁ,
mother / মা খান/খেতেন — yes / হ্যাঁ ☐ no / না ☐
father / বাবা খান/খেতেন — yes / হ্যাঁ ☐ no / না ☐

9. Do you drink tea or coffee ?
৯˙ আপনি কি চা/কফি খান ?

Tea / চা — yes / হ্যাঁ ☐ no / না ☐ — How many cups/day? / দিনে কত বার ? ....

Coffee / কফি — yes / হ্যাঁ ☐ no / না ☐ — How many cups/day? / দিনে কত বার ? ....

10. Do you take sugar in tea/coffee? yes ☐ no ☐ If yes, how many teaspoons/cup ?
১০˙ চা বা কফিতে কি চিনি খান ? হ্যাঁ ☐ না ☐ যদি হ্যাঁ, এক কাপে কত চামচ ? ....

Which type of sugar do you take ? White ☐ Brown ☐
কোন ধরণের চিনি খান ? সাদা ☐ বাদামি ☐

Do you use other sweeteners such as,
চিনির পরিবর্তে অন্য কিছু ব্যবহার করেন কি, যেমন,

gur (treacle) / গুড় ☐
honey / মধু ☐
other / অন্য ....

11. Do you eat greens? yes ☐ no ☐
১১˙ আপনি কি শাগ পাতা খান ? হ্যাঁ ☐ না ☐

If yes, which kinds of greens ?
যদি খান, তাহলে কি কি শাগ পাতা খান ?

jute / নালি শাগ ☐
spinach / স্পিনাস ☐
mustard / লাই পাতা ☐
cabbage / কবির পাতা ☐
other / অন্য ....

12. Do you smoke ? yes ☐ no ☐
১২˙ আপনি কি ধুম পান করেন ? হ্যাঁ ☐ না ☐