both the beliefs of the general practitioners and accepted medical opinion indicated that the decision to admit a patient with acute myocardial infarction to hospital should be based on multiple clinical and social criteria, in practice the statistical analysis suggested that the decision to admit was often based on simple and immediate criteria: those patients who had severe symptoms of acute myocardial infarction, who were seen at home, or who were seen outside surgery hours were more likely to be admitted to hospital.

This pronounced discrepancy between medical theory and practice raises several issues. Perhaps the most important of these is the extent to which this discrepancy holds for other processes of medical decision making. Generally, the results hint that there may be two distinct models of medical decision making. The first is that reflected in the professional and scientific reports, whereas the second is that reflected in the actual decision making of doctors. Our results raise the possibility that what doctors and medical reports recommend should be done is quite different from what is done in practice. In view of the small number of subjects studied and the fact that we limited our research to a single decision, however, it would be unwise to generalise the results too widely. Nevertheless, the pronounced discrepancy we found between accepted theory and actual practice is thought provoking.

Our research was limited to a management decision, and we

did not consider the more complex issue of whether variations in management decisions affect the outcome of acute myocardial infarction. Clearly, further research is required to examine the relations between medical theory, the clinical decisions of medical practitioners, and the outcomes of these decisions to determine whether any discrepancies between theory and practice have a bearing on the outcomes of the decision.

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Vitamin D deficiency in adult British Hindu Asians: a family disorder

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Abstract

The vitamin D state of 60 apparently healthy adult Hindu Asian couples living in Britain was studied on a community basis. Twenty six (22%) of the Asian subjects had pronounced vitamin D deficiency, defined as 25-hydroxycholecalciferol concentrations below 10 nmol/l (4 ng/ml), while none of the white controls had such low concentrations. Asian men and women were equally affected, and plasma concentrations were similar in husbands and wives. Vitamin supplements were being taken by only 31 (26%) subjects, most of whom were women.

It is suggested that the spouses of patients with osteomalacia should be screened for vitamin D deficiency.

Introduction

Over the past 20 years attention has been drawn to the high prevalence of rickets and osteomalacia in British Asians.¹⁻³ This problem was first recognised in the Pakistani Moslem community in Glasgow and subsequently emerged among east

African Asians living in London despite their normal 25-hydroxycholecalciferol (25-OHD) concentrations on arrival in the United Kingdom.⁴ A later study of British Asians by different subgroups suggested that deficiency was most severe in Hindus.⁵

We became interested in the vitamin D state of spouses after several women with proved osteomalacia said that their partners had similar symptoms. Among the five couples initially studied three spouses also had low 25-OHD concentrations. None had consulted a doctor. As both dietary and social factors might influence the development of nutritional osteomalacia in Asians we studied the relation between 25-OHD concentrations in married couples in a community based survey.

Methods

We obtained all samples over six weeks in late spring. At social meetings of local Punjabi and Gujarati associations 60 healthy couples volunteered (about 80% of all couples present), ranging in age from 21 to 75. Two interviewers who spoke Hindi used a preset questionnaire to collect demographic information, obtain details of symptoms, and take a simple dietary history. Subjects receiving treatment that might interfere with vitamin D metabolism were excluded. Forty eight healthy white volunteers (laboratory, nursing, medical, and para-medical staff) aged 18-62 served as controls.

Plasma was immediately separated and stored (at -20°C) for subsequent biochemical analysis of 25-OHD concentrations by competitive protein binding assay.⁶ Plasma calcium and phosphate concentrations and alkaline phosphatase activity were measured using standard automated techniques. The association between each variable and 25-OHD concentration was examined using the χ^2 test or *t* test, as appropriate. Multiple regression analysis was used to examine further the contribution of vitamin supplements and margarine to plasma 25-OHD concentrations.

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Results

Privational osteomalacia is thought to occur only when plasma 25-OHD concentrations are ≤ 10 nmol/l (4 ng/ml), although cases of bone disease have been recorded at concentrations of 15-20 nmol/l (6-8 ng/ml).⁷ Plasma calcium and phosphate concentrations are significantly lower in Asians with 25-OHD concentrations ≤ 10 nmol/l than in those with concentrations > 10 nmol/l.⁸ We therefore defined 25-OHD concentrations ≤ 10 nmol/l as indicative of vitamin D deficiency.⁹

WHITE SUBJECTS

Plasma calcium, phosphate, albumin, and 25-OHD concentrations and alkaline phosphatase activity were within the normal range (table I) with no differences between the sexes. Only three subjects (6%) had 25-OHD concentrations ≤ 20 nmol/l (8 ng/ml) (range 16-58 nmol/l (6.4-23.2 ng/ml)). None had deficiency as defined above.

HINDU ASIANS

Plasma calcium, phosphate, and albumin concentrations and alkaline phosphatase activity were within the normal range and did not differ significantly from those in white subjects (table I). Mean plasma 25-OHD concentrations were, however, significantly lower in both men and women than those in white subjects ($p < 0.001$) (fig 1). There was no difference in results between Asian husbands and wives.

TABLE I—Mean (SEM) plasma biochemical values

	White subjects (n = 48)	Asians (n = 120)	
Calcium (mmol/l)	2.35 (0.02)	2.36 (0.02)	NS
Phosphate (mmol/l)	1.13 (0.02)	1.12 (0.02)	NS
Alkaline phosphatase (IU/l)	38.1 (2.6)	52.8 (2.7)	NS
Albumin (g/l)	44.2 (0.5)	44.2 (0.4)	NS
25-OHD (nmol/l)	34.0 (2.0)	21.1 (1.2)*	$p < 0.001$

*25-OHD concentrations: Punjabi 17.6 (1.8) nmol/l (7.0 (0.7) ng/ml), Gujarati 24.0 (1.6) nmol/l (9.6 (0.6) ng/ml); $p < 0.009$.
Conversion: SI to traditional units—Calcium: 1 mmol/l $\approx$ 4 mg/100 ml. Phosphate: 1 mmol/l $\approx$ 3.1 mg/100 ml. 25-OHD: 1 nmol/l $\approx$ 0.4 ng/ml.

FIG 1—Concentrations of 25-OHD in apparently healthy Hindu Asians and white subjects.
Conversion: SI to traditional units—25-OHD: 1 nmol/l $\approx$ 0.4 ng/100 ml.

Sixty eight (57%) of all subjects had 25-OHD concentrations ≤ 20 nmol/l, while 26 (22%) had concentrations ≤ 10 nmol/l. In 43 (72%) couples at least one member had a 25-OHD concentration ≤ 20 nmol/l (table II). In 21 (35%) couples both husband and wife had 25-OHD concentrations ≤ 20 nmol/l. One third of all couples showed pronounced deficiency (≤ 10 nmol/l) in at least one partner, and in 6 (10%) both partners were noticeably deficient. Men and women were equally affected in all groups with similar mean 25-OHD concentrations between spouses. After log transformation of the data to normalise their distribution a correlation coefficient of 0.44 ($p = 0.0005$) was obtained between couples (fig 2).

Table III shows data obtained from the questionnaire. The mean age of the subjects was 43 (range 21-75). Eighty (67%) subjects had non-manual occupations, 14 (12%) had manual occupations,

TABLE II—Mean (SEM) plasma 25-OHD concentrations in 60 Asian couples

	Husband	Wife	No (%) of couples
Both partners > 20 nmol/l	35.8 (3.3)	32.0 (2.5)	17 (28)
One partner ≤ 20 nmol/l	19.1 (2.4)	23.9 (2.2)	22 (37)
Both partners ≤ 20 nmol/l	12.0 (1.0)	9.8 (1.2)	21 (35)
Both partners ≤ 10 nmol/l	7.2 (0.9)	4.5 (0.7)	6 (10)

Conversion: SI to traditional units—25-OHD: 1 nmol/l $\approx$ 0.4 ng/ml.

FIG 2—Relation between log 25-OHD concentrations in Asian husbands and wives ($r = 0.44$, $p = 0.0005$). Regression line based on all points is shown.

TABLE III—Lifestyle and dietary information in relation to 25-OHD concentrations

	≤ 10 nmol/l (n = 26)	> 10 nmol/l (n = 94)	p Value
Men/women	14/12	46/48	NS
Age (≤ 40 / > 40)	7/19	39/55	NS
Punjabi/Gujarati	18/8	34/60	0.02
Birthplace: India/east Africa	11/15	42/52	NS
Years resident in United Kingdom (≤ 4 / > 4)	1/25	7/87	NS
Vegetarian (yes/no)	5/21	26/68	NS
Eggs (yes/no)	21/5	66/28	NS
Fish (yes/no)	10/16	38/56	NS
Butter (yes/no)	25/1	79/15	NS
Margarine (yes/no)	11/15	62/32	0.03
Milk (yes/no)	23/3	87/7	NS
Brown flour chapatis (yes/no)	20/6	69/25	NS
White flour chapatis (yes/no)	10/16	32/62	NS
Vitamin supplements (yes/no)*	2/24	29/65	0.03
Do you ever have your arms or legs uncovered? (yes/no)	8/18	37/57	NS

*Vitamin supplementation also assessed for subjects with concentrations ≤ 20 or > 20 nmol/l: 10 of 59 with concentrations ≤ 20 nmol/l and 21 of 30 with concentrations > 20 nmol/l took supplements ($p < 0.002$).

22 (18%) were housewives, and 4 (3%) were unemployed or students. Neither age nor occupation affected 25-OHD concentrations, and our sample of elderly subjects (> 65) was too small to analyse separately. Duration of residence in the United Kingdom did not affect 25-OHD concentrations, but the data were difficult to interpret because 62 (52%) of the subjects had visited the tropics during the previous three years. Clinical symptoms (muscle pain, difficulty in rising from a squat or from a chair, and painful joints) did not correlate with 25-OHD concentrations. Being a vegetarian made no difference. Deficiency was more common in Punjabis than Gujaratis.

Vitamin supplements contributed significantly to maintaining plasma 25-OHD concentrations > 20 nmol/l, and those who ate margarine were more likely to have 25-OHD concentrations > 10 nmol/l. Multiple regression analysis showed that vitamin supplements and

margarine accounted for 29% of the total variation in 25-OHD concentrations ($p < 0.05$). Vitamin supplements considered alone significantly affected the total variation in 25-OHD concentrations, but margarine did not. Only 22 (18%) Asians (mostly women) took vitamin supplements and ate margarine. Table IV shows that the largest group (43%) ate margarine but did not take vitamin supplements and 31% did not consume either.

TABLE IV—Consumption of vitamin supplements and margarine by Asian men and women

	Men	Women	Total (%)
No margarine or supplements	21	16	37 (31)
Margarine but no supplements	32	20	52 (43)
Margarine and supplements	4	18	22 (18)
No margarine but supplements	3	6	9 (8)

Discussion

This is the first report of plasma 25-OHD concentrations in apparently healthy adult Hindu Asians in Britain, derived from a community based survey. All other subgroups of Asians were excluded because of their different dietary habits.⁵ The prevalence of vitamin D deficiency in this community was high, though two thirds of the subjects were prosperous non-manual workers. Husbands and wives had remarkably similar 25-OHD concentrations. We could not substantiate the claim that osteomalacia is commoner in women because they are housebound, have a poor diet, and are exposed to less sunlight than their husbands.¹⁰

Low concentrations of 25-OHD were equally common in adults of all ages and social states. This confirms previous findings that the incidence of deficiency remains unchanged in young adult Asians and reflects their adherence to traditional diets.^{3, 11} Wharton *et al* showed that the vitamin D content of non-English foods and recipes commonly used by pregnant Asian women is very low.¹² This suggests that 25-OHD concentrations in those living in the Asian subcontinent are maintained by synthesis of the vitamin by the skin.¹³ Emigration to the United Kingdom results in a reduction of the vitamin derived from this source, which eventually precipitates deficiency in those who do not supplement their diet or visit the tropics regularly.

Suggestions that chapati flour should be fortified have been rejected because of the potential risk to groups—for example, Goans—with little vitamin D deficiency.¹⁴ Health education programmes have reduced the incidence of rickets in children by providing supplements but have had little effect on the incidence of osteomalacia in adults.^{3, 15} Using simple measures of consumption of phytate and exposure to sunlight we were unable to detect any contribution of these variables to plasma 25-OHD concentration. Vitamin supplements, however, which were taken by 26% of the study population (largely women), resulted in higher 25-OHD concentrations. The finding of similar concentrations in these women's husbands may reflect a greater family awareness of the need for increased dietary intake of vitamin D.

A recent report from the Department of Health and Social Security suggested that Asians do not eat margarine,¹⁴ but this was not true of our study population. Our estimate of margarine consumption was simple and non-quantitative, and although we

could not show that margarine contributed significantly to plasma 25-OHD concentrations, it is nevertheless a potentially important source of vitamin D in the Asian diet. Future studies might examine its contribution in more detail, and health education programmes should encourage those Asians at greatest risk of vitamin D deficiency to include margarine in their diet either in addition to or in place of butter and ghee (clarified butter). Long term compliance is likely to be higher with margarine than vitamin supplements.

Our finding of similar 25-OHD concentrations in Asian spouses confirms the importance of a shared diet in determining vitamin D state. It would be good clinical practice to screen the families of those presenting with osteomalacia.

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Correction

Coffee, tea, and plasma cholesterol: the Jerusalem Lipid Research Clinic prevalence study

We regret that several errors occurred in this paper by Dr J D Kark and others (14 September, p 699). In the third paragraph of the results the sixth line should have read: "($p < 0.001$ for a linear trend). Men consuming five or more cups of. . .". In the top panel of table III (coffee in men) under the heading Low density lipoprotein cholesterol, unadjusted, the mean difference for men who drank 5+ cups of coffee should be 0.5** (not 0.05**) mmol/l. In table V under the heading Israel, low density lipoprotein cholesterol, for people who drank 5+ cups of coffee the SE should be 0.2 (not 0.02).