Is it certain that Pokhran will not lead as inevitably to Lahore, and/or Chagai to Mumbai, as Alamogordo led to Hiroshima?

Life affirming values

The claim of the amorality of science is a clever way of escaping responsibility for the horrors that have sprung or can spring from science. For example, the missile developer's statement that 'he is only an engineer' and that 'his missile can also be used for delivering flowers'. The relationship between the scientist (the subject) and the object of scientific study must be such that initial separation (and distance) ends in subsequent unification (and embrace). The suppression of emotion **during** analysis must give way to emotion **after** analysis. The functioning of scientists as individuals, groups and institutions must be constrained and limited by moral strictures and taboos. Otherwise, the isolation of the subject from the object and the removal or absence of emotions and feelings lead inevitably to science becoming the instrument of violence, oppression and evil and viewing people as 'things'. Science, therefore, is not neutral, but it can be – and must be – encoded with life-affirming values. The link between science and morality must be re-established.

A crucial safeguard is to insist that, quite apart from the top–down macro view of security, yields, kill-ratios, etc., there must be a bottom–up micro view based on human beings. One must see beyond the numbers and the statistics, one must see children and parents and grandparents, lovers and married couples, siblings, friends and comrades. The Gandhi talisman must never be forgotten: 'Recall the face of the poorest and most helpless person . . . and ask yourself if the step you contemplate is going to be of any use to him. Will he be able to gain anything from it? Will it restore to him control over his life and destiny?'

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SCIENTIFIC CORRESPONDENCE

Elevated serum levels of 25-hydroxyvitamin D_3 in outdoor workers of South India

Serum 25-hydroxyvitamin D_3 (25-OH-D_3) levels in humans are enhanced after short-term ultraviolet exposure either from natural sunlight or artificial UV irradiation[1–5]. Stamp *et al.*[1] have shown that serum levels of 25-OH-D_3 continues to rise for several days after exposure to solar irradiation has ceased. Mawer[2] confirmed these findings and also provided data to suggest that there is a rise in serum 25-OH-D_3 following ultraviolet radiation. The effect of extended and continuous exposure of sunlight on vitamin D metabolism in humans is not known[4]. Individuals living in tropical regions constitute appropriate subjects for examination because they have extended and continuous solar exposure throughout the year. Reports on vitamin D status in tropical populations are limited to dark-skinned individuals subjected to short-term ultraviolet radiation, elderly individuals, pregnant women and children[6–9].

We report here high serum levels of 25-OH-D_3 and significant differences in the vitamin D status between indoor and outdoor workers among a segment of apparently healthy population in Thiruvananthapuram, a coastal city in South India, located within 12° of the equator (latitude 8°N, longitude 74°E) which has abundant sunshine throughout the year. Environmental temperature in this region varies within 28 to 34°C during the year.

Blood samples were collected from 66 clinically normal males aged 18 to 65 years (mean ± SD : 33.05 ± 11.0) during the period between March and November. Twenty-five were indoor factory workers (Group I) and 41 were either labourers (Group II; $N = 21$) or fishermen (Group III; $N = 20$) who spent daily 6–8 h outdoors with no clothing on their chest. Dietary intake was recorded by using 24-hour recall method and vitamin D intake was computed using tables of nutrient data on locally consumed foods[10]. Serum 25-OH-D_3 was estimated according to the method of Jones[11] using high pressure liquid chromatography (HPLC) by measuring UV absorbance at 265 nm using Schimadzu 1989 model HPLC system (Figure 1). The sensitivity of the assay is 0.25 nmol/l. Accuracy of assay for 25-OH-D_3 was determined by adding known amounts of the vitamin to plasma and estimating its levels. Recovery of the extraction was 90 to 95%. Reference standard 25-OH-D_3 was obtained from Hoffmann La Roche, USA. HPLC was employed because of its specificity and availability though radioligand binding assay is superior in terms of sensitivity. Serum levels of calcium and magnesium were determined by atomic absorption spectrophotometry using a Perkin Elmer 2380 atomic absorption spectrophotometer and measuring the absorption at wavelengths 422.7 nm and 285.2, nm respectively. Sensitivity of the assay for Ca is 0.0125 mmol/l and for Mg is 0.00125 mmol/l. Inorganic phosphate was measured by the method of Fiske and Subbarow. Coefficient of variation of the assay for 25-OH-D_3 determined from pooled serum ($N = 10$) was 12.3%. Samples from different groups were assayed randomly in batches and the identity was not revealed to the person doing the assay of the samples. Data on all variables were available only in 49 subjects; 22 in Group I, 11 in Group II and 16 in Group III. Group medians of all outcome variables were compared using Kruskal–Wallis one-way ANOVA followed by Mann–Whitney test for pairwise comparisons. Overall and within-group correlations (Pearson's r) were computed between 25-OH-D_3 and

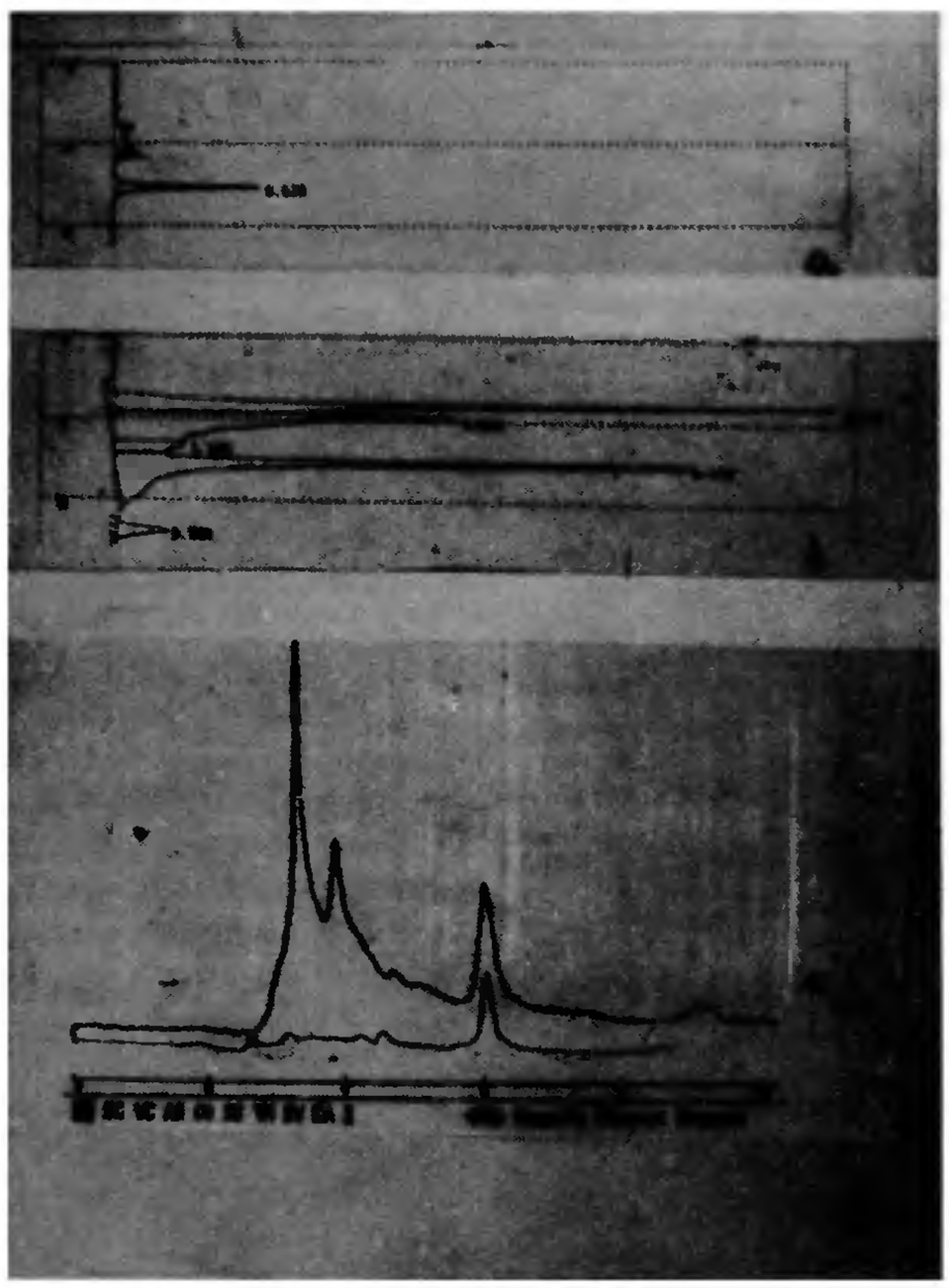

Figure 1. HPLC of vitamin D fractions on a reverse phase CLS–ODS (octadecyl silica) column. *a*, Elution pattern of standard 25-OH-D_3; *b*, Elution pattern of serum extract of adult men; and *c*, Overlay of the standard peak eluted on serum elution.

Table 1. Daily dietary vitamin D intake and serum levels of 25-OH-D_3, calcium, magnesium and inorganic phosphate (median and quartiles) in three groups from the Thiruvananthapuram population with varying solar exposure

Group	Vitamin D intake (μg)	25-OH-D_3 (nmol/l)	Calcium (mmol/l)	Magnesium (mmol/l)	Phosphorus (mmol/l)
I. Male factory workers ($n = 22$)	9.0 (8.4, 9.8)	88.8 (56.5, 182.8)	2.5 (2.2, 2.8)	0.8 (0.6, 0.8)	0.6 (0.5, 0.7)
II. Male labourers ($n = 11$)	8.6 (8.4, 10.6)	424.5 (198.5, 717.3)	2.7 (2.5, 2.9)	0.8 (0.7, 0.9)	0.8 (0.7, 0.8)
III. Fishermen ($n = 16$)	10.6 (10.6, 10.7)	277.3 (184.0, 529.8)	2.6 (2.3, 3.2)	0.8 (0.7, 0.9)	0.7 (0.6, 0.7)
P value (Kruskal–Wallis test)	0.0394	0.0009	0.3350	0.2509	0.0004
Group comparisons ($P < 0.05$)	*b*, *c*	*a*, *b*			*a*, *c*

a, *b*, *c* are the significant differences between Groups I and II, Groups II and III, and Groups I and III, respectively, by Mann–Whitney test.

serum calcium, serum magnesium and serum inorganic phosphate.

Results of the analysis are given in the Table 1. Serum 25-OH-D_3 levels in all three groups in the study are 2–3 times higher than that reported from non-tropical countries[12,13]. Serum levels of 25-OH-D_3 are higher in labourers and fishermen when compared to the levels in factory workers. An observation of interest in this study is the substantial proportion of individuals (26.5%) with serum 25-OH-D_3 levels above 375 nmol/l (150 ng/ml). Six of them are labourers and five are fishermen. Calcium and magnesium levels are not different between groups. Calcium levels are marginally higher than normal values reported in adults.

Inorganic phosphate levels are low in factory workers and fishermen. There is no correlation between serum 25-OH-D_3 and serum calcium or serum magnesium or serum phosphorus. High levels of vitamin D in serum associated with hypercalcemia have been reported in patients with granulomatous diseases[14,15] and those who are administered pharmacological doses of the vitamin. Our subjects had no obvious symptoms and signs of any granulomatous disease and did not give history of consuming large doses of the vitamin. Thiruvananthapuram being a coastal city, consumption of fish is high among all classes of people and fish forms the major dietary source of vitamin D. Dietary vitamin D intake in the different groups is low, but within recommended levels. Consumption by fishermen is significantly different from that of other two groups.

One would expect vitamin D levels to be higher in fishermen, when compared to labourers. However, we have found a lower median 25-OH-D_3 value in fishermen, though the difference is not statistically significant. Serum levels of 25-OH-D_3 could depend on the length of time spent outdoors in the sun and clothing habits and may not reflect body storage pool. The degree of skin pigmentation can modify effective penetration of ultraviolet rays into cutaneous layers. However, observations in negroes repeatedly exposed to ultraviolet radiation suggest that pigmentation has no significant effect on cutaneous synthesis of vitamin D (ref. 1). Since we have not measured the extent of UV exposure and intensity of skin pigmentation in indi-

viduals, we are not able to offer an explanation for the lower serum levels of 25-OH-D_3 in fishermen.

Vitamin D is transported on a specific plasma-binding globulin and up to 40% is transported by lipoproteins. During hypervitaminosis D these binding sites may become saturated with an increase in the free pool of vitamin D. For evaluating vitamin D status, 25-OH-D_3 is considered to be the best index by most workers[16]. Therefore, it is important to measure serum levels of 25-OH-D_3 to assess the status of individuals or animals. If serum levels of 25-OH-D_3 are increased beyond the normal range, vascular calcification may develop even within normal levels of 1,25$(OH)_2D_3$ (ref. 17). High doses of vitamin D_3 when given orally to experimental animals do not always increase the serum levels of 1,25$(OH)_2D_3$. But levels of 25-OH-D_3 increase because 1,25$(OH)_2D_3$ levels are closely controlled, their production being determined by parathyroid hormone, calcium and phosphorous levels in blood[17,18]. Hence we did not estimate serum levels of 1,25$(OH)_2D_3$ and instead measured serum levels of 25-OH-D_3. Our finding that people working outdoors have higher levels of 25-OH-D_3 than those working indoors suggests that tropical sunlight and UV radiation can lead to high serum levels of 25-OH-D_3 in humans. The mechanism of acclimatization to prolonged and continued solar exposure in tropical population as well as whether elevation in serum 25-OH-D_3 levels is associated with increase in levels of the active metabolite 1,25$(OH)_2D_3$ and increased risk for any pathological conditions in this population need further exploration.

The data reported here are from a small sample and do not contain information on related metabolites like 1,25$(OH)_2D_3$, parathyroid hormone and ionic calcium. However, the results indicate the need for a systematic investigation on vitamin D metabolism in tropical populations.

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In vitro propagation of white marigold (*Tagetes erecta* L.) through shoot tip proliferation

White marigold, belonging to the plant family Asteracae, is one of the important ornamental crops. In spite of its popularity and economic importance, it has not been properly commercialized due to nonavailability of planting materials. Multiplication rate of white marigold is not as fast as that of yellow marigold because of low seed viability and poor germination (30%). White marigold is very delicate and requires extremely favourable climatic conditions for vegetative growth as well as for good blooms. It is difficult to maintain pure line seeds due to its cross-pollinated nature. Tissue culture is the only method to maintain genetically identical clone having snow white flower colour and rapid propagation as well as long-term preservation of germplasm. There are very few reports on the tissue culture propagation of members of Asteracae family[1–5], still fewer on *Tagetes*[6–8] and none on white marigold. The present communication reports the clonal propagation of white marigold through shoot tip culture.

White marigold (cultivar of *Tagetes erecta* L.) was collected from an amateur grower in Lucknow. The explants were collected at two months intervals during different growth periods, i.e. vegetative and flowering. Shoot tips measuring ca. 2 cm in length and the single-node stem