25-OH Vitamin D₃ Concentrations in Chinese, Malays, and Indians

To the Editor:

With increasing recognition of the importance of vitamin D deficiency as a risk factor in many common diseases, such as malignancy, diabetes, and cardiovascular disease, there has been growing interest in studies to assess vitamin D concentrations in different populations. Measurement of 25-hydroxyvitamin D (25-OH-D) is accepted as the best estimate of vitamin D status. More than 95% of 25-OH-D is typically 25-OH-D3, with vitamin D₃ reaching measurable concentrations only in patients taking vitamin D₃ supplements. Much of the interest in vitamin D status has concentrated on seasonal variation in populations living at high latitudes, with little work done in populations living closer to the equator, perhaps because of plentiful sunshine. This study describes the range of 25-OH-D₃ concentrations seen in a multiethnic Asian population living close to the equator.

We measured 25-OH-D₃ concentrations in 240 anonymized leftover fasting venous serum samples from apparently healthy ambulatory outpatients undergoing health screening (40 men and 40 women from each race: Chinese, Malay, and Indian; median age 40 years, range 20–82). This was part of routine reference interval work during evaluation of a new assay and did not require institutional review board approval. The tests were performed on the Roche Cobas e601 immunoassay analyzer using the Roche Elecsys vitamin D₃ assay (Roche Diagnostics). Samples were collected over 6 months, stored at −20 °C until analysis and, after thawing and mixing, randomly allocated to 3 analytical runs over 3 consecutive days. Statistical analysis (median calculations, Mann–Whitney tests, and logistic regression) were performed using Analyze-It for Microsoft Excel and SPSS v12 (SPSS Inc.). A P value <0.05 was considered statistically significant.

Table 1 shows the distribution of 25-OH-D₃ concentrations for the Chinese, Malay, and Indian female and male groups. There were no samples with 25-OH-D₃ concentrations >40 µg/L. Median 25-OH-D₃ concentrations in the Malay female (18.3 µg/L) and Indian female (16.9 µg/L) groups were significantly lower than in the Chinese female (22.7 µg/L) group. Similarly, median 25-OH-D₃ concentrations in the Malay male (23.4 µg/L) and Indian male (19.6 µg/L) groups were significantly lower than in the Chinese male (26.3 µg/L) group. Median 25-OH-D₃ concentrations for women were significantly lower than for men for all 3 races. Logistic regression analysis to assess the independent effects of sex, race, and age on presence of low 25-OH-D₃ concentration (defined here arbitrarily as 25-OH-D₃ <20 µg/L) gave the following significant odds ratios (95% CIs): female (vs male), 3.2 (1.8–5.8); Malay (vs Chinese), 3.5 (1.7–7.3); Indian (vs Chinese), 7.1 (3.4–15.0). Age was not a significant predictor of low 25-OH-D₃ concentration.

This study demonstrates clear differences between sexes and races in 25-OH-D₃ concentrations. Singapore lies 1 degree north of the equator and has uniform temperatures and hours of sunlight throughout the year. It is thus unlikely that environmental factors such as latitude and season contributed significantly to the differences between groups. Personal factors, such as skin pigmentation, food, obesity, clothing, dressing style, and cultural habits, are the likely source of the differences, between both races and sexes. Skin melanin concentrations differ between races, and dark skin requires up to 5 times the exposure time (2, 3). Genetic factors may also play a role; some Indians have increased 24-hydroxylase activity that results in lower 25-OH-D concentrations (3). The sex-related differences may reflect negative attitudes and behaviors toward sun-

<table>
<thead>
<tr>
<th>25-OH-D₃ µg/L</th>
<th>Chinese</th>
<th>Malay</th>
<th>Indian</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>&lt;10</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>7.5 (3)</td>
</tr>
<tr>
<td>&gt;10 and &lt;20</td>
<td>35 (14)</td>
<td>15 (6)</td>
<td>57.5 (23)</td>
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<tr>
<td>&gt;20 and &lt;30</td>
<td>50 (20)</td>
<td>55 (22)</td>
<td>35 (14)</td>
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<tr>
<td>&gt;30 and &lt;40</td>
<td>15 (6)</td>
<td>30 (12)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

Data are % (n).
light among Asian women, who may take measures to avoid exposure (4). Different cutoffs ranging from 10 to 30 µg/L have been suggested to define vitamin D deficiency or insufficiency (3, 5). Using these cutoffs, the prevalence of vitamin D deficiency in this study varies from 0–12.5% (≤10 µg/L) to 70%–100% (≤30 µg/L) according to the subgroup examined. At all cutoffs suggested, however, the prevalence is higher in Indians and Malays than in Chinese, and higher in women than in men.

A limitation of this study was the possible inclusion of individuals on vitamin D supplements in the study population. Almost all vitamin D supplements in Singapore are vitamin D3, however, and this drawback is unlikely to alter the picture of intergroup differences seen here. These findings show the need to consider low 25-OH-D3 concentration in populations living in even sunny regions and to use sex and race to identify those persons at greatest risk.

**Author Contributions:** All authors confirmed they have contributed to the intellectual content of this paper and have met the following 3 requirements: (a) significant contributions to the conception and design, acquisition of data, or analysis and interpretation of data; (b) drafting or revising the article for intellectual content; and (c) final approval of the published article.

**Authors’ Disclosures of Potential Conflicts of Interest:** No authors declared any potential conflicts of interest.

**Role of Sponsor:** The funding organizations played a direct role in the design of study, choice of enrolled patients, review and interpretation of data, and preparation and final approval of manuscript.

**References**


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Previously published online at DOI: 10.1373/clinchem.2009.129403