Vitamin D deficiency in Northern Sweden

A cross-sectional study of an immigrant population at latitude 63°N, including an open partially randomized, controlled clinical trial studying the effect of supplementation with different doses of cholecalciferol

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Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av medicine doktorsexamen framläggs till offentligt försvar i Sal 933, målpunkt B, 9 tr, Norrlands Universitetssjukhus, fredagen den 1 juni, kl. 09:00.
Avhandlingen kommer att försvaras på svenska.

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Abstract
Background: Vitamin D is a prohormone that plays a key role in the calcium and phosphate balance and has physiological functions throughout the entire body. Vitamin D is supplied by exposure to ultraviolet light or by food. The prevalence of vitamin D deficiency in immigrants in Northern Sweden was unknown. There was no consensus on how to define or treat vitamin D deficiency and no pure preparations of cholecalciferol available in Sweden.
Aims: To study the prevalence and determinants of vitamin D deficiency in immigrants of African and Middle Eastern origin, to examine associations between vitamin D status and muscle strength, anxiety, depression and quality of life, and to determine the effect of supplementation with cholecalciferol on 25-hydroxyvitamin D₃ [25(OH)D₃] and vitamin D status.
Methods: 1. A cross-sectional, population-based study. Immigrants ages 25-65 from Africa and the Middle East (n=1306) living in Umeå, Sweden, were invited to participate. A total of 111 men and 106 women (16.5%) participated. 25(OH)D was measured by LC-MSMs. Anthropometry, medical, socioeconomic and lifestyle data was registered. Examinations: lower limb muscle strength, grip strength, HAD, health-related quality of life (QoL) 2. An open, partially randomized, controlled trial including immigrants from Africa or the Middle East, 192 subjects screened, 160 included and 147 completed the study. Intervention: cholecalciferol 12±2 weeks, 4 parallel groups; Group 1: 25(OH)D <25 nmol/L: 10000 IU/d, Groups 2a and 2b: 25(OH)D 25-49 nmol/L: 2000 IU/d or 2000 IU/w, Group 3: 25(OH)D 50-74 nmol/L: 2000 IU/d.
Results: Twelve percent of the immigrants showed a vitamin D deficiency (25(OH)D <25 nmol/L) and 73% showed 25(OH)D <50 nmol/L. Vitamin D deficiency was twice as common in African immigrants as in the Middle Eastern group. Vitamin D deficiency was associated with intake of fatty fish less than once a week, absence of travel abroad and use of long-sleeved clothing in summer. Lower limb muscle strength was associated with 25(OH)D levels and weaker grip strength was associated with vitamin D deficiency. Vitamin D deficiency was not associated with anxiety, depression or QoL in the total immigrant population. In Middle Eastern women, in whom prevalence of anxiety was higher, anxiety was associated with 25(OH)D ≤49 nmol/L. Oral cholecalciferol was effective in increasing 25(OH)D. At study end, 100% in Group 1, 89% in Group 2a, 55% in Group 2b and 96% in Group 3 reached adequate vitamin D status (25(OH)D ≥50 nmol/L). In Group 1; 62% reached 25(OH)D ≥125 nmol/L.
Conclusions: Vitamin D deficiency and insufficiency was common in the immigrant group and no difference was shown between men and women. A diet including a high intake of fatty fish was most important in avoiding vitamin D deficiency. Vitamin D status was associated with muscle strength in all immigrants. Vitamin D deficiency was not associated with anxiety, depression or QoL in the immigrants. In female immigrants from the Middle East, anxiety was associated with 25(OH)D levels ≤49 nmol/L. Supplementation with cholecalciferol 2000 IU/day for three months was safe in healthy individuals with initial 25(OH)D 25-49 nmol/L, but monitoring is warranted since 11 % did not attain sufficient vitamin D status. The dose 10 000 IU/day in patients with initial 25(OH)D <25 nmol/L was unnecessarily high.

Keywords
vitamin D deficiency, 25-hydroxyvitamin D, cross-sectional study, immigrant, muscle strength, grip strength, anxiety, depression, health related quality of life, clinical trial, cholecalciferol.