Ethnic Differences in Vitamin-D Metabolism

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Vitamin D requirements vary from one human population to another. This is because the capacity to synthesize vitamin D in the skin also varies as a result of differences in solar UV or skin pigmentation. There has consequently been natural selection to use this vitamin more efficiently in populations that live at higher latitudes or are darker-skinned.

Keywords: vitamin D ; natural selection ; Inuit ; solar UV ; skin pigmentation ; ethnic differences

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Vitamin D requirements vary from one human population to another. If solar UV is too weak or the skin too dark, there will be insufficient synthesis of vitamin D in the skin. Consequently, natural selection will favor those individuals who use this vitamin more efficiently or have alternate metabolic pathways.

There has apparently been selection to reduce vitamin D requirements among the Inuit people of Alaska, northern Canada and Greenland (Frost 2012; Frost 2018). Above the Arctic Circle, solar UV is usually too weak to permit vitamin D synthesis in the skin. Some vitamin D is obtained from the diet, i.e., fatty fish and certain marine mammals, but such sources are insufficient. According to a study from Nunavut and the Northwest Territories, even Inuit on a traditional diet get less than the recommended minimum of 10 µg/day (Kolahdooz et al. 2013).

Inuit have adapted to this insufficiency through physiological changes: receptors that bind more tightly to the vitamin D molecule; a lower set-point for calcium-regulated release of parathyroid hormone; and conversion of vitamin D at a higher rate from its common form to its most active form. There may be other adaptations. For instance, Inuit breast milk might be richer in ß-casein, which seems to facilitate the body's use of vitamin D (Frost 2018).

Vitamin D levels are generally low in dark-skinned human populations, even those that still inhabit the tropical zone and receive intense sunlight. This was the conclusion of several studies:

- Vitamin D levels were below 75 nmol/L in 51% of young tanned Hawaiians with 22.4 hours per week of unprotected sun exposure (Binkley et al. 2007).
- Among south Indians, 44% of the men and 70% of the women had less than 50 nmol/L. They were "agricultural workers starting their day at 0800 and working outdoors until 1700 with their face, chest, back, legs, arms, and forearms exposed to sunlight" (Harinarayan et al. 2007).
- In Saudi Arabia, levels were below 25 nmol/L in respectively 35%, 45%, 53%, and 50% of normal male university students of Saudi, Jordanian, Egyptian, and other origins (Sedrani 1984).
- In a sample of healthy Middle Eastern athletes, 91% had less than 50 nmol/L (Hamilton et al. 2010).
- Variation is significant even among Europeans. Vitamin D levels are lower in central and southern Europeans than in lighter-skinned Swedes (Snellman et al. 2009).
- A meta-analysis concluded that vitamin D levels are significantly lower in people of non-European origin than in people of European origin. Levels are consistently low in non-Europeans regardless of latitude (Hagenau et al. 2009).

Vitamin D levels are apparently lower in dark-skinned human populations for genetic reasons. A study of African Americans found that serum 25(OH)D decreased linearly with increasing African ancestry, the decrease being 2.5 to 2.75 nmol/L per 10% increase in African ancestry. The study also found that sunlight and diet were 46% less effective in raising these levels among subjects with high African ancestry than among those with low/medium African ancestry (Signorello et al. 2010).

If vitamin D levels are naturally lower in darker-skinned populations, the optimal range of levels will likewise be lower, and toxic effects will develop at lower levels [1][2][3][4][5][6][7][8][9][10].

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