Ultraviolet Radiation, Shade and Vitamin D_3

Abstract

The health effects of solar UV radiation vary significantly, from assisting calcium absorption in humans to the severe degradation of body tissue. The good effects are relatively few, but they are essential to a persons well being. Research has shown that exposure to small amounts of solar UV radiation are beneficial for the human body and important in the production of vitamin D_3, whereas excessive exposure to sunlight is known to cause erythema, skin aging, skin cancer and sun-related eye disorders. It is estimated that approximately 90-95% of our vitamin D requirement comes from exposure to the sun. Vitamin D_3 is essential to maintain extracellular fluid concentrations of calcium and phosphorous; hence, it is important for the prevention of rickets in children, osteoporosis, osteomalacia, and fractures in the elderly. Studies also indicate that low blood serum vitamin D_3 is linked to breast, prostate and colorectal cancer. UVB (280-315 nm) is acknowledged as an initiator of the synthesis of vitamin D_3 for humans as it assists in converting pre-vitamin D_3 to vitamin D_3. Although, over exposure to these UVB wavelengths are known to cause skin damage, pre-vitamin D_3 synthesis generally occurs at sub-damaging irradiances. Due to scattering in the earth's atmosphere, there is a significant proportion of the solar UV present in shade. Studies on the levels of UV observed in the shade of different shade environments have shown that the relative proportions of UVA (315-400 nm) and UVB in the shade are significantly different to those in full sun. In the shade there is an increase in the relative proportion of the wavelengths associated with pre-vitamin D_3 synthesis and a decrease in the biologically damaging UVA irradiances compared to full sun. This is significant because exposure to harmful solar UVA radiation is linked to skin cancer, DNA damage, macular degeneration and immunosuppression in humans. Therefore, utilizing diffuse solar UV radiation to obtain beneficial amounts of UVB, while at the same time reducing personal overexposure to harmful UVA radiation, may prove to be absolutely necessary for an improvement in public health.