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Action Spectrum Conversion Factors that Change Erythemally Weighted to Previtamin D3 Weighted UV Doses

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Many solar UV measurements, either terrestrial or personal, weight the raw data by the erythemal action spectrum. However, a problem arises when one tries to estimate the benefit of vitamin D3 production based on erythemally-weighted outdoor doses, like those measured by calibrated R-B meters or polysulphone badges, because the differences between action spectra give dissimilar values. While both action spectra peak in the UVB region, the erythemal action spectrum continues throughout the UVA region while the previtamin D3 action spectrum stops near that boundary. When one uses the previtamin D3 action spectrum to weight the solar spectra (Deff), one gets a different contribution in W/m2 than what the erythemally weighted data predicts (Eeff). Thus, to do proper benefit assessments, one must incorporate action spectrum conversion factors (ASCF) into the calculations to change erythemally-weighted to previtamin D3-weighted doses. To date, all benefit assessments for vitamin D3 production in human skin from outdoor exposures are overestimates because they did not account for the different contributions of each action spectrum with changing solar zenith angle and changing ozone and they did not account for body geometry. Here we describe how to normalize the ratios of the effective irradiances (Deff/Eeff) to get ASCF that change erythemally-weighted to previtamin D3-weighted doses. We also give the ASCF for each season of the year in the northern hemisphere every 5º from 30ºN to 60°N, based on ozone values. These ASCF, along with geometry conversion factors and other information, give better vitamin D3 estimates from erythemally-weighted outdoor doses.