Concurrent health risks and benefits of low level sunlight exposure in different skin types

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Solar UVR initiates (pre-)vitamin D synthesis but also DNA damage in exposed skin. We previously performed intervention and observation studies in humans in vivo to examine the relationship between sunlight/simulated sunlight exposure and vitamin D production, and the impact of behavioural factors. Now our objective is to examine concurrent beneficial (for musculoskeletal health) and harmful (for skin cancer) effects of low level sunlight in vivo in humans with skin ranging from very light to very dark pigmentation.

Firstly, influence of repeated, low level (absolute dose 1.3 SED) simulated summer exposures was examined in people 18-60y of light (phototype II) and dark (phototype V) skin, during wintertime at 53.5°N. They received 95% UVA/5% UVB 3x weekly for 6 weeks, to commonly exposed skin sites (~1/3 surface). Serum 25(OH)D assay was performed at baseline and weekly, urine was assayed for 8-oxo-dG and CPD, and skin receiving 1.3 SED 1x, and 18x, was biopsied for immunohistochemical analysis of CPD. A 50% gain in 25(OH)D was seen in both groups, phototype II reaching vitamin D sufficiency and V exceeding deficiency (consistent with earlier studies). More CPD occurred in II than V (p<0.0001) and V repaired a higher proportion of their CPD 24h after last UVR (p<0.0001).

However, skin CPD did not accumulate in either group (same amount after 1x and 18x exposures. Urinary oxidative DNA damage was higher in II throughout the course (p=0.002) and unaffected by UVR, and urinary CPD were not detected. Serum endocannabinoid (2-arachidonoyl glycerol) increased during the UVR course in both groups (p<0.01).

Thus repeated, absolute dose, low level sun exposure produces skin DNA damage that does not accumulate; difference in repair at 24h suggests differential advice on sun exposure to gain vitamin D for phototypes II and V. Elevated endocannabinoids hints at further health effects, with potential contribution to inflammation and mood change, and demands further study.

Current advice on sun exposure involves limiting this to beneath individual sunburn threshold, but the consequences are not fully understood. Further research will be presented relating to fractional sub-erythemal MED exposure across human skin types from very light to very dark (I-VI). This exacting study, employing a simulated sunlight dose-series in characterised individuals of each phototype, concurrently explores the thresholds for vitamin D and DNA damage production, and examines if the principal health benefit of cutaneous sun exposure can be gained without the principal hazard.