Concurrent Session 2

Methodologies to assess human UV exposures for estimates of synthesis of pre-vitamin D in human skin
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Background - Most of the population receive their nutritional Vitamin D requirements through exposure to solar UV, with cutaneous synthesis providing 80 to 100% of the Vitamin D requirements to the body, yet little is understood about the basic photobiology and photochemistry of Vitamin D production in humans. Low Vitamin D has been linked to the development of a surprisingly wide range of diseases. Epidemiological data and animal studies indicate that low Vitamin D is linked to rickets, bone mass loss, multiple sclerosis, hypertension, breast cancer, prostate cancer, colorectal cancer, insulin dependent diabetes and schizophrenia. Recent research has found that adults living in South East Queensland, Australia, have surprisingly high rates of Vitamin D deficiency and insufficiency (8% and 23% respectively).

Objective - This work aims to understand human UV exposures and determine the correct method for assessment of exposure for pre-Vitamin D synthesis.

Design - We describe the techniques that can be used to assess UV exposure of humans ranging from the photo activation of thin cast polymer films to mathematical modelling of exposure patterns.

Outcomes - The results presented show the important considerations research must take into account when estimating human UV exposure and the potential to synthesize pre-Vitamin D in skin. We found that the UV exposure to various sites over the human body varies not only with anatomical location, but also time of day and cloud cover. For example, the exposure to the facial region was found to be 25% to 30% lower on cloudy days compared to sunny days. However, we found that the distribution of UV over the face during this period also changed where the UV exposure to the nose during cloudy conditions increased by 15% when normalized to the vertex of the head. These results indicate that exposures to the human body are lower that the data measured by ambient UV detectors and correlations between ambient exposures and human UV exposures are complex. Significant errors in assessment of UV exposures for Vitamin D synthesis can occur and may impact on validity of sun exposure estimates if not taken into account in project planning and design.

Conclusions - This research highlights the need for further research into the interactions between the solar UV environment and humans. To take a simplistic approach to assessment of UV exposures is dangerous and may lead to results that are not valid. Data and methodologies presented in this presentation will aid researcher when undertaking Vitamin D research and UV exposure estimates.

Thyroglobulin as an index of mild iodine deficiency
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Background –The most commonly used indices to assess iodine status are urinary iodine concentration (UIC), thyroid volume (TV), and thyroid stimulating hormone (TSH). However, the measurement of TV requires trained personnel and access to an ultrasound machine, while changes in TSH, although metabolically significant, fall within normal ranges in mild iodine deficiency (IDD). Thyroglobulin (Tg) is the most abundant protein of the thyroid gland and shows promise as a sensitive index of mild IDD.

Objective – To determine the relationship between Tg and other indices of iodine status of iodine status using data from the New Zealand (NZ) National Children’s Nutrition Survey (CNS02) conducted in 2002.

Design - The CNS02 was a cross-sectional survey of 3275 school children aged 5-14 years. Blood drawn from an antecubital vein and a casual morning urine sample was obtained from 1154 children. UIC, serum TSH and Tg concentration, and plasma free tri-iodothyronine (fT3) and free thyroxine (fT4) concentration were determined.

Outcomes - The median UIC of the children was 67 µg/L, and 28% of the children had a UIC <50 µg/L, indicative of mild IDD. The concentrations (mean ± SEM) of TSH (1.72 ± 1.70 mU/L), fT3 (6.0 ± 0.0 pmol/L), and fT4 (14.9 ± 0.2 pmol/L) were similar to values published for children in other countries. The median Tg concentration was 12.8 ng/mL and fell within the range of 10-20 ng/mL; also indicative of mild IDD. Furthermore, children who had an UIC<50 µg/L had a significantly higher (P=0.000) serum Tg concentration than children with a UIC above this level, suggesting hyperplasia of the thyroid gland in children with lower UIC.

Conclusions - These data suggest that Tg is a sensitive index of mild IDD in NZ children.