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Short-term skin carotenoid changes following consumption of a typical Australian diet versus a healthy Australian diet: findings from a randomised crossover feeding trial

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Carotenoids, a group of phytochemicals found in plant-based foods with yellow, red, or orange pigments, have been shown to be stored in the skin upon consumption of carotenoid-rich foods[1]. Skin carotenoid levels can be measured using skin reflectance spectroscopy, which assesses skin lightness (L*), redness (a*), and yellowness (b*)[2]. Previous research has demonstrated significant increases in skin yellowness (b*) after a 4-week high-carotenoid diet[2]. The aim was to examine shorter-term changes (two weeks) in skin yellowness following the consumption of a Healthy Australian Diet rich in carotenoids compared to a Typical Australian Diet with low carotenoid content. The study analysed data from an eight-week randomised, cross-over feeding trial involving 34 adults (53% female, aged 38.44 ± 18.05 years). Participants were randomly assigned to each diet for two weeks, separated by a two-week washout period. The Healthy Australian Diet adhered to the Australian Dietary Guidelines[3], emphasising the consumption of carotenoid-rich fruits and vegetables such as carrots, pumpkin, tomatoes, red capsicum, and sweet potatoes. In contrast, the Typical Australian Diet was formulated based on apparent consumption patterns in Australia[4] and emphasised the intake of fruits and vegetables low in beta-carotene, such as white potatoes, onions, cauliflower, and pears. Skin carotenoids were measured using skin reflectance spectroscopy at three sites (palm, inner and outer arm), and each measurement was taken thrice. Overall skin yellowness (b*) was calculated as the average of all three measurements at all three sites. Measurements were conducted at four key visits: week 0 (end of run-in; baseline 1), week 2 (post-feeding phase 1), week 4 (end of washout; baseline 2), and week 8 (post-feeding phase 2). Differential changes in skin carotenoid levels between intervention groups were assessed using linear mixed-effect models, adjusting for diet sequence, feeding phase, body fat percentage, total fat intake, and subject ID as a random variable to account for potential autocorrelation. Post-hoc pairwise comparisons were conducted to evaluate the relative effects of each diet. Although there was a trend towards higher skin yellowness (0.215 ± 0.517; $p = 0.41$) following consumption of the Healthy Australian diet relative to baseline, and an inverse trend following the Typical Australian Diet (−0.118 ± 0.539, $p = 0.56$), the difference in change between the two diets was not statistically significant ($p = 0.32$). Notably, baseline values within this participant cohort were higher than previously reported at b* = 16.7[1] (baseline 1 b*: 17.57 ± 2.23, baseline 2 b*: 17.71 ± 2.26), which may influence the magnitude of observable change. The findings suggest that the two-week intervention duration may be insufficient to achieve statistically significant changes in skin carotenoid levels. Future investigations into whether plasma carotenoids increase first, with skin changes occurring later, could offer valuable insights into the potential utility of this as a biomarker validation of change in fruit and vegetable intake.

Keywords: carotenoids; skin reflectance spectroscopy; dietary intake; randomised controlled trial

Ethics Declaration

Yes

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