Ctori, I. & Huntjens, B. (2016). Do ethnic variations in foveal morphology explain variations in macular pigment spatial density distribution?. Investigative Opthalmology and Visual Science, 57(12), 3620..

Do ethnic variations in foveal morphology explain variations in macular pigment spatial density distribution?

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Posterboard #: B0223

Abstract Number: 3620 - B0223

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Disclosure Block: Irene Ctori, None; Byki Huntjens, None

Purpose: Macular pigment (MP) spatial density distribution may vary with ethnicity. Variations in central retinal thickness with ethnicity have also been reported. We investigated ethnic variations in MP spatial distribution in relation to foveal thickness profiles.

Methods: We measured MP optical density (MPOD) using heterochromatic flicker photometry (MAP test, City University London) in 76 white, 80 South Asian and 70 black volunteers (males and females,18 to 39 years; all UK residents). Exclusion criteria included ocular pathology, visual acuity worse than 0.3 logMAR and current/previous user of MP supplements. MPOD spatial profiles were classified objectively as exponential, ring-like or central dip, based on deviations away from an exponential fit to the data taking into account instrument measurement error. Inner retinal thickness (IRT) and inner and outer plexiform layer (IPL and OPL) thickness measurements were taken from Spectralis (Heidelberg, Germany) OCT scans at retinal eccentricities corresponding to MPOD measurement locations. We performed between-groups analysis of variance to analyze differences between groups and Pearson Chi-squared test to explore relationships between MP profile type and ethnic grouping.

Results: Integrated MPOD up to 1.8° (MPOD INT) was higher in South Asian (0.84±0.26) and black (0.84±0.31) than whites (0.63±0.24, $p<0.0005$). Ethnicity explained around 10% of the variance and gender played no significant role. Within each ethnic group, MPOD INT did not vary between subjects born and raised abroad vs. the UK, neither did it vary according to eye colour or smoking status ($p>0.05$). MPOD profile phenotypes were associated with ethnicity: 58% with ring profiles were South Asian and 43% with dip profiles were black ($\chi^2(4,226)=13.4$, $p=0.009$). There was a statistically significant difference in MPOD INT between exponential (0.66±0.21), ring-like (0.96±0.26) and central dip (1.00±0.32, $p<0.0005$) groups. White subjects had thicker IRT at 0° (130±21µm) than South Asian (123±16µm) and blacks (116±14µm; $F(2)=12.4$ $p<0.0005$), with comparable results for IPL ($p<0.0005$) and OPL ($p=0.03$). There was no significant difference in IRT, IPL or OPL (0 to 3.8°) between MP profile groups ($p>0.05$).

Conclusions: We report a significant difference in the amount and distribution of MP between ethnicities that is not explained by variations in central retinal thickness.

Layman Abstract (optional): Provide a 50-200 word description of your work that non-scientists can understand. Describe the big picture and the implications of your findings, not the study itself and the associated details.: Macular pigment (MP) is a yellow pigment located within the central retina. MP filters out damaging blue light, protecting the underlying photoreceptors. Lower levels of MP may be associated with increased risk of age-related macular degeneration (AMD), one of the leading causes of blindness worldwide. Given the paucity of AMD treatment there is great interest in understanding the risk factors. The amount of MP varies among individuals. Although MP is solely diet derived, dietary differences only account for 10% of variations, suggesting other factors are involved. We

report that ethnicity seems to play a role, with lower MP levels reported in whites compared to South Asians and blacks, which could not be explained by variations in retinal architecture. Our findings may explain reports of ethnic variations in prevalence of AMD.