



Cross-Cultural Effects of Fruit and Vegetable Consumption on SKIN COLOR

Ross D. Whitehead, Vinet Coetzee, PhD, Gozde Ozakinci, PhD, and David I. Perrett, PhD

Projected effects of fruit and vegetable consumption on White facial appearance. Each image is a blend of four faces of the same sex, thereby removing cues to individual identity. The central column (b, e) reflects the individual's starting skin color under calibrated conditions. The left images (a, d) simulate the effect of a 6.5 portion per day decrease in fruit and vegetable consumption. The right column (c, f) simulates the effect of increasing fruit and vegetable consumption by 6.5 portions. These simulations are based on the association of spectrophotometrically measured skin color and fruit and vegetable consumption in a mixed group of White and Asian ethnicity.^{2,4}

CAROTENOIDS, A CLASS OF MORE THAN 600 PLANT PIGMENTS, IMPART YELLOW-RED coloration to fruits and vegetables. These pigments also color human skin¹ and reflect the individual's diet; high consumers of fruit and vegetables have greater skin yellowness than do low consumers,² and changes in diet quickly affect the level of carotenoids in the skin.^{3,4} Serum carotenoid levels are lowered during chronic infection^{5,6}; hence skin carotenoid levels and skin color may serve as a perceptible cue of general health and diet quality.⁷ Carotenoid coloration has been shown to benefit appearance. White individuals who are able to manipulate the skin color of facial images consistently increase the yellowness to optimize the appearance of health.²

Individuals may be motivated to improve their diet if they are presented with images such as those in this article (see our Commentary in this issue as well), which illustrate the potential effect that a healthy diet can have on appearance. Such an approach could be suitable for reaching a wide audience; therefore, it is important to consider whether the change in skin coloration is seen as attractive across cultures. Empirical research suggests that this



Projected effects of fruit and vegetable consumption on African facial appearance. Images manufactured in similar way to that described previously.

would be the case: African² and Asian (R.D.W., unpublished data, April 2010) individuals share the preference with White individuals for raised skin yellowness in their own faces. This is illustrated in the facial images, which project the effect of increased or decreased fruit and vegetable consumption across different ethnicities. ■

About the Authors

Ross D. Whitehead and David I. Perrett are with Perception Lab, School of Psychology, University of St Andrews, Fife, UK. Vinet Coetzee is with Department of Genetics, University of Pretoria, South Africa. Gozde Ozakinci is with School of Medicine, University of St Andrews.

Correspondence should be sent to Ross D. Whitehead and David I. Perrett, PhD, Perception Lab, School of Psychology, University of St Andrews, St Mary's Quad, South St, St Andrews, Fife, United Kingdom, KY16 9JP (e-mail: rw394@st-andrews.ac.uk). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints/Eprints" link.

This article was accepted September 30, 2011.

doi:10.2105/AJPH.2011.300495

Contributors

R.D. Whitehead wrote the article, originated the study, and collected and manipulated the images. V. Coetzee collected images. G. Ozakinci revised the article. D.I. Perrett helped originate the study and draft and revise the article.

Acknowledgments

This work was supported financially by the UK Economic and Social Research Council, Unilever Research, the British Academy, and the Wolfson Foundation.

The authors would like to thank Daniel Re, Lesley Ferrier, Pete Wilcox, Anne Perrett, Dengke Xiao, and David Roche.

References

- Simon Alaluf, Ulrike Heinrich, Wilhelm Stahl, Hagen Tronnier, Shiela Wiseman, "Dietary Carotenoids Contribute to Normal Human Skin Color and UV Photosensitivity." *Journal of Nutrition* 132 (2002): 399–403.
- Ian Stephen, Vinet Coetzee, David I. Perrett, "Carotenoid and Melanin Pigment Coloration Affect Perceived Human Health." *Evolution and Human Behavior: Official Journal of the Human Behavior and Evolution Society* 32 (2011): 216–27.
- Maxim E. Darwin, Alexa Patzelt, Fanny Knorr, Ulrike Blume-Peytavi,



Projected effects of fruit and vegetable consumption on Asian facial appearance. Images manufactured in similar way to that described previously.

Wolfram Sterry, Juergen Lademann, "One-Year Study on the Variation of Carotenoid Antioxidant Substances in Living Human Skin: Influence of Dietary Supplementation and Stress Factors." *Journal of Biomedical Optics* 13 (2008): 044028.

4. Ross David Whitehead, David I. Perrett, Gozde Ozakinci, "Appealing to Vanity: Does Seeing the Potential Appearance-Benefits of Fruit and Vegetable Consumption Motivate Dietary Change?" *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine* 41 (2011): S214.

5. Stéphane Walrand, Marie-Chantal Farges, Olivier Dehaese, Nicolas Cardinault, Régine Minet-Quinard, Pascal Grolier, Corinne Bouteloup-Demange, Josep Ribalta, Brigitte M. Winkhofer-Roob, Edmond Rock, Marie-Paule Vasson, "In Vivo and In Vitro Evidences That Carotenoids Could Modulate the Neutrophil Respiratory Burst During Dietary Manipulation." *European Journal of Nutrition* 44 (2005): 114–20.

6. Henrik Friis, Exnevia Gomo, Pernille Kastel, Patricia Ndhlovu, Norman Nyazema, Henrik Krarup, Kim F. Michaelsen, "HIV and Other Predictors of Serum β -Carotene and Retinol in Pregnancy: A Cross-Sectional Study in Zimbabwe." *American Journal of Clinical Nutrition* 73 (2001): 1058–65.

7. Vinkler M, Albrecht T, "Carotenoid Maintenance Handicap and the Physiology of Carotenoid-Based Signalisation of Health." *Naturwissenschaften* 97 (2010): 19–28.