Appealing to Vanity: Could Potential Appearance Improvement Motivate Fruit and Vegetable Consumption?

Ross D. Whitehead, MSc, Gozde Ozakinci, PhD, Ian D. Stephen, PhD, and David I. Perrett, PhD

Fruit and vegetable consumption is inadequate among adults in the United States; this contributes to preventable morbidity and mortality. More effective dietary intervention strategies are needed.

Recently, interventions that advertise the consequences of behavior for appearance have been successful in modifying sun-exposure habits and tobacco use. Such an approach might also facilitate dietary improvement.

Consumption of carotenoid-rich fruit and vegetables positively affects skin color, which influences perceptions of health and attractiveness, and promoting such an effect may motivate target audiences to increase consumption of this important food group. This approach represents a novel direction for the field and is potentially suitable for cost-effective, population-level dissemination through the visual media. (*Am J Public Health.* 2012;102:207–211. doi:10.2105/AJPH.2011.300405)

INADEQUATE FRUIT AND VEGE-table consumption is an enduring problem that presents a significant challenge to human well-being, precipitating an estimated 2.6 million deaths per year worldwide[1] and placing a preventable burden on health systems, chiefly through incidences of cardiovascular disease,[2] diabetes and its complications,[3] and possibly some cancers.[4] The Produce for Better Health Foundation's *2010 Gap Analysis* revealed considerable discrepancy between the US Department of Agriculture's 2005 dietary guidelines and recent estimates of fruit and vegetable consumption.[5] To redress this balance, it is important to develop new public health strategies to facilitate population-level dietary improvement.

Current campaigns with this objective, such as the World Health Organization's 5-a-day scheme[6] and the Fruits and Veggies—More Matters program of the Produce for Better Health Foundation[7] predominantly aim to provide individuals with information on the health benefits of fruit and vegetables. As highlighted in the *2010 Gap Analysis*, however, recent evidence suggests that fruit and vegetable consumption has declined since the inception of such campaigns, suggesting that health information alone may not be sufficient to motivate adherence to recommendations at a population level. It may be that these campaigns have succeeded in making individuals aware of what constitutes a healthy diet but failed to motivate them to act on this knowledge.[8,9]

CURRENT SOLUTIONS

Smaller-scale intervention trials that have gone beyond providing information are relatively successful in motivating increased fruit and vegetable consumption. A systematic review by Pomerleau et al. concludes that interventions are most effective when they specifically target the individual's motivation to consume fruit and vegetables, through such techniques as motivational interviewing.[10] This approach has the drawback of being labor intensive, usually requiring multiple one-on-one sessions between each participant and a trained counselor,[11] which is impractical for wide-scale use. Michie et al. recently conducted a meta-regression of interventions targeting healthy eating and increased physical activity.[12] Their review revealed that interventions that explicitly encourage the participant to set goals, self-monitor and review goals (in light of feedback), and form behavioral intentions are among the most effective in achieving behavior change. Such techniques commonly form small parts of complex, multicomponent interventions, which use as many as 12 discretely identifiable techniques,[13] arguably rendering them too complex for use in a public health context and calling into question their utility. There is consequently an urgent call for more economically feasible dietary interventions to be developed and tested specifically for public health applications.

An effective strategy might involve augmentation of existing methods (e.g., the information provision approach of public health campaigns and self-management techniques) with novel evidence-based methods that may incentivize consumption of this food group. Carver and Scheier's self-regulation model of health behavior, for example, regards behavioral change as critically dependent on goal-directed action plans.[14] For behavior modification to be successful, individuals must establish a goal, which involves identification of a perceived discrepancy between the current self and a desired state. The individual must then use existing or newly acquired knowledge to determine how best to reduce this discrepancy. This suggests that fruit and vegetable consumption may improve if participants are also encouraged to create strong motivational goals or reinforce extant ones.

APPEARANCE-BASED BEHAVIORAL INTERVENTIONS

A motivational intervention paradigm recently shown to be effective involves highlighting the consequences of behavior for appearance.[15] Jones and Leary pioneered this strategy by explaining to individuals in writing how outward appearance is harmed by excessive sun exposure.[16] They found that these messages about appearance motivated sun protection intentions significantly more

than did health messages (i.e., emphasizing the negative consequences of sunbathing on health). More recently, Mahler et al. illustrated graphically to participants the negative consequences of ultraviolet light on facial appearance and significantly improved sun protection behavior.[15] This technique is sufficient to motivate lasting behavioral changes: longitudinal studies indicate that improved sun-exposure behavior was sustained for at least four months in a young adult sample[15] and up to one year in a study of male highway workers.[17] Sustained behavior change is a particularly important goal for dietary interventions; it may therefore be advantageous to explore appearance-based intervention techniques for dietary change.

The most effective of the sun-exposure interventions illustrate the negative consequences of sunbathing on images of the participant's own face. This may further strengthen goal formation and increase the salience and perceived relevance of the intended message.

Similar techniques have been used to target other complex health behaviors. Studies that simulate the negative impact of smoking on skin wrinkling and oral disfigurement have been successful in motivating adolescents to attend smoking cessation programs.[18] In the context of the self-regulation model,[14] such an approach may facilitate development of a goal state (improved appearance), which people can strive toward by using knowledge of the link between behavior and appearance.

APPEARANCE-BASED DIETARY INTERVENTION

Appearance-based interventions may prove to be an effective strategy in the framework of the self-regulation model. In the absence of illness, individuals are strongly motivated by changes in their own appearance, perhaps even more so than by their health status.[16] Furthermore, appearance is a particularly potent motivational force in an adolescent's dietary choices,[19] potentially representing a channel for establishing lifelong habits.

A dietary intervention focused on appearance may be practicable because of the impact that food pigments have on skin color and the general influence of skin color on human appearance and attractiveness.[20] Carotenoids are yellow-red organic pigments, which cannot be synthesized in vivo but are abundant in and impart color to fruit and vegetables. These phytochemicals are found in all layers of human skin[21,22] and contribute to normal skin color.[23] Individual differences in fruit and vegetable consumption are associated with variation in skin carotenoid concentrations[24] and skin yellowness.[20] Further, within-person dietary changes have been qualitatively linked with changes in skin carotenoid levels within a matter of days[25]; carotenoid supplementation also has been shown to affect skin yellowness.[20] Despite changes in carotenoid concentration, skin color may not be affected this rapidly, because the pigments are gradually assimilated into the outermost layer of the skin.[25] Preliminary studies, however, indicate that modest diet change over a six-week period is sufficient to confer perceptible skin color changes.[26]

Although factors other than skin color contribute to the appearance of healthiness, such as skin texture[27] and face shape or structure,[28–30] recent studies suggest that skin color has greater influence on Caucasian facial attractiveness than do some morphological cues of quality (e.g., masculinity[31]). Perceptual experiments also reveal that change in skin coloration (mimicking the effects of carotenoids) is alone sufficient to enhance the appearance of health in Caucasian, African,[20] and Asian individuals (see our Images of Health article in this issue[32]). The level of carotenoid pigmentation arises from the display and expenditure of these phytochemicals in their capacity as antioxidants, which may reflect the health status of the individual. Oxidative stress leads to increased expenditure of circulating carotenoids and is associated with negative health outcomes.[33–35] Hence carotenoid coloration is likely an indicator of actual health in humans, a mechanism that is also hypothesized to operate in other species.[36]

Significantly, skin coloration caused by carotenoids was found to make Caucasians appear healthier than did melanin coloration associated with tanned skin.[20] If such perceptions are general, it follows that advertising the appearance improvements associated with fruit and vegetable consumption may also serve to reduce incidences of the hazardous habit of sunbathing, a prevalent cause of skin cancer,[37] and instead motivate healthier eating.

In contrast with the majority of existing appearance-based interventions, which focus on the damage associated with noncompliance, a campaign targeting fruit and vegetable intake could also involve illustration of the appearance gains associated with increased produce consumption. Thus, we might illustrate to individuals how their appearance may benefit from dietary change, which may provide a more palpable, gratifying, and immediate benefit to strive for than do current attempts to improve diet.

IMPLEMENTING AN APPEARANCE-BASED DIETARY INTERVENTION

In practice, implementation of such a strategy requires empirical investigation of diet-linked appearance changes. Published cross-sectional studies that investigated the impact of diet on appearance[20] can be used to quantify the typical skin color change associated with a portion difference in fruit and vegetable consumption. These empirically derived color-change values can be applied to facial images with appropriate computer software[38] to illustrate the impact of a better or worse diet. Such illustrations could involve comparison between an individual's current appearance and what is potentially achievable through a specified increase in fruit and vegetable consumption (Figure 1). For instance, individuals who consume fewer than five portions a day (the World Health Organization recommendation) could be shown images that demonstrate the appearance improvements associated with meeting this goal.

Alternatively, individuals could use an interactive computer program to manipulate their own facial image along a fruit and vegetable consumption color axis. Such a program could indicate, at each color-change interval, the change in diet necessary to achieve the illustrated skin coloration. This would allow participants to explore their facial appearance in various guises and help shape the diet change required to achieve the facial appearance that they consider to be the healthiest or most attractive.

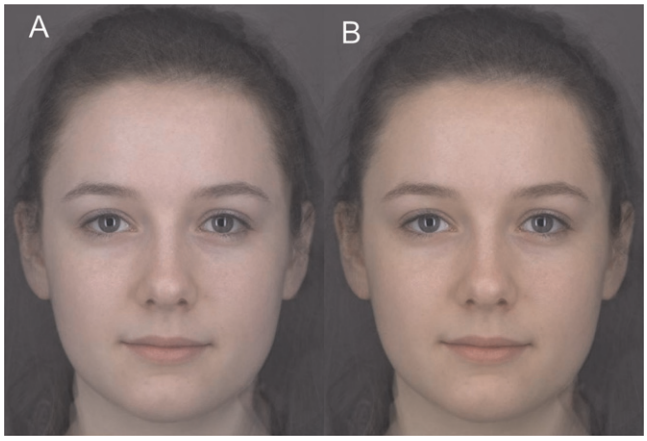

FIGURE 1—Examples of face stimuli to be used in an appearance-based intervention, with face color manipulated to represent (a) an increase of 6.5 and (b) a decrease of 6.5 fruit and vegetable portions relative to starting appearance (not shown); the color difference between these 2 images thus represents a difference in daily consumption of 13 portions of fruit and vegetables.

Published research predicts that participants would desire skin coloration associated with increased fruit and vegetable consumption, potentially creating a motivational target to improve appearance and diet.[20]

Appearance may act as a motivator of diet change, but several additional personal and demographic factors likely affect the efficacy of an appearance-based dietary intervention. For instance, an individual's readiness or ability to change dietary habits may be equally as important as potential appearance improvements, or even more important. A person's health behaviors, such as diet, are often influenced by others with whom they live or have other contact. The nature of the individual's social network may also affect fruit and vegetable consumption: individuals with low psychosocial resources are at higher risk of low intake of fruit and vegetables.[39] Furthermore, it may be harder for such individuals to alter their diet because they lack social support.[40,41]

Our approach assumes that persons who consume little produce will view diet-associated skin color changes as beneficial to appearance. This is likely to be a valid assumption: recent research indicates that 67% of college students consume fewer than five fruit and vegetable portions per day, and this population also reliably perceives increased carotenoid coloration as healthy.[20] Moreover, faces initially exhibiting low skin yellowness receive the greatest color change in perceptual experiments when participants are asked to maximize healthy appearance.[20] Thus, individuals with the lowest fruit and vegetable intake may enjoy the most improvement in appearance.[20] Such an intervention could therefore be most effective in this group. Further work is required to determine whether these findings extrapolate to other populations because age may be a key determinant of an individual's desire and perceived need to appear attractive,[19] and gender may also be a factor.

Because the proposed technique involves demonstrating the impact of diet on skin color, ethnicity may also be an important determinant of intervention efficacy. Perceptual studies suggest that preferences for enhanced carotenoid coloration are cross-cultural,[20] so we may expect that advertising appearance improvements will serve as a motivational force for many people and groups. Skin color–related appearance gains may be less visible or motivational in individuals with more heavily pigmented skin. It is critical to determine the extent to which this is true, because ethnicity is an important determinant of fruit and vegetable intake in the United States: African Americans have the largest divergence between recommended and actual intake.[42]

Socioeconomic status is a further key correlate of fruit and vegetable intake; individuals in low socioeconomic groups often cite prohibitive cost as restricting fruit and vegetable consumption.[43–45] It is critical to determine whether demonstration of appearance benefits is sufficient to overcome this barrier to healthy nutrition. A large cross-sectional study revealed that appearance concerns generalize across socioeconomic groups, suggesting that the proposed intervention technique would be motivational regardless of status.[46]

It is necessary to employ randomized controlled trials to verify the feasibility and efficacy of the intervention across each of these key demographic and intrapersonal factors. Trials should be appropriately sized, to allow for sufficient variation in determinants of interest. For instance, to determine the impact of a participant's baseline skin color on intervention efficacy, a sufficiently wide sample should be collected to investigate the effect of dietary and ethnic variations in skin color.

It is also important to establish whether any intervention motivates long-term improvement to diet. Appearance-based interventions targeting sun-exposure behavior are sufficient to sustain behavior change for up to one year[17]; ultimately, appearance-based dietary interventions should be evaluated over a similar duration. We hypothesize that longer-term efficacy might be achieved through reminders. For example, participants could be directed at regular intervals to online versions of intervention materials. Participants could be recruited to such longitudinal trials by various means. Recruitment at worksites or in communities chosen for their demographic characteristics might allow sampling of particular socioeconomic, racial/ethnic, gender, and age groups.[47] If the results of such trials warrant—and with appropriate automation—the image manipulation technique could be used to motivate wider-scale dietary change, such as in health care settings, to echo the dietary recommendations of medical practitioners. Various forms of visual media, including the Internet, could be used to disseminate illustrations of the effect of diet on appearance in generic faces at a population level. This would require further investigation into whether seeing this effect in an unfamiliar generic face would also act as a sufficient motivator.

Diet is recognized as a key factor in noncommunicable disease prevalence[48] and has proved

challenging to ameliorate with current methods. A strategy such as we propose could offer a valuable and novel incentive, which added to other methods may ultimately serve to reduce the prevalence of disease associated with inadequate fruit and vegetable consumption. ■

About the Authors

Ross D. Whitehead and David I. Perrett are with the Perception Lab, School of Psychology, and Gozde Ozakinci is with the School of Medicine, University of St Andrews, Fife, UK. Ian D. Stephen is with the School of Psychology, University of Nottingham, Malaysia Campus, Kuala Lumpur.

Correspondence should be sent to Ross D. Whitehead, 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.

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Contributors

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