ACS FOOD SCIENCE & TECHNOLOGY

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Viewpoint

Nutricosmetics: Vanity Can Help Increase the Consumption of Health-Promoting Foods in the Sustainability Era

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Cite This: *ACS Food Sci. Technol.* 2022, 2, 474−475

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THE LARGEST HUMAN ORGAN IS KEY FOR PROTECTION AND VANITY

The skin is the largest organ of the human body and can account for ∼15% of its weight. The outermost layer is called epidermis and acts as a physical barrier that protects us from biotic and abiotic aggressions (radiation, xenobiotics, microorganisms, etc.). The dermis is below. It is rich in water and the so-called extracellular matrix protein complex where collagen fibers, elastic tissue, and other materials are found. This layer confers mechanical strength and elasticity. The innermost layer is the subcutis and is key for insulation and mechanical protection and contributes to thermoregulation. Skin health is therefore crucial for preventing disorders of a different nature and gravity, ranging from infections to cancer. However, this organ is also important from an aesthetic point of view as some attributes of its appearance (color, wrinkling, elasticity, hydration, etc.) have clear social implications and can have an impact on mating possibilities and even on socioeconomic status (reviewed in ref 1 and excellent works cited therein).

FOODS FOR SKIN HEALTH AND BEAUTY

The relationship between some dietary compounds and skin health and appearance is undeniable and has been long-known (for example, vitamin C and vitamin A). Thus, vitamin C deficiency can result in impaired wound healing and skin fragility, due to the role of the vitamin as an antioxidant and in collagen synthesis. Furthermore, it is well-known that retinoic acid (a form of vitamin A) and its derivatives can modulate the expression of genes involved in cellular differentiation and proliferation at the skin level, hence their many therapeutic and cosmetic applications. Over the past several decades, others (Table 1) are being increasingly used for cosmetic purposes. One of the targets of these compounds with putative aesthetic benefits is combating photoaging, characterized by undesirable signs such as wrinkles, teleangiectasia (spider veins), or hyperpigmentation. Another target is skin color, which is not only due to melanin but also due to carotenoids and hemoglobin derivatives. In this scenario, a new buzzword, "nutricosmetics", is becoming popular in the commercial, technical, and scientific literature. Although there is not a consensus definition for it, the term revolves around the oral consumption of products containing food components seeking a cosmetic benefit. Related terms are "beauty pills", "beauty from within", "beauty foods", "nutraceuticals for skin care", or "oral cosmetics".[1,2]

Table 1. Food Components with Alleged Cosmetic Effects[1,2,4,5]

compounds	sources
peptides derived from collagen	marine and terrestrial animal protein sources
glycosaminoglycans	marine fish and bone matrix
polyphenols	fruits (apples, grapes, berries, citrus, etc.), vegetables (tomatoes, onions, cabbage, radishes, etc.), cereals, soy, chocolate, coffee, and tea
polyunsaturated fatty acids (PUFAs)	oils, nuts, and seeds
	cold-water fish
carotenoids	fruits (mangos, apricots, citrus, papayas, etc.), vegetables (green vegetables, tomatoes, carrots, pumpkins, peppers, etc.), salmon, and egg yolk
squalene	olive oil
coenzyme Q10	oils (soybean, corn, olive, and canola), nuts, and seeds
	meat, poultry, and fish
vitamins	
vitamin A	green vegetables, sweet potatoes, carrots, apricots, mangos, and palm oil (provitamin A carotenoids)
	liver and fish oils, milk, and eggs (preformed vitamin A)
vitamin C	raw red and green peppers, oranges, acerola, grapefruits, kiwi, strawberries, broccoli, Brussels sprouts, etc.
vitamin E	nuts, seeds, vegetables (tomatoes, spinach, asparagus, Swiss chard, and broccoli), corn, soy, and avocados
minerals	
copper	nuts, seeds, and grains
	seafood and meat
selenium	Brazil nuts and grains
	seafood, organ meats, poultry, and dairy products
zinc	cereals, nuts, and legumes
	meat, seafood, and eggs

AESTHETICS AND PUBLIC HEALTH?

An advantage of nutricosmetics is that their typical components (Table 1) can contribute to improved health either systemically or at least in other locations in addition to the skin. Due to a series of insightful and brilliant works, it is now becoming

Received: February 7, 2022
Accepted: February 8, 2022
Published: February 16, 2022

https://doi.org/10.1021/acsfoodscitech.2c00049
ACS Food Sci. Technol. 2022, 2, 474−475

apparent that aesthetic benefits (specifically color imparted by carotenoid) can be linked to the consumption of health-promoting foods, such as fruit and vegetables. In turn, this could be somehow harnessed in public health to promote healthy dietary habits in the future as envisioned by Whitehead et al.[3] and others ever since. In this case, a clear association between the consumption of carotenoid-rich foods and skin color change can be established. Future studies establishing unarguable aesthetic associations with other health-promoting food components will certainly contribute to the foundations of this emerging strategy.

"VANITY FOODS" AND THE NEED FOR SUSTAINABLE PRODUCTION

Generally, the term "cosmetics" evokes a range of products usually resulting from the formulation and processing of several ingredients. More importantly, there are several food groups featured in recommended reference diets (cereals, fruits, vegetables, legumes, nuts, unsaturated oils, etc.) that are rich sources of compounds with putative cosmetic effects (Table 1) and could be considered natural dietary nutricosmetics.

The current need to optimize resources and contribute to protecting the environment in alignment with the United Nation's Sustainable Development Goals, the Paris Agreement, or the European Union's Green Deal, among other frames, can pave the way for the development of innovative products. Such products cater to the preferences of growing numbers of sustainability-concerned consumers, a group that is expected to grow in the future.

Definitely, nutricosmetics, regardless of the degree of naturalness, processing, or formulation (that is, from raw foods to multi-ingredient supplements), need to contribute to sustainable development. This can be done through a series of approaches in key areas such as biodiversity, sustainable agro-food, and sustainable industry that can contribute to the goal of achieving climate neutrality, a global challenge. Within the scenario, the promotion of clean innovative products and technologies as well as the transition to a circular model of economy, where resources are kept for as long as possible, must be adopted. The way is paved. Bioprospect studies regularly result in the description of exotic plant foods with interesting compositions and adapted to different edaphoclimatic conditions, not to mention research on sources such as microbes, fungi, and the emerging field of edible insects. Tapping into aquatic ecosystems that host a large proportion of biodiversity will continue to be an important research field with many chances to afford innovative products. The agro-food industry is one of the major pressures for planet Earth ecosystems. The impact can be reduced by changing production systems (by adopting hydrosustainable practices, reduction of fertilizer use, regenerative cultivation practices, etc.), shifting dietary habits toward more sustainable sources (for instance, by increasing the consumption of plant foods, and reducing the consumption of animal foods), and reducing food waste from production through household use. With respect to industrial processing, there are many possibilities for sustainable innovation via combination of a wide variety of technologies. For example, there are emerging and established technologies that can reduce environmental costs (for example, by saving energy, time, solvents, etc.) and can be used for different purposes, ranging from prolonging shelf life to favoring the bioavailability of components of interest (ultrasounds, microwave, pulsed electric fields, high pressures, etc.). Biorefinery approaches are particularly timely in terms of making the most of foods, byproducts, or wastes. This approach can result in the production of diverse bioproducts for the agro-food, health, and cosmetic industries, including bioactive-rich extracts for formulation, bioplastics for packaging, biosurfactants, biogas, or soil amendments, contributing thus to a circular economy. Last but not least, R+D+I on nutricosmetics will need to include life cycle assessments (LCA) to evaluate environmental impacts associated to all the stages of the life cycle of the products.

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Notes

The author declares the following competing financial interest(s): A.J.M.-M. carries out consultancy work for diverse companies.

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