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Short communication

Bioactivity of carotenoids and their role in skin disorders: from tradition to application

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Abstract

Carotenoids, also known as tetraterpenoids, comprise a class of natural fat-soluble plant pigments which consist of a hydrocarbon skeleton with two terminal rings determining the yellow, orange or red coloration of different products. There are currently described near 1000 of different carotenoid compounds, of about 40 are regularly consumed in the human diet (Saini et al., 2020). Carotenoids include the non oxygenated carotenes (e.g. lycopene, β-carotene, α-carotene) and the oxygen containing xanthophylls (e.g. lutein, astaxanthin and zeaxanthin). Apart from role in the photosynthesis, they are involved in range of signalling pathways in plant cells, especially related to environmental stress responses and establishment of symbiotic relations (Sun and Li, 2020). In recent years, carotenoids have been researched for their health benefits and thus are extensively used in food, pharmaceutical, cosmetic and nutraceutical industries (Khalil et al., 2019).

Carotenoids express high antioxidant, anti-cancer and anti-aging properties (Rivera-Madrid et al., 2020). The main reason for fortification the food stuff with carotenoids is to reduce dietary deficiency in these nutrients and to avoid malnourishment in developing countries. The actual global carotenoids' market of 1.55 billion USD is projected to reach 2,0 billion by 2026 (https://www.marketsandmarkets.com/Market-Reports/carotenoid-market-158421566.html). Carotenoids' bioavailability varies greatly on endogenous (product-related) and exogenous (process-related) factors, due to their high sensitivity to light, temperature and other impacts. Therefore, different biotechnologies focusing on encapsulation of carotenoids are developed, including extrusion, homogenization, electrospinning, nano spray drying, and emulsification (Rehman et al., 2020). The food grade biopolymers are used as a wall material or carriers, enabling stability of physiochemical properties of capsulated carotenoids for their projected release and safe targeted delivery.

Our paper aims to highlight the recent approaches of bioactivity of carotenoids, especially linked to their role in prevention and mitigation of dermatological disorders. The photoprotective effects of carotenoids have been well documented, in addition to their prophylactic role in various diseases by supplementing the skin (systemically or topically) with different carotenoids. Two original data bases, one referring to carotenoid rich sources and the second to the traditional use of the Balkan plants for skin related problems were matched to identify the most promising carotenoids-containing herbal drugs (e.g. *Calendula officinalis*, *Rosa canina*, *Crataegus* ssp., *Cornus mas, C. sanguinea*, *Vaccinium vitis idaea*, etc.). Ethnobotanical data were linked to phytochemical composition of skin affecting plant drugs, whereas specific activity and role of main carotenoids compounds is further discussed. Additionally, best encapsulation techniques and mechanisms of bioaccessibility of

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carotenoids particles are pointed out. Special attention is paid to application of vibrational spectroscopy techniques, such as FTIR and Raman in qualitative and quantitative characterization of carotenoids, using advanced chemometric modelling approaches.

Key words: natural pigments, traditional medicine, dermatological conditions, bioccessibility, encapsulation, vibrational spectroscopy.

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References

Khalili, Z., Jalili, H., Noroozi, M., Amrane, A., 2019. Effect of linoleic acid and methyl jasmonate on astaxanthin content of *Scenedesmus acutus* and *Chlorella sorokiniana* under heterotrophic cultivation and salt shock conditions. J Appl Phycol 31, 2811–2822. https://doi.org/10.1007/s10811-019-01782-0

Saini, K.R., Keum, Y., Daglia, M., Rengasamy, K.R.R., 2020. Dietary carotenoids in cancer chemoprevention and chemotherapy: A review of emerging evidence, Pharmacol. Res. 157, 104830. https://doi.org/10.1016/j.phrs.2020.104830

Sun, T., Tadmor, Y., Li, L., 2020. Pathways for Carotenoid Biosynthesis, Degradation, and Storage, in: Rodríguez-Concepción, M., Welsch, R. (Eds.), Plant and Food Carotenoids. Methods in Molecular Biology, Humana, New York, pp. 3-23. https://doi.org/10.1007/978-1-4939-9952-1_1

Rivera-Madrid, R., Manuel Carballo-Uicab, V., Cárdenas-Conejo, Y., Aguilar-Espinosa, M., Siva, R., 2020. 1 - Overview of carotenoids and beneficial effects on human health in: Galanakis, C.M. (Eds.), Carotenoids: Properties, Processing and Applications, Academic Press, p.p 1-40, https://doi.org/10.1016/B978-0-12-817067-0.00001-4

Rehman, A., Tong, Q., Mahdi Jafari, S., Assadpour, E., Shehzad, Q., Muhammad, R. A., Waheed I.M., Marwan Rashed, M.M.A., Sajid Mushtaq, B., Ashraf, W., 2020. Carotenoid-loaded nanocarriers: A comprehensive review, Adv. Colloid Interface Sci. 275, 102048. https://doi.org/10.1016/j.cis.2019.102048