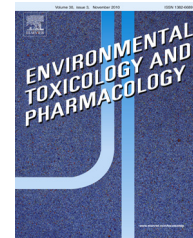


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Review

Anticedants and natural prevention of environmental toxicants induced accelerated aging of skin



Tanuja Yadav¹, Shivangi Mishra¹, Shefali Das, Shikha Aggarwal, Vibha Rani*

Department of Biotechnology, Jaypee Institute of Information Technology, A-10, Sector-62, Noida, 201307 Uttar Pradesh, India

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ABSTRACT

Skin is frequently exposed to a variety of environmental and chemical agents that accelerate ageing. External stress such as UV radiations (UVR) and environmental pollutants majorly deteriorate the skin morphology, by activating certain intrinsic factors such as Reactive Oxygen Species (ROS) which trigger the activation of Matrix Metalloproteinases (MMPs) and inflammatory responses hence damaging the extracellular matrix (ECM) components. To counter this, an exogenous supply of anti-oxidants, is required since the endogenous anti-oxidant system cannot alone suffice the need. Bio-prospecting of natural resources for anti-oxidants has hence been intensified. Immense research is being carried out to identify potential plants with potent anti-oxidant activity against skin ageing. This review summarizes the major factors responsible for premature skin ageing and the plants being targeted to lessen the impact of those.

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Abbreviations: LC, langerhan cells; GAG, glycosaminoglycans; MMP, Matrix Metalloproteinase; CPD, cyclo-butane pyrimidine dimers; UCA, urocanic acid; PAC, poly-aromatic carbons; PCB, polychlorinated benzene; HA, hyaluronic acid; ICAM, Inter-Cellular Adhesion Molecule; CHS, contact hyper-sensitivity; PYCR, pyrroline-5-carboxylate reductase; GTP, green tea polyphenols; EC, epicatechin; EGC, epigallocatechin; ECG, epicatechin-3-gallate; EGCG, epigallocatechin-3-gallate.

* Corresponding author. Tel.: +91 120 2594210; fax: +91 120 2400986.

E-mail address: vibha.rani@jiit.ac.in (V. Rani).

¹ These authors have contributed equally.

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1. Introduction

Skin is the most superficial organ, directly exposed to a wide range of pro-oxidants including ultraviolet radiations (UVR), chemical pollutants and air pollutants such as cigarette smoke in the environment, known as gerontogens, which are age promoting toxicants and result in morphological changes such as dehydration, sagging and even cancer of the skin. Various skin components together maintain the skin morphology and provide protection against the negative impact of gerontogens (Swann, 2010). Stratum corneum, the top-most layer of skin, protects from the environmental damages while melanocytes in the basal layer are responsible for skin pigmentation and photo-protection. The ECM components proteoglycans, glycosaminoglycans (GAGs), peptide growth factors and structural proteins such as collagen, elastin, types I and III collagen fibres maintain the cell structure. These components lose their integrity when regularly exposed to the exogenous environmental factors like UVR and particulate matters (PM). Additionally, absorption of these pollutants changes the dermal structure and function, compromising the ability of skin to get rid of the toxic compounds, as a consequence of oxidative stress. For instance, in case of smokers, smoke constituents damage the skin integrity by compromising the growth of fibroblasts which hence impairs the ability of skin cells to repair the damage. Oxidative stress is caused due to reduced concentration of GSH-Px that catalyzes the reduction of H_2O_2 to H_2O and O_2 and SOD. Reduced levels of SOD and GSH-Px weaken the cell's ability to eliminate oxidative molecules in mitochondria which further lead to an increase in ROS levels and thus aggravate mitochondrial dysfunction (Yang et al., 2013).

Regular exposure to the environmental insults such as UVR and toxic compounds speeds up the ageing process. However,

ionizing radiation, alcohol intake, poor nutrition, overeating, mental stress, less-sleep, infections and the level of some of the hormones that keep changing with age also contribute towards ageing. On the basis of the causable factors, the ageing process is classified as: (i) *intrinsic ageing*: mainly regulated genetically and includes factors like telomere shortening and hormonal expression and (ii) *Extrinsic ageing*: mainly occurs due to the gerontogens majorly including UV rays and the pollutants (Florence et al., 2012) [Fig. 1]. Present review focuses on the environmental factors and their cellular targets in skin ageing. A section is also included that discusses the natural remedies currently used against premature skin ageing. This review has wide scope and applications in the area of skin therapeutics.

2. Environmental factors affecting skin ageing

Age promoting gerontogens induce factors which are majorly responsible for pathways eliciting ROS production and MMP activation and further contributes towards morphological alterations leading to premature skin ageing (Jessica et al., 2014). Arsenic, a common toxicant of ground water causes premature age-related phenotypes, skin and bladder cancer, type 2 diabetes, neurodegenerative disease, and atherosclerosis.

2.1. Ultraviolet radiation

Exposure to UV rays, one of the most significant external stress inducing factors, is a major cause of premature skin ageing. The UV spectrum consists of three specific regions: UVA (320–400 nm), UVB (280–320 nm), and UVC (200–280 nm). UVC having the shortest wavelength (200–280 nm) gets primarily absorbed by the ozone layer, which hence prevents

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