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Review Article

Yoga may attenuates hallmarks of skin aging

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ABSTRACT

Background: Aging is the continuous loss of homeostasis in a cell, tissue, organ, and whole body. Over time, skin, the biggest organ in the body, may age and become more susceptible to injury. In this study, we thoroughly examined signs of ageing skin. A challenge in front is the fast aging of the people with this finding a lifestyle intervention or strategy to improve skin as well overall health with negligible harmful effects. Yoga is an inclusive program that includes dietary, lifestyle, behavioral, and psychological involvements to re-establish the system's homeostasis and works simultaneously at the body, mind, and spirit levels. Yoga is an auspicious lifestyle intervention that has exposed antiaging effects to extend healthspan by reducing the nine hallmarks of skin aging and related disorder and diseases.
Aim: To evaluate the impact of yogic practices on hallmarks of skin aging leading to improved healthspan and lifespan.
Conclusion: This article evaluates that Yoga is a promising tool in controlling nine hallmarks of biological skin aging which increases both health span as well as lifespan. There is a need to verify its application and find a modest, appropriate, and costless substitute to improve longevity and health span.

1. Introduction

Aging is the continuous loss of homeostasis in the human body. The human body's largest organ, the skin performs a wide range of intricate tasks. Epidermal stem cells (ESC) are abundant in the basal layer of the epidermis. The principal source of mesenchymal stem cells, which generate collagen fibroblasts (a constituent of blood vessels that supply the skin) and immune cells in the skin is the mesoderm. Uneven pigmentation, colour changes, decreased supplements, skin shrinkage, loss of underlying tissues, and compromised barrier function are the general characteristics of ageing skin.[1] The structural integrity and functionality of various skin regions may eventually be destroyed by these alterations, resulting in diminished flexibility and bad visual features that make ageing skin more prone to illness and injury.

According to holloszy Primary aging is the loss of cellular anatomy and physiology such as hearing and visual loss not influenced by any other situational factors. Secondary aging is the functional deviations influenced by other internal as well as external factors and can be enhanced by inactive lifestyle which can be slow or prevent by mind-body interventions. Chronological aging is the actual time a person has passed since birth in terms of days, months, and years. Biological aging is all about epigenetic alteration and DNA methylation also called physiological or functional age. External environment and internal genomic aspects contribute to various skin disorders and accelerate the biological skin aging process. As progressive loss of homeostasis accelerated the process of biological skin aging. According to Lopez Otin, 9 hallmarks of aging accelerate the physiological skin age.[2,3] These hallmarks

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can generally be divided into three categories including.[4] a. Causes of damages as primary hallmarks in skin aging; b. Responses to damage as antagonistic hallmarks in skin aging; and c. Culprits of the phenotype as integrative hallmarks in skin aging.

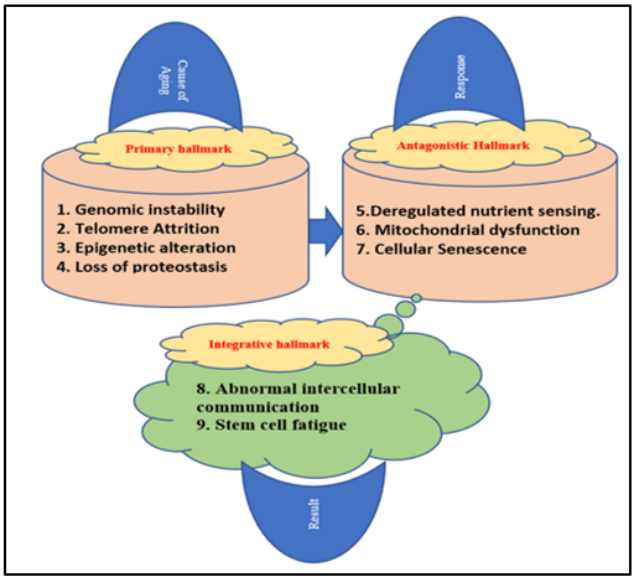

Figure 1: Hallmarks of skin aging

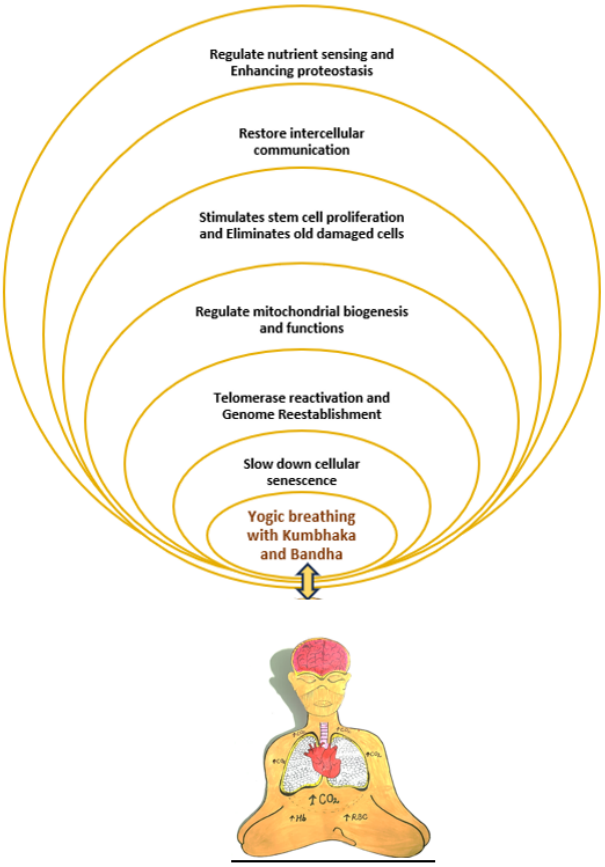

Figure 2: Yogic breathing with Kumbhaka and Bandha attenuates hallmarks of skin aging

2. Yoga may Aattenuate Hallmarks of Skin Aging

2.1. Genomic instability

Mutations, translocations, deletions, telomere shortening, and damage in DNA and nuclear architecture due to external (environmental) and internal (genetic and biological) factors cause genomic instability**.**[5] It is a sign of ageing skin and may cause chromosomal instability and replicative cellular senescence. The shortened telomere length in blood leukocytes and the estimated role of DNA damage in human dermal fibroblasts were found in a recent update on patients with systemic sclerosis.[6]

Yogic exercises can minimize this instability of genetic material through: Decreasing 8-hydroxy-2-deoxyguanosine (8-OHdG), Oxidative stress, nuclear factor kappa B(NF-kB), and PGC-1a signalling, and through increasing Telomere length and telomerase enzyme activity.[7,8]

2.2. Telomere attrition

During aging decreased telomere length of chromosomes is most vulnerable to age-related skin and other disorders such as sclerosis, metabolic syndrome, cardiovascular diseases, and neurodegenerative diseases. Today various studies report a correlation between telomere length, anxiety, depression, DNA deterioration, and age-related skin disorders.[9] Skin homeostasis loss that triggers the p53 signalling pathway and causes planned cell death.[10]

Yogic practices can prevent and increases telomere length through: Increasing Telomerase enzyme activity**,** Telomerase reverse transcriptase (TERT)**,** Proteins involved in DNA repair such as Ku, Neurogenesis (hippocampal, olfactory bulb), and Stem cells and decreasing Oxidative stress[11,12]

2.3. Epigenetic alterations

An unhealthy environment and lifestyle factors can alter and degrade DNA. Which causes DNA methylation and influences gene function known as epigenetic changes such as loss of histon protein, imbalance of histone and heterochromatin modifications, transcriptional abnormalities, damaged nuclear lamina, and abnormal DNA methylation are the causes of accelerated aging.[13] According to a recent study, the DNA of the aged exhibits a distinct hypermethylation pattern with great tissue specificity. This suggests that phenotypic changes associated with skin ageing may be the origin of DNA methylation and these modifications.[14]

2.3.1. Yogic practices can regulate

1. Regulates cellular energy metabolism and mitochondrial biogenesis by activation of peroxisome proliferator-activated receptor-gamma coactivator (PGC -1α).
2. Citrate synthase (CS) which is a quantitative marker of intact mitochondria in skeletal muscles.
3. Mitochondrial transcription factor (TFAM) plays a vital role in the maintenance of genetic material.
4. Pyruvate hydrogenase kinase isozyme (PDK4) converts Pyruvate to Acetyl CoA and finally in the generation of energy.
5. By decreasing Pro- inflammatory cytokines (IL-1b and IL18) through methylation of apoptosis-associated speck-like protein caspase (ASC) gene.
6. Stimulated Sirtuin upregulates hematopoietic stem cells (HSCs) [15–17]

2.4. Loss of proteostasis

Dysfunctional and damaged cellular proteins and other cellular structures occur with an increased aging process, which disrupts cellular homeostasis and causes various old age-linked chronic skin illnesses. [18] The FOXO transcription may reduce protein imbalance extends skin as well overall health. [19–22] Skin ageing is caused by the ageing of dermal fibroblasts, which is known to be accompanied with a progressive loss in proteasome function and altered protease production. UV radiation-induced skin aging by proteasome subunit inactivation and buildup of oxidized proteins. [23] In older dermal fibroblasts, keratinocytes, melanocytes, and epidermal stem cells, reduced autophagy, increased secreted matrix metalloproteinases (MMP), and down-regulated hyaluronic acid synthases were previously studied parameters. [24]

Yogic practices can regulate protein homeostasis by controlling the following signalling: By decreasing Target of rapamycin complex 1 (TORC1) and by increasing Autophagy [25], IGF-1**,** mTOR**,** FoxO3a.

2.5. Deregulated nutrient-sensing

The human body loses the ability to sense and respond to changes in cellular nutrient levels with age such as lipid sensing, cholesterol sensing, amino acid sensing, and mechanistic target of rapamycin (mTORC1) and autophagy, which have a vital role in energy production, cellular biomass and metabolism. Nutrient homeostasis, anabolism, storage, catabolism, and autophagy are deregulated with age- and induce age-related diseases. The pathway between the cells contains GH, and IGF-1 and IGF-1and insulin having the same pathway that's why IGF-1 and insulin signaling is known as the 'insulin and IGF-1 signaling (IIS) like glucose sensing. The utmost focused pathway that controls skin aging is IGF-1 signaling (IIS) system. Other related nutrient controlling systems such as mTOR, for the sensing of high level of amino acid and AMPK, and sirtuins which regulates low energy, [26] the FOXO group of transcription and the mTOR complexes are utmost focused in slowing biological skin aging. [27–29] Genetic alterations that affect the functionality of GH, IGF-1, insulin, mTOR, and FOXO pathways have a major impact on skin health. [30]

Yogic exercises can regulate the nutrient sensing pathways through: AMPK pathway regulation and mitochondrial biogenesis, decreasing oxidative stress, and regulating nutrient sensing pathway**,** sertuin proteins/genes (regulates metabolism, redox status of cell) and, Mitogen-activated protein kinase (MAPK) (cell proliferation survival and differentiation).

2.6. Mitochondrial dysfunction

According to Harman, reactive oxygen species (ROS) results in oxidative stress is one of the utmost causes of mitochondrial dysfunction and increased biological skin aging. [3,31] Mitochondrial damage may impact cellular functioning and crosstalk within the cell. [32] SIRT1 controls mitochondrial biogenesis through activation of PGC-1α and autophagy. [33,34]

Yogic practices can regulate mitochondrial structure and functions through: Activation

of PGC-1α**,** mitochondrial biogenesis and its content in skeletal muscle, and by improving mitochondrial transcription factors. [8,35]

2.7. Cellular agedness

Cellular aging is a state of irreversible or irreparable cell division due to various external and internal reasons such as DNA replication stress, oxidative stress, inflammatory cytokines, telomere shortening, inactive telomerase enzyme due to activation of p53 tumor suppressor and p16 kinase inhibitor affects cellular homeostasis and accelerates the aging process. p53 and p16 increase with age in stem/progenitor cell and leads to decreases in neurogenesis, [36,37] and an indicator of senescence whose expression is directly correlated with the ageing of human skin over time. [24,38]

Yogic practices suppress senescence markers through: Decreasing gamma glutamyl transpeptidase activity, p53, p16, oxidative stress, and inflammatory markers and by increasing telomere length, telomerase activity, stem or progenitor cells (neurogenesis), angiogenesis and mitochondrial biogenesis [11,12,39]

2.8. Stem cell exhaustion

Progenitor cells are undifferentiated raw cells having capacity to develop into diverse forms of cells in the body from muscle to brain cells. But the ability of stem cells decreases with age like the decline in satellite cells

which reduces muscle mass with increased old age.[40] Skin ageing and illnesses such as skin shrinkage, fragility, dyspigmentation, and delayed wound healing can also be caused by skin stem cell (Epidermal stem cells) exhaustion. Oxidative damage, DNA damage, reduced telomere length, and altered telomerase activity are all responsible for the aberrant behavior of epidermal stem cells.[41]

Yogic practices can enhance or stimulate pluripotent stem cells like neuroglia, satellite cells, and mesenchymal cells which increases neurogenesis, and angiogenesis which improves brain regenerative capacity.

2.9. Altered intercellular communication

Altered cell communication results in diseases, due to loss of signals, signals don't reach their target, the target ignoring the signal, too much signal, and multiple signals breakdowns.[18] Age-related damage to cells or tissues breaks coordination among organs. contagious aging' in which aging cells induce agedness in neighbouring skin cells or defected cells induce defects in neighbouring cells[42] as like impaired kidney can damage the cardiovascular system in humans.[43] Increase of cytokines in the bloodstream, pro-inflammatory tissue damage, or a reduction in immune system function, which can lead to a number of ailments, including diabetes, heart disease, and skin conditions.[44]

Yogic practice can improve or restore intercellular communication that is lost during skin aging.

3. Discussion

The most widely discussed theories of aging are "wear and tear theory, neuro-endocrine theory, genetic control theory, free radical theory, mitochondrial theory, waste accumulation theory, and telomerase theory".[45,46] Regulated mind-body communications, nutrition and energy controlling pathways encouraging healthy skin and life.[47] Information is scanty about whether yoga can improve age-associated deteriorating deviations in the human body. According to American lung Association "If you can't breathe, nothing else matters". The brain consumes the highest oxygen due to which it is more prone to diseases. There is a need to understand the hypoxic responses in the brain and find novel therapeutic approaches to regulates brain anatomy and physiology. The mammalian brain requires a continuous supply of glucose and oxygen for energy production.[48] Any interruption in the oxygen delivery to the mind may leads to harmful impact on brains anatomy and physiology. Hypoxia results in irreparable cellular damage and ultimately leads to accelerates aging.[49] Hypoxia increases with age and increased susceptibility toward to cerebral dysfunction and neuroinflammation, stroke, reduce telomere length, oxidative stress and skin aging.[50,51] It has been reported that through yogic practices, improves production of brain-derived neurotrophic factor (BDNF) and cortical neurogenesis, promoting hippocampus growth, and ganglions,[52] increasing cerebral perfusion and hence oxygen delivery to each and every cell of the brain and body which will improve holistic as well skin health.[53]

Yoga has been proved very effective in the management of various ailments like hypertension, cardiovascular abnormalities, diabetes, obesity, back pain[54] and cancer, improves respiratory capacities and volumes, cognitive function, improve vagal tone and cerebral perfusion[55] activation of the prefrontal cortex, and anterior cingulate gyrus,[56] increased neuronal connectivity,[57] regulates circadian rhythm,[58,59] increased Gray matter in the cerebellar, occipital, temporal, limbic, and frontal lobe of the brain[60,61] increases the amplitude of P3 wave which improves neuronal pool of the brain.[62] Improves Brains cognitive potential such as P300 auditory[63–65] decreased chemical reflex of hypoxic and hypercapnic responses and enhanced baroreflex actions has been reported[66] Practice of some specific Yogic practices (Bandh and Kumbhaka) improved adaptation to hypoxic conditions of different receptors such as peripheral, central chemoreceptors and pulmonary stretch receptors with decreases inflammatory markers.[67] Hence, Yoga therapy might be a capable strategy to understand the intrinsic capability of the body in handling hypoxia which may improves overall skin health.

Reduces oxidative stress, prevent DNA mutations, improves telomerase action, and reverses epigenetic changes.[68] To fight oxidative stress use of oral antioxidants without monitoring reactive oxygen species levels resulting in degenerative stress[69] unlike in yogic practices which regulates ROS levels so that no redox-sensitive physiology gets weakened.

Psychological stress due lifestyle, external and internal circumstances, and medical interferences results in faster biological aging, and disturbs physical, psychological, and social capability.[70] Yoga can play a vital role in encouraging these capabilities.

Previous studies have confirmed the experimental assistances of Yogic practices.[71] Such as reducing testicular aging and regulating telomerase activity[68] reversal of cellular aging, decreasing interleukins, and other inflammatory markers.[72] Improved cellular longevity through regulating biochemical markers of biological aging such as β-endorphin, cortisol, interleukins, BDNF, and sirtuin-1 which promotes cellular recovery.[73,74]

Yoga may be as effective or better than other adverse or extraneous exercise in regulating biochemical markers of aging and associated disorders. The practice of Yoga results in energy conservation and brings about homeostasis in each and cell of the body through holistic growth and development of the body, mind and spirit on the other hand physical exercise and other adverse or extraneous exercise results in energy expenditure may cause irregular variations in biochemical markers of skin aging[75]. Antioxidants

pills or tablets can only decrease ROS rather than its regulation and may inconsistently condense healthspan.[76,77] Yogic practices establish homeostasis by balanced physical, mental and biological processes[68]. Such as heart rate inconsistency[78] mental performance[79] blood glucose, lipids, cortisol, oxidative stress.[80,81] Tiredness, aching and sleep discomfort[82] Improves anatomy and physiology of cardiovascular system by moderating heart, B.P, and HRV.[83] Enhance brain's structure and functions by increasing grey matter, cognitive functioning and brain waves.[84] Yoga, practiced in a more integrated form, Yogic practice consisting entire synovial joints mobilization synchronized with breath regulation and mental awareness. Hence, may provide supplementary profits over an extraneous exercise.[85]

4. Conclusion

Yogic practice consisting entire synovial joints mobilization synchronized with breath regulation and mental awareness, which makes a man free from all ailments, restore homeostasis and gives healthy skin with aging. This article evaluates that Yoga might be a promising tool in controlling nine hallmarks of biological skin aging. There is a need to verify its application and find a modest, appropriate, and costless substitute to improve skin health.

5. Source of Funding

None.

6. Conflict of Interest

None.

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