Recent Advances in Anti-Aging – A Review

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Abstract: From the very ancient time, mankind has already been interested in preventing and keeping ourselves young as long as possible. The term aging is a universal biological process that leads to progressive and deleterious changes in organisms. In present scenario, the meaning of anti-aging has been changed from simply prolonging lifespan to increasing health span, which emphasizes more on the quality of life no matters how long is the life span. Telomeres which are the part of chromosome play an important role in terms of aging as they are having repetitive DNA sequences. Resveratrol, an important antioxidant polyphenol extracted from red wine, has been the subjected to an interest as they are having a range of unique anti-aging properties. Anti-Aging therapies are being used now, days to cure aging. As phenotypes are regulated by genes they are also influenced by epigenetic factors which focus on appearance in aging.

Key words: Antiaging, Aging, Antioxidant, Polyphenols, Resveratrol, Telomeres, Antiageing creams, Cosmeceuticals, Skin care

INTRODUCTION

Aging refers to the rapid, deleterious and universal changes in organisms. Aging is a process that occurs in all living organisms. Anti-aging in present scenario has become an interesting topic to mankind. The study of herbal medicine has received increasing attention in aging research. Today, the goal of anti-aging medicine depends completely on health span. The diseases like Alzheimer’s disease (AD) and Parkinson’s disease (PD) are aging associated neurodegenerative diseases that can greatly impair quality of life. These diseases affect the brain, which is the control center of our body. With the inferences of these factors, our bodies undergo rapid deterioration of physical functions, loss of homeostasis. After so much research being done in this field of anti-aging, it is now accepted that aging is a multifarious event resulting from the collective effects of genetic variation, nutritional factors and lifestyle [1]. The study of skin problems of aging can be divided in terms of microscopic, biochemical and molecular changes. Aging is divided into two parts i.e. intrinsic and extrinsic aging. The skin and hair are subject to intrinsic aging and extrinsic aging due to external factors. Extrinsic factors for skin aging include U.V rays of the sun and smoking. Intrinsic factors are caused by genetic and epigenetic mechanism. So, this can be prevented by protecting skin from U.V rays of sun and smoking. We can do prevention using sun protecting agents and anti-aging compounds, cosmetic products such as chemical peels, microderm-abrasion, soft tissue fillers, non-ablative laser rejuvenation, radio-frequency techniques and toxin such as botulinum. [2]

Telomere: Telomeres are non-coding DNA (TTAGGG), repetitive elements which are present at the ends of chromosomes which are capped with a series of single- and double-stranded DNA binding proteins. As cell division takes place the size of telomere gets shortened. It is seen that in newborn babies, the size of telomeres are approximately 15–20 kb in length and this gets shortened throughout life. This shortening of telomeres occurs in mainly in proliferating cells of the skin, gastrointestinal system and blood. It is frequently seen that once a shortened telomere length is attained, cell senescence is triggered. When these cells become senescent in a tissue, this changes the homeostasis of that tissue, leading to ageing. Shortened telomeres in chromosome of cells in tissues have been reported as liver cirrhosis, Barrett’s oesophagus and eloproliferative disorders [3].

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Role of Telomere in Aging: Telomere plays an important role in chromosome stability which was first proposed in the 1930s by Barbara McClintock working with maize and Hermann Muller working with fruit flies. The term telomere, from the Greek for “end” (telos) and “part” (meros) was coined by Muller. McClintock noted that without these end structures i.e telomere, chromosomes would fuse and would break upon mitosis. It was concluded that “telomeres” are required to protect chromosome ends, to provide chromosome stability and also for segregation of genetic material into daughter cells upon cell division. So, through this phenomenon we can study aging in humans. After certain cell divisions, the human cells placed in tissue culture stop dividing by the process of replicative senescence. Telomere also plays an important role in cellular responses to stress and DNA damage. Cells divide in order to recover injury or to balance the normal cell loss. Some cells in human body divide more times than needed during lifetime. [4]

Appearance: Many people become unsatisfied with their aged appearance and they feel unhappy with their skin.[5] There are several changes which take place in the aging body and those are sensory and structural changes which are as follows:

Sensory Changes: As the name suggests sensory changes means loss in the senses like decline in sight and peripheral vision, hearing, smell and taste.

Structural Changes: As the age moves on our body also get losing in mass resulting in reduced muscle mass such as skeletal muscle, smooth muscle and that muscle that affects vital organ function. Cardiac capacity can be reduced. This change can also result into reduced body water. The loss in body mass may also result in decrease in basal energy metabolism. This may also lead to change in the kidneys, lungs and as well as liver which results inability to generate new protein tissue. Aging may also affect the immune system responses in making antibodies against antigens. Aging not only alters our physical appearance like changes in skin, bones and muscle tone, but also affects our internal organs. The heart and immune system become less efficient and diseases that are rare in young people become increasingly more prevalent in older adults. Aging is a multi factorial biochemical and physiological process that leads to change in cellular breakdown and death [6].

Loss of Telomeric DNA with Age: The loss of telomeric DNA at the cellular level is related to replicative history and life span in somatic cells. Thus aging cause telomere shortening or telomere shortening cause aging. The issue of organismal aging as a consequence of short telomeres resulted when Dolly was “cloned” by transfer of an adult mammary gland nucleus into an enucleated egg was shown to have short telomeres. The “immortal” growth properties of embryonic stem cell lines are derived by pre implanting embryos of many species which suggests that telomere loss can be attenuated in early development. As the age goes on the loss of telomere repeats in human cells greatly between cells and tissues. It has been noted that the total number of cell divisions in stem cells is approximately 100 divisions over a human lifetime and it is also noted that those stem cells which undergo least cell division are most primitive as well as having longest telomeres [7].

Selection of Anti-aging Compounds:

- Grape Seed Extract- Are extracted from polyphenols & flavonoids from fruits extracts which acts as an antioxidant for skin treatment.
- Collagen, Hydrolyzed- These are extracted from protein & protein fragments, animal/vegetable derived from protein containing compounds which acts as moisturizer and it also helps in regeneration and also helps for an anti-wrinkle treatment.
- Jojoba Protein-These are also extracted from protein which is derived from Jojoba plant which acts as Moisturizer and it also helps in regeneration and also helps for an anti-wrinkle treatment.
- Elastin- It is extracted from protein, which is derived from animal/plant/marine which helps in moisturizing, restructuturing and for anti-wrinkle treatment.
- Gelatine- It is extracted from protein derived from animal/plant/marine which helps in moisturizing, restructuturing and also acts as an anti-wrinkle treatment extract used in cosmetic creams.
- Chondroitin Sulphate- It is extracted from polysaccharide derived from animal/plant/marine used for moisturizing and in regeneration.
- Oligopeptides- Are derived from animal/plant/marine which stimulates collagen synthesis & skin cells growth.
- Phytic Acid- Derived from botanical extract which acts as (fibroblasts) Antioxidant & chelating agent, scavenges the free radicals.
- Spirulina Extract-Derived from botanical extract from plankton which provides free-radicals as antioxidant, acts as immune-stimulator and acts as moisturizer.
- Calcium PCA- These are found in minerals, it stimulates cell differentiation & synthesis of epidermal layer.
- Ceramides- Ceramides are packed in milk-liposomes (lacto-ceramides), lipids which replenishes own skin-ceramides and also recovers barrier.
- Zea Mays Kernel Extract-Derived from botanical extract from Zea Mays Corn which is rich in inositol which functions as an antioxidant for skin.
- DHEA-3-Beta-Hydroxy-5-androsten-17-one-acts as Protective reagent and also acts as a regenerator.
- Pullulan- Are extracted from natural sugar i.e. glucan from fungus \textit{A. pullulans} which gives Skin tightening effect and stimulates collagen synthesis.
- Ferulic Acid-These are derived from phenolic compounds which are derived from plants and acts as antioxidant, anti-inflammatory agent.
- Hyaluronic Acid-This is derived from polysaccharide, which is derived from soy peptone and yeast extract which acts as Moisturizer which promotes growth of skin cells and also helps in antiwrinkle treatment.
- Genistein- Isoflavone compound, plant-This is derived from soya, tofu which acts as an antioxidant, protective agent.
- Kojic Acid Dipalmitate -Derived from natural products derived from Japanese mushroom which helps in toning, invigorating and in skin-lightening/whitening treatment.
- \textit{Phyllanthus emblica}-Extracted from polyphenols & flavonoids from fruit extracts acts as an antioxidant which promotes incollagen & elastin synthesis and in Skin relaxation.
- Coenzyme Q10- Derived from Ubiquinone which is vitamin like compound extracted from plant acts as moisturizer and protects from cell damage Inhibition.
- Ectoin- Derived from natural compound extracted from halophilic bacteria which helps in enzymes that degrade collagen in the skin and acts as an antioxidant.
- TIMP2- Extracted from protein and biotechnologically derived produced which stimulates in collagen synthesis and in skin-lightening and acts as an Anti-wrinkle treatment.
- L-ascorbic acid (Vit. C) - Derived from natural derived or synthetic which inhibits the facial skin muscle tightening and acts as contracts collagen.
- Argireline- Derived from peptide from acetyl hexapeptide-3 which acts as moisturizer and inhibits “age enzymes” and acts as regenerator.
- Dipalmitoyl Hydroxyproline- Derived from amino acid combined with palmitic acid which promotes skin cell growth and acts for anti-wrinkle treatment and acts as moisturizer and it also improves in skin elasticity and acts as a regenerator [2].

**Skin Aging Prevention and Therapy:** The anti-aging strategies for skin are done to change the signs of chronological aging which can be divided under the following:

- Caring through Cosmetics –The skin can be prevented through correct sun protection means should prevent the skin from ultra violet rays directly coming from sun by using cosmetics like sun screen etc. Aging can also be prevented through using daily skin caring protectants. Today, skin can also be protected by Aesthetic non-invasive procedures.
- Topical medical agents or topical agents- For protecting the skin from anti aging antioxidants play a crucial role. Cell regulators to play an important role in controlling the aging of skin.
- Invasive procedures–This procedure includes use of chemical peelers, use of visible light devices, use of intense pulsed light (IPL), prevention from dynamic wrinkles, Restoration or redistribution of fat and volume loss, skin augmentation and contouring, correction of static, anatomical wrinkles, using injectable skin biostimulation and rejuvenation, use of radio frequency and using ablative and non ablative laser photo rejuvenation.
- Systemic agents–This includes hormone replacement therapy and antioxidants.
- Avoiding of exogenous factors of aging, correction of lifestyle and habits – Should be free from stress, should prevent the skin from solar UV radiation, should prevent the skin from pollution, skin should also be prevented from smoking, should take proper nutrition diet and alimentary supplementation, should do proper physical activity like yoga and exercise[7].
- Antioxidant –Antioxidants are more potent in wine polyphenols and generally many times greater than vitamins A, C and E. It is observed that antioxidants found in vegetables are less efficient than antioxidants found in red wine. Not only antioxidants vitamins are responsible for antiaging but
polyphenols also benefit in anti-aging. These polyphenols are extracted from tea which acts as an antioxidant to cure antiaging. These antioxidants functions by scavenging reactive oxygen species through direct and indirect method. In this direct antioxidant activity occurs through scavenging free radicals and through chelation of redox active transition metal ions and in indirect method there is an induction of antioxidant enzymes superoxide dismutases and glutathione S-transferase. Catechins, epicatechins and gallic acids which are found in red wine and ellagic acid found in pomegranate acts as antioxidant for curing antiaging. In present scenario studies synthetic coenzyme Q analog idebenone has been become an important and strongest antioxidant [8].

- **Prevention of photoaging**

Antioxidant compounds play an important key ingredient in skin caring products which have received importance in present scenario. Resveratrol and other botanical antioxidants are one of the most used antioxidant for curing aging. Resveratrol acts on cellular signaling mechanisms which are related to UV-mediated photoaging. Resveratrol lowers down the level of reactive oxygen species in UVA-exposed HaCaT keratinocytes in a proper dose [8].

- **Hydration Is Key**

Skin tone can be preserved through hydration. Natural moisturizers nourish and tone the skin which represents an innovative application of natural extractives in skin caring products. Today, unsaturated fatty acids are acting as the skin’s barrier which prevents moisture loss through the topmost skin layer i.e. epidermis, which prevents the skin from damaging by external means. These fatty acids soften the skin and smoothen the skin by inhibiting the formation of corneous cells. Lipid helps in preventing water loss and also repairs lipid layers and restores barrier functions. A fruit such as green coconut water which is rich in nutrients, amino acids including arginine and growth factors, also supports hydration and preserves the skin elasticity. One example polysaccharides such as chitosan and their derivatives with low molecular weight glycans which prevents water loss from the skin, tissue components such as hyaluronic acid and complexes. The skin roughness and improved skin tone can be obtained through cream containing Coconut water solid part which improves keratinous tissue and also reduces the sign of aging [9].

- **Plants as skin protectants**

The skin can also be protected through the use of plants in many ways. Oils which are extracted from plants are used as protective emollient layer which reduced water loss and increases hydration from skin layer. These plant oils also provide smoothing to the wrinkles. The use of sunscreens will also reduce the solar damages which are caused on skin. The aim of cellular regeneration from plant sources is possible through the use of phytosterols and phytohormones and there are many other chemical entities within plants which can reduce erythema, reduce swelling and repair skin damages [10].

The role of nutrition in slowing down the rate of aging

- **Dark chocolates** –Chocolates are made up of cocoa beans which are having higher antioxidant capacity and high concentration of antioxidant flavanols which reduces inflammation of skin caused by exposure of UV light.

- **Berries** - All type of berries contains flavonoids and anthocyanins which acts as powerful antioxidants which protects the body from damages caused by free radicals and aging. This also slows down the cancer rate and as well as improve brain function, muscle tone.

- **Yogurt** - calcium, vitamin D and proteins are important for skin and all are available in yogurt. Yogurts also contain probiotics, which can reduce the inflammation and also increases the oxygen level.

- **Extra Virgin Olive Oil** –This acts as an excellent anti-inflammatory food as it helps in reducing cholesterol levels and also reduces aging, cancer and cardiovascular diseases.

- **Nuts** -Nuts are good sources of minerals, particularly walnuts and brazi nuts. As walnuts are rich in calories, potassium, magnesium, iron, zinc, copper and selenium so they enhances the functioning of digestive and immune systems also improves skin and also helps in controlling cancer.

- **Tomatoes** –Tomatoes contain lycopene which is an antioxidant compound which helps in maintaining good skin texture and also reduces the risk of some types of cancer and also reduces chances of aging.
Whole meal pasta and rice - Carbohydrates provides supply of energy throughout the day like pasta containing carbohydrates and fibre which also controls factors such as aging. 

Watermelon - The flesh of watermelon contains vitamin A, B and C; the seeds contain selenium, essential fats, zinc and vitamin E, which helps against free radical damage and aging. 

Fish - Fish is famous for preventing premature aging as it contains Omega-3 fatty acids. 

Teas - White and green tea contains the most EGCG, one of the most powerful antioxidants which reduce the aging as well as chances of cancer. 

Herbs & spices – Garlic a day helps to protect the body against cancer and heart disease. Turmeric is rich in antioxidants and prevents the formation of free radical. Cinnamon may help lower blood sugar [6].

**CONCLUSION**

Plants containing phenolic compounds, flavonoids and proanthocyanidins contain antioxidation activity. Herbal products are mainly explained by their chemical structure and their ability to donate free electron and hydrogen. The extracts of Green tea i.e. *Camellia sinensis* are having strong photoprotective properties.

The most important point is extraction and purification of active compounds. There are two ways by which we utilize medicine i.e. traditional way and western way. Western medicine is those medicines in which extract are taken out from active compounds from herbs. Traditional medicine is those in which we directly use plant parts for treatment. It should be noted that western medicines have unique properties as multi-target actions of anti-aging herbs which make these medicines different from conventional medicines. The advantage of using single compound extract with well-defined chemical structure is that this can facilitate the generation of basic pharmacological information such as molecules interaction, post GI tract modification, pharmacokinetic and metabolism.

The benefits of oral supplementation of resveratrol remain speculative. The bioavailability, metabolism and dosing should be quantified before treatment of aging. Resveratrol when injected is absorbed quickly by glucuronic acid which accumulates in epithelial tissues. The derivatives of resveratrol allows for more targeted sites, although the other form is important for free radical absorption capacity than antioxidant, vitamins and derivatives which are used in present scenario.

**REFERENCES**