

FORMULATION & EVALUATION OF PLANT BASED COLLAGEN POWDER

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ABSTRACT

From ancient times people have been taking care of their skin and using different formulations to make it healthy and beautiful so that they may look young for long. In Ayurveda anti-ageing has been described as Vayasthapana, Varnya, Sandhaniya, Shothahara, Vranaropan, Tvachya, Tvachagnivardhini. Today there is once again a revival of preference for natural products. In present formulation of collagen powder ingredients have been used which are rich in amino acids, vitamins and minerals etc. Sea Buckthorn (leh berry), Acai berry, Gulab phal (Rosehip), Acerola cherry, Agastya (Sesbenia), Shatavri mool (Asparagus), kaddu ke beej (pumpkin seeds), etc. Collagen powder has been formulated on the basis of nutrients present in its ingredients and evaluated on the basis of physical parameters. Food supplements containing raw ingredients that support collagen production in the body can be consumed as part of a healthy diet leading to healthy life which slows down the process of ageing.

KEYWORDS: Food Supplement, Natural Product, Nutrients, Physical Parameters, Anti-Aging.

INTRODUCTION

Ayurveda is one of the most ancient medical traditions practiced in India, and now spreading in whole world with proofs of its authenticity. From ancient times people have been taking care of their skin and using different formulations to make it healthy and beautiful so that they may look young for long. In Ayurveda anti-ageing has been described as *Vayasthapana*, *Varnya*, *Sandhaniya*, *Shothahara*, *Vranaropan*, *Tvachya*, *Tvachagnivardhini*. Today there is once again a revival of preference for natural products. Modern research also revolve around principles of anti-aging activity based on herbs described in Ayurveda. There is a growing demand for plant based health products in the form of medicines and food supplements. Plants are the source of all the nutrients that make human body healthy and that health reflecting in beauty of skin, hair and activeness in day to day life.

Food supplement containing collagen protein is working well in delaying the process of ageing. "Collagen" it is a primary building block of skin, muscles, bones, tendons and ligaments. It is the most abundant protein found in the extracellular space in the connective tissue of the body. It constitutes about 35% of whole body protein content and about 80% of skin epidermis. There is no method to measure the collagen in body but there are some signs that suggests that collagen level is decreasing in the body like wrinkled skin, hallowing around eyes and face, weakening muscles, joint pain due to worn cartilage, loss of mobility due to joint damage or

stiffness, gastrointestinal problems due to thinning of the lining of the digestive tract. Collagen can't be absorbed by the body in its whole form. Eating collagen-rich foods doesn't directly result in higher collagen levels in the body, but body breaks down the collagen proteins present in raw foods into amino acids (triple helix: prolin, glycin and hydroxyprolin) which further results in making collagen. So foods containing raw ingredients that support collagen production can be eaten as part of a healthy diet. Plant based collagen aid the body in boosting its collagen production naturally. Anti-oxidants, flavonoids, polyphenols, and vitamins present in plants provide the skin with right building blocks and support so that it can produce its own collagen, it significantly increase the synthesis of collagen from within and also slow down the breakdown of naturally occurring collagen.

METIRIAL AND METHODS

In present formulation of collagen prash 14 ingredients have been used which are rich in amino acids, vitamins and minerals. Sea Buckthorn (leh berry), Acai berry, Gulab phal (Rosehip), Acerola cherry, Agastya (Sesbenia), Shatavri mool (Asparagus), kaddu ke beej (pumpkin seeds), tilla (sesame), Soya bean, Alsi (Flax seeds), Amla (Indian gooseberry), Tulsi (Holy basil), Mungphali (peanuts) and Anjeer.

Sea-Buckthorn (Leh Berry)

Berries, leaves, and seeds of the sea buckthorn plant (*Hippophae rhamnoides*) all are beneficial. It can be applied on skin or taken orally. It is referred to as the holy fruit of the Himalayas. It is a popular ingredient in *Ayurvedic* and traditional Chinese medicines. It's said to provide health benefits ranging from more radiant hair and skin to a lower risk of cancer and heart disease. The oil present in sea buck thorn berry is similar to natural skin sebum lipids, and provide important healing and anti-aging benefits to skin. Palmitoleic acid (omega-7) fatty acid nourishes the skin and useful in treating skin diseases like atopic dermatitis. It diminishes inflammation, relieve pain, remove blood stasis, increases immunity and promotes regeneration of tissues. Research on patients treated with sea buckthorn revealed the positive therapeutic effect on skin wrinkles, melanosis, xanthosis, and freckles. It is a great antioxidant and also used to firm and tone the sagging skin.

Acai Berry

The plant has been valued commercially for its high-quality hearts of palm and is cultivated in India. Its fruits is known as a super food. Acai berry fruit is enriched vitamin A, C and especially vitamin E which have an antioxidant potential and with action to combat wrinkles and free radicals. Its Phenolic compounds protect from oxidative damage, rich in Omega 3, 6, and 9 helps in collagen synthesis, magnesium – nourishes dry skin, Zinc- heals wound, Copper- hydrates skin, Calcium-repairs lipid barrier in epidermis, Anthocyanin- helps in cell regeneration.

Acerola Cherry

Acerola is an evergreen small tree with spreading branches on a short trunk. The drupes are juicy and high in vitamin C and other nutrients. They are divided into three obscure lobes and are usually acidic to sub acidic having a sour taste. When consumed as a food supplement it provides good amount of the nutrients like calcium, iron, niacin (vitamin B-3), phosphorus, riboflavin (vitamin B-2), thiamine (vitamin B-1) that help in building good health. Vitamin C and vitamin A present in cherry is a known antioxidant which helps to prevent free radical damage, builds collagen, and protects mucus membranes.

Sesbania Grandiflora

Sesbania grandiflora, is commonly known as vegetable humming bird, katurai, agati, or West Indian pea. It has edible flowers and leaves commonly eaten in Southeast Asia and South Asia. Loaded with nutrients, including proteins, minerals, and vitamins, sesbania grandiflora boosts immunity, regulates diabetes, and supports muscle health. It has unique medicinal properties and used as a herbal drug for its antibiotic, anthelmintic and anti-tumor properties.

Rosehip

It hydrates the skin due to presence of linoleic fatty acid making skin strong. Vitamin A present in rosehip reduces dullness, provides glowing, vibrant skin by collagen production. Rosehip is also known to inhibit the production of enzyme MMP-1 which is responsible for breakdown of collagen in the body. Polyphenols and anthocyanin present in rosehip help to reduce inflammation. Vitamin A and E helps protect against sun damage. Nutritional compound retinoid present in vitamin K helps to reduce hyperpigmentation and other visible signs of aging. As rosehip is enriched with essential fatty acids and antioxidants it has significant effect in reduction of fine lines around the eyes and post-surgical scars. Poly unsaturated fatty acids present in rosehip prevent breakdown of cell membrane in the skin which prevent bacteria to invade the skin which further prevent bacterial infection boosting the immunity.

Pumpkin Seeds

Pumpkin seeds boost the energy levels of the body. Pumpkin seeds have ability to improve the immune system and to prevent osteoporosis. They aid in the formation of new skin cells as well as collagen as a result they maintain the elasticity of the skin. Essential fatty acids aids in maintaining the oil production and moisture levels of the skin. Pumpkin seeds enable the body to fight against skin-related issues like aging, acne, pimples and the appearance of premature fine lines. These seeds are enriched with Vitamin A, K, B (biotin), sulfur, zinc and omega-3 fatty acids, which are responsible for the health of scalp and hair. Vitamin E acts as a strong antioxidant and improves the skin tone. It contains Bio-fermented Hyaluronic acid a boon for the skin. These seeds contain phytosterols, which decreases bad cholesterol in the body. Pumpkin seeds assists in maintaining the healthy bladder and urinary function.

Soyabeans

It is a species of legume, native to East Asia. Soybean is rich in protein and other nutrients like isoflavones, which are phytoestrogens, also known as plant sources of oestrogen. As per research isoflavones in soybean boost hyaluronic acid production in the body. Soya beans contain phenolic acids, flavonoids, isoflavonoids (quercetin, genistein, and daidzein), small proteins (Bowman-Birk inhibitor, soybean trypsin inhibitor), tannins, and proanthocyanidins which help to improve overall skin health providing numerous dermatological benefits such as anti-inflammatory, collagen stimulating effects, Potent anti-oxidant peroxy, skin lightening effect and protection against UV radiations reducing pigmentation, and wrinkles.

Asparagus

Shatavari is common throughout Sri Lanka, India and the Himalayas. Some species are grown in India, and most commonly used in indigenous medicine. *Shatavari*, *Asparagus racemosus* (family *Asparagaceae*) is one of the well-known drugs in *Ayurveda* with *madhur rasa*, *madhur vipaka*, *sheet-veerya*, having properties to treat

chronic fever and internal heat. In *Charak Samhita* and *Ashtang Hridayam shatavari* has been used as part of the formulas to treat women's health disorders. It is a well-known *Ayurvedic rasayana* which prevent ageing, increase longevity, impart immunity, improve mental function, vigor and add vitality to the body. It is also used in nervous disorders and have immunomodulatory activities. The root has anti-oxidant properties rich in various nutrients that protects the body, skin and hair from free radicals. Root of *shatavari* work as great anti-aging ingredient in skin care products.

Sesame Seeds

Sesame plant is tall herb that grows extensively in Asia, particularly in Burma, China and India. Seeds are small, almost oblate in shape.

Sesame seeds are natural antioxidant being rich source of vitamin E & K. It contains magnesium, copper, calcium, iron, zinc and vitamin B6. In *Ayurveda* out of all other oils sesame oil has been described as the best oil by *Acharya Charak* and *Acharya vagbhat*. Sesame seeds are *twachya* (good for skin), *Balya* (provide strength), *keshya* (good for hair), *dantya* (good for teeth), *agnijanan* (increases digestion), *medha janan* (increases memory).

Flax Seeds

Alsi is very high in fibre and contain good amount of protein, antioxidants and omega -3 fatty acids that can lighten scars, making skin smooth and radiant, provide more hydration to skin. Flax seeds can balance out oestrogen in body helping to regulate the production of excess sebum that causes acne, so flax seeds are used to treat acne. Fibers present in seeds speed up the healing process thus helps to reduce inflammation.

Indian Goosbery

Amla plant grows throughout in India is the most used *Ayurvedic* ingredient. It is both a food and medicine. It is stuffed with the innumerable health benefits. Antioxidants present in *amla* helps in fighting the free radical damage in skin. Studies show that *amla* helps skin to revive its aging cells, helps in boosting collagen production keeping skin soft firm and youthful. It has astringent properties that helps in tightening skin pores and protects the skin from uv damage, pollutants and dirt. Rich source of vit.-C, polyphenol, tannis, gallic

acid, ellagic acid, phyllembic acid, emblicol, alkaloids, phyllantidine and phyllantine, pecins, and minerals. *Amla* helps fight the common cold, Builds immunity, Supports digestion, metabolism, and normal liver function, Excellent for hair and skin, Improves eye sight, burns fat.

Holy Basil

Benefits of tulsi plant needs no introduction. It is rich in vitamin C and zinc that act as a immunity booster. It helps to clear skin blemishes and acne. It is rich source of vitamin-C & A and phytonutrients that helps to prevent premature ageing, strengthens hair roots. Contains protein, sodium, potassium, iron, magnesium, calcium, vitamin -C, vitamin B6.

Peanut

Pea nuts are rich in proteins, zinc, vitamin B6 and iron which help to strengthen hair and nails. Vitamin E helps to protect the skin from sun damage. Niacin, vitamin E and zinc help to improve skin tone and texture, zinc being a powerful antioxidant helps to kill harmful bacteria and fungi which help to reduce risk of developing a skin infection. Peanuts help to reduce wrinkles, age spots and improve skin elasticity by increasing blood flow to the skin. Fibres present in peanuts help to improve digestion and promote regular bowel movements.

Fig

Anjeer is a small pear or bell-shaped flowering plant that belongs to the mulberry family. It is very sweet fruit with several seeds and are consumed both fresh and in dry form. *Anjeer* is also known as nature's candy as it is densely packed with natural sugar. It is available in various colours ranging from purple, red, green and golden. Dried anjeers are very good source of minerals like calcium, magnesium, copper, potassium, selenium and zinc. It is stuffed with goodness of essential nutrients that work well for all types of skin. The powerful antioxidant property of fig is beneficial for reducing wrinkles and makes the skin look supple. vitamin C and E is highly beneficial to nurture the skin and rejuvenate skin cells. Iron, potassium, magnesium and vitamins E play an imported role in strengthening and improving hair moisture promoting the growth of hair. It help in preventing age related macular degeneration, a major reason behind vision loss in elderly people.

Table 1.

sr. no.	Name of the drug	Latin name	Quantity			
			Sample-1	Sample -2	Sample-3	Sample -4
1.	Sea Buckthorn	Hippophae rhamnoides	2 gm	2 gm	1 gm	1 gm
2.	Acai berry	Euterpe oleracea	2 gm	4 gm	10 gm	12 gm
3.	Acerola cherry	Malpighia emarginata	2 gm	10 gm	20 gm	20 gm
4.	Agastya (Sesbenia)	Sesbenia grandiflora	2 gm	2 gm	1 gm	1 gm
5.	Gulab phal (Rosehip)	Rosa centifolia	20 gm	10 gm	4 gm	4 gm
6.	Shatavari (Asparagus)	Asparagus racemosus	1 gm	1 gm	2 gm	2 gm
7.	Kaddu ke beej (Pumpkin seeds)	Cucurbita pepo	4 gm	10 gm	20 gm	20 gm

8.	Soyabean	Glycine max.	10 gm	15 gm	20 gm	14 gm
9.	Shweta tilla (Sesame seeds)	Sesamum indicum	10 gm	10 gm	1 gm	1 gm
10.	Alsi (flax seeds)	Linum usitatissimum	2 gm	2 gm	2 gm	2 gm
11.	Amla	Embllica officinalis	10 gm	10 gm	2 gm	2 gm
12.	Tulsi	Ocimum Sanctum	15 gm	10 gm	2 gm	2 gm
13.	Peanuts	Arachis hypogaea	18 gm	10 gm	15 gm	15 gm
14.	Anjeer	Ficus carica	-----	-----	-----	4 gm

The raw materials of above mentioned herbs were purchased from the market and authenticated in the Pharmacognosy department of pharmacy. The authentication is carried out based on the microscopic characteristics of powdered drug. The drugs were cleaned and dried properly. The finely powdered raw materials were passed through sieve number 85 and

mixed in four appropriate ratios (Table-1) and four formulations were prepared. The samples of churna were packed in air tight glass containers. Sample no. 4 was found best out of four samples, as far as taste, smell & texture was concerned. After that collagen powder was sent to lab for evaluation.

Table 2: Evaluation of Physical Parameter of Collagen Powder.

Sr.no.	Physical Parameter	Value
1.	Loss on drying	4.02%
2.	Ash value	8.16%
3.	Acid insoluble ash	5.63%
4.	Extractive values	
	1. Water soluble – extractive value	36.73%
	2., Alcohol soluble- extractive value	30.06%
5.	pH	6.8
6.	Crude fiber content	22.19%
7.	Microbial test	
	Total microbial plate test	120cfu/gm
	Total yeast and moulds	30cfu/gm
8.	Pathogen test:-	
	Escherichia coli	Absent
	Staphylococcus aureus	Absent
	Pseudomonas arruginasa	Absent
	Salmonella	Absent
9.	Heavy metals	
	Arsenic	Not detected
	Cadmium	Not detected
	Lead	Not detected
	Mercury	Not detected
10.	Thin layer chromatography	COMPLIES

RESULTS AND DISCUSSION

The present formulation is in the form of powder consisting of fine powder of 14 herbs in appropriate ratio. This powder is subjected to standardization by means of various physical, chemical and microbiological methods. The physical parameters such as pH is done to avoid gastric irritation and the moisture content is determined to find out any increase in weight caused by moisture absorption. When a product sample is subjected to muffle furnace to become an ash, this process involves oxidation of components of product, an increase in ash value indicates contamination, substitution and adulteration. The total ash value is an indicative of total amount of inorganic material after complete incineration and the acid insoluble ash value obtained is an indicative of silicate impurities, which might have raised due to improper washing of crude drugs. Here in this product

both the ash values obtained were found to be within the standard limits. water-soluble and alcohol soluble extractive values indicates the amount of active constituent in given amount of plant material when extracted with respective solvents, a lower value compared to standard value indicates presence of exhausted material. In the present study both the extractive values were found to be more than the standard values. The determination of crude fiber content is an indicative of fiber content in formulation and was found to comply with the standard value. Heavy metals if present in formulations will have a deleterious effect on different organs of body in particular kidneys and leads to renal toxicity. Hence evaluation of heavy metals is of an important role. Heavy metals include arsenic, cadmium, lead and mercury. In the present study arsenic, iron & lead were found to be within the limits. The presence of mercury was determined qualitatively and

found to be absent. The formulated powder was finally subjected to microbiological evaluation namely for *E. coli* and was found to be absent. This formulation of plant based collagen powder is rich in nutrients that provide a healthy and active life.

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