Exploring the Therapeutic Potential of Safed Musli (Chlorophytum Borivilianum) in Skincare Preparations

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Abstract: ***In Indian traditional medicine number of herbs explored for their astonishing medicinal effects on health. Out of which the one of the most Powerful herbs is Chlorophytum Borivilianum (Safed Musli) belonging to family Liliaceae. A traditional herb renowned for its highest medicinal and nutraceutical values in India. Due to its magical effects on heath, it is named as "Divya Aushadh" in Ayurveda. Traditionally the herb is used for Adaptogenic, Aphrodisiac, Rejuvenator, boost immunity, general disability, Male Impotency and Health promoter. Chlorophytum Borivilianum is a rich source of Protein, carbohydrates, Vitamins, Minerals, Calcium, Fiber, Resin, Glycosides, 25 different Alkaloids, Saponins including steroidal saponins and sapogenins which is used as alternative 'Viagra' having great therapeutic applications.***

The demand for natural and sustainable ingredients in skincare formulations has prompted researchers to explore traditional medicinal plants for their therapeutic properties. This paper explores the utilization of Chlorophytum borivilianum in the development of skin preparations for therapeutic purposes.

Keywords: Chlorophytum Borivilianum, Medicinal & Nutraceutical, Aphrodisiac, Therapeutic

I. INTRODUCTION

From centuries the herbal extracts as a whole or a part have been used for the various ailments of the skin, hair and for overall appearance. The market research shows upward trend in the herbal trade with herbal cosmetic industry playing a major role in the fuelling this worldwide demand for herbals. The recent interest of consumers in herbal cosmetics has stimulated by the decline of faith in modern cosmetics, the belief that plant remedies were natural and there by superior to manmade synthetic cosmetics and the reference to historical use by the different cultures. These resources have contributed to the increased acceptance as well as manufacture of herbal cosmetics.[1]

Scientific literature is continuously reporting plant drugs having immunomodulatory activity.[2] The Indian system of medicine Ayurvedaí, conceptualizes a category of drug activity known as Rasayanaí. The word Rasayana is composed of two words Rasaí meaning elixir and Ayanaí meaning house. The word therefore signifies property of the plant that helps to rejuvenate the system, i.e. adaptogenic activity [3]. Rasayaní therapy prevents diseases and counteracts the aging process by means of optimization or homeostasis. Many plants have been extensively used as Rasayanaí drugs in Ayurveda for the management of neurodegenerative diseases, as rejuvenators, immunomodulators, aphrodisiac and nutritional supplements [4-7]. Safed Musli has been described in ancient Indian literature such as Bhavaprakash nighantu, Rasendra Sarsangrah, Raja Ballabh Nighantu as Vajikaraní or aphrodisiac which is a special type of immunomodulator [8-10]. A prominent member of the Vrishya (Eugenic and Aphrodisiac), Rasayana (Adaptogenic and Rejuvenating) and Balya (Tonic) Safed musli is highly popular in all traditional medicine like Ayurveda, Unani, Siddha has served for the betterment of health since 11th Century (Ref-Sharangadhar Samhita) as a potent aphrodisiac, as a health promoter which delays ageing, better muscle tone, optimize the use of body's energy resources. [11]

Safed Musli, a herb indigenous to the Indian subcontinent, has long been acclaimed in traditional medicine for its diverse applications, including its reputation as an aphrodisiac and adaptogen. Recent scientific investigations have delved into its phytoconstituents, revealing a rich repository of bioactive compounds such as saponins, alkaloids, Glycosides and antioxidants. These constituents are known for their anti-inflammatory, antioxidant, and antimicrobial properties, suggesting a promising avenue for Safed Musli's application in skincare.

Among the plethora of botanicals, Safed Musli (Chlorophytum borivilianum) has emerged as a potential candidate, drawing attention for its multifaceted therapeutic properties. This review aims to provide a comprehensive exploration of the

therapeutic potential of Safed Musli in skincare preparations, shedding light on its botanical profile, phytochemical composition and the scientific evidence supporting its integration into skincare formulations.

A. Botanical Overview:

Safed Musli, belonging to the family Liliaceae, is a perennial herb predominantly found in the Indian subcontinent. Ayurvedic texts describe it as "Shvet Musli," emphasizing the importance of its white tuberous roots.

Chlorophytum borivilianum (Safed musli)

Botanical Classification:

Kingdom: Plantae

Clade: Angiosperms

Clade: Monocots

Order: Asparagales

Family: Asparagaceae

Subfamily: Agavoideae

Genus: Chlorophytum

Species: C. borivilianum

Cultivation of Safed Musli

Tubers of Safed Musli with plant

B. Morphology:

Chlorophytum borivilianum is an herbaceous plant with a condensed stem disc from which a whorl of leaves originates. Leaves are sessile, 10-40 cm in length and 0.6-4.0 breadth. The inflorescence is racemes, flowers are pendicellate with joints, small, white, bracteate, zygomorphic. The fruit is a capsule, which is trilobed and bears 3-12 seeds inside. The seeds are black and flat. The fibrous roots of the plant are modified into fascicular roots (fleshy root), comprising the economically useful part. Its root tubers are fleshy, fascicled and directly originate from the stem disc devoid of any fibrous structure. They are cylindrical and 5- 20 in numbers.[12] Flowers turn white in color after 45 days of the plantation, probably in August and September. Leaves are dried in the end of December and mid-January. The roots are matured after 9 months of the plantation.[13]

Roots are pale brown to white colour with characteristic odour and are tasteless in nature. Root tubers are fleshy, fascicled and directly originate from the stem disc devoid of any fibrous structure and distinguished it from other species of Chlorophytum genus. The shape of tubers were cylindrical, the thickness being on the average 0.9 cm and the length 8cm.The number of tubers varies from plant to plant and on an average 5-30 tubers/ plant are observed and slightly tapering towards lower side look like pestle.[14]

Botanical sources of Sweta Musli in India belong to species of genera Chlorophytum and Asparagus. Chlorophytum borivilianum, C. arundinacium, C. tuberosum and Asparagus adsendense are the most prominent sources in the country. Chlorophytum tuberosum is taken as an official source of Sweta Musli in India, which is indicated in the Ayurvedic Formulary of India.[15]

C. Climatic conditions and Geographical Source:

Safed musli grows satisfactorily in wide range of temperature and rainfall. But high and low temperature extremes are found to affect the growth and tuber yield. The plant can be grown in all kind of soils in India but performs well in the sandy loamy to red loamy soils having neutral pH range (6.5 to 7.5). The soils having good drainage system are reported to promote better tuber growth (15).

There are total 215 species in the genus Chlorophytum. Most species are originated from

Africa and distributed throughout warmer regions of the world [16,17]. Safed Musli is available in deep forests or reserve sanctuaries in the Aravali Hills. The genus Chlorophytum is distributed in the tropical and subtropical regions of the world. Tropical and subtropical Africa is probably the centre of origin of the genus, where about 85% of the species are found in India. Chlorophytum borivilianum is mainly distributed in Southern Rajasthan, North Gujarat and Western Madhya Pradesh.[18]

The plants grow in a wide variety of places in nature, starting from open rocky places to shady and highly humus rich soil in the forest. Thirteen species of Chlorophytum have been reported from India. All these species differ in appearance, native species are sold as 'Safed musli' in the Indian drug market. Amongst these, C. borivilianum produces the highest yield and highest saponin content. [19].

II.PHYTOCHEMICAL COMPOSITION

In India, traditional use of herbal medicines known as Ayurveda is being passed from one generation to generation due to many reasons such as availability, acceptability, compatibility, and affordability. The plant yields a flavanone glycoside, which is a powerful uterine stimulant, steroidal saponins which have muscle building properties and their structure is similar to male anabolic hormones testosterone. Major biochemical constituents of Chlorophytum borivilianum are carbohydrates 42%, protein 10%, fibres 20 - 30%, saponins 2 - 17% and alkaloids 15 - 25%. Primarily saponins and alkaloids impart medicinal value. It is a rich source of over 25 alkaloids, vitamins, proteins, calcium, magnesium, phenol, resins, mucilage, and polysaccharides [20]. Research studies on Chlorophytum conducted in India and elsewhere indicate that saponins [21] are responsible for medicinal properties. Saponins in Safed Musli are known to ensure the defense of the plant against microbial or fungal attack. Several drugs owe their anti-inflammatory and antiedemic properties to saponins. Inulin type 2-1 linked fructans have been reported. The other phytoconstituents reported from the plant are high quantities of simple sugars mainly sucrose, glucose, fructose, galactose, mannose and xylose [22] Apart from bilogically effective steroidal and triterpenoidal saponins, sapogenins and fructans having prebiotic importance are determined. [23] Proteins, phenolics, triterpenoids, gallo-tannins and mucilage are also reported from Chlorophytum borivilianum [24].

The studied carried by Bordia et al. [25] revealed following organic and inorganic constituents of Safed musli tubers.

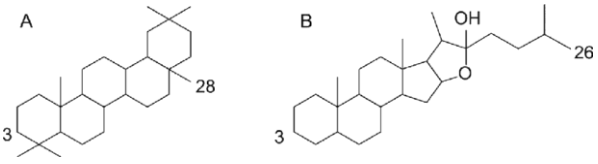
Organic Constituents	%
Carbohydrates	42 .0
Proteins	8 - 9.0
Fibers	3 - 4.0
Saponins	2 - 17.0

Inorganic Constituents	Mg g-1 dry weight
Sodium	0.040
Potassium	0.800
Calcium	6.600
Magnesium	1.900
Phosphorus	3.200
Zinc	0.002
Copper	0.148

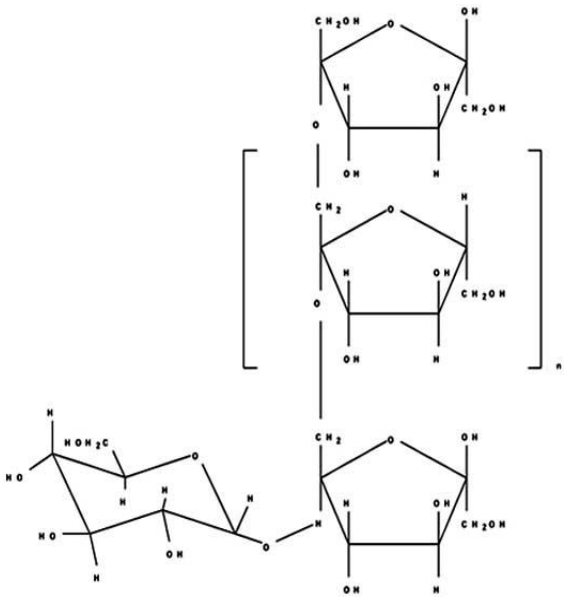
The organic analysis of root powder was performed by some scientists. It reveals following data -

Constituents	Percent data
Saponins	12-17 %
Stigmasterol	1.9-3.5 %
Sugars Arabinose	0.79 %
Galactose	3.80 %
Glucose	0.73 %
Rhamnose	0.78 %
Xylose	0.76 %
Reducing sugar	20-25 %
Nonreducing sugar	15-17 %
Sapogenin (Hecogenin)	0.17%
Root Fiber	5.00%
Aqueous extract	30.00

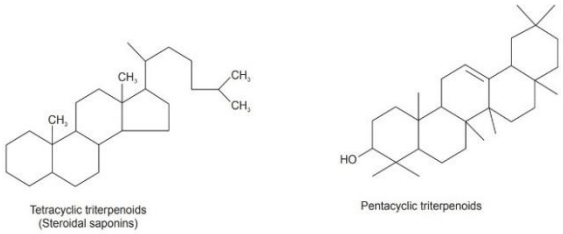
The author noticed that the tubers contain 0.63% of polyphenols and very low amount of ascorbic acid (0.12%) on fresh weight basis (26)



Structures of (A) triterpenoid and (B) steroidal saponins



Structure of fructans isolated from Chlorophytum borivilianum.



III. MEDICINAL PROPERTY

Chlorophytum borivilianum also known as Safed Musli is a traditional herbal plant with assorted Ayurvedic relevance. Safed Musli is renowned in Ayurveda for its Rasayana (Rejuvenative) and Vajikarana (aphrodisiac) properties It has therapeutic application in Ayurvedic system of medicine.[28] Chlorophytum borivilianum holds an important place in the ayurvedic medicinal system and is a major ingredient in about one hundred ayurvedic formulations prescribed for joint pain, diabetes, diarrhoea. [29,30] The root powder is effective in curing rheumatism, joint pain, and throat and mouth ulcers. Traditionally, it is given in Ladoo's as a diet to mothers after delivery. The roots of Safed Musli are used as a Vajikaran Rasayana and the main constituent in Chyawanprash. [31]

The species was first described from India in 1954 and reached rare status in nature due to over exploitation. The National Medicinal Plant Board (NMPB) of Government of India has recognized Safed Musli as sixth among the 28 selected priority medicinal plants to be protected and promoted.[32] It is considered as an excellent herb to increase general body immunity. Its aphrodisiac properties have proved very much useful for the people suffering from Erectile Dysfunction and to increase male potency. It has spermatogenic property and helpful in curing impotency as they are rich in glycosides. Roots are widely used for various therapeutic applications in the Ayurvedic and Unani systems of medicine. It is known to cure many physical illness and weaknesses with arthritis.[33]

The roots of this plant are diuretic, aphrodisiac, astringent and are used as a galactagogue, antidiabetic and appetizer [33,34] This plant is associated with immunomodulatory significance and prevents premature ejaculation.[35] The dried root powder of this plant with warm milk is effective in male sexual disorders. It is also used as a health promoter and blood purifier.[36] The dried root powder of the plant is used to cure gonorrhea, leucorrhea, gynaecological disorders. It also helps in increasing lactation in both nursing mothers and lactating cows.[37] s. Chlorophytum borivilianum root maintains normal levels of blood glucose, glycated haemoglobin, insulin and lipid profile levels of metabolites and prevented oxidative stress-induced damage to the pancreas in diabetes.[38] It is proved by the researcher that aqueous extract of Chlorophytum borivilianum improves the immune function of the human body. [39] The researcher investigated Chlorophytum borivilianum has anti-tumor, anti-mutagenic and chemo modulatory properties. [40] The stem, cladodes, seeds and rhizomes of safed musli were also very important in Indian and Unani traditional medicinal remedies for treatment of spermatorrhoea, chronic leucorrhoea, diarrhoea, dysentery, general debility, senile pruritus, asthma and fatigue. Indian system of Ayurveda, Safed musli (Chlorophytum borivilianum) is considered as a 'Divya Aushadh' or Rasayana a nature's gift and 'God-given wonder drug' for the treatment of health disorders as well as general debility [41,42]

VI. NUTRITIONAL PROPERTY

Safed Musli has some important phytochemical constituents which make it very popular and useful for a nutritional dietary regime in body builders and sports person. The important constituent of Chlorophytum borivilianum is Inulin type fructans. Researchers of India and Vienna have reported that presence of neutraceutical components viz. fructans and fructo-oligosaccharides present in Chlorophytum borivilianum. Fructans improve calcium absorption in bone and provide important fiber and roughage to

the body, thus providing a perfect blend for a healthy diet. Fructans are also very low in calorie and help in prevention of diabetes induced problems. Inulin supplementation also fulfils the urgent energy requirements to overcome muscle fatigue during body-building processes. C. borivilianum root contains considerable quantity of zinc and iron, (3.75 mg/100g zinc and iron as 4.65 mg/100g). Zinc is responsible for the antioxidant property of Chlorophytum. [43] The steroidal saponins present in the chlorophytum borivilianum are rapidly absorbed in the body and are converted to male hormone testosterone which assists in building up muscles and gaining masculine power [44]

The tubers of this plant are utilized as a nutritious meal in the form of chips/ flakes in the USA and England. [45] The tribal people of Western Ghats consume the leaves of Safed Musli because of its expectorant property. The leaves of this plant are utilized in the states of Madhya Pradesh, Chhattisgarh and Gujarat of India as a leafy green vegetable. [46] The roots of this plant are used as a substitute for European salad. [47] Due to the many therapeutic applications and several bioactive compounds, C. borivilianum is also called 'The white gold for biopharmaceuticals and neutraceuticals'.

V. PHARMACOLOGICAL AND THERAPEUTIC ACTION

1. Antibacterial Activity- Antibacterial property of different extracts of Chlorophytum borivilianum was carried out against 4 bacteria, Staphylococcus aureus, E. coli, Pseudomonas aeruginosa and Bacillus substalis, using cup diffusion method. Acetic acid extract shows antibacterial activity against all these 4 bacteria in the order of sensitivity as Staphylococcus aureus Pseudomonas aeruginosa E. coli Bacillus substalis.

2. Antimicrobial activity - The antimicrobial potential of Chlorophytum borivilianum was screened against eight bacteria and four pathogenic fungi, using microbroth dilution assay. Lowest concentration of the extract, which inhibits any visual microbial growth after treatment with p-iodo-nitrotetrazolium violet, was considered to be minimum inhibitory concentration. Water extracts of Chlorophytum borivilianum showed antimicrobial activity in a range of 75-1200 µg/ml {48}

3. Antistress Activity- This activity was carried out using chronic cold restraint stress rat model. Chronic stress resulted in significant increase in plasma glucose level, plasma cholesterol, triglycerides level, serum corticosterone level and adrenal gland weight as compare to control. Pre-treatment with aqueous extract of C. borivilianum at both dose levels (125 and 250 mg/kg) reverted significantly the rise in plasma glucose levels indicating adaptogenic potential, plasma cholesterol level, triglyceride level, serum corticosterone level and also adrenal gland hypertrophy.

4. Antioxidant Activity- Antioxidant activity of aqueous extract of C. borivilianum (250 mg/kg for 7 days) was studied by 1, 1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging assay and lipid peroxidation assay. The aqueous extract of C. borivilianum (250 mg/kg for 7 days) inhibits significantly the levels of DPPH free radicals and thiobarbituric acid reactive substances, respectively in a dose-dependent manner. Antioxidant activity of C. borivilianum root extract was again proved using chemicals/metals-mediated oxidation. Aqueous extract, when used in graded-dose (25 to 1000 µg/ml), exhibits a very good antioxidant potency as evidenced by powerful nitric oxide, superoxide, hydroxyl, DPPH and ABTS [2, 20-azinobis (3-ethylbenzothiazoline6- sulfonic acid)] radicals scavenging activity along with reducing capacity (ferricyanide couple assays), metal chelating ability, as well as markedly suppressed the lipid peroxidation in mitochondrial fractions. Further, aqueous extract significantly decreased ($P < 0.05$) copper-mediated human serum and kinetics of LDL oxidation20 .) Significant increase ($p<0.05$ to $p < 0.001$) in the activity of reduced glutathione, catalase and superoxide dismutase and a significant decrease in the hepatic malondialdehyde level has been observed at 100, 400, and 800 mg/kg body weight of C. borivilianum root extract when compared with the control value. [49].

Chlorophytum borivilianum root powder also increased the activities of antioxidant enzymes and vitamin C levels, which may have enhanced the antioxidant capacity of the liver

5. Suspending Agent: To evaluate suspending properties, 20 % zinc oxide suspension was prepared with three concentrations of Chlorophytum borivilianum Mucilage (1, 2, and 3%) and compared with same concentrations of CMC and tragacanth. 0.2 % benzoic acid was used as a preservative. After preparation of all suspensions, 20 ml of each were kept aside and observed during 50 days for its

separation ratio. From results it is cleared that CBM is better suspending agent than tragacanth.

6. Binding Agent: Chlorophytum borivilianum mucilage was evaluated for its granulating and binding properties in tablets using nimusulide as a model drug. Granules were prepared by two concentrations (5 and 10%) of CBM by wet granulation technique. Same concentrations of gelatine were used as a standard binding agent. Binding properties has shown that binding of CBM giving same binding as that of gelatine.

VI. CONCLUSION

This paper explored the therapeutic potential of Safed Musli, a medicinal herb in skincare preparations. We conducted a comprehensive review of scientific literature and found that safed musli possesses several properties beneficial for body health. The bioactive compounds in Safed Musli, including saponins, alkaloids, and glycosides, contribute to its antioxidant, anti-inflammatory, and skin-rejuvenating properties, making it an effective ingredient for addressing a range of skin concerns.

Scientific evidence supports its role in promoting collagen synthesis, enhancing skin hydration, and protecting against oxidative stress, which are crucial for maintaining healthy, youthful skin. However further research is needed to fully understand the mechanism of action and optimal formulations for using Safed musli in skin care products. Clinical trials are also necessary to validate the efficacy and safety of Safed musli -based preparations. In conclusion, this review highlights the promising potential of safed musli as a natural ingredient for skincare.

AKNOWLEDGMENT

I would like to thank my professor who gave me a chance to publish the papers. I would also like to give thank who are directly or indirectly involve completing this review. I am also thankful to my parents and husband who is always supporting me.

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