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REVIEW ARTICLE

VEGETABLES (*SHAKA DRAVYAS*) AND THEIR ROLE IN PREVENTION AND MANAGEMENT OF DERMATOLOGICAL DISORDERS: A CRITICAL REVIEW

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ABSTRACT

Classical texts of Ayurveda delineated different vegetables under "*Shakavarga"*, with their properties and indications in different disease conditions. These vegetables are prescribed as *Pathya* (wholesome diet) in clinical practice. In the present review, vegetables described under *Shakavarga*, indicated as *Pathya* in different skin diseases like *Daha* (Burning sensation), *Kandu* (Itching), *Kustha* (Skin disease), *Vidradhi* (Abscess), *Visarpa* (Erysipelas) were compiled from 15 different Ayurvedic classical texts. The obtained data has been critically analysed and presented in a precise manner with regards to their various reported pharmacological activity in skin diseases. Analysis of the compiled data reveals that, out of 332 plants described under *Shakavarga*, 49 are indicated in skin diseases. Among them, botanical identities of 46 classical plants have been established and maximum number of vegetables belong to the family cucurbitaceae. On critical analysis, it is observed that some of these vegetables have been well studied and reported for their various pharmacological activities like antioxidant activity (20), anti-inflammatory activity (17), antibacterial activity (14), immunomodulatory activity (7), anti-allergic activity (3) and antihistamine activity (3) which are related to prevention and management of certain skin disorders. The observed results may be helpful in planning the usefulness of these vegetables as *Pathya* in the prevention and management of skin diseases.

Keywords: *Kustha*, *Pathya*, *Shakavarga*, Skin diseases, Vegetable

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INTRODUCTION

Ayurveda promotes the use of wholesome diet (*Pathya)*, in the prevention as well as management of different disease conditions. *Pathya* is a specific diet prescribed during drug therapy based on the principle that drug action is influenced by dietary components[1]. The word diet is derived from the Latin word diaeta, meaning "prescribed way of life," and from the Greek word diaita, meaning "way of life, regimen, dwelling [2]." Majority of classical texts have allotted separate chapters for dietetic items and described different group of food items such as *Dhanyavarga* (Group of grains), *Mamsavarga* (Group of flesh), *Shakavarga* (Group of vegetables) etc [3].

The health benefits of vegetables have been identified by the authors of various classical texts of Ayurveda and all the vegetables are included under the group *Shakavarga,* with their properties and indications in different disease conditions including skin diseases. In Ayurveda, all the skin disorders are described under the heading of *Kushtha*[4], which is considered as one among the *Ashtamahagada* (Eight important diseases) [5].

Relation between health and food has gained interest in recent years. Dermatologic conditions linked with nutrition can range from nutritional deficiencies, excess nutrients or metabolic disorders [6]. There are certain disorders where one or more components in food are central to the pathogenesis, e.g. dermatitis herpetiformis, wherein dietary restrictions constitute the cornerstone of treatment. A brief list, although not comprehensive, of other disorders where diet may have a role to play includes atopic dermatitis, acne vulgaris, psoriasis vulgaris, pemphigus, urticaria, pruritus, allergic contact dermatitis, fish odor syndrome, toxic oil syndrome, fixed drug eruption, genetic and metabolic disorders and miscellaneous disorders such as vitiligo, aphthous ulcers, cutaneous vasculitis and telogen effluvium [7].

Though, dietary interventions have been an under-appreciated aspect in treatment of skin diseases. However, recent research has found a significant association between diet and some dermatological diseases [8]. Ayurveda is recognized as foremost life science which describes ways to prevent and manage diseases through proper dietary management. Therefore, there is an urgent need to scrutinize the vegetables described under *Shakavarga* in classical texts of Ayurveda and to critically analyze to identify the evidences linking diet and dermatology. Recent review shows that, there is no single hand information regarding classical vegetables of Ayurveda and its role in the prevention and management of skin disorders. In this review,

an attempt has been made to compile and present the vegetables explained in Ayurveda for the prevention and management of different skin diseases.

MATERIALS AND METHODS

Plants described under *Shakavarga*, in different categories like *Patra* (Leaf), *Pushpa* (Flower), *Phala* (Fruit), *Nala* (Stem) and *Kanda* (Tuber), indicated for different skin diseases were compiled from Charaka Samhita[9], Sushruta Samhita[10], Astanga Sangraha[11], Astanga Hridaya[12] and twelve different Nighantus i.e. Dhanvantari Nighantu[13], Shodhala Nighantu[14], Madhava Dravyaguna[15], Madanapala Nighantu[16], Kaiyadeva Nighantu[17], Bhavaprakasha Nighantu[18], Raja Nighantu[19], Priya Nighantu[20], Gunaratnamala[21], Dravyaguna Sangraha[22] and Dravyaguna Shatasloki[23], Rajavallabha Nighantu[24]. Various research journals and books were referred to gather the update information regarding scientific documentation of the role of these vegetables in the prevention and management of skin diseases. The recorded data are presented in a scientific manner with regards to their Sanskrit name, part used, botanical identity and reported activity in skin diseases.

DISCUSSION

All the Samhitas and majority of Nighantus have allotted a separate *Varga* (Group) known as *Shakavarga* and included all the vegetables under this group along with their properties and indications. Different plants described under *Shakavarga* and being indicated in skin diseases have been classified (Table 1). It is observed that, out of about 332 classical vegetables described under *Shakavarga,* [25], [26] 49 are indicated in different skin diseases like *Daha* (Burning sensation), *Kandu* (Itching), *Kustha* (Skin disease), *Tvak dosha* (Skin disorder), *Vidradhi* (Abscess), *Visarpa* (Erysipelas), *Visphota* (Blister).

Table 1: Part wise distribution of classical vegetables used in skin diseases

S N	Indications	*Patra* (Leaf)	*Pushpa* (Flower)	*Phala* (Fruit)	*Nala* (Stem)	*Kanda* (Tuber)
1.	*Daha* (Burning sensation)	*Guduchi, Hamsapadi, Patha*	*Shalmali*	*Karkati, Patola, Shimbi*		*Grinjana, Kadali, Kaseru, Shaluka,*
2.	*Kandu* (Itching)	*Chakramarda, Brahmi, Kakajangha, Patha*		*Brihati, Kantakari,*	*Sarshapa*	*Dharini kanda*

				Koshataki, Patola, Vrintaka.		
3.	*Kustha* (Skin disease)	*Brahmi, Chakramarda, Changeri, Dugdhika Gojihva, Guduchi, Gunja, Hilamochika, Kakajangha, Kakamachi, Kiratatikta, Mandukaparni, Patha, Saptala, Sateena, Shitivara, Sunnishanaka, Suvarchala, Tilaparni, Vasa*	*Arka, Asana, Kutaja*	*Brihati, Eranda, Kantakari, Karavellaka, Karkotaki, Koshataki, Patola, Phanphata, Shigru, Vrintaka*	*Sarshapa*	*Dharini kanda, Hastikarna, Kemuka, Lashuna, Varahi*
4.	*Tvak dosha* (Skin disorder)	*Ghoti, Loni*		*Karavellaka*		*Hastikarna*
5.	*Vidradhi* (Abscess)		*Shigru*	*Shigru, Shimbi*		
6.	*Visarpa* (Erysipelas)	*Hamsapadi, Jyotishmati*		*Shimbi*		
7.	*Visphota* (Blister)	*Suvarchala.*				

Classical vegetables, indicated in skin diseases, and their equivalent botanical name, family are given in Table 2. Out of 49 classical vegetables, botanical identities of 46 have been established [27], [28] and the botanical identity of three plants are yet to be confirmed. Majority of these vegetables belongs to the family cucurbitaceae and solanaceae (Table 2).

Table 2: Botanical equivalents of classical vegetables used in skin diseases

SN	Shaka	Botanical name	Family	Ref.
1.	*Arka*	*Calotropis procera* (Ait) R. Br.	Asclepiadaceae	[10]
2.	*Asana*	*Pterocarpus marsupium* Roxb.	Leguminosae	[10]
3.	*Brahmi*	*Bacopa monnieri* (L.) Pennell	Scrophulariaceae	[15], [17]
4.	*Brihati*	*Solanum indicum* Linn.	Solanaceae	[10-12], [15], [22]
5.	*Chakramarda*	*Cassia tora* Linn.	Caesalpiniaceae	[9-12], [15], [17-19]
6.	*Changeri*	*Oxalis corniculata* Linn.	Oxalidaceae	[11-12], [16], [19]
7.	*Dharini kanda*	-	-	[19]
8.	*Dugdhika*	*Euphorbia hirta* Linn.	Euphorbiaceae	[17]
9.	*Eranda*	*Ricinus communis* Linn.	Euphorbiaceae	[10-11]
10.	*Ghoti*	-	-	[21]
11.	*Gojihva*	*Launea pinnatifida* Cass.	Asteraceae	[9-12], [15], [17-18], [21]
12.	*Grinjana*	*Daucus carrota* L.	*Umbeliferae*	[10-11], [13], [15-20]
13.	*Guduchi*	*Tinospora cordifolia* (Willd.) Miers	Menispermaceae	[9-12], [15], [18-19]
14.	*Gunja*	*Abrus precatorius* Linn.	Fabaceae	[17]
15.	*Hamsapadi*	*Adiantum lunulatum* Burm.	Polypodiaceae	[9], [17]
16.	*Hastikarna*	*Leea macrophylla* Hom.	Vitaceae	[18-19]
17.	*Hilamochika*	*Enhydra fluctuans* Lour.	Compositae	[15], [17-18], [20-22]
18.	*Jyotishmati*	*Celastrus paniculatus* Willd.	Celastraceae	[17]
19.	*Kadali*	*Musa sapientum* Linn.	Musaceae	[15], [18], [21-22]
20.	*Kakajangha*	*Peristrophe bicalyculata* Nees.	Acanthaceae	[9], [15], [17]
21.	*Kakamachi*	*Solanum nigrum* Linn.	Solanaceae	[9-12], [15], [17], [22]
22.	*Kantakari*	*Solanum xanthocarpum* Schrad.	Solanaceae	[10], [12], [18], [21]
23.	*Karavellaka*	*Momordica charantia* Linn.	Cucurbitaceae	[9-18], [21-22]
24.	*Karkati*	*Cucumis utilissimus* Roxb.	Cucurbitaceae	[9-12], [14-18], [21]
25.	*Karkotaki*	*Momordica dioica* Roxb.	Cucurbitaceae	[9-19], [21]
26.	*Kaseru*	*Scirpus kysoor* Roxb.	Cyperaceae	[9-11], [15], [18], [20],[21]
27.	*Kemuka*	*Costus speciosus* (Koenig) Sm.	Zingiberaceae	[8-11], [17], [19]
28.	*Kiratatikta*	*Swertia chirata* (Buch-Ham)	Gentianaceae	[9]
29.	*Koshataki*	*Luffa acutangula* (Linn.) Roxb.	Cucurbitaceae	[10-12],[14-17],[20], [23]

30.	*Kutaja*	*Holarrhena antidysenterica* Wall.	Apocynaceae	[10]
31.	*Lashuna*	*Allium sativum* Linn.	Liliaceae	[10- 12], [16], [19]
32.	*Loni*	*Portulaca oleraceae* Linn.	Portulaceae	[9-12], [14-18], [20-21]
33.	*Mandukaparni*	*Centella asiatica* (Linn) Gaertn.	Umbelliferae	[9- 12], [14]
34.	*Patha*	*Cissampelos pareira* Linn.	Menispermaceae	[9], [11], [15]
35.	*Patola*	*Trichosanthes dioica* Roxb.	Cucurbitaceae	[9-12], [14-21]
36.	*Phanphata*	-	-	[17]
37.	*Saptala*	*Acacia concinna* (Willd.) DC.	Mimosaceae	[10-12]
38.	*Sarshapa*	*Brassica campestris* Linn.	Cruciferae	[9-12]
39.	*Sateena*	*Pisum sativum* Linn.	Papilionaceae	[9-11], [14], [19-21]
40.	*Shalmali*	*Bombax malabaricum* DC.	Bombacaceae	[10-11], [19]
41.	*Shigru*	*Moringa pterygosperma* Gaertn.	Moringaceae	[9-10], [12-13], [15], [20]
42.	*Shimbi*	*Dolichos lablab* Linn.	Leguminoseae	[13], [15-20], [22]
43.	*Shitivara*	*Celosia argentea* Linn.	Marseliaceae	[16], [18], [21]
44.	*Sunnishanaka*	*Marsilea minuta* Linn.	Marseliaceae	[9-12], [14-15], [21-22]
45.	*Suvarchala*	*Malva rotundifolia* Linn.	Malvaceae	[10-12]
46.	*Tilaparni*	*Gynandropsis pentaphylla* DC.	Capparidaceae	[9-12], [16], [17]
47.	*Varahi*	*Dioscorea bulbifera* Linn.	Dioscoreaceae	[10], [14-19], [22]
48.	*Vasa*	*Adathoda vasica* Nees.	Acanthaceae	[9-12], [21]
49.	*Vrintaka*	*Solanum melongena* Linn.	Solanaceae	[9-12], [14-23]

Analysis of information regarding the effect of vegetables from various research journals reveals that, among the 49 classical vegetables indicated in skin diseases, some of the vegetables have been reported for their effect in different activities related to prevention and management of skin disorders. Maximum vegetables are reported for antioxidant activity (20) followed by Anti-inflammatory activity (17), Antibacterial activity (14), Immunomodulatory activity (7), Anti-allergic activity (3) and Antihistamine activity (3).

Antioxidants: Because of the critical role of oxidative stress in cancer and other cutaneous conditions [29], studies have attempted to assess if exogenous antioxidants can have preventive and/or therapeutic effects against skin cancers. There are many antioxidants that have been studied with varying success rates. Several antioxidants, including vitamins C, E [30]

and the green tea polyphenol-epigallocatechin-3-gallate (EGCG) [31], [32] have been shown to possess protective effects against cutaneous disorders [33]. This article reports antioxidant activity of 20 classical vegetables. (Table 3)

Table 3: Antioxidant activity of classical vegetables indicated in skin diseases.

S N	Vegetable	Result
1.	*Allium sativum* Linn. (*Lashuna*)	*A. sativum* oil at the dose of 100 mg/kg showed effective antioxidant activity against oxidative damage in Nicotine-induced lipid peroxidation in rats[34].
2.	*Bombax malabaricum* DC. (*Shalmali*)	Water, 50% ethanol, and 80% acetone extracts of flowers of *B. malabaricum* showed remarkable antioxidant capacity compared with ascorbic or gallic acids in DPPH radical-scavenging activity, oxygen radical absorbance capacity (ORAC), reducing power, and inhibition on phosphatidylcholine liposome peroxidation[35].
3.	*Calotropis procera* (Ait) R. Br. *(Arka)*	Ethanol extract (70%) of *C. procera* flowers at the dose of 5, 10, 25, 50 and 100 µg showed dose dependent reduction in lipid peroxidation induced by CCl_4. In addition, it showed dose dependent radical scavenging activity[36].
4.	*Cassia tora* Linn. *(Chakramarda)*	Ethanol extract of *C. tora* showed strong antioxidant activities in total antioxidant capacity, DPPH-scavenging activity and ferric ion reducing assay[37].
5.	*Celosia argentea* Linn. *(Shitivara)*	Methanol extracts of *C. argentea* showed significant DPPH, Nitric oxide and hydrogen peroxide scavenging activity[38].
6.	*Centella asiatica* (Linn.) *(Mandukaparni)*	Total reducing power and DPPH-radical scavenging activity of 50% ethanol extract of *C. asiatica* were significantly higher when compared to those of the 100% ethanol and water extracts[39].
7.	*Dioscorea bulbifera* (DB) *(Varahi)*	Hydro alcohol extract at the dose of 100, 200 and 400 mg/kg exhibited significant increase of peroxidase, catalase and reduction in glutathione peroxidase, glutathione and lipid peroxidation level in tissues of Indomethacin-induced gastric ulcers in rats[40].
8.	*Enhydra fluctuans* Lour.	DPPH scavenging activity, nitric oxide-scavenging activity and super oxide scavenging activity of ethanol extract of *E. fluctuans* was found to be more

	(Hilamochika)	than that of Chloroform and Pet-Ether extracts [41].
9.	*Euphorbia hirta* Linn. (*Dugdhika*)	Alcoholic extract of *E. hirta* at 100µg dose has showed dose dependent increase in reducing power. Similar results are obtained in case of superoxide anion, hydroxyl radical scavenging activity and nitric oxide radical scavenging activity [42].
10.	*Launeae pinnatifida* Cass. (*Gojihva*)	Ethanol extract of *L. pinnatifida* leaves exhibited significant antioxidant activity against DPPH free radical and hydroxyl radical scavenging activities compared to the petroleum ether, chloroform, and water extracts and standard [43].
11.	*Luffa acutangula (*Linn.) Roxb. *(Koshataki)*	Aqueous extract showed effective free radical scavenging power in DPPH free radical screening activity, superoxide radical scavenging activity and reducing power assay which can be attributed to the presence of tannins and phenolics along with other compounds [44].
12.	*Momordica charantia* Linn. *(Karavellaka)*	IC50 values of alcoholic extract of *M. charantia* in DPPH & Hydrogen Peroxide radical scavenging activity was found to be 120.07 ± 0.77µg/ml & 175.78 ± 0.63 µg/ml respectively [45].
13.	*Musa sapientum* Linn. *(Kadali)*	Hexane extracts of *M. sapientum* had highest DPPH and ferric reducing antioxidant power (FRAP) activity (85.32% inhibition at 100 µg/mL compared to Ethanol and water extract [46].
14.	*Portulaca oleracea* Linn. *(Loni)*	Methanol extract of *P. oleracea* Linn. showed significant antioxidant activity in DPPH radical-scavenging activity, reducing power, Nitric oxide radical scavenging assay [47].
15.	*Solanum melogena* L. (*Vrintaka*)	IC50 value of crude and ethyl acetate fractions of *S. melogena* was found to be 66.745 + 1.008 µg/mL and 58.735 + 1.734µg/mL, respectively in DPPH assay [48].
16.	*Solanum indicum* Linn. (*Brihati*)	Ethanol extract of *S. indicum* showed (10.17 ± 0.6) Ic50 for DPPH assay where aqueous extract showed (21.83 ± 0.84). β - Carotene assay showed that ethanol extract (37.22 ±1.3) possesses more antioxidant activity than water extract (29.07±1.5) [49].
17.	*Solanum nigrum*	Decreased levels of antioxidant enzymes and increased mucosal injury were

	Linn. (*Kakamachi*)	altered to near normal status upon pretreatment with methanol extract of *S. nigrum* berries at the dose of 250, 500 and 1000 mg/kg [50].
18.	*Swertia chirata* (Buch-Ham) (*Kiratatikta*)	Methanol extract of *S. chirata* exhibited significant free radical DPPH scavenging activity and hydroxyl radical scavenging activity while it exhibited non-significant nitric oxide radical scavenging activity [51].
19.	*Tinospora cordifolia* (Willd.) Miers. (*Guduchi*)	Ethyl acetate, methanol, butanol and water extracts of *T. cordifolia* leaves at 250 µg/ml concentration showed significant DPPH radical scavenging activity, reducing power, phosphomolybdenum and metal chelating activity [52].
20.	*Tricosanthes dioica* Roxb. (*Patola*)	Methanol extract along with its organic soluble fractions of *T. dioica* showed concentration dependent antioxidant activity in DPPH radical-scavenging activity, reducing power, nitric oxide radical scavenging assay [53].

Anti-inflammatory: Inflammation is a complex process, essential for the host defense system. Excessive production of some inflammatory mediators may lead to chronic diseases. Inflammation is provoked by pathogens, noxious mechanical and chemical agents, and autoimmune responses [54]. Inflammation is characterized by symptoms such as redness, swelling, itching, heat, and pain [55]. Present review reports 17 plants for their anti-inflammatory activity (Table 4) and hence can be used against various inflammatory agents.

Table 4: Anti-inflammatory of classical vegetables indicated in skin diseases.

S N	Vegetable	Results
1.	*Adhatoda vasica* Nees. (*Vasa*)	Vasicine, vasicinone, vasicine acetate, 2-acetyl benzyl amine, vasicinolone present in chloroform fraction of *A. vasica* leaves showed most potent anti-inflammatory effects at the dose of 20.0mg/kg after 6 hour in carrageenan induced paw edema [56].
2.	*Allium Sativum* Linn. (*Lashuna*)	In carrageenan induced paw edema, methanol extract of *A. sativum* with a concentration of 50 mg/kg produced 81.81% inhibition, which was also high as compared to the standard drug, aqueous and ethanol extracts [57].
3.	*Calotropis*	The methanol extract of *C. procera* flowers at the dose of 100, 200 and 300

	procera (Ait) R. Br. (*Arka*)	mg/kg showed significant dose-dependent inhibition in leukocyte and neutrophil count and showed good anti-inflammatory profile against leukocyte and neutrophil infiltration model [58].
4.	*Cassia tora* L. (*Chakramarda*)	Methanol extract of the leaves of *C. tora* at the dose of 400 mg/kg showed maximum inhibition at the end of 3 hours in carrageenan, dextran, histamine and serotonin-induced rat paw edema [59].
5.	*Celosia argentea* L. (*Shitivara*)	Flavonoid fraction from alcoholic extract of *C. argentea* at the dose of 10 mg/kg exhibited significant dose dependent anti-inflammatory activities in carrageenan induced rat paw edema and cotton pellet induced chronic inflammation[60].
6.	*Centella asiatica* (Linn.) Gaertn (*Mandukaparni)*	Aqueous and ethanol extracts of *C. asiatica* at the dose of 100mg/Kg showed similar degree of activity to the standard Ibuprofen in carrageenan induced rat paw edema [61].
7.	*Costus speciosus* (Koen.) sm. (*Kebuka*)	Ethanol extract of the rhizome showed significant anti-inflammatory effect at the dose of 800 mg/kg against carrageenan induced paw edema and at doses of 400 mg/kg and 800 mg/kg against cotton pellet granuloma formation [62].
8.	*Daucus carota* Linn. (*Grinjana*)	Aqueous extract of *D. carota* at the dose of 100, 200 and 400 mg/kg showed anti-inflammatory activity in acetic acid induced experimental colitis by inhibiting release of inflammatory mediators such as nitric oxide [63].
9.	*Dioscorea bulbifera* L. (*Varahi*)	Aqueous and methanol extracts of *D. bulbifera* at the dose of 300 and 600 mg/kg caused significant anti-inflammatory activity in carrageenan, histamine, serotonin and formalin induced inflammation [64].
10.	*Enhydra fluctuans* Lour. (*Hilamochika*)	Flavonoids isolated from the ethyl acetate fraction showed potent anti-inflammatory activity at the dose level of 200 and 400 mg/kg in carrageenan and histamine induced acute inflammation and Freund's complete adjuvant (FCA) induced chronic inflammation[65].
11.	*Euphorbia hirta* Linn. (*Dugdhika*)	Ethanol and aqueous extract of plant reduced inflammation and prevented the development of experimentally induced inflammation in rats [66].

12.	*Moringa pterygosperma* Gaertn. (*Shigru*)	Seed infusion of *M. pterygosperma* at 1000 mg/kg showed significant effect in carrageenan induced rat paw edema [67].
13.	*Oxalis corniculata* L. (*Changeri*)	Ethanol extract at the dose of 200, 300 and 400 mg/kg showed significant anti-inflammatory activity in acetic acid induced colitis animal models [68].
14.	*Solanum nigrum* Linn. (*Kakamachi*)	The methanol extract of *S. nigrum* berries at the dose of 125, 250 and 375 mg/kg has showed significant anti-inflammatory activity in carrageenan induced rat paw edema [69].
15.	*Solanum indicum* Linn. (*Brihati*)	Methanol extract of the fruit at the dose of 250, 500 mg/kg showed a significant anti-inflammatory activity in carrageenan induced paw edema [70].
16.	*Swertia chirata* Buch-Ham. (*Kiratatikta*)	Xanthone derivative (1,5-dihydroxy-3,8 dimethoxy xanthone) of *S. chirata* at the dose of 50 mg/kg. significantly reduced carrageenan-induced pedal edema (57%) and formalin-induced pedal edema in rats (58%) [71].
17.	*Tricosanthes dioica* Roxb. (*Patola*)	Methanol extract along with its organic soluble fractions at the dose of 100, 200, 400 mg/kg, exerted a significant and dose dependent inhibition on carrageenan induced rat paw edema compared to control group [53].

Anti-bacterials: Bacterial skin infections are the 28th most common diagnosis in hospitalized patients [72]. Cellulitis, impetigo, and folliculitis are the most commonly seen bacterial skin infections. The majority of bacterial skin infections are caused by the gram-positive bacteria Staphylococcus and Streptococcus species [73]. In the present review, 14 vegetables are found to be reported for their antibacterial activity. (Table 5)

Table 5: Antibacterial activity of classical vegetables indicated in skin diseases.

S N	Vegetable	Results
1.	*Adhatoda Vasica* Nees. (*Vasa*)	Ethanol, petroleum ether and water extracts of *A. vasica.* showed significant effects against tested microorganisms like *S. aureus, S. epidermidis, B. subtilis, E. faecalis, E. coli, P. vulgaris, K. pneumoniae* and *C. albicans* by

		minimum inhibitory concentration method [74].
2.	*Bombax malabaricum* DC. (*Shalmali*)	In minimum inhibitory concentration method, methanol extract of flowers of *B. malabaricum* showed marked inhibitory activity against bacteria and fungi [75].
3.	*Brassica campestris* L. (*Sarshapa*)	The ethanol extracts of all the plant parts were found to be highly effective whereas the petroleum ether, methanol and ethyl acetate extracts of root, stem and leaves respectively exhibited a good antibacterial activity against all bacterial strains studied by disk diffusion method [76].
4.	*Cassia tora* Linn. (*Chakramarda*)	Aqueous extract of *Cassia tora* leaves showed maximum inhibitory activity against *S aureus, Lactobacillus* and moderate activity against *P aeruginosa, P. vulgaris* [77].
5.	*Celosia argentea* L. (*Shitivara*)	In minimum inhibitory concentration assay, ethanol extract of *C. argentea* showed significant antibacterial activity against gram positive bacteria (*S aureus* and *B subtilis*), and gram negative bacteria (*E coli*, and *P aeruginosa*) [78].
6.	*Centella asiatica* (Linn.) (*Mandukaparni*)	Ethanol and water extracts of *C. asiatica* were studied for antibacterial activity by disc diffusion method. The ethanol extracts had more potential antibacterial activity than the water extracts [79].
7.	*Costus speciosus* (Koenig) Sm. (*Kebuka*)	Among methanol and water extract of *C. speciosus,* the aqueous extracts showed better antibacterial activity against *S. aureus* by agar disc diffusion method [80].
8.	*Luffa acutangula* (L.) Roxb. (*Koshataki*)	Methanol extract of *L. acutangula* inhibited the growth of the *P. aeruginosa, E. coli, B. subtilis* and *S.aureus*. The ethyl acetate extract showed the highest antibacterial activity against *P. aeruginosa, E. coli, B. subtilis* and *S. aureus* [81].
9.	*Momordica dioica* Roxb. (*Patola*)	Hexane and ethyl acetate soluble portion of methanol extract of fruit pulp of *M. dioica* had a potential antimicrobial activity which was concentration dependent. Both extracts were found to be effective mostly against *S typhi* and *S dysenteriae* [82].

10.	*Moringa pterygosperma* Gaertn. (*Shigru*)	In minimum inhibitory concentration method, ethanol extract of flower of *M. pterygosperma* showed antibacterial activity against *M luteus, S aureus, B subtilis, E coli, P aeruginosa* and *V cholera* [83].
11.	*Peristrophe bicalyculata* Nees. (*Kakajangha*)	Ethanol, acetone and chloroform extracts were studied for antibacterial activity by disc diffusion method. Ethanol extract was found to be most effective against *E. coli, B. cereus* and *S. typhi*. Highest zone of inhibition was observed against *E. coli* [84].
12.	*Solanum Melogena* L. (*Vrintaka*)	*S. melogena* aqueous extract showed significant antibacterial activity on tested microorganisms. The bacterium *Proteus vulgaris* exhibited susceptibility to extract with less MIC value [85].
13.	*Solanum xanthocarpum* Schrad. (*Kantakari*)	*S. xanthocarpum* berries at the dose of doses of 5, 10 and 15 mg/mL, prepared through methanol extracts displayed significant zones of inhibition in hole-plate diffusion method [86].
14.	*Swertia chirata* Buch-Ham. (*Kiratatikta*)	Methanol and aqueous extracts of *S. chirata* showed concentration dependent antibacterial activity but the methanol extract possess better activity than aqueous extract in agar diffusion method [87].

Immunomodulators: Immunosuppression plays the important role in pathogenesis of some infectious diseases. Many recurrent and persistent infections can develop as the result of inherited or acquired abnormality of the immune system reactivity [88]. Immunomodulatory activity of 7 vegetables are reported in different experimental studies (Table 6)

Table 6: Immunomodulatory activity of classical vegetables indicated in skin diseases.

S N	Vegetable	Results
1.	*Adhatoda vasica* Nees. (*Vasa*)	Alcohol extract of *A. vasica* leaves at the dose of 500 mg/kg showed significant increase in total WBC, blood lymphocytes, splenic lymphocytes and peritoneal macrophages in SRBC induced delayed type hypersensitivity [89].
2.	*Tricosanthes*	In SRBC induced delayed type hypersensitivity, *T. dioica* aqueous extract at

	dioica Roxb. (*Patola*)	the dose of 100 and 200 mg/kg showed increasing antibody production in dose dependent manner. It enhances the production of RBC, WBC and Haemoglobin [90].
3.	*Centella asiatica* (Linn.) Gaertn. (*Mandukaparni*)	Ethanol extract of *C. asiatica* leaves at the dose of 25, 50, 100 mg/ml stimulated cell mediated immune system by increasing neutrophil phagocytic function [91].
4.	*Alllium sativum* Linn. (*Lashuna*)	Aqueous extract of *Alllium sativum* at the dose of 50 and 100 mg/kg didn't show any significant effect on leukocytes mobilization in albino strain Wistar rats [92].
5.	*Swertia chirata* (Buch-Ham.) (*Kiratatikta*)	Methanol extract of aerial parts of *S. chirata* at the dose of 200 mg /kg showed dose related decrease in primary and secondary antibody response and delayed type hypersensitivity (DTH) response [93].
6.	*Momordica charantia* Linn. (*Karavellaka*)	In carbon clearance assay and percentage adhesion of neutrophils to nylon fibers, the aqueous extract of *M. charantia* at the dose of 450 mg/kg and 900 mg/kg, showed improvement in the phagocytic index in a dose dependent manner. At higher dose, the extract significantly increased the percentage of adhesion of neutrophils to nylon fibers when compared with the normal control animals [94].
7.	*Solanum xanthocarpum* Schrad. (*Kantakari*)	Methanol extracts of fruits in 100mg/kg dose level showed pronounced immuno-protective activity by increasing the depleted levels of total WBC count and RBC, % Hb, and % neutrophils adhesion in cyclophosphamide induced immunosuppression model [95].

Anti-allergics: Allergy or altered immune response is one of the harmful effects of the immune system. There are many types of itchy skin allergies and rashes. The atopic dermatitis, urticaria, contact dermatitis are the most common types of allergic skin rashes [96]. These common forms of allergies can be treated and managed by anti- allergic drugs. In the present review, 3 vegetables are found to be reported for their anti-allergic activity. (Table 7)

Table 7: Anti-allergic activity of classical vegetables indicated in skin diseases.

S N	Vegetable	Results
1.	*Centella asiatica* (Linn) Gaertn. (*Mandukaparni*)	Aqueous and alcoholic extracts at the dose of 100 mg/Kg were found to have inhibitory effects on *in vitro* anti-allergic activity using sheep serum method and compound 48/80 induced mast cell degranulation [61].
2.	*Momordica dioica* Roxb. (*Patola*)	In milk induced leukocytosis, milk induced eosinophilia and differential leukocytes count on mice, methanol extract at the dose of 200 mg/kg showed more significant anti-allergic activity as compared petroleum ether, ethyl acetate and aqueous extracts [97].
3.	*Solanum nigrum* Linn. (*Kakamachi*)	The petroleum ether extract of *S. nigrum* berries at the dose of 50, 100 and 200 mg/kg significantly inhibited clonidine-induced catalepsy, increased leukocyte and eosinophil count and showed maximum protection against mast cell degranulation by clonidine [98].

Anti-histamines: Histamine has a key role in allergic inflammatory conditions. The inflammatory responses resulting from the liberation of histamine have long been thought to be mediated by the histamine H_1 receptor, and H_1 receptor antagonists, commonly known as antihistamines, have been used to treat allergies for many years [99]. Antihistamines, both old first-generation and new, are frequently prescribed to patients with allergic skin diseases [100]. In the present review, 3vegetables are found to be reported for their antihistamine activity. (Table 8)

Table 8: Anti-histamine activity of classical vegetables indicated in skin diseases

S N	Vegetable	Results
1.	*Calotropis gigantea* L. (*Arka*)	Anti-anaphylactic property in specific in-vivo animal models was studies using petroleum ether, ethanol (95%) and water extract of *C. gigantea* flowers. Mast cells were protected by ethanol extract at a dose of 400 & 600 mg/kg by 72.25 % and 77.14 % respectively [101].
2.	*Momordica dioica* Roxb. (*Karkotaki*)	Water, 50% and 100% ethanol extracts of *M. dioica* fruits at the dose of 50, 100 and 500 µg/ml were studied for effect on histamine release in human basophilic KU812 cells. The water extract showed strongest inhibitory effect on

		histamine release as compared with the other extracts [102].
3.	*Solanum nigrum* Linn. (*Kakamachi*)	Petroleum ether, ethanol and aqueous extracts (50, 100 and 200mg/kg) were studied for their effect on smooth muscle of guinea pig ileum (*In vitro*). Petroleum ether extract resisted contraction induced by histamine better than other extracts [98].

CONCLUSION

Based on theoretical grounds or anecdotal reports, intake of dietary vegetables might help to prevent recurrences of many skin diseases through different mechanisms. Some experimental studies also give insight in understanding the role of classical vegetables in skin diseases. However, there is a gap in the understanding how these drugs can be helpful in clinical practice. Further studies are required to fulfill this gap. The effective dosage and toxicity of these vegetables need to be defined.

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