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Review Paper

Integrative Understanding of Arka On Kushta: A Conceptional Review

Dr Sushma Kalyani, Dr R. Hiremath*, Dr Varsha Malagi, Dr Yukta Gawas

Department of Rasashastra and Bhaishajya Kalpana. KAHER'S Shri B M Kankanawadi Ayurveda Mahavidyalaya Shahapur, Belagavi.

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ABSTRACT

Arka a semi-poisons plant which is widely used in ayurveda for its kushthaghna properties, krimighna and vrana shodhana-ropana properties. Its importance is mentioned in kushta disorders which involve vitiation of tridosha and other dushya such as twak, rakta, mamsa and lasika. Its guna like ushna tiksha support for a deep tissue action. Arka contains phytochemicals such as alkaloids, flavonoids, terpenoids that exhibit anti-microbial, anti-fungal, anti-oxidant and wound healing activities. Therefore, the classical indication of Arka are strongly supported by its pharmacological actions, by highlighting its relevance in management of skin disorders. A comprehensive review of literature was conducted mainly focusing on arka its utility in kushta this was examined to identify reference of Arka, its indication, formulations mainly focusing on brihartrayi. Information on its phytochemicals and their action of skin disorders were collected through relevant articles from modern database such as IMPAAT, PubMed, Google Scholar etc. Highlighting the Classical reference of arka its indication and formulations containing arka as ingredient. Also, focusing on arka its properties and mode of action in kushta disorder. Phytochemical analysis also reveals the presence of flavonoids, alkaloids, glycosides, tannins and terpenoids. These constituents exhibit significant anti-inflammatory, anti-microbial, anti-oxidant properties. Many studies indicate effectiveness against reduction of inflammation, microbial infection and modulation of oxidative stress in skin conditions. Therefore, this integrative understanding bridges classical ayurvedic concepts with modern phytochemical and pharmacological evidence

INTRODUCTION

Arka is one among the semi-poisonous group of plants, belonging to the family Asclepiadacea that is used since ancient times in management of

***Corresponding Author:** Dr R. Hiremath
Address: *Professor and HoD Department of Rasashastra and Bhaishajya Kalpana. KAHER'S Shri B M Kankanwadi Ayurvedic Mahavidyalaya Shahpur, Belagavi..*
Email ✉: drrshiremath.pub24@gmail.com
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various diseases. In ayurveda Arka are mainly of two varieties i.e shwetaarka and raktaarka, the botanical sources of these are calotropis procera and calotropis gigantea respectively. Acharya charaka have included arka in bhedaniya vamonopaga, svedopaga and ksheeri dravya. Acharya Sushruta has mentioned under arkadi gana and Adhobhagahara [(1)] and specially indicating its utility in kushta, varna (shodhana,ropana) and krimi. Acharya Sushruta has also quoted arka pushpa as kapahapittahara and kushthaghna [(2)]. Arka has been quoted for sekarth to the infected vrana [(3)]. In ashtanga Hridaya Arka has been included in Arkadi gana[(4)], Arka with other drugs indicated for lepa in infected wound [(5)]. Different Acharya and nighantus have mentioned different properties of Arka according to which it is being used in various diseases such as kushta, kandu, krumi, raktavikara, pleeha, tamak shwasa etc [(6)].

In traditional medicine the latex from calotropis procera is widely used as a rich source of biologically active compounds which are capable of providing diverse benefits like anti-microbial, dermal fungal infections and analgesic [(7)]. In many recent studies it has been proved for its anti-microbial, anti-inflammatory, antioxidant, wound healing properties. Arka which is known for its ushna, Tikshna (deep penetrating) properties, making it suitable for utility in twak vikara particularly kushta,visarpa, shwitra.

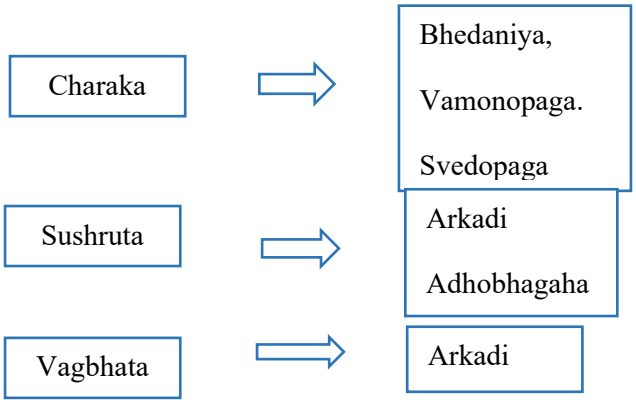
Skin being the largest organ which covers the body and a first organ to react environmental stimuli. In addition to this it acts as initial line for self-defence, as among all organs skin being larger one it is exposed more to disease and injury. In ayurveda the word ‘twacha’ or ‘charma’ is used for skin. The word twacha is derived from - Twacha samvarne which means covering the body. Therefore, all the skin diseases have been considered under the broad heading of kushta[(8)] Kushta it involves all three types of tridosha and four dushya, in which the three dosha are vitiated by nidana (etiological factors), which further vitiated the twak(skin), rakta(blood), mamasa(muscle), lasika(lymph).

Extent and severity of vitiations of these seven-fold pathogenic components leads to unique manifestation of Kushta. Depending on the symptom’s severity and prognosis, all acharya have classified kushta as either maha kushta or kshudra kushta. The kushta results when tridosha,twak, rakta, mamsa, lasika are vitiated. [(9)]. In Modern perspective skin disease are caused by infections (bacterial, fungal), autoimmune(psoriasis,vitiligo), allergic(eczema) etc so the therapeutic utility of Arka act as potent intervention by utilizing its anti-microbial, anti-fungal and other properties. According to various research articles arka is been proved to have anti-microbial, anti-fungal properties making it ideal for treating various skin disorders.

MATERIALS AND METHODS-

An extensive review of literature from classical ayurvedic texts was done to gather information on traditional properties, uses and therapeutic application of Arka (calotropis procera) has been done from brihartrayi, these textes were examined to identify reference of Arka, its indication, formulations containing Arka as ingredient and their different forms were collected together manually. Information related to chemical constituents, pharmacological and therapeutic action on skin disorder have been collected from different articles available on internet and online database.

CLASSICAL CATEGORIZATION [(10)]



RASAPANCHAKA OF ARKA [11]

- Rasa -Katu,tikta rasa
- Guna- Laghu, Ruksha,Tiksna,
- Virya- Ushna,
- Vipaka- Katu,
- Karma- Kushta, visarpa, sopha, vrana, kandu, krimi, arsha, gulma, udara, medoroga, visa roga, Vatahara, Recana , Visaghna, Dipana, Plihoroga[14].
- **PART USED** – Root, bark, flower, leaf, latex, seeds.

RESULTS –

Therapeutic formulations of Arka and its reference in Brihatrayi

Table 1- Charaka Samhita [12]

Si no	Formulations	Indications	Ref
1	Pradeha /Dantyadi Pradeha	kushta	Ch Chi 7/56-57
2	Chitrakadi lepa	mandala	Ch Chi 7/85-86
3	Kusthadi taila/lepa/udvartana	kushta	Ch Chi 7/102
4	Shweta karveera palladia taila	Kushta and kandu	Ch Chi 7/106
5	Kanaka ksheeri taila	mandala kushta,kandu, krimi	Ch Chi 7/111-116
6	Dantyadi lepa	Kaphaja visarpa	Ch Chi 21/126

Table 2-Sushruta Samhita [13]

Si no	Formulations	Indications	Ref
1	Lepa/samudraphenadi lepa	Kushta	Su chi 9/10
2	Lepa /tutthadi lepa (vitiligo)	svitra	Su chi 9/27
3	Mahanila ghrta	Kushta, svitra	Su chi 9/35
4	Lepa /putikadi lepa	Svitra, dadru, vrana	Su chi 9/40
5	Kwatha (nimba or alarka, arka and saptacchada)	Kushta	Su chi 9/51
6	Varjraka taila	Kushta, nadi dusta vrana	Su chi 9/54
7	Maha Varjraka taila	Kushta	Su chi 9/58
8	Mantha kalpa	Mahakushta	Su chi 10/4
9	Medicated oil	Kushta	Su chi 10/15
10	Tika – cakradatta have mentioned under ushna virya	Visarpa	Su chi 17

Table 3-Ashtanga Hridaya [14]

Si no	Formulations	Indications	Ref
1	Dantyadi lepa	Granti visarpa chikitsa	AH 18/26
1	Yoga (lepa)	Kushta	AH 19/70
2	Vajraka taila	Kushta	AH 19/79
3	Mahavajra taila	Ksuhta, svitra	AH 19/82

4	Putikadi lepa	Svitra, dadru, pama, kotha	AH 20/9
5	Bhallatakadi lepa	Kushta, kilasa, charmakhila,	AH 20/16-17

PHYTOCHEMICALS PRESENT IN ARKA

(15)

Part	Phytochemicals
Whole plant	Uscharin, ouabain, calotropin
Stem	Calotropin, Calotropagenin, alpha-Amyrin, beta-Amyrin, Rutin.
Root	Calotropin, Benzoyllineolone, alpha-Amyrin, beta-Amyrin, Rutin.
Latex	Uscharin, Calactinic acid, Uscharidin, Voruscharin, Syriogenin, Proceroside, Uzarigenin, Calotropin, Calactin, butyric acid, Calotropagenin, Taraxasterol acetate, alpha-Amyrin, Valeric acid, beta-Amyrin, Lupeol, beta-Sitosterol, Rutin
Leaf	Myristic acid, beta-Bisabolene, Geranylacetone, Myristicin, Nonanal, Calotropin, p-Cymene, beta-lonone, Eucalyptol, Calotropagenin, Farnesylacetone, 4-Carvomenthenol, alpha-Amyrin, alpha-Terpinene, Linalool, alpha-Pinene, beta-Pinene, Sabinene, beta-Amyrin, Caryophyllene oxide,phytol, beta-Caryophyllene, beta-Sitosterol, Cedrol, Fenchol, Limonene, Rutin.
Flower	Flavylium, Keracyanin, Procesterol, Calotropenly acetate, Multiflorenol, Cyclosadol, alpha-Amyrin, beta-Amyrin, beta-Sitosterol, Stogmasterol, Rutin.
Bark	Gigantol, Sterol, beya-Amyrin, beta-Sitosterol
Others	Uscharin, Calactinic, Uscharidin, Syriogenin, Proceroside, Gigantol, Keracyanin, Uzarigenin, Choline, Calotropin, Calactin, Procesterol, Cardenolide, Benzoyllineolone, Multiflorenol, Cyclosadol, Cycloart-23-en-3beta,24-diol, Calotropagenin, 2,3-dihydroxybenzoic acid, Taraxasterol acetate, Lupeol, beta-Sitosterol, Stigmasterol, D-Glucosamine, D-Glucose, L-Rhamnose, Taraxasterol.

LIST OF MAJOR PHYTOCHEMICALS RESPONSIBLE FOR SKIN ACTIVITY

Phytochemical class	Examples	Therapeutic action on skin
Flavonoids	Quercetin, Isorhamnetin, Kaempferol, Luteolin.	Anti-inflammatory, anti-oxidant, anti-pruritic. [16]
Phenolic compounds	Ferulic acid, p-Coumaric acid, catechin, rutin, caffeic acid.	Anti-oxidant,anti-inflammatory, anti-microbial anti-melanogenic effect. [17]
Terpenoids	Ursane, oleanane type triterpenes.	Anti-microbial, anti-inflammatory. [18]
Glycosides	Calotoxin, calotropin, Uscharin.	Anti-microbial, cytotoxic, irritant. [19]
Steroids	Beta-sitosterol, stigmasterol	Anti-inflammatory. [20]

DISCUSSION

➢ Mode of action of Arka on Classical perspective -

Arka possessing Katu-Tikta rasa, laghu ruksha guna, ushna virya properties which help in samprapti vighatana of kushta. As kushta is characterized by sanga i.e. obstructions in micro-channels of skin, Arka's tiksha(sharpa) and sukhma guna allowing it to penetrate into these blocked channels helping to scrape out the accumulated morbid doshas. Katu-tikta rasa and Ushna virya of Arka helps in reducing the kapha and vata dosa. Pitta dosa associated with Rakta dushti is pacified by Tikta rasa of Arka. The Ushna

and Tikshna guna helps in removing srotorodha. Other properties like kushtaghna , lekhana, krimighna, kandu helps in reducing the itching, lesions, discoloration, eliminating the krimi's (pathogens/microbes) making it effective against bacterial and fungal skin infections.

Arka possessing katu, tikta rasa has an action of kapha-pitta shamaka, lekhana, meda shoshana, lasika shoshana, Deepana, pachana, which can help in managing of kushta. As it involves kapha-pitta dushti and kleda accumulation in twak, rakta, mamsa, these actions help in reducing the pathological accumulation of kleda and lasika in the body, thereby helping to control the progression of diseases. Additionally, these rasa aid in digestion of the ama, purifying the rakta, elimination of toxins and are beneficial in conditions such as visarpa(herpes), kushta(leprosy), kandu (itching) daha (burning sensation), krimi (worms) and other skin disorder. (21)

The laghu, ruksha, tikshna guna of Arka contributes to lekhana(scrapping), kleda-shoshana and srotoshodhana actions. It helps in removing kapha-induced obstruction in the channels and scrape pathological deposits through these mechanisms. Ruksha guna of arka is also associated with the anti-microbial and wound healing activity. (22)

Ushna veerya of Arka exhibits kapha-vata shamana, Deepana, pachana properties. As there is kapha predominance in kushta leading to symptoms such as kandu, kleda, gaurava, sthairya, while the involvement of vata contributes to dryness, roughness and chronicity of kushta. These can be alleviated by ushna veerya which contributes these pathological changes by normalising the vata and reducing the kapha accumulation, there by relieving the itching, heaviness and other abnormal secretions from the skin. Additionally, the Deepana and pachana properties further aids in the digestion and elimination of ama and other pathological metabolites present in the body. (23)

The kattu vipaka tend to reduce kapha, meda and other pathological secretions. Therefore, it is particularly useful in chronic kushta conditions that involves kapha-meda accumulation. (24)

The kushtaghna, krimighna and shothahara properties of arka can be correlated with its modern pharmacological properties such as anti-oxidant, anti-microbial and anti-inflammatory activities. (25,26)

➢ MODE OF ACTION OF PHYTOCHEMICALS ON SKIN

Quercetin-

Anti-oxidant property – As the Quercetin has a potent anti-oxidant effect, based on its polyphenol structure. It combines with free radical species to make them less reactive phenoxy radicals. Additionally, the quercetin reduces oxidative stress-induced cell death in keratinocytes through its anti-oxidant actions. Quercetin enhances cellular antioxidant defences by increasing the expression of the key enzymes such as glutathione peroxidase and superoxide dismutase (27)(28). Anti-inflammatory property – Many recent studies have shown about the quercetin and its derivatives exert potent anti-inflammatory effects and suppressed inflammatory cytokines such as serum IgE, eosinophil levels. Quercetin reduces neutrophil infiltration, promotes apoptosis of activated neutrophils, thereby reducing the tissuse damage in inflamed skin. (29) Anti-allergy action- It helps in inhibiting the release of histamine from basophil cell and also reduces itching, skin redness caused by histamine (30). Additionally, quercetin enhances the skin health by improving the skin barrier function of keratinocytes, as it promotes keratinocyte proliferation and differentiation, it stabilizes intercellular junctions and it also activates PPAR – α while reducing inflammatory cytokines. Increase the skin hydration by

upregulating genes such as TGM-1 and HAS-1, this enhances natural moisturizing factors and lipid synthesis and protect against irritation, inflammation and infection. [31]

Luteolin-

It is a naturally occurring flavonoid that exhibits significant therapeutic action in various skin disorders due to its potent anti-oxidant, anti-inflammatory and immunomodulatory properties. Luteolin plays a crucial role in modulating the immune response by inhibiting the mast cells, dendritic cell and T-cells, which are involved in allergic and inflammatory skin reactions. So, this contributes its effect in managing skin disorders like atopic dermatitis and hypersensitivity conditions by reducing irritation and itching. Additionally, it enhances cell viability, decreases reactive oxygen species levels and protects keratinocytes from damage by increasing the anti-oxidant enzyme activity such as superoxide dismutase, while reducing the oxidative injury markers like lactate dehydrogenase and malondialdehyde. Luteolin, it exerts its anti-inflammatory action by inhibiting inflammatory mediators such as tumour necrosis -alpha, interleukins and cyclooxygenase-2 (COX-2). This leads to reduction in oedema, erythema and overall inflammation observed in conditions like eczema, dermatitis, psoriasis. Overall, luteolin enhances skin barrier function reduces inflammation, improves healing and protects against oxidative damage, making it a promising natural compound for managing skin disorders. [32,33,34]

Isorhamnetin-

A naturally occurring methylated flavonoid which exhibits a strong anti-oxidant and cytoprotective effect against UVB-induced skin damages in keratinocytes. Due to its phenolic hydroxyl group, it effectively scavenges reactive oxygen species, thereby reducing the oxidative stress within the skin cells. By reducing lipid peroxidation and protein oxidation, isorhamnetin helps in maintaining normal cellular function and skin integrity. Additionally, it exhibits anti-inflammatory effects by downregulating pro-inflammatory cytokines, mediators thereby helping in reducing erythema, oedema and irritation that are associated with skin disorders such as eczema and dermatitis etc. [35,36]

Kaempferol-

Kaempferol functions as the potent flavonoid which prevents oxidative damage, skin inflammation and apoptosis, thereby maintaining the skin integrity and health. It exhibits a significant protective effect against oxidative skin damage, particularly in the dermal fibroblasts which is exposed to 12-O-tetradecanoylphorbol-13-acetate (TPA) induced stress. kaempferol exhibits s therapeutic potential in skin disorder particularly eczema due to its anti-inflammatory, anti-oxidant and immunomodulatory properties.it enhances the skin. It modulates immune-mediated inflammation by inhibiting T-lymphocyte activation. Enhances skin barrier functions by promoting expression of structural proteins such as keratin, thereby preventing entry of allergens and irritants. [37,38]

Ferulic acid-

Ferulic acid is a low-toxicity phenolic compound with powerful antioxidant, anti-inflammatory and anti-microbial properties making it more beneficial for skin health. It inhibits enzymes that are responsible for reactive oxygen species generation and also neutralises free radicals particularly hydroxyl radical, superoxide and nitric oxide. It also plays important role in protecting key components of skin such as keratinocytes, fibroblast, collagen and elastin, thereby maintaining skin structure and functions. [39]

p-Coumaric acid-

p-Coumaric acid is a natural metabolite present in many plants, which has a anti-oxidant, anti-melanogenic and photoprotective properties. Inhibits the melanin synthesis by suppressing both gene expression of tyrosinase and catalytic activity a enzyme in melanogenesis. In addition, p-coumaric acid absorbs UV radiation and reduces inflammation and UV induced oxidative stress, thereby preventing hyperpigmentation. (40)

Catechin-

Catechin is the polyphenol derived from a green tea, which acts as a strong anti-inflammatory, UV protection, anti-oxidant and anti-aging. Green tea catechins they help in reducing chronic inflammation, thereby improving the skin conditions like eczema and psoriasis. Additionally, it facilitates DNA repair mechanisms within the dermal fibroblasts which are exposed to damging agents, also promotes photoprotection by absorbing and screening harmful UV radiation. (41)

Rutin-

Is a bioactive flavonoid with a significant anti-oxidant, anti-inflammatory and anti-aging effect on skin. Rutin, it exhibits a significant therapeutic potential in many inflammatory skin disorders, especially atopic dermatitis, because of its immunomodulatory and barrier-enhancing effect on skin. Rutin by upregulating PD-L1 expression in keratinocytes it helps in alleviating skin inflammation and pruritus, this helps in regulating immune response by suppressing excessive T-cell activation and by promoting immune tolerance. Further leading to an increase in anti-inflammatory mediators and reduction in pro-inflammatory cytokines, there by restoring the immune balance in the skin. Rutin has showed effective decreases in atopic dermatitis symptoms such as itching, inflammation and skin thickening in experimental models. Over all it acts by reducing inflammation, strengthening skin barrier and modulating the PD-1/PD-L1 signalling pathway, making a promising agent for managing the inflammatory skin disorders. (42)

Caffeic acid –

A derivative of caffeic acid i.e. Caffeic acid -2,4-dihydroxyphenylpropanol ester it demonstrates an enhanced skin benefits due to its increased lipophilicity and its improved dermal absorption. It exhibits strong anti-oxidant activity by reducing the intercellular reactive oxygen species (ROS), thereby protecting skin cells from oxidative stress. it also suppresses the activity and expression of key melanogenic enzymes such as tyrosinase (TYR), TRP-1 and TRP-2, it also downregulates MITF, the master regulator of melanin synthesis. Additionally, it also shows potent skin-brightening effects by inhabiting melanogenesis through multiple mechanisms. (43)

Beta-sitosterol-

It is a natural plant phytosterol which exhibits beneficial effects on skin primarily through its anti-oxidant and anti-inflammatory properties. It reduces the oxidative stress by lowering levels of reactive oxygen species such as oxygen free radicals and hydrogen peroxide, thereby protecting skin cells from damage. It does not directly act as a radical scavenger, but it modulates anti-oxidant enzyme systems, contributing to cellular protection. In addition, Beta-sitosterol demonstrates anti-inflammatory activity by reducing pro-inflammatory mediators. These effects help in controlling skin inflammation associated with conditions like dermatitis and other inflammatory skin disorders. (44)

Stigmasterol –

It is the natural steroid alcohol that demonstrates significant therapeutic potential in allergic and inflammatory skin disorders through its anti-

pruritic, anti-inflammatory and anti-allergic activities. It exhibits strong anti-pruritic effect by reducing scratching behaviour and inhibiting mast cell proliferation and degranulation, which are key contributes to itch. It also suppresses IgE-mediated allergic responses by stabilizing mast cells and inhibiting their degranulation, thereby reducing the release of histamine and other inflammatory mediators. Overall, it protects the skin by modulating immune responses, reducing inflammation and itching and maintaining skin integrity making it as promising agent in the management of allergic and inflammatory skin diseases. [45]

SYNERGISTIC ACTIVITY OF ARKA – BOTH CLASSICAL AND CONTEMPORARY PERSPECTIVE-

When examined from the perspective of both contemporary phytochemistry and ayurvedic principles, Arka has a unique synergistic therapeutic effect. Traditionally, its katu-tikta rasa, Ushna virya and tikshna guna facilitate Deepana, Lekhana and Srotoshodhana activities,
which aid in detoxifying and clearing the vitiated dosha-dushya involved in kushta. The properties such as kushtghna, krimighna and ropana-shodhana work together to lessen the inflammation, infection and itching and healing of skin lesions. From modern standpoint the inclusion of several phytoconstituents, including alkaloids, flavonoids, glycosides and terpenoids, these compounds exhibit complementary pharmacological actions including anti-microbial, antifungal and anti-inflammatory etc. For instance, flavonoids lessen inflammation and oxidative stress, while glycosides support anti-bacterial traditionally, its Katu-tikta rasa, ushna virya and Tikshna guna facilitate deepana, lekhana and srotoshodhana activities, which aid in detoxifying. Thus, the therapeutic effect of Arka in skin disorders arise from combined and mutually enhancing effects of its classical guna and modern bioactive compounds, establishing a clear synergistic action by bridging between ayurvedic wisdom and scientific validation.

CONCLUSION

Arka (Calotropis procera), a potent drug which is described under brihatryis in ayurveda, holds a significant therapeutic value in the management of various skin disorders(kushta). Its classical properties such as katu-tikta rasa, Ushna veerya and katu vipaka-contributes to kapha-vata shamana, kleda shoshana, lekhana and krimighna actions, which are essential in breaking the pathogenesis of skin diseases.
From modern scientific perspective, the presence of diverse phytoconstituent such as flavonoids, triterpenoids, cardiac glycosides and phenolic compounds, supports the pharmacological activity such as anti-microbial, anti-inflammatory, anti-oxidant and immunomodulatory effects. These actions can be correlated with its traditional indications in conditions such as eczema, psoriasis, leprosy and other inflammatory dermatoses. However, the integration of ayurvedic principles with its phytochemical and pharmacological evidence highlights Arka as promising drug in management of skin disorders.

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