



**AYURVEDIC MANAGEMENT OF CHILDHOOD DIARRHOEA: A  
PHARMACOLOGICAL ANALYSIS OF DHATAKYADI YOG**

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**ABSTRACT**

Diarrhoeal disease is the second leading cause of death in children under the age of five years, and is responsible for killing around 525000 children every year (WHO may 2017). It is also important to quote here that the irrational use of antibiotics is not safe for healthy flora of child's intestine. The frequent use of antimicrobials may even cause drug resistance for causative pathogens. This practice instead of treating acute diarrhoea increases its severity and converts it into chronic diarrhoea. Therefore, keeping all above things in mind present study is an attempt to find out some safe, cost-effective, alternative cure for childhood diarrhoea.

**INTRODUCTION**

Balatisara (childhood diarrhoea) is one of the major health problem in developing countries like India. It constitutes a leading cause of morbidity and mortality among children. Diarrheal diseases rank among the "top three" causes of death in pediatric population of the developing world. It is the second leading cause of death in children under the age of five years, and is responsible for killing around 525000 children every year (WHO may 2017). In Ayurvedic classics Atisara is explained as an individual disease in addition it is also a condition occurring during various periods of childhood disorders like dentition, weaning etc for which the causes may be nutritional deficiency or infection. Individual or combined doshic vitiation leading to the formation of Aama is the main reason for the condition Atisara.<sup>[1]</sup> Many drugs have been mentioned for the treatment of different types of diarrhea in different *Ayurvedic* texts, but "*dhatakyadi yoga*" is one of the important antidiarrheal compound due to its pharmacodynamic properties. This drug is a unique combination of Bilva, Dhataki, Lodhra and Gajapippali in equal proportion that is mentioned in yogratanakar-balarogachikitsa.<sup>[2]</sup>

**Pharmacological Analysis of Dhatakyadi Yog**

**BILVA:** Aegle marmelos.

**Ayurvedic pharmacodynamic properties<sup>[3]</sup>-** *Rasa:* Katu, Tikta, Kashaya ; *Guna:* Laghu, Ruksha; *Virya:* Ushna; *Vipaka:* Katu and *Doshshaman:* Pittakshamak, Vatakaphahara.

**Classical indication<sup>[3]</sup>:** Balya, Dipana, Grahi, Pachana, Pravahika, Agnimandya, Graharoga.

**Ayurvedic Therapeutic Evaluation:** it is having Deepan pahchan and Grahi properties. Basically it is vaat-kaphshamak because of its ushna virya but it is also having pittashamak properties due to tikta-kasay rasa and ruksh guna. Hence, its efficacy on Aamatisara, pakkwatisara and all type of doshaj atisara can be understood by above description.

**Chemical constituents<sup>[4]</sup>:** Marmalosin, Tannins, Mucilage, Fatty oil, and Sugar.

**Pharmacological activities:** Anti-diarrheal, Anti-inflammatory, Anti -bacterial, Anti- ulcer activity (Experimental studies).

**Experimental Studies**

1. Anti-diarrheal activity: Chloroform extract of the root of A. marmelos shows anti-diarrheal effect in a vitro study. The extract was comparable to that of ciprofloxacin and mostly active against the strains of Vibrio cholerae, followed by E. coli and Shigella species. (Mazumder et al).
2. Antimicrobial activity: Aqueous and ethanolic extract has activity against E. coli, Pseudomonas aeruginosa, Staphylococcus aureus and B. subtilis. The ethanolic extract showed considerably more activity than the aqueous extract. Maximum antibacterial activity was shown against Bacillus subtilis followed by Staphylococcus aureus, E. coli and Pseudomonas aeruginosa. (Venkatesan et al).
3. Antiviral activity: The in vitro viral activity of various parts of A. marmelos tree has been evaluated for their efficacy against human coxsackie viruses

B1-B6 shown by. It seems that *A. marmelos* has antiviral activities.(Balasubramanian *et al.*)

4. Antifungal activity: The essential oil isolated from the leaves of *A. marmelos* tree has proved to have antifungal activity against animal and human fungi in various clinical isolates of dermatophytic fungi.(Balakumar *et al.*).
5. Antipyretic potential: Ethanol extract at dose of 200 mg/kg body weight and 400 mg/kg body weight, produced significant reduction in elevated body temperature in a dose dependent manner. This antipyretic effect of extracts was comparable to that of paracetamol (100 mg/kg body weight).(Shukla *et al.*).
6. Anti-inflammatory activity: In acute and chronic inflammatory animal models, *A. marmelos* showed significant anti-inflammatory activity and it can be a promising anti-inflammatory agent. These activities may be due to the presence of lupeol and skimmianine in the leaves because both the compounds have shown the same potentialities in pure form.(Benni JM *et al.*).

**Toxicology** – Generally, *A. marmelos* considered safe and few studies have been carried out with respect to its toxicity. It was found that no remarkable changes in histopathological studies of heart, liver, kidney, testis, spleen and brain after 50 mg/kg body weight of the extracts of *A. marmelos* administered intraperitoneally for 14 d successively. Pathologically, neither gross abnormalities nor histopathological changes were observed.(Veerappan *et al.*)

## 2. DHATAKI - woodfordia fruticosa

**Ayurvedic pharmacodynamical properties**<sup>[5]</sup>: *Rasa* – Kashaya; *Guna* – Laghu, Ruksha; *Virya* – sheeta *Vipaka* – Katu and Dosh Shaman – Kapha and pitta.

**Classical indication**<sup>[5]</sup>: *Kaphapitavikar, agnidagdha, atisar, pravahika, raktapita, paitikaprameha, visarpa, twakvikar, jwar, krimi, trushna, daha.*

**Ayurvedic Therapeutic Evaluation:** it is stambhak in nature and contain kaph pitta Shamak properties. It is pitta-shamak due to sheeta virya and kashay rasa while it also pacifies kapha dosha by virtue of its laghu ruksha guna, kashay rasa and Katu vipak. Therefore it is clearly understood that dhatki is useful in pakkwatisara Pittaj and kaphaj Doshaj atisara because of above properties.

**Chemical constituents**<sup>[6]</sup> – Flavonoids, Octasanol, Sitosterol, Betulinic acid, Gallic acid, Tannins, Lawsone and Betulin.

**Pharmacological activities:** Antibacterial, antiviral, antipyretic, analgesic, antioxidant, anti-proliferative, hepato-protective, anti-ulcer, immunomodulatory, antihyperglycemic (experimental studies).

## Experimental Studies

1. Antimicrobial activity: Different extracts of dried flowers of *W. fruticosa* have been reported for their significant antibacterial activity against 14 human pathogens. (Kumaraswamy MV *et al.*).
2. Antibacterial activity: The methanol extract of *W. fruticosa* was most active against *P. Pseudocaligenes* in comparison to all the microorganism tested. The plant extract are more active against Gram positive bacteria than Gram-negative bacteria.(Chanda S *et al.*).
3. Antiviral activity: Methanolic and aqueous extracts of the flower and leaves inhibited avian myeloblastosis virus reverse transcriptase (RT). (Kaneria *et al.*).
4. Antipyretic activity: The ethanol extract of the flower of *W. fruticosa* show significant antipyretic activity at a dose of 500 mg/kg body weight. (Kaneria *et al.*).
5. Analgesic activity: The present study revealed the positive analgesic activity of extracts of *W. fruticosa* stem bark in hot plate model and acetic acid induced writhing model. (Ahmed *et al.*).
6. Wound healing activity: Oral administration of the ethanol extract of *W. fruticosa* flower was effective in wound healing. (Verma N *et al.*).

**Toxicology:** A study done on albino rats suggest that when *W. fruticosa* given in 30g/kg body weight dose it causes a delirium. (Mishra N. *et al.*)

## 3. SUGANDHBALA: Valleriana wallichii.

**Ayurvedic pharmacodynamic properties**<sup>[7]</sup> - *Rasa* - katu, kashaya, Tikta; *Guna* – Laghu, snighdha; *Virya* - Ushna; *Vipaka*–Katu; *Doshshaman*- Kaphavata.

**Classical indication**<sup>[7]</sup> -Madaty, Apasmara, visha, Chakshuroga, Shiroroga, Raktadosha, Shoola.

**Ayurvedic Therapeutic Evaluation:** It is having deepan and shool prasahan properties due to its tikt rasa and ushna virya. It is *kaphahar* in nature by katu, tikta, kashay rasa, ushna virya and katu vipak. By snigtha gun and ushna virya balakam is vata shamak. therefore balakam is therapeutically useful in amatisara and atisara of vataj and kaphaj dominance.

**Chemical constituents**<sup>[8]</sup> - Cyclopentapyrans, Valepotriates, Valtrate, Rutinosides. The essential oil from the root contains calarene, beta- bergamotene, valeranone, ar- curcumene, maaliolide and maaliol. The main acid present in the plant are isovaleric acid and beta methyl valeric acid.

**Pharmacological activities;** Analgesic, anti-inflammatory, anti-helminthic, antioxidant, hypnotic, anticonvulsant, radio-protective(Experimental studies).

### Experimental Studies

1. Antimicrobial activity: The plant root and the stem of *Valeriana wallichii* of different extracts showed a maximum zone of inhibition against almost all organisms. (Kim J, et al).
2. Anthelmintic activity: The anthelmintic activity of the extract shown can be due to the presence of tannins that had bonded with free proteins in the gastrointestinal tract of the host animal that is earthworm taken for experiment. (Potdar V H et al).
3. Antispasmodic activity : The antispasmodic effects of *Valeriana wallichii* are mediated possibly through KATP channel activation (Anwar H Gilani et al).
4. Anti - inflammatory activity :By using in vitro lipoxygenase inhibition assay, methanolic extract and ethyl acetate fractions of *Valeriana wallichii* show anti- inflammatory in male wistar rats. (Khuda F et al).
5. Analgesic activity :Essential oil and alcohol extract of *Valeriana wallichii* exerted good peripheral analgesic action via inhibition of prostaglandin synthesis on acetic acid induced writhing (S P et al).

**Toxicology:** *V. wallichii* rhizome didn't exhibit mortality, morbidity or any other neurologic, hematologic or biochemical adverse effects apart from sedation which is extension of their known pharmacological activity, after single oral dose of 2000mg/ kg (14 days of observation) or after once daily 200mg/kg, 600mg/kg 1800mg/kg oral treatment for 90days in healthy adult Swiss albino mice. (Lovely joseph et al).

#### 4. LODHRA: *Symplocos racemosa*

**Ayurvedic pharmacodynamic properties<sup>[9]</sup> -Rasa:** Kashaya, Guna: Laghu, Virya: sheeta Vipaka: Katu; Karma: Chakushya, Grahi, Kaphapitahar.

**Classical indications<sup>[9]</sup> –** Shotha, Atisara, Netraroga, Raktapitta, Pradara,

**Ayurvedic Therapeutic Evaluation:** *Lodhra* is *pureeshsandhaniya* and *grahi* in nature because of *kashayarasa*, sheet virya and katu vipaka. It is pitta shamaka due to kshaya rasa and sheet virya properties. It is also having kaphhar property by virtue of its kashay rasa, laghu guna and katu vipaka. Thus *Lodhra* is more effective in pakkwatisara and kaphaj and pittaj atisara. Along with above properties it is also having antibacterial, antimicrobial, antihelminthic, anti-inflammatory, anti oxidative and hepatoprotective pharmacological properties(experimental studies).

**Chemical constituents<sup>[10]</sup>:** Alkaloids (loturine and colloturine) and red colouring matter.

### Experimental Studies

1. Anti-secretory activity; Decrease in gastric volume and reduction in free and total acidity of the extracts

- at 500mg/kg was noticed in pylorus ligation induced ulcer model.(Gopala Krishna M et al).
2. Antibacterial Activity- Ethanolic extract of *S. racemosa* shows good antibacterial activity as compared to petroleum ether, but it has poor antibacterial activity against gram negative microorganism like *P. aeruginosa* and *E. Coli*.(Devmurari et al).
3. Antimicrobial Activity- Methanolic extracts of leaves, root and stem barks were screened for antimicrobial activity. All crude extracts and fractions showed a broad spectrum of antibacterial activity that was enhanced on fractionation. (M.R. Khan et al).
4. Antihelminthic effect: The anthelmintic activity of petroleum ether, chloroform and ethanol extract of bark of *S. racemosa* on adult Indian earthworms revealed that the ethnolic extract had more anthelmintic property as compared to other extract. (Narsimha Rao et al).
5. Anti-inflammatory activity:\_Methanol extract of leaves of *S. racemosa* have effective in-vitro anti-inflammatory activity so it was selected for in vivo anti-inflammatory activity by carrageenan induced paw edema models in rats. The extract showed significant anti-inflammatory activity (53%) at the dose of 400mg/ml.(Rajendran Vadivu et al).

**Toxicology:** There are no known side effects with this herb.

#### 5- GAJAPIPALI -*Scindapsus officinalis*.

**Ayurvedic pharmacodynamic properties<sup>[11]</sup> - Rasa:** Katu; Guna: Ruksha; Virya: Ushna; Vipaka: Katu.

**Classical therapeutic uses and indications<sup>[11]</sup>:** Deepana, Kanthya, Kaphahara, Vatahara, Agnivardhaka, Malavisosana, Stanya, Varnya also Atisara, Swas, Krimiroga, Kantha roga.

**Ayurvedic Therapeutic Evaluation:** Pharmacological studies on *S.officinalis* suggests that it is potent anti-diarrhoeal, antibacterial, antihelminthic, anti-inflammatory and analgesic in action. Classical indication of *gajpippali* in ayurveda is as deepen, soolprashman, and krimihar. It is vatkaphshamak in nature. All these actions of *gajpippali* is because of katu rasa, ruksh gun, Ushna virya and katu vipak. Thus *Gajpippali* is beneficial in amatisara, kapha and pitta doshaj atisara by virtue of its above said properties.

**Chemical constituents<sup>[12]</sup>-** glucosides viz. Scindapsin A & Scindapsin B, Sugars & Fixed oil.

**Pharmacological activities- Antibacterial** activity, anthelmintic activity, antiulcerative activity, anti-inflammatory and analgesic activity, hepatoprotective activity, anti-oxidant activity, anti-histaminic activity (experimental studies).

### Experimental Studies

1. Anti- diarrheal activity- The aqueous extract or decoction of the dried fruits showed significant analgesics and anti-diarrheal activity in albino rats. (Khare CP, 2015)
2. Antibacterial activity This study performed by Rakshit et al. (2011) to evaluate antibacterial activity against *Escherichia coli*, *Salmonella typhi*, *Klebsiella pneumonia* and *Staphylococcus aureus*. Both the ethanolic and aqueous extracts inhibited the growth of the test organisms, while *S. typhi* showing the highest susceptibility. This research supports the local use of the fruits of the plant *Scindapsus officinalis* for prophylactic and therapeutic purposes against bacterial infections.
3. Anthelmintic activity: Aqueous, methanol and hexane extract of fruits of *Scindapsus officinalis* showed the anthelmintic activity against *Haemonchus contortus*. Extract of *Scindapsus officinalis* also showed the in-vitro effect on the motility of mature *Haemonchus contortus* of goat origin. (Iqbal Z et al, 2005).
4. Anti- inflammatory and analgesic activity: The ethanolic extract is also proved to be anti-inflammatory & analgesic as it triggers significant pain reduction in carrageenan induced rat paw edema at the dose of 50,100 and 200 mg/kg.
5. Anti-ulcerative activity- The hydroalcoholic extract of the fruits of the plant has shown anti-ulcerative activity contributing to gastric ulcer healing and gastric anti-secretory outcomes. (Chaudhary A et al, 2014).

**Toxicology-** The decoction of the plant did not exhibit any toxicity up to 10 ml/kg. (Pullaiah T. Encyclopedia of world medicinal plants, vol 1, 2006)

### DISCUSSION

#### Mode of action on the basis of *samanyasamprapti*

After analysing *samanya samprapti* of *atisara* according to different acharyas, we can understand that *asatmya aahara vihara* causes *mandagni* which leads *dhatvagni mandata*. An increase in *jaliyagundharmi sharirik dhatu mootra, sweda* etc. occur due to *manda dhatvagni*<sup>13</sup>. These are normally formed when *jatharaagni* and *dhatvagni* are in normal state. Formation of *mutra, sweda* etc. gets disturbed in *mandagni* state, followed by excessive fluid secretion into lumen of intestine. *Vitiated vata* drags this excessive water content (*jaleeyansh*) down into large intestine (*pakwashay*) where it gets mixed with stool and causes downward movement of watery stool called as *atisara* (प्रचुरद्रवमलता).

Three important factors which are responsible for pathogenesis of *atisara* emerged out from above discussion on *samanya samprapti*, these are: *मन्दाग्नि* (त्रयोदशविधअग्नि), *जलीयांशप्रचुरता* and *वातविकृति*. Proposed drug is a unique combination of ingredients, which acts on all the pathological factors of *atisara*. It is

observed that majority of drugs used are having deepen, *pachan & grahi* properties. *Bilwa, gajpippali* and *sugandhbala* acts on *mandagni* due to *deepan* property by virtue of its *ushna virya* and *katu vipaka*. *Ama jaleeyansh* is metabolized and absorbed by *bilwa* due to its *pachan* and *grahi* properties. *Dhataki* acts as *stambhan* by virtue of *sheeta virya, kashay rasa, laghu- Ruksha gun* and *katu vipaka*. *Lodhra* also acts on *ama jaleeyansh* because of its *grahi karma*, which in turn is due to *sheet virya, kashaya rasa, laghu guna* and *katu vipaka*.

The second factor responsible for causing pathology of *atisara* is *vata vikriti*. *Vitiated vata* is managed by *vatshamak* property of *bilwa, sugandhbala* and *gajapippali*.

By all above analysis we can easily understand that "dhatakyadi yog" is specially formed by the combination of ingredients that are having *deepan, pachan, grahi* and *stambhan* properties by which it acted on different stages of *samprapti* of *atisara*.

#### Mode of action of Dhatakyadi yog on *atisaraawastha*

*Dhatakyadi yog* is formulated with such ingredients that are beneficial in both stages of *atisara* i.e- *amawastha* and *pakkwawastha*.

धातकीबिल्वरोधाणिबालकंगजपिप्पली ।।७१।।

एभिः कृतंश्रतंशीतंशिशुभ्यः

क्षौद्रसंयुतम् ।प्रदधादवलेहंवासर्वातिसारशान्तये ।।

- *Bilwa, Sugandhbala* and *Gajpippali* are beneficial in producing therapeutic effects in *amatisara* by *deepena, pachana* and *grahi* actions due to *ushna virya* and *katu vipaka*.
- *Dhataki* and *Lodhra* having its effect on *pakkwatisara* by virtue of its *stambhana karma* because of *kashay rasa, laghu, ruksha guna, sheet virya* and *katu vipaka*.

By above discussion we are able to understand the significant therapeutic effects of trial drug on initial stages of *atisara* I.e- *amatisara* and *pakkwatisara* also.

#### Mode of action on Type of *Doshaj Atisara*

This effect is due to unique combination of trial drug which is having *vat-kaphhar karma* (e.g- *bilwa, Balakam, gajapippali*), *kapha-pittahar karma* (*dhatki and lodhra*). These ingredients have properties that are capable to pacify all three *doshas* by virtue of its *vata shamak* properties like *snigtha gun* (*balakam*) and *Ushna virya* (*bilwa, balakam, gajpippali*), *pitta shamak* properties are due to *sheet virya* (*dhatki and lodhra*), *kashay rasa* and *laghu tikshna gun* (*dhatki, lodhra*). *Kapha shamak* property is due to *katu rasa* (*gajpippali*), *tikta rasa* (*bilwa, sugandhbala*), *kashay rasa* (*bilwa, dhatki, sugandhbala*), *laghu gun* (*lodhra, bilwa, dhatki, ruksh gun* (*bilwa, dhatki, gajpippali*) and *katu vipaka* (*bilwa, dhatki, lodhra gajpippali, sugandhbala*), *ushna virya*

(*bilwa, sugandhabala, gajpippali*). Therefore *Dhatakyadi yog* is effective in all type of *doshaj atisara*.

## CONCLUSION

Childhood diarrhoea has broad spectrum of seriousness, from mild illness to life threatening conditions can be seen with complications. Irrational use of antibiotics is not only hazardous for child's intestinal healthy flora but also causes drug resistance to causative pathogen. In case of children applicability of classical *amapachan* treatment i.e *langhan*, use of drugs having *katu, ushna, tikshna*, properties is not feasible because children are delicate in nature. The disease becomes severe very quickly in children. So here we can't wait for the duration from *amavastha* to *niramavastha*. In present scenario there is a need of an ayurvedic formulation that can be beneficial in both stages of diarrhoea either *amavastha* or *pakkvavastha*. *Dhatakyadi yog* is important compound mentioned for *balaatisar* in ayurvedic classics. In our clinical practice we also found it very effective. By *ayurvedic* pharmacological analysis it is found that *Dhatakyadi yog* is not only beneficial in *ama* and *pakva awastha* of *atisara* but also in all type of *doshaja atisara* by virtue of *rasa-guna-veerya-vipaka* properties. Experimental studies on its ingredients viz. *Dhataki, Bilwa, Lodhra gajpippali* and *sugandhbala* have also shown that they have antidiarrhoeal, antimicrobial, antihelminthic, antiviral and antisecretory activities. Efficacy of *Dhatakyadi yog* must be evaluated by clinical studies on the basis of scientific research criteria.

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