

## ROLE OF PLANTS AND THEIR METABOLITES IN THE TREATMENT OF DIARRHOEA

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### Abstract

Diarrhoea is a one of the most common disease affects throughout the population of world. In the patients of diarrhoea, their infection either lead to excess production of fluids or prevent absorption of fluids, which leads to injury in the gastrointestinal tract and also fever, nausea, vomiting, and abdominal pain. Their allopathic treatment adversely affects the health of humans by their harmful side effects. To mitigate the side effects of allopathic medicines, secondary metabolites or the plants product appear as one of the suitable choice for the patients. Currently many medicinal plants and their metabolites have been reported for the beneficial uses in the diarrhea treatment. Many herbal plants were categorized in the table having specificity in the treatment of diarrhoea diseases.

**Keywords : Medicinal Plants, Diarrhoea, Secondary metabolites, Drugs.**

### Introduction

The Indian subcontinent is the richest source of natural resources in terms of flora and fauna due to their geographical location. A large number of plants had been directly used in the treatment of various diseases from the ancient times as mentioned in Indian holy book "Veda". These types of treatment, through the uses of medicinal plants have been termed as Ayurveda and Unani system of treatment. These types of treatment have many benefits over the traditional allopathic treatment because of low cost and have fewer side effects in the patients. In Recent years, large number of chronic diseases successfully cured by the use of herbal medicines as reported by many researchers. Though existing population of medicinal plants are diminishing due to the unsustainable harvesting from wild and destruction of its natural habitat, that lead to a decline in plants populations even extinction of natural populations in some places (Sharma et al., 2012).

According to World Health Organization, Diarrhoea is the condition of excess dehydration from body due to three or four time loose or water rich stool within 24

hours (Allen et al., 2003). Basically, diarrhoea can be divided into chronic and acute type, the latter being more common. Rotavirus has been considered as the major contributor of diarrhoea in young children, however, other bacterial and viral agent can also lead to the serious diarrheal condition. Approximately, 4-5 million deaths per annum including 2.5 million belonging to children are estimated worldwide due to Diarrhoea (Kosek et al., 2003; Thapar and Sanderson, 2004) especially in developing countries. Diarrhoea has been proclaimed as the second most frequent reason of global child death (UNICEF, 2012). Eighty five percents of deaths occurring worldwide have been recorded from developing countries (Agunu et al., 2005). Death rates reaching up to 20 deaths/1000 population have been recorded in childrens with age below two years indicating their susceptibility (Synder and Merson, 1982). Deaths occurring in developing countries due to diarrhoea have led to the construction of diarrhoeal disease control program by WHO for promoting the conventional remedial practices, health education and disease preventive measures (Abdullahi et al., 2001). The overview of diarrhoea and role of herbal medicine in the treatment have been displayed in fig.1.

### **An overview of plant derived drugs research**

Ethno-botany a science deals with the direct relation between human life and plants and their interactions. The US botanist John William Harsh Berger in 1895 firstly used the term ethno-botany in reference to the study of plants used by the aboriginals of Australia (Shyma et al., 2012). And after that it was revised time to time by the many researchers and organizations. According to Martin the ethno-biology implies description on local people perspective on cultural and scientific knowledge (Sreedevi et al., 2013). It covers everything from interaction and interrelation of human communities with plants.

Traditional medicines are the stockpile of all the knowing, adroitness, theories, ethical beliefs and experiences primordial to different cultures and there asset to manage health, as well as to prevent, diagnose, improve or treat physical and mental illness. Developing countries still show reliance on ethno-medicine having 30-50% use of traditional medicines of the total medicinal consumptions. Traditional medicines served as first line of treatment for the most of the population of developing countries (Sharma, 2011). Several first-rate medicinal drugs whose genesis served the mankind a lot, e been developed from the ethno-medicinal plants. These include Vinblastin, Vincristine, Aspirin, Quinine, Artether, Taxol etc. (Tiwari, 2013). Far from the middle period of the 'Pleistocene Epoch' (2.3 million years ago) when humans were in their early developmental stage, their dependency on plants can be uncovered. Some present-day discovery revealed that they cooked and ate plant materials along with animal products.

India can be taken as the canvas to understand the history of human-plant relationship as it was possibly accumulated there from Rigveda period. Manu-Smriti also explicated awareness about the importance of plants and forest in maintaining the appropriate environmental conditions for the balanced growth and development of the living world, they declared that the plants are sacred in origin, and named the many plants as the 'Abodes of God'.

### **Plant and their products with anti-diarrhoeal activity**

From very ancient time people across the globe are practicing the traditional medicine to cure the multiple human diseases. People from rural areas of developing countries are still using the medicinal plants as one of major source of disease prevention (Chitme et al., 2003). Approximately eighty percent people of developing countries are dependent on medicinal plants for health management (Kim, 2005). Natural products derived from medicinal plants are known to harbour the diverse bioactive compounds which can serve as lead compounds for pharmaceutical industry. Emergence of microbial resistance towards currently used several antibiotics and antivirals, have promoted to search for newer plant based alternative sources of disease remedy. Out of 500,000 plant species estimated to exist globally, only one percent of them have been analyzed phytochemically, which signifies the further assessment of plant wealth for important bioactive compounds. There are great chances of occurrence of biologically active metabolites. The rate at which plants and animals are losing their existence on earth, we are missing one major important metabolic compound every two year (Groombridge and Jenkins, 2002). The current extinction rate thus warrants the fast screening of existing plant species for search of newer drug and their utilization in human welfare.

Evaluation of five medicinal plant extract for antidiarrheal activity was performed by Agunu et al. (2005). Medicinal plants selected for disease remedy were *Acacia nilotica*, *Acanthospermum hispidum*, *Gmelina arborea*, *Parkia biglobosa* and *Vitex doniana*. Details of medicinal plants having antidiarrheals property have been listed in Table 1. The experimental study was performed on isolated jejunum from rabbit and castor oil stimulated diarrhoea. For perfused rabbit jejunum the responses of plant's methanolic extract were dose dependent. However, the response was not similar for all the tested plant extract. Relief from diarrhoea was better observed at lower concentrations (0.5, 1.0 mg/ml) as compared to higher concentration (2.0, 3.0 mg/ml) of methanolic extracts from *Gmelina arborea* and *Vitex doniana*. Biphasic consequences of extract treatment i.e. relaxation followed by fast contraction were also found at 3.0 mg ml<sup>-1</sup> dose of *Acacia nilotica*. Complete relief from oil induced diarrhoea was noticed by methanolic extract of *Acacia nilotica* and *Parkia biglobosa*

while dose dependent result was established for *Vitex doniana*. Extract from *Acanthospermum hispidum* proved least effective amongst the selected plants to cure the disease in question. Although all the tested plant species extract had anti-diarrhoeal response at some extent, they can be satisfactorily used in traditional medicine. Experiments were performed to assess the efficiency of methanolic extract prepared from parts of root, stem and leaves of *Securinega virosa* belonging to family Euphorbiaceae to treat the diarrhoea induced by castor oil in mice (Magaji et al., 2007). The effect of methanolic extract application was studied on isolated jejunum from rabbit. The methanolic extract of leaf and stem and root bark had differential responses on rabbit jejunum. Dose dependent relaxation of jejunum was observed for methanolic leaf extracts while contraction was noticed for methanolic extract of stem and root bark. The methanolic extract of root bark demonstrated complete relief from castor oil mediated diarrhoea at relatively high dose of  $100 \text{ mg kg}^{-1}$  as compared to standard loperamide ( $5 \text{ mg kg}^{-1}$ ). Leaf extract had also similar behaviour but it was dose independent. Phytochemical appraisal of different plant part extract indicated the presence of important chemical constituents like flavonoids, tannins, alkaloids, saponins, and cardiac glycosides.

Aqueous and methanolic extract from different part of four plants was determined for their activity against castor oil induced diarrhea (Shoba et al., 2001). The plants selected for the purpose were *Acorus calamus* (rhizome), *Aegle marmelos* (unripe fruit), *Strychnos nux-vomica* (root bark), and *Pongamia glabra* (leaves). Better activity was observed in methanolic extracts at higher concentrations as compared to aqueous extracts. Antidiarrheal responses of the extract were determined in terms of onset of diarrhoea and wet of faeces produced. The phytochemicals present in plant extract belongs to flavonoids, terpenes, alkaloids, and tannins which help reduce the severity of diarrhoea by enhancing the electrolyte reabsorption and colonic water. The results obtained from the experimental data provided the basis for use of ethnomedicinally important plants to cure the diarrhoea. Bello et al. (2016) has revealed the potential of methanolic extract of *Nymphaea lotus* rhizome in treatment of castor oil and magnesium sulfate induced diarrhea. The doses of methanolic extract used for treatment were found significantly higher as compared to standard loperamide. Antidiarrheal activity of compounds isolated from *Eriosema chinense* root has been described by Prasad et al. (2017). The compound eriosematin E was efficient in protection of castor oil induced diarrhoea. Alteration in physiological and biochemical activities was satisfactorily achieved by eriosematin E. Significant recovery in loss of important ions such as sodium and potassium established the protective function of the isolated compound.

### Future prospective

Plants and their secondary metabolites have been used as one of the important sources in the field of medicines or health related issues since ancient times. The role of medicinal plants in the health care had been already mentioned in the “Vedas” approx 45, 000 plants being practiced for the medicinal purposes across the globe. The medicinal plants are a potential source of nature for the development of new herbal drugs. In the 21st century, the therapeutic effects of medicinal plants have been emerged as a promising future for the drug/medicine development for the management of health care. Currently, the scientific researcher have attracted their attention to explore the medicinal plants as a source of potential drug in this aspect research on the medicinal plants open a new way of diarrhoea treatment.

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**Table 1** : List of some medicinal plants having antidiarrhea property:

S. No.	Botanical name	Common Name	Family	Part used
1	<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz	Snakeroot	Apocynaceae	Root
2	<i>Calotropis procera</i> (Aiton) Dryand.	Madar	Asclepiadaceae	Dry latex
3	<i>Butea monosperma</i> (Lam.) Taub.	Palash	Fabaceae	Stem bark
4	<i>Curcuma longa</i> L.	Haldi	Zingiberaceae	Rhizome
5	<i>Emblica officinalis</i> Gaertn.	Gooseberry	Euphorbiaceae	Fruit
6	<i>Abutilon indicum</i> L.	Indian Mallow	Malvaceae	Leaf
7	<i>Acacia nilotica</i> (L.) Delile	Babool	Caesalpiniaceae	Bark
8	<i>Madhuca indica</i> J.F.Gmel.	Mahua	Sapotaceae	Dried bark
9	<i>Euphorbia hirta</i> L.	Dudhi	Euphorbiaceae	Whole plant
10	<i>Jatropha curcas</i> L.	Physic nut	Euphorbiaceae	Root
11	<i>Zingiber officinale</i> Rosc.	Ginger	Zingiberaceae	Rhizome
12	<i>Psidium guajava</i> L.	Guava	Myrtaceae	Leaf, Bark
13	<i>Piper nigrum</i> L.	Kali mirch	Piperaceae	Fruit
14	<i>Trigonella foenum-graecum</i> L.	Methi	Fabaceae	Whole plant
15	<i>Tinospora cordifolia</i> Miers	Giloy	Menispermaceae	Stem
16	<i>Asparagus racemosus</i> Willd.	Satavar	Liliaceae	Root
17	<i>Santalum album</i> L.	Chandan	Santalaceae	Heartwood
18	<i>Murraya paniculata</i> (L.) Jack	Kamini	Rutaceae	Leaf
19	<i>Dalbergia sissoo</i> DC.	Rosewood	Fabaceae	Leaf
20	<i>Clerodendrum indicum</i> (L.) Kuntze	Bharangi	Verbenaceae	Leaf
21	<i>Ficus benghalensis</i> L.	Banyan	Moraceae	Leaf, Root
22	<i>Quercus infectoria</i> G.Olivier	Oak	Fagaceae	Gall

23	<i>Hemidesmus indicus</i> L.	Ananthamoola	Apocynaceae	Root
24	<i>Cyperus rotundus</i> L.	Motha	Cyperaceae	Rhizome
25	<i>Bauhinia purpurea</i> L.	Kaniar	Caesalpiniaceae	Leaf
26	<i>Grewia bicolor</i> Juss.	White raisin	Tiliaceae	Roots
27	<i>Crossopteryx febrifuga</i> (Afzel. ex G.Don) Benth.	Crown-berry	Rubiaceae	Bark
28	<i>Flacourtia indica</i> (Burm.f.) Merr.	Indian plum	Flacourtiaceae	Leaf
29	<i>Kirkia acuminata</i> Oliv.	Shona	Kirkiaceae	Bark
30	<i>Mangifera indica</i> L.	Mango	Anacardiaceae	Bark
31	<i>Euclea divinorum</i> Hiern	Magic guarri	Ebenaceae	Roots
32	<i>Catharanthus roseus</i> (L.) G. Don	Vinca	Apocynaceae	Roots
33	<i>Cassia abbreviate</i> Oliv.	Sjambok pod	Fabaceae	Roots
34	<i>Vangueria infausta</i> Burch.	Medlar	Rubiaceae	



**Fig.1** : Overview of diarrhoea and role of herbal plants :



