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"A review on phytochemical and anti-diarrheal properties of seasonal flower"

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ABSTRACT :

Bengal is home to a diverse range of flowers that bloom in almost all seasons, creating a vibrant palette of colors — white, red, pink, blue, orange, and more. Each season showcases specific floral varieties. During summer and the rainy season, flowers such as champa, hibiscus, bakul, karabi, yuthi, and ketki are in full bloom. In autumn, kash and siuli flowers dominate the landscape, while winter welcomes marigolds, roses, and chrysanthemums. Spring brings forth the bright red blossoms of simul and palash.This phenological review explores how these seasonal flowers contribute to health, particularly focusing on their anti-diarrhoeal properties. Several flowers, including **Sesbania grandiflora, Ixora coccinea, Calotropis procera, Jasminum sambac, Moringa oleifera, Musa acuminata Linn, and Bauhinia acuminata Linn,** have been found to possess anti-diarrhoeal activity. These flowers are traditionally used to treat ailments such as cerebral pain, runny nose, diarrhoea, dysentery, high blood pressure, eczema, asthma, allergies, conjunctivitis, high cholesterol, snake bites, chickenpox, and more. The naturally occurring phytochemicals and antioxidants in these flowers offer great potential for the development of functional foods with anti-diarrhoeal and other therapeutic benefits. Products like jelly, tea, and noodles infused with floral extracts not only provide nutritional value but also exhibit antioxidant activity, helping combat oxidative stress and free radical damage. For instance, jasmine tea has shown effects on oxidative stress, and curd is considered a rich source of calcium. Furthermore, the cultivation and commercialization of these medicinal flowers can also contribute to reducing unemployment in the region. Meeting domestic demands and expanding into export markets can create economic opportunities, while the inherent aesthetic and emotional appeal of flowers enhances overall well-being.

Keywords:Seasonal flower, Phytochemical, Anti-diarrheal, antioxidant, functional food

INTRODUCTION

India, known as the land of six seasons, is home to a vast variety of flowers that bloom throughout the year. Each season brings its own vibrant display of color and fragrance, making flowers an integral part of India's natural and cultural heritage. Seasonal Flowering Patterns in Bengal

- Summer: Flowers like champa, jasmine, bakul, and karabi bloom in abundance. Their soothing fragrances help mitigate the harshness of the summer heat.
- Rainy Season: The blooming of keya flowers marks the onset of the monsoon. The lotus, India's national flower, decorates water bodies, while yuthi and ketki are prominent in this season.
- Autumn: A calm and gentle season characterized by the appearance of shiuli flowers and the white kash grasses that line riverbanks.
- Winter: Despite the dry air, vibrant marigolds, roses, and chrysanthemums continue to bloom.
- Spring ("Rituraj"): Known as the "king of seasons," spring bursts into life with flowers like shimul, palash, dahlias, and sunflowers**.(1) Prathapa Reddy M. et al., 2015**

Medicinal and Nutritional Value of Seasonal Flowers

Beyond their beauty, many seasonal flowers are valued for their medicinal properties. These flowers are rich in phytochemicals that contribute to antioxidant, anti-inflammatory, and even anti-cancer activities. Their use in traditional treatments offers affordable, natural remedies with minimal side effects—particularly beneficial for managing chronic conditions**.(1) Prathapa Reddy M. et al., 2015;(2) Mwambete & Joseph, 2010)**

Flowers can be broadly classified into four categories:

Ornamental , Commercial , Medicinal , Edible Many flowers are nutrient-rich, containing carbohydrates, proteins, fats, fiber, vitamins, and minerals. Some are used in functional foods like jelly, teas, noodles, and curds, contributing to both health and culinary traditions. However, caution is necessary as some flowers can cause toxicity or allergic reactions and may require high cultivation costs**.(1, 2)**
Socio-Economic Importance With rising demand, scientific methods are now used to cultivate flowers for weddings, festivals, and commercial purposes. This has opened up employment opportunities, supported rural livelihoods, and enhanced export earnings. **(1)**

Flowers in the Fight Against Diarrhoea

Diarrhoea, commonly known as "the runs," involves frequent loose or watery stools, typically occurring multiple times in a 24-hour period. It remains a major public health concern, especially in developing nations.Between 2000 and 2003, diarrhoea accounted for 17% of childhood mortality in developing regions. **(3) Helle Wangensteen et al., 2013** Major pathogens responsible for diarrhoea include: Shigella flexneri , Staphylococcus aureus , Escherichia coli , Salmonella typhi , Candida albicans **(4) Osuntokun et al., 2016**
Types of diarrhoea include: Acute and Bloody, Persistent (lasting 2–4 weeks). **(5) Christoph Lübbert, 2016**

Treatment and Prevention

Primary treatment includes Oral Rehydration Solution (ORS)—a mix of clean water, sugar, and salt—as recommended by the World Health Organization (WHO). Additionally, zinc supplementation (20 mg/day for 10–14 days) has been shown to reduce the duration and severity of diarrhoea. **(5)**
Prevention strategies include: Access to safe drinking water, improved sanitation, Handwashing with soap, Proper food hygiene, Health education, complete immunizations **(5)**

METERIALS & METHODS

The study of the seasonal timing of biological phenomenon is recognized as phenology. The broad topic of this review is the contribution of phenology to the success of antidiarrhoeal properties of seasonal flower. We will highlight how different seasonal flower can aid in the treatment of diarrhoeal episodes, using their potential phytochemical as examples, and then examine how naturally occurring antioxidant in these seasonal flower drives formulation of functional food with antidiarhoel properties. Then we will discuss the pharmacology of sesasonal flower in controlling diarrhoea.

REVIEW OF LITERATURE

Sesbania granidflora (Bokful)

Part Used	**Medicinal Use**	**Refference**
Bark	Used to treat smallpox, ulcers, infantile disorders, diarrhoea, and dysentery	**(6)Ahire and Kadam (2011)**
Blossoms	Utilized to prevent diarrhoea	**(20) R.China , S mukherjee (2012)**
Leaves of blossoms	Contain phytochemicals; used traditionally for colitis, diarrhoea, and dysentery	**(16)Mohiuddin (2019)**

Ixora coccinea (Rangan flower)

Part Used	**Medicinal Uses**	**Refference**
Blossoms (Flowers)	Hypertension, menstrual irregularities, dysentery, bronchitis, skin diseases, female reproductive infections, contusion	**(17)Baliga & Kurian (2011)** **(3)Wangensteen et al. (2013)** **(19)Devendran & Gnanavel (2020)**
Leaves	Diarrhoea, nausea, fever, bronchitis, ulcers, eczema, boils	**(17)** **(3)** **(19)**
Stems	Eczema, boils	**(17)**
Bark	Nausea, fever, loss of appetite, ulcers	**(3)**
Roots	Diarrhoea, ulcers	**(19)**

Calotropis procera (Akhanda flower)

Part Used	Medicinal Uses	Refference
Flowers	Migraine, abdominal pain, asthma, dysentery, flatulence, anorexia, enhance digestion, stimulate appetite	**(22)Verma & Satsangi (2010) (21)Parihar & Balekar (2016)**
Leaves	Treatment of paralysis	**(7)Oloumi (2014)**
Latex	Improve digestion, stimulate appetite, prevent diarrhea	**(7)**
Leaves and Bark	Toxic (Caution)	**General knowledge**

Jasminum sambac (Bela flower)

Part Used	Medicinal Uses	Refference
Roots	Diabetes, wound healing, snake bites	**(15)Gowdhami & Rajalakshmi (2015) (9) Mourya & Bhopte (2017)**
Leaves	Wound healing	**(15)**
Flowers	Ulcers, fever, vomiting, skin diseases, diarrhea, stomach disorders	**(15) (9)**

Moringa oleifera (Moringa flower)

Part Used	Medicinal Uses	Refference
Leaves	Prevent diarrhea, aid digestion	**(26)Rahman et al. (2010), (29)Tajudeen Lamidi (2014)**
Bark	Treatment of diarrhea	**(29)**
Flowers	Anti-diabetic, lower cholesterol, manage dyslipidemia, hyperglycemia, anti-diarrheal	**(30)Adejoh et al. (2016) (23)Kumar et al. (2017) (27) Sharma & Sharma (2019)**
Fruit	Diarrhea	**(23)**

Musa acuminata (Banana Flower)

Part Used	Medicinal Uses	Refference
Blossoms (Flowers)	Heart pain, diabetes, diarrhea, menstrual discomfort, asthma, stomach cramps, dysentery	**(12)Sumathy et al. (2011) (8)Marikkar et al. (2016) (13)Swargiary et al. (2021)**
Unripe Fruits	Treat diarrhea	**(13)**

Bauhinia acuminata (sweatkanchan)

Part Used	Medicinal Uses	Refference
Blossoms (Flowers)	Diarrhea, laxative	**(24)Das (2017), (25)Dongray et al. (2017)**
Leaves	Asthma, gallbladder stones, gastrointestinal disorders, skin problems	**(25)**
Seeds	Laxative	**(25)**

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TABLE: 1 SEASONAL FLOWER& ITS PHTOCHEMICAL PROPERTIES

Sl. No	Scientific Name	Bengali Name	Phytochemistry	Pharmacology	Medicinal Uses	Reference
1	*Sesbaniagranidflora*	Bokful	Polyphenols, catotinoids, vitamin B3, ascorbic acid, Zn, K	Antimicrobial, antioxidant, antihelminthic, anxiolytic	Cerebral pain, head clog, runny nose, loose bowels, dysentery, ulcers, stomach clutter, smallpox, diarrhea (flower)	**(6) Ahire and Kadam (2011) (16)Mohiuddin (2019) (20) China (2012)**

2	*Ixoracoccinealinn*	Rangan flower	Oleanolic acid, ursolic acid, quercetin-3-rutinoside, triterpenoids, flavonoids	Anti-ulcerogenic, antidiarrheal, chemoprotective, CNS, analgesic	Diarrhea, dysentery, nausea, fever, high blood pressure, irregular menstruation, eczema	**(3)Wangensteen et al. (2013) (18) Nasir Uddin (19)Devendran & Gnanavel (2020)**
3	*C procera*	Akhanda flower	Cardenolide, proceragenin, benzoylinesolone, calotropin, multiflavenol, terphenol ester	Analgesic, anti-fertility, anti-tumor, wound healing, anticancer, antimalarial, hepatoprotective	Fever, acid reflux, skin inflammation, asthma, loose bowels, dysentery, eczema	**(7)Oloumi (2014 (22)Verma & Satsangi (2010) (21)Parihar & Balekar (2016) (11) Sandeep Arora (2013)**
4	*Jasminumsambac*	Bela flower	6-O-malonyl-β-D-glucopyranoside, benzyl 6-O-β-D-xylopyranosyl-β-D-glucopyranoside, 6-O-α-L-rhamnopyranosyl-β-D-glucopyranoside (β-rutinoside), dotriacontanoic acid, dotriacontanol, oleanolic acid, daucosterol, hesperidin	Analgesic, anti-inflammatory, antipyretic activity	Stomach issues, torment, conjunctivitis, dermatitis	**(15)Gowdhami & Rajalakshmi (2015) (9) Mourya & Bhopte (2017) (14) NidhiSengar (2015)**
5	*Moringaoleifera*	sweatkanchan	Niazimnin A, gamma-tocopherol, methionine, niazirin, methyl-p-hydroxybenzoatebenzylglucosinolate, moringine, vanillin	Anti-diabetic, anti-hypertensive, CNS activity, anti-asthmatic	High BP, cancer, diarrhea, diabetes, lowers cholesterol	**(10) Adejoh (2016) (28) Poonam Patel (2017) (30)Adejoh et al. (2016) (23)Kumar et al. (2017)**
6	*Musa accuminata*	Banana Flower	Glycosides, tannins, saponin, steroids, phenols, flavonoids	Antioxidant, antibacterial, anti-diabetic, contraceptive, anti-dysenteric, hepatoprotective	Heart issues, the runs, stomach cramps	**(12)Sumathy et al. (2011) (8)Marikkar et al. (2016) (13)Swargiary et al. (2021)**
7	*Bauhinia acuminata .linn*	sweatkanchan	Vitamin C, lupeol, palmitic acid, carbohydrate, saponins, glutamic acid	Anti-fungal, anti-diabetic, antioxidant, anti-inflammatory, wound healing	Diarrhea, dysentery, diabetes, gall bladder stone, snake bite, chicken pox	**(24) Bandana Nabis Das (2017) (25)ArchanaDongray (2015)**

NAME OF FLOWER	**WHEN TO BLOOOSM**		**USE IN FOOD FORMULATION**		**RESULTS**	**REFERENCE**
Sesbaniagrandflora	Allmost all year around		Formulation of jelly , cookies and pasta		potent source of exhibiting antioxidant activity against free radicals, prevent oxidative damage to major biomolecules and afford significant protection against oxidative damage	**(44) AK Mohiuddina (2016)**
Ixoracoccinealinn	Summer & rainy season		Not found		Not found	

C procera	Flowers bloom in umbel-like clusters especially in march &april		Formulation of curd		The curds ph were relatively neutral because no lactic bacteria were added during cheese making , the calcium contents in curds were considered as high , magnesium was also more concentrated , sodium and potassium were not concentrated in the curds	**(54) Issa Ado Rayanatou (2017)**
Jasminumsambac	March to june&continoues to flowers till october		Formulation of jasmine tea		The existence of reactive free radicals in the human body over long periods of timecan induce oxidative stress, Chronic hyperglycemia is mainly accountable for oxidative stress, which is the pivotal cause of increased oxidative stress damage	**(51) Yayuan Tang (2021)**
Moringaoleifera	Spring		Fomulation of noodles		noodles had a better effect on the mammary glands of rats andimproved milk production. The effect ofsautéing on the noodles improved lactogogum values	**(52) Devarai Santhosh Kumar (2016)**
Musa accuminata	The entire year		Formulation of jelly		Free radical scavenging activity & The antioxidant activity was determined by using DPPH method, one of the most effective methods for evaluating radical-scavengers The utilization of M. acuminata for jelly formulation without adding any pectin was successful. The ex-tracts with higher concentration contained higher phenolic content and scavenging activities, which reflect their potential as antioxidant sources	**(53) Mariam Firdhaus (2015)**
Bauhinia acuminata .linn	In the end of spring to autumn		Not found		Not found	

RESULTS

TABLE: 2 COMPOSITION & NUTRITIONAL CHARACTERISTICS OF SEASONAL FLOWERS

Flower Name	Protein	Fat	Carbohydrate	Vitamin	Minerals	Moisture	(Reference)

Sesbaniagranidflora	2.4 g	2.2 g	47 g	34 mg	2.23 mg	9.75 %	**(31) Saowalak Bunma1 (2019) (32) Aye Aye Aung (2011) (33) Huma Shareef (2012)**
Ixoracoccinealinn	6.33 %	6.10 %	52.76 %	Not found	19.55 mg	7.46 %	**(34) Nada (2017) (35) AkanjiOlufunkeChristy (2018)**
C procera	181.0 mg/g	41.4 mg/g	79.1 mg/g	0.044 mg/g	2.63 µg/mg	112.6 mg/g	**(36) AMIT KUMAR (2016) (37) NasrinKazemipour (2015) (38) Hitesh Vashrambhai Patel. (2014)**
Jasminumsambac	16.24 mg	Not found	4.10 %	Not found	Not found	6.19 %	**(42) T. Gowdhami (2015) (50) P. Manimaran (2018)**
Moringaoleifera	8.1 g	1.7 g	9.1 g	8.6 mg	0.86 mg	8.43 %	**(39) Rasha Khalid Abbas (2018) (40) Ndubisi A. Aviara (2013)**
Musa accuminata	1.53 %	2.01 %	52.6 %	Not found	Not found	8.45 %	**(41) Thompson (2021)**
Bauhinia acuminata .linn	Not found	Not found	+	Not found	Not found	7.2 %	**(43) Divya Sebastian (2020)**

TABLE: 3 EFFECTS OF SOME SELECTIVE PROCESSING METHODS ON THE FUNCTIONAL AND ANTI-DIARRHOEAL PROPERTIES OF SEASONALFLOWER

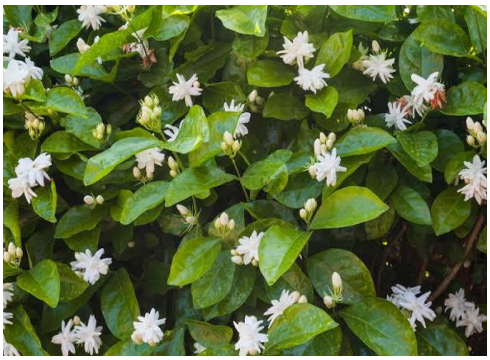
Seasonal Flower	Anti-diarrhoeal Activity	Type of Study	Doses	Results	Processing Method	Result (Property ↑ / ↓)	Reference
Sesbania grandiflora	Yes	Albino mice	200 mg/kg	Successful	Dried flower with petroleum ether and then extracted with ethanol in Soxhlet apparatus	Increase ↑	**(44) NafisaBinteArfana (2016)**

Ixoracoccinealinn	Yes	Albino wistar rats	200–400 mg/kg	Successful	Flowers dried 4 weeks, dissolved in 1:3 ratio water (250 mg in 750 ml)	Increase ↑	**(45) Yasmen Maniyar (2010)**
C procera	Yes	Rat	Atropin and PBZ, 500 mg/kg	Successful	Extract and 100 ml distilled water, 90% ethanol	Increase ↑	**(46) Gaurav Parihar (2016)**
Jasminumsambac	Yes	Mice	400 mg/kg	Successful	Powder extract macerated in 1.5 l methanol for 7 days	Increase ↑	**(47) TasnuvaSharmin (2017)**
Moringaoleifera	Yes	Albino wistar rats	150–300 mg/kg	Successful	Powdered flower extract with 95% ethanol and double distilled water	Increase ↑	**(27) Sharma & Sharma (2019)**
Musa accuminata	Yes	Rats	0.25, 0.50, 1.0 ml	Successful	Flower extract mixed with 20% Splenda solution	Increase ↑	**(48) Varsha J. Galani 2019**
Bauhinia acuminata .linn	Yes	Mice	200 & 400 mg/kg	Successful	Dried flower extract with methanol	Increase ↑	**(49) Divya Sebastian (2020)**

Sesbaniagrandiflora

ixoracoccinealinn

C.procera



jasminumsambac

Morningsolifera

Musa accuminata Linn

BauhiniaaccuminataLinn

DISSCUSSION AND CONCLUSION

Seasonal flowers that have received positive reviews may serve as effective alternatives to address the limitations of synthetic medications and play a significant role in disease treatment. It is recommended to explore the anti-diarrheal properties and phytochemical constituents of these flowers. S. grandiflora, rich in vitamins and moisture, has been linked to anti-inflammatory, analgesic, and antipyretic effects. Ixora is recognized as the national flower of Suriname. Jasmine tea presents a promising source of natural antioxidants and hypoglycemic agents, which could be beneficial in healthy diets. Further research is needed to investigate the in vivo antioxidant and anti-diabetic properties of novel bioactive polysaccharides derived from jasmine tea. Moringa oleifera, indigenous to India, has the potential to become a significant source of income for the country if its nutritional benefits are harnessed by the industry, as it exhibits notable anti-diabetic and anti-cancer properties. Studies have demonstrated that moringa induces reactive oxygen species (ROS) in cancer cells, leading to apoptosis or necrosis. An extract of Calotropis procera has been shown to act as a coagulant, resulting in curds with distinct texture and microstructure compared to non-homogenized milk. The anti-hyperglycemic effects and antioxidant properties of banana flowers position them as a valuable food supplement for health benefits. Future research will focus on isolating and characterizing individual antioxidant compounds from banana flowers using various chromatographic techniques. Bauhinia acuminata Linn. exhibits a high SPF value along with antioxidant and antibacterial properties, making it a viable agent against UV radiation hazards. It also contains a significant amount of oil compared to soybean and cotton seeds, contributing to its nutritional value for human health.

This paper discusses the use of various flowers in the treatment of ailments such as diarrhea and dysentery, as well as their benefits for other conditions including high blood pressure, ulcers, bronchitis, blood sugar regulation, and cancer. Additionally, these flowers are incorporated into different cuisines. For instance, C. procera and J. sambac are offered to the deity Shiva, while S. grandiflora, Moringa oleifera, and Musa acuminata are utilized in traditional recipes. Bauhinia acuminata Linn is commonly used as a pickle in Northeast Asia, and Ixora is consumed as a beverage and used for home decoration. Furthermore, while it is emphasized that a pollution-free environment is crucial, it is also noted that such an environment contributes to our own well-being.

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