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Anti-Diarrheal Activity-A Review

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Abstract
Diarrheal diseases are a major problem in Third World countries and are responsible for the deaths of millions of people each year. Plants have long been a very important source of new drugs and many plant species have been screened to see if they contain substances with therapeutic activity. Medicinal plants are a promising source of antidiarrheal drugs. For this reason, international organizations such as WHO have encouraged studies for treatment and prevention of diarrheal diseases using traditional medicinal practices. The present study contains signs and symptoms, diagnosis, treatment, pharmacological studies done by different medicinal plants.

Keywords
Antidiarrheal activity, Herbal drugs.

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INTRODUCTION:
Diarrhea can be defined as alteration in the normal bowel movement, characterized by a situation in which daily stools exceeds 300 gm and contains 60 – 95 % water.[1]
There are nearly 1.7 billion cases of diarrhea disease year globally. Worldwide, diarrhea accounts for more than 5-8 million deaths in infants and small children less than 5 years every year.[2]
Diarrhea is usually a symptom of an infection in the intestinal tract, which can be caused by a variety of bacterial, viral and parasitic organisms. Infection is spread through contaminated food or drinking-water, or from person-to-person as a result of poor hygiene.[2]
According to World Health Organization (WHO) estimation for the year 1998, there were about 7.1 million deaths due to diarrhea. In Bangladesh, one third of the total child death burden is due to diarrhea. WHO organized a Diarrhea Control Program where they emphasized use of traditional medicines to combat the episodes of diarrhea.[2]
Diarrhea appeared by several mechanism such as increasing the gut motility, along with increased secretion of ions and a decrease in the absorption of fluid, and thus a loss of electrolytes, particularly Na+ and water. [2]

1.1 CLASSIFICATION:
Diarrhea generally is divided into two types: [3]

1. **Acute diarrhea**: It lasts from a few days up to a week. Acute diarrhea is typically caused by bacteria, viruses or parasites.
2. **Chronic diarrhea**: It lasts more than three weeks. It may result due to various conditions like irritable bowel syndrome (IBS), crohn's disease, ulcerative colitis, celiac disease, diverticulae disease and bowel cancer.

Based on pathophysiology, it is divided into: [4]

1. **Osmotic diarrhea:** It involves the retention of water in the bowel, which results from the accumulation of non-absorbable substances.
2. **Secretory diarrhea**: When electrolyte absorption is affected, the body releases water into the small intestine, causing loose bowel movements. It mainly results due to infections or intake of certain drugs.

3. **Motility-related diarrhea**: It involves changes in digestive system, that affect the process of absorption. Some conditions which result this type of diarrhea like hyperthyroidism, irritable bowel syndrome, and having partial gastrectomy.
4. **Inflammatory diarrhea**: It occurs when the lining of the colon becomes inflamed, which typically causes bloody diarrhea. This is common in people with ulcerative colitis.

SIGNS AND SYMPTOMS OF DIARRHEA:

- Dehydration: Lethargy, depressed consciousness, sunken anterior fontanel, dry mucous membranes, delayed capillary refill.
- Failure to thrive and malnutrition: Reduced muscle/fat mass or peripheral edema

Abdominal pain/cramping

- Borborygmi
- Perianal erythema

DIAGNOSIS:

Examination for ova and parasites Leukocyte count Cultures: Always culture for *Salmonella*, Shigella, and *Campylobacter* spp and Y. enterocolitica in the presence of clinical signs of colitis or if fecal leukocytes are present; look for Clostridium difficile in those with diarrhea characterized by colitis and/or bloody stools; assess for Escherichia coli, particularly O157:H7, with bloody diarrhea and a history of eating ground beef; screen for Vibrio and *Plesiomonas* spp with a history of eating raw seafood or foreign travel

Enzyme immunoassay for rotavirus or adenovirus antigens

Latex agglutination assay for rotavirus

TREATMENT:

Antimicrobials used in diarrhea caused by Traveler's diarrhea, or EPEC, Cholera, Campylobacter jejuni, Clostridium difficile, Amoebiasis, Giardiasis

Anti-microbials: Cotrimoxazole, Doxycycline, Erythromycin, Clositin, Nalidixic acid or Norfloxacin. Other anti-diarrheal drugs used are:

Absorbents: Ispaghula, Psyllium, Methyl cellulose.

Antisecretory agents:

- Anti-inflammatory: Sulfasalazine, Mesalazine, Bismuth sub-salicylate
- Anti chlonergics: Atropine
- Corticosteroids: Prednisolone
- Anti-suppressants:

Azathioprine, Methotrexate, Cyclosporine

Anti-motility drugs:

Codeine, Dipheoxylate-atropine

REVIEW:

S.No	Plant & Family	Part	Extract	Model & Std drud	Animal	Parameters	Mechanism	Statistical Analysis	P Value	Author Name	Year
1	Euphorbia hirta (Euphorbiaceae)	Leaves	Ethanol Extract	castor oil induced,prostaglandin induced diarrhea. Std drug:Loperamide.	Albino mice(15-20g)	Vol. of fecal dropping	Irritation and inflammation	–	–	J. Galvez, A. Zarzuelo, M. E. Crespo, M. D. Lorente, M. A. Ocete, J. Jiménez [6]	1993
2	Alchornea cordifolia (Euphorbiaceae)	Leaves	Ethanol Extract	Castor oil induced diarrhea. Std drug: Loperamide.	Albino mice(15-20g)	Vol. of fecal dropping	Irritation and inflamma-tion	–	–	Aqbor GA,Leopdd T,Jeanne NY	2004
3	Stachytarpheta jamaicensis	Leaves	Methanolic extract	Castor oil induced diarrhea, magnesium sulphate induced diarrhea. Std drug: loperamide(3mg/kg)	Swiss albino mice(25-35gms)	Vol. of fecal dropping	Irritation and inflammation	One way anova	P< 0.05	S. Sasidharan, L. Yoga Latha, Z. Zuraini, S. Suryani, S. Sangetha, L. Shirley[7]	2007
4	Kigelia Africana	Leaf	Aqeous Extract	Castor oil. Std drug: Loperamide.	Albino mice(20-25g)	Vol.of fecal	Irritation and inflamma-tion	Two-way anova	P<0.01	Peter A. Akah[8]	2008
5	Zingiber officinalis (family:zingiberacea)	Rhizome	Acetone Extract	Castor oil. Std drug: Loperamide.	Albino rats(150-200g)	Vol. of fecal matter	Irritation and inflamma-tion	One way anova	P<0.01	EC Nwoko,PC Unekwe,K.C Chilaka,E.D Kwobodo,CN Okwuosa[9]	2008

6	Punica granatum(fam:puniaceae)	Peels	Aqeous Extract	Castor oil induced diarrhea. Std drug: Loperamide.	Albino rats(150-200g)	Vol.of fecal dropping	Irritation and inflamma-tion	One way anova	P<0.05	E.Y Qnais,A.S Elokda,Y.Yabu Ghalyun & F.A Abdulla [10]	2008
7	Emblica officinalis(family:euphorbiaceae)	Fruit	Metanolic Extract	Castor oil induced Magnesium sulfate induced diarrhea. Std drug: Diphenoxylate	Albino wistar rats (150-200g)	Vol.of fecal dropping	Irritation and inflamma-tion	One way anova	P<0.05	J.B Periananayagam,S.Narayanan,G.Gnanarkar,A.Panduanyan,S.Raja,K.Rajagop, R.Rajesh,P.Vijayarajkumar,S.G Vijay Kumar	2008
8	Spheranthus amaranthoides(family :aster	Whole Plant	Ethanolic Extract	Castor oil induced diarrhea. Std drug: Lopramide.	Albino wistar rats(150-200g)	Decrease in defecation & wetness in fecal dropping	Irritation & inflamma-tion of intestinal mucosa	Two way anova with student t test	P<0.01	L. Swarna Latha And P. Neelakanta Reddy [11]	2009
9	Morinda morindoides (Family:Rubiaceae)	Leaves	Ethyl Acetate Extract	Castor oil induced diarrhea. Std drug: Loperamide.	Albino wister rats(150-200g)	intestinal fluid accumulation (enteropooling) was assessed	Irritation & inflamma-tion of intestinal mucosa	One way anova with dennets t- test	P<0.05	S Meite, J D N'guessan, C Bahi, HF Yapi1, A J Djaman, And F Guede Guina[12]	2009
10	Alocasia indica(family:araceae)	Leaves	Aqeous & Etanol Extract	In vitro method. Std drug: Loperamide.	Albino wistar rats(150-200g)	Gastric enterpoolin g	–	–	–	Wahid A. Mulla,Atul R.Chopade, Sathish G.B Bishe, Kishor B.Bradde, Chitra C. Khunwelkar [13]	2010
11	Plantago ovate(fam	Seed Husk	Ethanolic And	–	–	-	–	–	–	–	2010

	ily:plantaginaceae)		Methanolic Extract								
12	Psidium guajava (Myrtaceae)	Leaves	Ethanolic Extract	Castor oil induced diarrhea. Std drug: Loperamide.	Albino rats(150-200g)	Vol. of fecal droppings	Irritation and inflamma-tion	One-way ANOVA	P<0.01	J. O. Ezekwesili, U. U. Nkemdilim And C. U. Okeke [14]	2010
13	Trilepisium madagascariense	Stem, bark	Methanol extract	Castor oil induced diarrhea. Std drug: diphenoxylate HCl(2.5mg/kg), loperamidee (2.5mg/kg)	Albino rats(200-250gms)	Vol. of fecal dropping	Irritattion and inflammation		P<0.05	Gerald Ngo Teke, Jules-Roger Kuiate, Victor Kueté, Rémy Bertrand Teponno, Léon Azefack Tapondjou, Gerard Vilarem [15]	2010
14	*Calpurnia aurea (family:leguminaceae)*	Leaves	methanol Extract	castor oil induced diarrhea. Std drug: Loperamaide.	mice(20-25g)	Vol of fecal dropping	Irritation and inflamma-tion of intestinal mucosa	One-way ANOVA with Turkey-Kramer as post hoc test.	P<0.05	Shemsu Umer, Alemu Tekewe,Nigatu Kebede [16]	2011
15	Cyperus tegetm (Family:Cypereceae)	Rhizomes	Methanolic extract	Castor oil induced diarrhea. Std drug: Loperamide 3mg/kg	Albino mice(20-25gms)	Vol. of fecal droppings.	Irritation and inflammation.	Values are Mean ± SD (n=6)	-	Nitai Chand Chaulya, Pallab Kanti Haldar, Arup Mukherjee	2011

16	*Musa sapientum* (*M.sapientum*)	Fruit	Methanolic extract of fruit	Castor oil induced diarrhea, magnesium sulfate induced, gastrointestinal motility test. Std drug: loperamide 3mg/kg	Albino mice(20-25 gms)	Vol.of fecal dropping	Irritation and inflammation.	mean ± standard error of the mean (SEM).	P< 0.001	M. Sarowar Hossain, M. Badrul Alam, M. Asadujjaman, Ronok Zahan, M. Monirul Islam, M. Ehsanul H. Mazumder, and Md. Ekramul Haque [17]	2011
17	Rosa canina	Leaves		Castor oil induced diarrhea. Std drug: Diphenoxylate (5 mg/kg)	Albino mice(20-25 gms)	Vol. of fecal dropping	Irritationand inflammation	mean ± standard error of the mean (SEM).	P<0.05	Rajesh J. Mandade, Avijit Choudhury, Amol Harsulkar, Ravikiran Wakade [18]	2011
18	*Rhododendron arboreum*	Flowers	Ethanolic extract of flowers	Castor oil induced diarrhea, magnesium sulfate induced, grastric transit time. Std drug: loperamide 3mg/kg	Albino mice(20-25 gms) or albino rats(200-230 gms)	Vol. of fecal droppings.	Irritation and inflammation.	one-way ANOVA followed by Student's *t*-test	P< 0.5	Neeraj Verma, Anil P. Singh, Amresh Gupta, P.K. Sahu, and Ch V. Rao [19]	2011
19	Moringa oleifera (family: Moringaceae)	Leaves		Castor oil induced, magnesium induced enterpooling ,prostaglandi	Albino rats(150-200g)	Vol. of fecal dropping.	Irritation & inflammation,	Analysis of variance and Dunnet`s posttest	P<0.05	Lakshminarayana M, Shivkumar H, Rimaben P , Bhargava Vk [20]	2011

				n induced,charcoal meal test. Std drug: Loperamide.							
20	Cassia sieberiana (fam:fabaceae)	Leaves	Methanol Extract	Gastric motility tet,castor oil induced diarrhea. Std drug: Loperamide.	Albino mice(20-25g)	Vol. of fecal dropping.	Irritation	One-way ANOVA with student t-test	P<0.05	Madubuike,G.Keleci & Onyeachelam,O.Favour	2012
21	Ceratotheca sesamoides	Leaves	Ethanolic Extract Gastro Intestinal Transit &Enteropooling	Cator oil induced diarrhea. Std drug: Loperamide.	Ailbino wistar rats(200-250g)	Vol. & mass of intestinal fluid.	Irritation & inflammation.	One-way ANOVA with student t-test	P<0.01	Toiyn M Y.A, Opakunle, F.Khadijat,Salimon,S.Saobo,Ajiboye T.Olakunle,Bamisaye F.Abraham,Quadria,Luqman	2012
22	Berberis arista bark(family:berberidaceae)	Stem	Aqeous Extract	Magnesium sulfate,castor oil induced diarrhea. Std drug: Loperamide.	Albino wistar rats(150-200g)	Decrease in induction time, vol. of fecal dropping.	Irritation and inflammation.	One way anova with t test	P<0.05	Shamkuwar P B, Pawar D P [21].	2013
23	Cyperus rotundus(linn	Root Extract	Chloroform	Castor oil induced diarrhea.	Albino rats(150-200g)	Vol. of fecal content.	Irritation and inflammation.	One way anova,t test,z-test	P<0.01	Shivakumars.I,Amreen Begum,Syeda Sana,Ansari Firdous	2013

	(family:cyperaceae)		And Methanolic Extract	Std drug: Loperamide, Diphenoxylate.							
24	Sapindus laurifolia(family:sapindaceae)	Fruit	Alcoholic Extract	Castor oil induced diarrhea & magnesium induced. Std drug: Loperamide.	Albino wistar rats(150-200g)	Vol. of Feccal dropping.	Irritation and inflamma-tion of intestinal mucosa	–	–	Varshitha.C And Bandenawaz Ramadurg	2013
25	*Desmodium puchellum* (family: Fabaceae)	Leaves	Methanol And Petroleum Ether Extract	Castor oil induced diarrhea. Std drug: Loperamide.	Albino wister rats(150-200g)	Vol. of fecal dropping.	Irritation and inflamma-tion	Two way anova by student t test	P<0.05-0.01	Ritika Sharma,Bharat Parashar And Atul Kabra [22]	2013
26	Trigonella foenum-graecum (fabeceae)	Whole Plant	Aqeous Extract	Castor oil induced diarrhea. Std drug: Loperamide.	Albino rats(150-200g)	Vol. of fecal dropping.	Irritation and inflammation.	One way anova followed by Dunnet"s „t" test	P<0.05	Revathi Boyina , Sreya Kosanam And Thirumala Rani 23	2014
27	*Zehneria scabra*	Leaves	80% methanolic extract.	Castor oil induced diarrhea, gastric motility test.	Albino mice(20-30 gms)	Vol. of fecal droppings.	Irritation and inflammation.	one way ANOVA followed by Tukey's	P< 0.05	Wondmagegn Tamiru Tadesse, Abebe Ejigu Hailu, Abyot Endale Gurmu, and Abraham Fikru Mechesso [22]	2014

				Std drug: Loperamide.				post hoc tests			
28	Sapium Ellipticum (family:Euphorbiaceae)	Powder	Aqeous Extract(Decoction)	Castor oil induced diarrhea. Std drug: Loperamide.	Swiss albino mice(20-25g)	Decreased the frequency of defecation and the intestinal transit.	Irritation & inflamma-tion of intestinal mucosa	One way anova withTukey-Kramer as post hoc test.	P<0.05	Sylvie L Wansi, Elvine P Nguelefack-Mbuyo, Moïse L Nchouwet, David Miaffo, Paulin Nyadjeu, Josué P Wabo, Marius Mbiantcha, Pepin A Nkengefouet, Telesphore B Nguelefack And Albert Kamanyi [1]	2014
29	Pandanus odoratissimus linn	Fruit & Leaves	Ethanolic Extract	Castor oil induced diarrhea. Std drug: loperamide.	Albino rats(150-200g)	Vol of fecal dropping	Irritation & inflamma-tion	One way anova	P<0.05	Md.Khalidar Rahman,Md Fokheul Islam,Soumita Barna,Md.Masudur Rahman,Md Abu Saeed [25]	2014
30	Alstonia scholaris	Parts of plant	Methanolic extract	Castor oil induced diarrhea, castor oil induced enterpooling. Std drug: loperamide 5mg/kg	Albino mice (20-25 gms)	Vol. of fecal droppings.	Irritation and inflammation.	–	($p < 0.01$, $p < 0.001$)	Mohammad Shahadat Hossain, Ziku Chandra Dey, Md. Imdadul Hoque, Md. Saddam Hossain Bhuiyan, Hasan Al Banna [26]	2014
31	Clemone gyndra (family:capperdiaceae)	Leaves	Methanolic Extract	Magnesium sulphate and castor oil induced diarrhea. Std drug: Loperamide.	Albino wister rats(150-200g)	Vol. of fecal dropping	Irritation &inflamma-tion of intestinal mucosa	One way anova followed by dunnet's t-test	P<0.01	Nadiminti Satish Reddy,D.Santhosha,Vidyasabbani,P.Vishwanth Reddy,Ch.Venu	2015
32	Maranta arundiaceae(family:	Leaves	Methanolic	Castor oil induced	Albino rats(150-200g)	Vol. of fecal dropping	Irritation and inflamma-tion	One way anova withSPSS	P<0.05-0.01	Md.Khalidar Rahman,Md Ashraf Uddin Chowdary,Md Taufilal	2015

	marantaceae)		Extract	Gastrointestinal motility test. Std drug: Loperamaide.				11.5 software		Islam,Md.Anisuzzamam Chowdary,Md Erfan Uddin,Chandra Data Sumi [27]	
33	Jatropha curcus (Euphorbiaceae)	Leaf, Roots	Methanol Extract	Castor oil induced diarrhea. Std drug: Loperamide.	Albino rats(150-200g)	Vol. of fecal dropping	Irritation and inflamma-tion	_	_	Fatima U. Maigari, Musa Halilu, M. Maryam Umar, Rabia Zainab [28]	2016

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