

Probiotics: Treatment for Diarrhoea

Jayanand^{1*}, Sanjeev Mittal², Dinesh Kumar Yadav³, Ajay Kumar⁴, Krishna Raj singh⁵

¹ School of Biomedical Engineering, Shobhit Institute of Engineering & Technology, Meerut, Uttar Pradesh, India

² Department of Pharmaceutical Sciences, RIMT University, Mandi Gobindgarh, Punjab, India

³ Department of Pharmacognosy, SGT University, Gurugram Haryana, India

⁴ Department of General Medicine, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India

⁵ Department of Biotechnology, Sanskriti University, Mathura, Uttar Pradesh, India

ABSTRACT

Diarrhoea is termed as a state when a human being suffers from at least three incidents of watery liquid and successive loose bowl movement arising from either due to some infection inside the gut or due to some other underlying health condition that results in improper working of the digestive system as the food consumed by the person does not completely digests and eventually results in onset of diarrhoea. Many medications are provided for the treatment of diarrhoea but all the medications prescribed by the medical practitioners show some side effects and are not advisable for the patients of all age groups. Thus to give the patient ease from the side effect of medications the study provides a means for treating diarrhoea by consuming probiotic rich food and opens a future prospects to carry out more research on the effectiveness of probiotic food for other gut related ailments in order to cure patients.

Keywords: Antibiotics, Bacteria, Diarrhoea, Gut flora, Probiotic

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Corresponding author: Sudheesh Shukla

e-mail ✉: sudheesh.shukla@shobhituniversity.ac.in

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INTRODUCTION

Diarrhoea is usually termed as a condition which involves frequent bowl movements one after another having water and loose bowl movements. In some cases, diarrhoea lasts for few days usually from one to three days and results in weakness of patients suffering from diarrhoea due to excessive water loss from the body. As a result of water loss and disturbed health condition patient's food intake also reduces during the period when the patient is suffering from diarrhoea and thus eventually results in weakness due to insufficient food intake and excessive loss of water from the body. The loss of water from the body are determined by many symptoms caused due to diarrhoea and the symptoms include: stretching of skin of the patient suffering from diarrhoea, changes in behaviour,

yellow coloured urination, paleness in the colour of skin, increased heart rate as a result of frequent motions, reduced response from the patient, and in severe cases patient get faint due to excessive salt loss from the body [1]. Thus, as a means to prevent the patient from severe conditions arising from excess water loss and weakness due to less food intake, patients are advised to give electrolyte supplements in small quantity during the onset of diarrhoea. The onset of diarrhoea is related to many causes in a person, but, behind every cause there lies a fact that the person suffered from some medical issues related to gut which resulted in onset of diarrhoea in the patient. In order to prevent the patient from frequent diarrhoea, patient is suggested to consume probiotic supplements so as to increase the gut health of the patients and to combat the underlying reasons behind the frequently occurring diarrhoea [2].

Causes of diarrhoea

There are several reasons that are responsible for the cause of diarrhoea in patients and the reasons includes:

Virus induced diarrhoea

There are many virus species that are responsible for diarrhoea and diarrhoea like symptoms in patients and the virus species involve COVID-19 virus, Cytomegalovirus (CMV) belongs to the class of herpes virus, Norwalk virus, Rotavirus commonly infects children, and Hepatitis virus results in watery diarrhoea along with severe fever, abdominal cramps, vomiting, and nausea [3]. Usually the onset of virus induced diarrhoea is observed by eating infected food or coming in contact with the person suffering from diarrhoea induced due to viral infection [4].

Medicines induced diarrhoea

There are some medicines that results in onset of diarrhoea in patients, as the patients consumes some medicines because of strong effect of the medicines good and bad bacterial flora that is present inside the gut of the human being gets disturbed. As a result of this disturbed gut bacteria/gut flora human being suffers from diarrhoea [3]. The medicines that cause diarrhoea includes, antibiotics, excess consumption of antacids especially proton pump inhibitor drugs, laxatives, and cancer treatment drugs particularly chemotherapy drugs, gastrointestinal cancer drugs, Alzheimer's treatment drugs galantamine, donepezil, rivastigmine, diabetes drug especially metformin, a toxins producing bacteria *C. difficile* results in blood secretion along with diarrhoea and thus characterised as a severe diarrhoea, gout treatment drug particularly Colchicine, Non-Steroidal anti-inflammatory drug, antidepressant drugs, digoxin, and many more [5].

Fructose induced diarrhoea

The fructose is a form of sugar usually found in plant products and honey, fructose is a monosaccharide usually bonded to glucose and is a simple ketone in nature and found as a disaccharide when bonded with glucose. Fructose is usually consumed by human beings as a sugar in diet and belongs to the category of monosaccharides like glucose, and galactose. Galactose, glucose and fructose are consumed by human beings as a natural sweetener and provides instant energy once consumed as a result of instant production of energy in the form of adenosine triphosphate by the pathway of glycolysis. But, when the fructose is not efficiently absorbed in the intestine by the intestinal wall, the left over fructose is transported to the gut. The fructose reached inside the gut is consumed by the harmful bad bacteria lying inside the gut of the human being [6]. The bad bacteria present inside the gut of the human being when consumes fructose the harmful toxins are released, as a result of the consumption of fructose by the harmful bacteria present inside the gut of the human being, harmful by-products including methane gas, hydrogen gas, are released and eventually cause diarrhoea, bad breath as a result of hydrogen released from the mouth, bloating inside the gut, cramping [7]. To determine the mal absorbed level of fructose in the body a test is conducted to determine the level of hydrogen released by the bad bacteria while

digesting fructose which is then absorbed by the bloodstream and removed by means of the lungs and ultimately excreted out of body via bad breath.

Lactose intolerance induced diarrhoea

Lactose is a type of sugar, lactose is a disaccharide present milk and the lactose is a combination glucose and galactose having the molecular formula $C_{12}H_{22}O_{11}$. Lactose is found in milk and lactose intolerance is characterised by a state in which the patient could not easily digest and incompletely digest the lactose sugar present in the milk which the patient has consumed. Because of the incomplete digestion the patient feels gases and bloating after eating and drinking any of the dairy obtained products. The state of lactose intolerance is usually not much harmful but; the condition usually causes uneasiness to the patient. The main reason behind the lactose intolerance in patients is the comparative less secretion of lactase enzyme inside the small intestine which is usually responsible the digestion of lactose sugar inside the human body [8]. The patients who are deficient in lactase secretion, lactose present in the food consumed reaches to the colon where the bacteria present consumes the lactose present along with the food consumed and eventually results in symptoms related to the lactose intolerance. There are patients who have low levels of lactase in their small intestine but they efficiently digest lactose sugar but, if the gut lactose level reaches an extreme low level, patient faces difficulty in digesting lactose consumed by means of dairy products. The difficulty in digesting the lactose sugar present in dairy products results in diarrhoea, nausea, bloating, gases, vomiting, cramps in stomach. Lactose intolerance is also seen in patients having age group of 50 and above thus it can be related that, lactose intolerance is observed with increasing age [9].

Surgery induced diarrhoea

In some patient's diarrhoea or diarrhoea like symptoms are observed after they undergo some surgery, in some cases diarrhoea or diarrhoea like symptoms are severe whereas in some cases these symptoms are mild. Mild symptoms of diarrhoea usually lasts for one to two days on the contrary in severe cases, diarrhoea symptoms prolong up to 4 weeks after the patient has undergone any severe surgery [10]. Some diarrhoea causing surgeries includes spleen surgery, appendix surgery, liver surgery, pancreas surgery, stomach surgery, large intestine surgery, gall bladder surgery, small intestine surgery. After the procedure of the surgery is over, patients usually see some symptoms related to vomiting, nausea, and mild to severe diarrhoea. The usual reason behind the diarrhoea and diarrhoea like symptoms is the bacterial growth on the site of the surgery. As a result of bacterial growth infection occurs in the patients, less nutrition absorption by the patient results in weakness and eventually severe infection inside the patients gut. In some cases when patient has undergone liver and gall bladder surgery, relatively higher secretion of the bile juice inside the gut of the patient occurs. The excess bile

juice released work as a laxative and eventually causes diarrhoea. In case if the patient has undergone stomach surgery the rapid emptying of stomach is observed which results in diarrhoea like symptoms in the patient [11].

Bacterial and parasitic induced diarrhoea

In some patients, bacteria or parasite induced diarrhoea is observed and these types of diarrhoea is observed when the patient consumes some contaminated food or contaminated drink or in some cases come in contact with a contaminated surface. The bacterial induced diarrhoea arise as a result of ulcers and inflammation inside the body of the patient. The bacteria induced diarrhoea results in dysentery type symptoms and the symptoms of dysentery occur as a result of ulcers and inflammation. Some common diarrhoea causing bacteria includes: *Yersinia* causes infectious diarrhoea in human beings and commonly caused due to consumption of infectious dairy products. *Staphylococcus aureus* is the bacterial specie that causes diarrhoea as a result of the toxins released by the *Staphylococcus aureus* and the diarrhoea caused is explosive in nature. *Clostridium difficile* induced diarrhoea is observed in patients who are concurrently using antibiotic and in some cases the diarrhoea is linked to the prior infection in patients. Now a days, *clostridium difficile* is linked with hospital-acquired diarrhoea. *Vibrio* induced diarrhoea is observed in patients consuming raw sea food.

Escherichia coli induced diarrhoea is observed in patients consuming dairy products and food that are contaminated and results in *Escherichia coli* induced diarrhoea and results in haemorrhagic colitis. *Campylobacter* induced diarrhoea is commonly a food born diarrhoea occurred as a result of consuming contaminated food and results in bloody diarrhoea occur as a result of severe intestinal inflammation. *Shigella* induced diarrhoea is usually seen in children particularly children of preschool age group, *Shigella* induced diarrhoea is observed on consuming infected food and results in bloody diarrhoea in kids of preschool age group. *Salmonella enteritidis* induced diarrhoea is observed in patients who have consumed contaminated drink or have consumed contaminated food, the symptoms are observed within 12 to 72 hours of consuming contaminated drink or food and results in abdominal cramps, diarrhoea, fever. Parasite induced diarrhoea is seen in every part of the globe, parasite induced diarrhoea is primarily caused due to protozoa. Protozoa are unicellular organisms seen in multiple forms and are usually transmitted via consuming infected water [12]. The most common parasitic diarrhoea causing species are: *Entamoeba histolytica* results in diarrhoea that releases blood via stool, contamination in the patient occurs by means of fecal –oral transmission and the parasite reaches the intestinal wall of the patient. *Cryptosporidium* induced diarrhoea results in watery diarrhoea affecting gastrointestinal tract along with respiratory canal of the patient and eventually results in diarrhoea with excess water loss. *Giardia lamblia* induced diarrhoea infects people who have consumed infectious

food or by means of infection from one person to another person that come in contact with the person who has contacted the infection. As a result of infection diarrhoea symptoms are observed within two days of infection and results in explosive diarrhoea. Other reasons induced diarrhoea includes celiac disease, Crohn's disease, irritable bowel syndrome, microscopic colitis, and ulcerative colitis and all the diseases results in diarrhoea or diarrhoea like symptoms [3].

Types of diarrhoea

There are different ways to categorise diarrhoea and these categories include: Acute diarrhoea, persistent diarrhoea, chronic diarrhoea. Acute diarrhoea: Acute diarrhoea is the most commonly seen category of diarrhoea, acute diarrhoea is the loose watery diarrhoea that usually occurs for a day or two days, acute diarrhoea is very common and less severe and usually cures automatically without the need of any medications to treat the disease and to control the symptoms of the disease. Acute diarrhoea starts rapidly and continues for a short span of time ranging from 1 day to 3 days and in some cases up to two weeks. The cause behind acute diarrhoea varies from patient to patient and includes: bacteria induced diarrhoea, virus induced diarrhoea, parasite induced diarrhoea, lactose or fructose intolerance induced diarrhoea, medicines induced diarrhoea, surgery induced diarrhoea, eating contaminated food and drink induced diarrhoea. Acute diarrhoea symptoms includes fever, headache, chills, abdominal pain, vomiting, nausea, dehydration induced dry skin, thirst, fast heartbeat, reduced urination, dark yellow urination, sunken eyes. Persistent diarrhoea: persistent diarrhoea usually persists for two to four week duration of time and the symptoms are mild to severe depending upon the cause of the diarrhoea and also the health condition of the patient. Chronic diarrhoea: chronic diarrhoea is characterised by frequent occurrence of diarrhoea lasting for more than two weeks of duration, in few patients chronic diarrhoea persists daily and in some patient's diarrhoea occurrence is not observed daily but in few days.

Probiotic

Probiotics are basically bacteria that resides in human gut in quite a large number, according to a recent study almost 39-300 trillion bacteria resides inside human being out of which maximum number of bacteria is observed in human gut which includes bacteria – *Lactobacillus*, *Saccharomyces*, *Escherichia*, *Streptococcus*, *Bacillus*, *Enterococcus*. Each genus comprises variety of species and each specie includes a broad variety of strains. The variety of strains of probiotics boost the health of human being when consumed in right quantity in the form of supplement or in the form of natural food. Food prepared from the fermentation of bacteria also constitutes probiotics. Probiotic food include yogurt, kimchi, sauerkraut, tempeh, kefir [13]. A variety of probiotic bacteria are found to show positive effect on human health, thus choosing the right one to get the right

health benefit is essential to maintain the health of human gut. The complex community of microbes in gut is called gut flora and most of the gut flora is seen in large intestine, small intestine, colon, which covers most of the part of the human digestive tract. Gut flora manufactures vitamins including few of Vitamin B and Vitamin K, gut flora also turns fibres into a small chain of fatty acids including propionate, butyrate, acetate and these small chain fatty acids feed the wall of the human gut and aids in performing many metabolic activities, including strengthening of the immune system of the human being and thus prevents the human being from many infectious diseases [14].

REVIEW OF LITERATURE

Johnston B C et al. conducted a study on the prevention of diarrhoea in paediatric patients and concluded that even after taking the variety of strains of probiotics in different quantity and for a varied time duration the overall effect of probiotics for treatment of diarrhoea is observed to be effective in case of varied dosages in case of antibiotic associated diarrhoea. Population provided with low dosages showed good recovery from diarrhoea, whereas population group under high dosage of probiotics showed very good efficacy against diarrhoea treatment. But the study do not provide a defined treatment plant of consuming probiotics to combat diarrhoea [15].

Michael V et al. colleagues studied the effect of prebiotics and probiotics on diarrhoea and concluded that in patients suffering from antibiotic induced diarrhoea and virus induced diarrhoea the effect of consuming

probiotics showed increased level of issues arising from the diarrhoea, whereas patients suffering from diarrhoea due to disturbed intestinal gut flora showed good results of consuming probiotics in treating the diarrhoea caused due to intestinal microbiota. However, prebiotics showed less effect in treatment against intestinal bacteria induced diarrhoea. The study does not provide a treatment plan to cure diarrhoea [16].

Alfredo G et al. determined the efficiency of probiotics in treating the diarrhoea and preventing the diarrhoea and showed that the treatment and prevention of diarrhoea by consuming probiotics as a medicine in the early onset of disease prevented the patient from the disease and also the dose of probiotics as a medicine was dependent on the strain of the probiotic consumed and the quantity of the dose of the probiotic consumed so as to treat the virus induced diarrhoea. The study do not provide a treatment plan to cure diarrhoea [17].

METHODOLOGY

A questionnaire form is distributed in several physicians clinic and the patients suffering from diarrhoea including those who frequently suffer from diarrhoea and those patients who have suffered from diarrhoea more than three times in last six months were considered for the study. A total of 100 candidates filled the questionnaire form out of which 90 candidates were selected for the study. Table 1 shows the questionnaire form distributed in several physician's clinic in order to conduct the survey.

Table 1: The questionnaire form distributed in several physician's clinic to collect the data regarding the occurrence of diarrhoea due to various factors.

Name:	
Age:	
Sex:	
Occupation:	
Are you suffering from diarrhoea?	Yes: No:
What is the cause of diarrhoea?	Virus induced diarrhoea: Medicine induced diarrhoea: Fructose induced diarrhoea: Lactose intolerance induced diarrhoea: Surgery induced diarrhoea: Bacterial and Parasitic induced diarrhoea: Other reasons induced diarrhoea:
How many times you have suffered from diarrhoea in last six months?	Never: One to two times: Three or more than three times:
Do you frequently suffer from diarrhoea?	Yes: No:

All the candidates suffered from diarrhoea in last six months were asked to consume five probiotic rich Indian food on a regular basis during meals and mid meals and share their experience regarding the frequency of the onset of diarrhoea after consuming probiotic rich food

for a period of three months. All the 90 candidates belonging to varied age group were grouped into three different groups of 10 candidates each depending upon the severity of the diarrhoea. All the patients were suffering from diarrhoea were asked to consume Indian

probiotic rich food including dahi (curd) 1 cup two times a day with meals, paneer (Indian cottage cheese) 25-30 grams per day, chaas (buttermilk) 2 glass per day before meal as a mid-meal snack, dhokla as a mid-meal snack or in breakfast 25-30 grams per day for a period of 3 months on a regular basis and in the quantity based on the dietary guideline of Indian Council of Medical Research (ICMR) for the Indian population [18] based on their activity level throughout the day, the severity of the diarrhoea caused to the patient, the cause and type of diarrhoea from which the patient is suffering

RESULT AND DISCUSSION

Diarrhoea is generally known as a condition which involves repetitive bowel movements one after another having excess water loss and loose bowel movements. In few cases, diarrhoea continues for few days generally from one to three days and results in weakness of patients suffering from diarrhoea due to excess quantity of water loss from the body. Probiotics supplements shows evidences to cure antibiotic induced diarrhoea. Diarrhoea caused due to prolong consumption of antibiotics results in chronic diarrhoea for a duration of several weeks even after the infection is eradicated and the diarrhoea like symptoms are also observed by the patient. The patient encounter diarrhoea like symptoms since excess consumption of antibiotics results in killing

of many of the natural healthy gut flora and eventually allows harmful bacteria to live inside the gut. As a result of harmful bacterial presence in human gut person feels bloating, diarrhoea, constipation, digestive problems, gases and many other digestion related issues. To reduce the patients problems arising as a result of disturbed gut flora the survey allows the patients to consume probiotic rich food as a means to reduce the problems arising due to disturbed gut microbe flora.

Table 2 shows results obtained on conducting the survey regarding the effectiveness of consuming probiotic rich Indian food on regular basis and its effect on the occurrence of diarrhoea. The results obtained showed that when patients suffering from diarrhoea consumes probiotic rich Indian food on a regular basis for a period of three months a prominent reduction in occurrence of diarrhoea and the severity of diarrhoea is observed in all three groups suffering from acute diarrhoea, persistent diarrhoea, chronic diarrhoea. The reduction in occurrence of diarrhoea in all three groups after consuming the probiotic rich food for a period of 3 months occurred because of the presence of probiotic bacteria. The probiotic bacteria on reaching the patients gut by means of probiotic food maintains the balance of healthy gut bacteria inside the gut of the patient and thus reduces the severity of symptoms and occurrence of diarrhoea.

Table 2: Shows the results obtained on conducting the survey regarding the effectiveness of consuming probiotic rich Indian food on regular basis and its effect on the occurrence of diarrhoea.

Patient group (90 candidates)	Number of patients who consumed dahi/curd (1 cup two times a day with meals)	Number of patients who consumed paneer/Indian cottage cheese (25-30 grams per day)	Number of patients who consumed Chaas/buttermilk (2 glass per day before meals as a mid-meal snack)	Number of patients who consumed dhokla (25-30 grams per day as a breakfast or as a mid-meal snack)	Results obtained (Very effective, Effective, Not effective)
Acute diarrhoea patients who followed diet plan (30 patients)	27	26	28	27	Effective
Persistent diarrhoea patients who followed diet plan (30 patients)	26	25	28	25	Very effective
Chronic diarrhoea patients who followed diet plan(30 patients)	28	27	29	26	Effective

CONCLUSION

To reduce the patients' issues occurring as a result of hampered gut flora the survey allows the three group of patients involving 10 patients in each group to consume probiotic rich food as a means to minimise the ailment arising due to hampered gut microbe flora. All the 90 patients who were grouped into three different groups based on the severity of the diarrhoea i.e. acute, persistent, chronic diarrhoea caused and all the patients suffering from diarrhoea were asked to consume Indian probiotic rich food including dahi (curd) 1 cup two times a day with meals, paneer (Indian cottage cheese) 25-30 grams per day, chaas (buttermilk) 2 glass per day before meal as a mid-meal snack, dhokla as a mid-meal snack or in breakfast 25-30 grams per day for a period of 3 months on a regular basis and in the quantity based on

the dietary guideline of Indian Council of Medical Research (ICMR) for the Indian population. The results obtained showed that when patients suffering from diarrhoea consumed probiotic rich Indian food on a regular basis for a period of three months a prominent reduction in the frequency and the severity of diarrhoea is observed in all three groups suffering from acute diarrhoea, persistent diarrhoea, chronic diarrhoea. The reduction in occurrence of diarrhoea in all three group is observed due to consuming probiotic rich food. Probiotic bacteria balances the disturb level of healthy bacteria inside the gut of the patient and thus results in improvement of patients health condition. The results were obtained on the basis of the improvement in the health observed by every patient participated in the survey. After discussing with every survey candidate

regarding the frequency of diarrhoea and diarrhoea like symptoms all patients followed suggested diet plan. Patients suffering from acute diarrhoea observed that the diet plan reduced their frequency of diarrhoea to a great extent and reported that the probiotic rich food was effective in treating their diarrhoea.

On further discussing the improvement in the occurrence of the diarrhoea observed by the patients suffering from acute, persistent, and chronic diarrhoea it was observed that in all three groups of patients suffering from acute, persistent, and chronic diarrhoea all the patients only those patients who followed the complete suggested diet plan observed positive result. The positive result was concluded by reduction in the occurrence of the diarrhoea in all the patients. Thus, accordingly those patients who observed highly reduced number of occurrence of diarrhoea showed very effective results whereas, patients who showed slight reduction in the occurrence of diarrhoea showed effective results.

Patients suffering from persistent diarrhoea also followed the probiotic rich diet plan in order to treat diarrhoea. As per the discussion done with all the patients who followed probiotic rich diet plan to treat diarrhoea, all patients who participated in the survey followed the probiotic rich diet plan aiming to cure their illness. The results observed by the patients suggested that all the patients observed improvement in their health status after consuming probiotic rich food for a period of 3 months. All the patients suffering from persistent diarrhoea showed a prominent improvement in their health status and reduction in the occurrence of diarrhoea and thus called the treatment plan very effective.

Patients suffering from chronic diarrhoea also actively participated in the study and followed the probiotic rich diet plan for a period of 3 months and after following the probiotic rich diet plan for a duration of 3 months all the patients observed some improvement in their health status. According to the discussion conducted with every chronic diarrhoea patient who participated in the survey and followed probiotic rich food diet plan few patients observed mild improvement in the health status, whereas, few patients observed a great change in their health status. Thus, it was concluded that the probiotic rich diet plan was effective for treating the patients suffering from chronic diarrhoea. Thus, current research opens the future prospects to conduct research on the efficiency of Indian food in treating various abdominal diseases.

REFERENCES

1. Spinner CD, Schulz C. Infectious diarrhea. *Der Gastroenterologe* 2020;15(3):159-167.

2. Giddings SL, Stevens AM, Leung DT. Traveler's diarrhea. *Med Clin N Am* 2016;100(2):317-330.
3. Stephen AT. Diarrhoea. Mayo Clinic Publications 2019.
4. Yang X, Zhao J, Yan Q, et al. A case of COVID-19 patient with the diarrhea as initial symptom and literature review. *Clin Res Hepatol Gas* 2020;44(5):e109-e112.
5. ABCD study team. A double-blind placebo-controlled trial of azithromycin to reduce mortality and improve growth in high-risk young children with non-bloody diarrhoea in low resource settings: The Antibiotics for Children with Diarrhoea (ABCD) trial protocol. *Trials* 2020;21(1):71.
6. Arasaradnam RP, Brown S, Forbes A, et al. Guidelines for the investigation of chronic diarrhoea in adults: British society of gastroenterology, (3rd Edition). *Gut* 2018;67(8):1380-1399.
7. Jorden. 'Fructose malabsorption'. *Healthgut* 2016.
8. Steve. lactose intolerance, *Mayo Clin* 2020.
9. Cairncross S, Hunt C, Boisson S, et al. Water, sanitation and hygiene for the prevention of diarrhoea. *Int J Epidemiol* 2010;39:i193-i205.
10. Andrew. surgery induced diarrhoea. *Healthline* 2019.
11. Fischer-Walker CL, Igor R, Liu L, et al. Global burden of childhood pneumonia and diarrhoea. *Lancet* 2013.
12. Kelly L, Jenkins H, Whyte L. Pathophysiology of diarrhoea. *Paediatr Child Health* 2018;28(11):520-526.
13. Wieërs G, Belkhir L, Enaud R, et al. How probiotics affect the microbiota. *Front Cell Infect Microbiol* 2019;9:454.
14. Gunnars, K. Probiotics. *Healthline*. (n.d).
15. Guo Q, Goldenberg JZ, Humphrey C, et al. Probiotics for the prevention of pediatric antibiotic-associated diarrhea. *CDSR* 2019;4(4):CD004827.
16. De Vrese M, & Offick B. Effects on diarrhea. *Bioact Foods Promot Heal* 2010:205-227.
17. Guarino A, Lo Vecchio A, Canani RB. Probiotics as prevention and treatment for diarrhea. *Curr Opin Gastroenterol* 2009;25(1):18-23.
18. Gopalan C, Ramasastri BV, Balasubramanian SC, et al. Nutritional value of Indian foods. 2000.