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Role of *Lactobacillus* as a Probiotic Against the Zoonotic Potential of Rotavirus Infection

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ABSTRACT

Rotavirus is a naked double Standard RNA virus that causes watery diarrhoea in humans and animals. It comprises three layers of viral proteins and spreads through air and contact with the feces of infected individuals. It affects enterocytes and crypt cells of villi. It causes changes in electrolyte numbers inside the host leading the patient to extreme tiredness. Probiotics are those live bacteria and yeast which already exist in living organisms' bodies and patients can use them as food supplements to maintain their microbiota. *Lactobacillus* is a rod-shaped gram-positive bacteria found inside the gastrointestinal pathway, especially in the small intestine. It helps to maintain body metabolism and is a powerful agent for diarrheal patients. It blocks various rotavirus protein binding activity. It acts as a buffer inside digestive organs. The researcher concludes that *Lactobacillus*-rich food is a good treatment against diarrheal infection.

Introduction

Rotavirus is a non-enveloped double-standard RNA virus and has high zoonotic potential. [1]. Its major signs and symptoms are fever, and vomiting followed by 3 to 7 days of watery diarrhea. It can cause serious abdominal pain if the infection is not treated within a week. Physical signs of rotavirus in humans are anxiousness, crying without tears, less peeing, Dizziness, oversleeping, Pale skin and diplopia [2]. Signs of rotavirus are identified as liquid feces followed by mucous in animals. It is transmitted by the oral route both in humans and animals [3]. It can be spread through the air by coughing and sneezing of animals that is why it is called airborne disease infection [4].

Probiotics are beneficial living microbes that impact mainly the digestive system. Probiotics maintain the internal homeostasis of living organisms. Flavonoids are probiotics present in fruits and vegetables [5]. Flavonoids have several therapeutic applications against numerous infectious and non-infectious diseases. They bind with specific viral proteins to control the infected cell rate [6]. *Lactobacillus* works to improve intestinal health and it works as a good remedy to treat diarrheal infections. It helps to maintain intestinal PH rate [7].

Viral Morphology:

Rotavirus has a wheel-like shape and lacks an envelope. The virus has 11 genera with multiple segments of linear double-standard RNA and 18555 nucleotides. Capsid of rotavirus protects its genome [8].

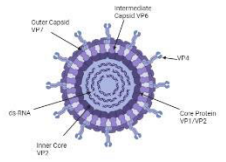

Figure 1: Structure of Rotavirus (Retrieved from Bio-Render)

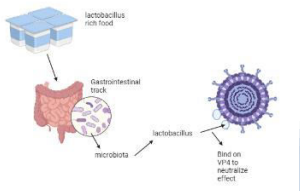

Figure 2: *Lactobacillus* impact on Rotavirus (Retrieved from Bio-Render)

The capsid of rotavirus comprises three concentric protein layers. Two proteins (VP7 and VP4) form the capsid of the outer layer. The middle layer of the virus is composed of VP6, while the inner layer of VP2 comprises two proteins, VP1 which is RNA-dependent RNA polymerase and VP3 a viral-capped enzyme [9].

Pathogenicity of the Virus:

Rotavirus mainly causes diarrhoea in children (6 months of age) and animals, especially, bovines under 1 month after birth but it can infect adults also [10]. The pathogenic effect of rotavirus is different than other diarrheal diseases. It infects mature enterocytes and the upper portion of the villi of the small intestine in this way it damages the enterocytes of villi and crypt cells [11]. It alternates the mechanism of sodium-chloride transport, water movement inside the gastrointestinal tract, and disaccharide metabolism [12]. The rotavirus causes lactose intolerance in infected individuals. This way energy production decreases inside the body of animals and humans [13]. The patient feels extreme weakness during the diarrheal period. The patient's skin starts drying [14]. Dehydration, loss of appetite, dullness and pain in the lower abdomen start after four days of viral infection [15].

Clinical Manifestations and Diagnosis of the Virus:

Rotavirus infection starts during two days of exposure in a viral environment. During infection first-week fever, diarrhoea and vomiting are common as in other diarrheal infections. In healthy adults, rotavirus shows no or rare signs in the first week. The rotavirus antigen test is used in laboratories for rotavirus detection. The feces of an infected person are taken to detect the virus by dying strips, respective, color changes give positive results [16]. If rotavirus is left untreated for one week it causes severe loss of minerals and salt which results. The patient is treated by intravenous fluid and if the excess amount of fluid is lost it may cause death [17]. Cleanliness is important during the treatment of rotavirus.

Zoonotic Aspects of the Virus:

However, rotavirus strains are somehow different based on the genomic sequence of animals and humans due to reassortment of the genomic segments allowing the virus to multiply and mutate rapidly to produce new strains. These new strains cooperate with other species' genomic sequences to infect them. This means the rotavirus can jump from animals to humans and, therefore, is classified as a zoonotic- virus [18].

***Lactobacillus* Effect on Virus:**

Lactobacillus is found mainly in dairy products, especially yogurt and fruits [19]. It works in acidic PH and helps digestion by breaking lactose into lactic acid. Inside the gastrointestinal tract, it helps to increase the action of various enzymes that work on acidic PH [20]. It helps food digestion and maintains the mucous composition of the digestive system. It strengthens the tight junctions that seal the intestinal tract. These tight junctions block pathogenic microbial mobility inside the host cell. Similarly, in rotavirus, *Lactobacillus* neutralizes the effect of antibodies, especially rotavirus outer protein (VP4) [21]. It produces mucous and forms the mucosal barrier of the small intestine during viral infection, so curd is usually recommended during extreme diarrheal diseases [22].

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