Probiotics- A new diabetes management tool

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Abstract

Diabetes mellitus is commonly known worldwide by the name of diabetes which occurs in all age groups. About >90% of diagnosed patient specially are Type-2 diabetes. The hallmark of Type 2 diabetes developments is increased insulin resistance, whereas Type 1 is related to less production of insulin which leads to uncontrolled hyperglycemia. Hyperglycemia slowly produces mild-to-very serious complications in patient mainly affecting vital organs such as blood vessels, eyes, neurons, nephrons, heart, and brain which increase the risk of heart attack, retinopathy, nephropathy, neuropathy, and stroke. Proper management of hyperglycemia is a key to prevent from diabetes and its complications. This concept has attracted many researchers to target various cells and tissue through special remedy so that hyperglycemia can be managed and complications can be reduced. The patient shows numerous side effects during therapy. There is craving demand for the proper cure of diabetes by sufferers. In this aspect, probiotics can be more helpful if proper research and formulation are done. Probiotics are good microorganism which can control hyperglycemia and its complications by utilizing and modifying glucose before absorption. Appropriate research is required to make strategy for searching and formulating good microorganism to be used as probiotics for the regulation of blood glucose and prevention from complexity.

Key words: Diabetes, hypoglycemia, nephropathy, neuropathy, probiotics, retinopathy

INTRODUCTION

Diabetes mellitus Type 2 (DM2) is the world’s fastest growing metabolic disorder and is concerned with adult patients with obesity. The uncontrolled hyperglycemia can lead to various complications of microvascular which develop into retinopathy,¹ nephropathy,² as well as neuropathy.³ Similarly, macrovascular chronic disorder emerges as coronary heart disease, hypertension, and related complications.⁴ The management of hyperglycemia is quite helpful to control those various complications.⁵ It is the main target of many researchers to control hyperglycemia in DM2. If we limit the absorption of glucose in the intestines, then hyperglycemia can be managed.⁶ To limit the absorption of glucose in the intestine, an attempt to change the microflora of intestine can be done with those which utilize glucose only [Figure 1]. The use of probiotics in regular basis before a meal may increase the population of those microbes which may use glucose only as a sole source of energy. The microbes as probiotics may oxidize glucose through anaerobic glycolysis into lactic acid which can be absorbed in the blood. The lactic acid can be transported to the muscles, brain, liver, and kidney for energy production.⁷

The probiotics can be made in such a way that its microbes may optimally grow at intestinal environments. After they oxidize glucose into lactic acid, the pH might be changed which may suppress their own or other gut microbiota (GM) optimal growth or may be excreted out through fecal material. This review suggests researcher to prepare special probiotics that may not harm the consumer if taken orally [Figure 2]. The good probiotics that decrease the amount of glucose absorption in the intestines will be supposed to be a better way of management of hyperglycemia with respect to many drugs that have various side effects after their intake. Their use might be much economic than those of various chemical drugs.⁸

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The use of probiotics might interfere with the metabolic pathway of diabetic patients. There can be enhanced partially reversed Krebs cycle, enhanced gluconeogenesis, enhanced oxidation of fatty acids, and enhanced ketogenesis. This will burn excess fat from the patient body. The blood glucose level might be normal since the dietary glucose will be utilized by probiotics before its absorption. The source of glucose in the blood will be arranged through gluconeogenesis pathway, and little amount may come through dietary absorption.

The use of probiotics may produce no harm to the patient as it would be the body normal microflora only. If anyone uses it, there may be the managed blood glucose level and fewer complications which can be further controlled by other means of treatment.

Small intestine is a house of many normal floras. Bacterial population in gut varies from person to person. The reason for this variation is stress, obesity, lean, physical and mental work, intake of vegetarian and non-vegetarian food, weather, and environment. The most common bacteria are the members of Bifidobacterium and Lactobacillus. More than 90% of GM has been recognized as Bifidobacterium spp. in the infant’s colon which gradually decreases in grown person and old-aged people. Imbalance in normal flora population leads to several metabolic complications.

**PROBIOTICS AND ITS ROLE**

The credit for describing probiotics first goes to Lilly and Stillwell who defined probiotic in 1965 that a substance like antibiotics
specially synthesized by few microorganism which has a tendency to encourage the growth of other microorganism. In 1974, Parker further added his thought that probiotics represent both microorganisms and their products which promote microbial balance in the host intestine to produce health-related benefits. In 1989, the probiotics were understood as microorganisms in living form but not their products which produce useful effects in the intestine. In 1992, probiotics were recommended as live microorganism in mix or pure form that produces beneficial effects on the host. Once more, proper explanation of probiotics was established as consumption of microbial preparation in live form can produce several useful effects on host health by improving gut microbial community. This was further simplified as microbes consumed for a health effect can be considered as probiotics. These days, probiotics are known as “live microorganisms, when administered in adequate amounts confer a health benefit on the host.”

Few research studies have claimed that regular utilization of lactic acid bacteria through fermented dairy products has potential to improve health and longevity in people. At present, the use of genetically modified lactic acid bacteria has been suggested to deliver compounds of health interest.

Most common microorganism suggested to be used as probiotics are Lactobacilli, Lactococci, bifidobacteria, Streptococci (Enterococci), yeast (Saccharomyces boulardii), and Escherichia coli. These organisms should be non-pathogenic, should resist adverse pH of gastric as well as intestinal juices, and they should survive in gut for longer periods if taken orally. Bifidobacteria and Lactobacilli spp. growth promotion in the gut has benefited many patients with allergic disorders. GM has been getting worldwide attention day by day to recognize their specific health benefits. Their administration has been found to reduce occurrence of various unwanted complications such as eczema, dermatitis, lactose intolerance, irritable bowel syndrome, peptic ulcers, traveler’s diarrhea, and autoimmune disorders in human subject. Since there is no appropriate harmony specifying particular bacterial groups that affect individual health. Hence, more research is required to search a specific set of organism that specifically can target particular disease.

**ADVERSE EFFECT OF PROBIOTICS**

Many reports have shown undesirable effect of microbial preparation when used for therapeutic purpose. Hence, it has become important to choose right microorganism through right protocol to make specific probiotics and propose specific dose for therapeutic point.

**ROLE OF PROBIOTICS IN OBESITY**

Intake of high energy diet and stagnant lifestyle are thought to be major contributors in obesity development since long time. However, recent advancement in knowledge had identified another important factor responsible for causing obesity which gradually leads to fatty liver, cardiovascular diseases, and DM2. Researchers now believe that few group of microbiota in gut has emerged as a causative agent to induce obesity in individual. A study in animal model has shown that obese microbiota gathers comparatively more energy from diet than normal microbiota which are considered prime factor to cause obesity. GM in obese individual promotes carbohydrates fermentation, glucose absorption, and SCFA production which ultimately increase substrates for lipogenesis in the liver and fat storage in adipose tissue. This leads to obesity.

**ROLE OF PROBIOTICS IN DIABETES MANAGEMENT**

Bifidobacteria and Lactobacilli have been thought to pretense efficacy for the management of hyperglycemia in DM. Bifidobacterium genus is Gram-positive, rod shape, non-motile, non-spore forming and anaerobic organism. Several species of bifidobacteria colonize intestinal tract in many animal species. Most of the complex carbohydrates if not digested properly in the small intestine usually reach intact in the colon. On the contrary, after proper digestions, simple sugars and disaccharides are absorbed in small intestine. Bifidobacteria are able to use galacto, manno-, and fructo-oligosaccharides, at different levels and with different intensities. These differences can be due to the individual nature of each strain, since strains belonging to the same species, and originated from different culture source, have different patterns of carbohydrate fermentation.

Bifidobacterium degrades hexoses only and exclusively by the fructose 6-phosphate pathway. The “bifid shunt” generates acetyl phosphate and erythrose 4-phosphate. The final product of the fermentation generates glyceraldehyde 3-phosphate that further enters to the Embden-Meyerhof-Parnas pathway. The organic acid that produces at the end always differs between the exponential and the stationary phase and between different members of the genus. For example, in Bifidobacterium animalis, acetic acid production is similar in both phases, but lactic acid production is remarkably high in the early stages of the fermentation, and later it decreases.

It has been recorded that most of the strains which belong to Bifidobacterium species are able to degrade D-glucosamine, D-galactosamine, amylose, and amylopectin. Similarly, Bifidobacterium bifidum and Bifidobacterium infantis can ferment D-glucuronic acid, whereas B. longum ferment arabinogalactans and gums. B. infantis, Bifidobacterium Breve, and Bifidobacterium pseudocatenulatum have been found fermenting L-fucose effectively. However, few strains which are isolated from animals have shown less fermentation activity. These showed the diversity in the
capacity of carbohydrate catabolism within the species of *Bifidobacterium* genus.

Recent studies have forwarded the idea of combination therapies for effective treatment of metabolic diseases.[56] This concept can be used in probiotics preparations by selecting multiple microorganisms which show unique metabolic property. This may help in the development of new therapeutic agent for efficient hyperglycemic management in DM along with benefiting other lifestyle diseases.

**DISCUSSION**

It has been suggested that depletion of normal flora of human body may trigger health-related issue. When the microbial ecosystem become imbalance (dysbiosis) in human gut, unwanted microorganism is believed to grow more that may create situations of illness and complications. Dysbiosis may slowly lead to metabolic disorders such as DM, cardiovascular diseases, and stroke, in which most affected part will be nephrons, neurons, and retina.[57] There are no medications available in the market to counteract these complications. New treatment strategies need to be developed to overcome these health-related issues.[56] Hence, selection of novel microorganism and its preparations for using as probiotics has become a critical demand in health care which has attracted attention of many researchers to identify and study their biological effect.[56]

**CONCLUSION**

The available antidiabetics have some serious side effects, and there are no medicines available to manage the secondary complications. No mechanism of action has been reported for a number of pure phytochemicals, and it is essential to understand the antidiabetic effect as well as their mode of action. Phytochemicals might be a good alternative to chemically synthesized drugs to overcome these problems because of their natural origin. Free radicals play a major role in the secondary complications of diabetes. There are very few reports available on the performance of a combination of probiotics. Combination therapy using probiotics along with few drugs is a new therapeutic strategy for managing diabetes and its complications. The antidiabetic effects of probiotics alone and in combination can be validated in an animal model to make effective remedies for diabetes.

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