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Review Article

Prebiotics and their activity for the handling of diabetes: Literature review

Abstract

Prebiotics are non-digestible substance that provides a positive physiological effect by selectively stimulating the growth or action of a limited number of indigenous bacteria in the host. From previous decade there is increase in public interest and demand for the development of new product and prebiotics formula to improve quality of life. Prebiotics are also used to treat type 2 diabetes by activation of receptors and microorganism recognition in the intestinal lumen. Assumed as pivotal role for treatment of metabolic disorders including major potential for intestinal microflora perspective. Also result in improvement of insulin sensitivity and reduction of autoimmune response. However, further researches are required to clarify whether the administration of probiotics can be proficiently used for the prevention and treatment of type 2 diabetes.

Introduction

A prebiotics are fermented component that makes specific changes, both in composition and activity of gastro intestinal tract (GIT) microflora that provide benefit for host. Particular prebiotics are fructooligosaccharides (FOS), galactooligosaccharide (GOS), lactulose, polydextrose and inulin. While other dietary fiber also include in the list of prebiotics that are Larch arabinoglactin, resistant starch, beta-glucans, Xylooligosacchrides (XOS) [1,2].

Present naturally in diet & having bifidiogenic effect- that increase the activity level bifidobacteria and lactic acid bacteria; have beneficial effect on host like improving digestion, enhancing mineral absorption and strengthen the immune system [3,4].

In Supermarket huge variety of baby formulas present that function as prebiotics for growth and development of baby. Some of them are iron fortified while other is essential fatty acid like Arachidonic acid (ARA) and docosahexaenoic acid (DHA); necessary for child optical, cognitive and brain development. Infant formulas are lactose free for lactose intolerance baby and while some lactose rich formulas are also available in the market. Choosing a best infant formula based on composition and effect on baby health is very important.

There are different types of formula. First one is ready

to use formula that doesn't require mixing or measuring. You just have to open it and serve to newborn in the hospital and are hygiene but these formulas have short half life of 4,8 hrs. Second are powder formula are most economically and commercially use baby formula but these require time for preparing them and must follow the instruction. Last one is liquid formulas that need mixing equal parts of water with formula based on instruction prescribed on formula packing. These formulas are cheaper and require less storage space then other and expensive as compared to powdered formula.

Formula milk for babies

There are different types of formula that suit every child needs that are given below. Cow milk based formula; Cow milk is main ingredient in these babies' formulas. The manufacturer modifies the protein of the milk that's easier for children to digest. Soy-based Formula; in this brand modify the plant protein to ease its digestion and recommended when you are vegetarian or your child face problem in digesting cow based milk formula. Lactose- free formula; these are giving to child's that suffered from lactose intolerance that is rare condition. If it is detected, to the pediatrician will recommend a formula that has corn syrup instead of lactose. Extensively hydrolyzed formula; in this formula, they breakdown large protein in smaller to make easier for baby to digest. These are recommended for these babies that are difficulty in absorbing nutrient. Metabolic formula; if baby is ill and need specific nutrition then doctor recommended this metabolic formula.

Review of literature

Breast milk is ideal food for infant child and growth. In the absence of breast milk, different formula milk is given to child but these are not appropriate to fulfill the nutritional needs of the infant. Research data show that both of prebiotics and probiotics could safely add in to food is needed during first month of life. It is important to highlight the importance of healthy intestinal microflora [5]. The GIT micro flora of breastfeeding infant differ from the formula fed infants because the mother milk contain oligosaccharides prebiotics and small amount of probiotics while artificial formula does not have that property. Infants on formula milk have lower stool pH, less stool consistency and frequency while less concentration of bifidobacteria in their intestine as compared to milk feeding infants. Prebiotics formula brings infant formula one step closer to breast milk and having significance health benefits throughout the alteration of the gut microflora [6,7].

The composition of microflora is different for each individual and intestinal bacteria is of three types that are (a) lactobacilli and bifidobacteria (b) pathogenic bacteria alike some species of clostridium (c) commensal bacteria such as bacteroids that have both positive and negative behavior [8,9]. Oligosaccharide in human milk act like growth factor for bifidobacteria in the infant gut while milk oligosaccharide act as prebiotics and act as soluble receptor for gut pathogens that make resistance for pathogens that's why these are immunomodulatory [10]. Human milk oligosaccharides (HMOs) are unconjugated glycans that are similar to human milk and revealed as prebiotic "bifidus factor" serve as metabolic substrate for bacteria and shape of intestinal microflora composition. These are also suggested as antiadhesive, and antimicrobial nutrient that serve as soluble decoy receptor, reduce mucosal leukocyte infiltration, activation, and lesser the risk of enterocolitis; also offer essential nutrition like EPA & DHA for brain and cognitive development [11].

Metabolic disorder like type 2 diabetes notably undermines quality of life of individual that is linked with changes in macronutrient intake and lifestyle. Research data show that change in microflora composition constitutes one of the most likely factors in the progress of metabolic disorder. That result in increased adiposity, β cell dysfunction that improves the type 2 diabetes in the gut microflora, which refer to insulin signal stimulation [12].

Different types of microbial communities present in gut that offer payback to host with nutrient produce from food and defense form pathogens. Initially regulate by both host gene, atmosphere and also manipulate by physiology and lifelong health. Globally death rate is fall in other disease while 93% increase in total number of death in diabetes in last decades that show that there is association among diabetes and micro biome & burden is increasing further more one in there adults have diabetes by 2050 [13-15].

Prebiotics are necessary for the growth of probiotics and

play a significant role against the development of metabolic disorder like diabetes and model study on rats show that are diabetes prone rat that develops insulinitis. By altering the gut composition with the help of antibiotics lead to β cells destruction. Recent study suggest that healthy fat diet given to mice treated with antibiotics for four weeks were moderately protected against the development of diabetes [16]. Oligofructose that are prebiotics apply as antidiabetic effect and stimulate the secretion of glucagon like peptide (GLP-1). Oligofructose better the glucose tolerance, fasting blood glucose, glucose stimulated insulin secretion & insulin sensitive hepatic glucose production and reduced body weight. Oligofructose applied on high fat fed mice for 4 week and having result of therapeutic potential of increasing endogenous GLP-1 secretion for curing of type 2 diabetes [17].

Prebiotics consumption result in glucose homeostasis. The main is the life style factor, supplementation on biomarkers having good effect on the fasting glucose metabolism [18]. GOS stop the absorption of certain substances like short chain fatty acid (SCFA) and alter the GIT microflora. Healthy benefits include GIT mitigation, prevention and improvement of diabetes by altering the food ingestion, digestion, absorption and metabolism. Latest research show that prebiotics role in immunomodulation, infection anticipation [19]. Type 1 diabetes is most common disease in children having long term complication leading to disability in adults and this is due to genetic, environmental, focus on dietary intake and microflora relationship that play an important role in primary and secondary prevention of type 1 diabetes [20].

Pre-clinical studies

Gut microflora is a tool used for treating of metabolic disorder like diabetes, obesity and other disease. Alteration in the gut microflora by using prebiotics; improve gut fence functioning, metabolic endotexemia and inflammation for the above diseases [21-23]. Basically there is alteration in the occluding and zonula occludin ZO-1 result in membrane permeability and inflammation caused by prebiotics with the regulation of GLP-2 [21]. Proglucagon (GLP-2 precursor) modulate the gut microflora and increase the number of cell by enteroendocrine L cell and study show that usage of prebiotics alter bacterial taxa and more abundance relate to positively or negatively with the cell number [24].

When there is change in the gut permeability due to diabetes the body weight decrease, fat mass accumulation, insulin resistance and lipid metabolism is disturb in that case prebiotics modulate the GLP-1, peptide YY, ghrelin. This enhances the GLP-1 receptor activity and glucose homeostasis and improves in diabetes [17,21,24].

Human intervention studies

Inference on healthy individual with non digestible carbohydrate results in increase in satiety level with low food intake [25]. Prebiotics increase satiety and decrease in hunger and this describe about the change in postprandial plasma

glucose level response and gut microflora alteration due to prebiotics intake that improve short chain fatty acid and peptide level in gut microflora [26–28]. Due to this change in level of acetate, butyrate, propionate and total short chain fatty acid level in human fecal and decrease in plasma LPL level result in glucose homeostasis and regulation of food intake and gut permeability [29].

Conclusion

Result data show that there is relationship between microflora of GIT and diabetes in the child by improving the environment by intake of prebiotics and enhancement activity of probiotics in the gut. This facilitates the insulin activity in lowering the diabetes in the child and help in treatment of blood glucose level. Microflora is totally depend upon nutrient intake and dysfunction result in metabolic disorder and use of prebiotics make beneficial alteration in the gut microflora to improve glucose and lipid homeostasis.

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