[0040] The term “diabetes” shall refer to a disease that results in high glucose levels in the bloodstream.

[0041] “Cognitive function” may be defined as the mental process of knowing, including aspects such as awareness, perception, reasoning, and judgment, including but not limited to that which comes to be known, as through perception, reasoning, or intuition; knowledge. In specific embodiments, compositions as contemplated herein are provided to an individual to improve memory, including in an individual with normal or impaired memory.

[0042] The terms “food”, “food supplement”, “food product” and “food composition” mean a product or composition that is intended for ingestion by an individual such as a human and provides at least one nutrient to the individual. The compositions of the present disclosure, including the many embodiments described herein, can comprise, consist of, or consist essentially of the elements disclosed herein, as well as any additional or optional ingredients, components, or elements described herein or otherwise useful in a diet supplement.

[0043] “Prevention” includes reduction of risk, incidence and/or severity of a condition or disorder. The terms “treatment” and “treat” include both prophylactic or preventive treatment (that prevent and/or slow the development of a targeted pathologic condition or disorder) and curative, therapeutic or disease-modifying treatment, including therapeutic measures that cure, slow down, lessen symptoms of, and/or halt progression of a diagnosed pathologic condition or disorder; and treatment of patients at risk of contracting a disease or suspected to have contracted a disease, as well as patients who are ill or have been diagnosed as suffering from a disease or medical condition. The terms “treatment” and “treat” do not necessarily imply that a subject is treated until total recovery. The terms “treatment” and “treat” also refer to the maintenance and/or promotion of health in an individual not suffering from a disease but who may be susceptible to the development of an unhealthy condition. The terms “treatment” and “treat” are also intended to include the potentiation or otherwise enhancement of one or more primary prophylactic or therapeutic measures. As non-limiting examples, a treatment can be performed by a patient, a caregiver, a doctor, a nurse, or another healthcare professional.

[0044] As used herein, the term “low lactose” shall refer to a composition with less than or equal to 30% of lactose.

[0045] As used herein, the term “low sugar” shall refer to a composition with less than or equal to 55% of the sugar.

[0046] As used herein, a prophylactically or therapeutically “effective amount” is an amount that prevents a deficiency, treats a disease or medical condition in an individual, or,

comprising: 0.1-30% by weight of the lactose, 8-40% by weight of the glucose, 0.1-20% by weight of the galactose and 40-90% by weight of the galactooligosaccharide.

[0094] The improving of the immune health can comprise at least one result selected from the group consisting of: (a) protection from infections, such as viral respiratory infections; (b) protection against pathogens; (c) reducing inflammation; (d) preventing and/or attenuating oxidative stress; (e) improving intestinal barrier; (f) reducing intestinal permeability; (g) promoting growth of *Bifidobacterium*; (h) increasing *Bifidobacterium* shunt pathway; (i) increasing NAD salvage pathway; and (j) preventing and/or treating allergic asthma, (k) promoting immune homeostasis; (l) preventing and/or treating clostridium difficile infection, (m) cancer immunotherapy; (n) preventing and/or treating intestinal inflammation; (o) preventing and/or treating autoimmune diseases; combinations thereof.

[0095] The composition may further comprise 0.5-30% by dry weight of at least one of milk fat or mineral derived from milk, preferably a combination thereof. The composition *may* further comprise 5-20% by dry weight of vegetable oil.

[0096] Preferably the composition is administered in an amount effective to increase one or more metabolite levels selected from the group consisting of: 3-indole propionate, acetate, caprylic acid, nicotinamide, beta-alanine, ketone bodies, 3-hydroxybutyrate, 12,13-diHODE, indole-3-carboxylate, propionate, valerate, N,N-Dimethylglycine, tricarballylic acid, and/or 3-hydroxydecanoic acid. Preferably, the composition is administered in an effective amount to increase one or more *Bifidobacterium*, including but not limited to B. *longum*, B. *adolescentis*, B. *bifidum*.

[0097] Another aspect of the present disclosure is a method for preventing and/or treating allergic asthma, preventing and/or treating autoimmune diseases, promoting immune homeostasis, preventing oxidative stress, reducing inflammation, improving the intestinal barrier, and/or reducing intestinal permeability, the method comprising administering to an individual in need thereof or at risk thereof any of the compositions disclosed herein. The composition may be administered in an amount effective for increasing levels of 3-indole propionate or propionate in the individual. The composition may be administered to the individual in a unit dosage form, wherein the unit dosage form comprises an amount of the composition effective for increasing levels of 3-indole propionate or propionate in an individual. Research has shown that increasing propionate levels has been linked to the listed benefits (See Trompette A, Gollwitzer ES, Yadava K, Sichelstiel AK, Sprenger N, Ngom-Bru C, et al. Gut microbiota metabolism of dietary fiber influences allergic airway disease and hematopoiesis. Nat Med (2014) 20(2):159–66. doi: 10.1038/nm.3444; Zaiatz-Bittencourt V,

[00117] Table 3: Active composition

	NSC-24h	**GOS-24h**	**Composition after INFOGEST "MLG-H 24h"**
Lactose (g/L)	0	0	0
GOS (g/L)	0	4.31	4.3

[00118] Table 4: Lactose and GOS levels of compositions after INFOGEST

[00119] FIGS. 17-21 include box plots showing significant increase in production of beneficial metabolites after 24h fermentation of the composition disclosed herein by comparison to GOS alone or negative control (NSC) using batch fermentation.

[00120] Embodiments

[00121] 1: A method for improving immune health, the method comprising administering to an individual in need thereof a low sugar, low lactose, milk-based composition comprising galactooligosaccharide.

[00122] 2: The method of 1, wherein the milk based composition comprises:

milk protein, preferably at 20-40 % by dry weight of the composition; and

a mixture of lactose, glucose, galactose and galactooligosaccharide, the mixture preferably at 35-55% by dry weight of the composition;

preferably, the mixture comprising: 0.1-30% by weight of the lactose, 8-40% by weight of the glucose, 0.1-20% by weight of the galactose and 40-90% by weight of the galactooligosaccharide.

[00123] 3: The method of 1 or 2, wherein the improving of immune health comprises at least one result selected from the group consisting of: (a) protection from infections, such as viral respiratory infections; (b) protection against pathogens; (c) reducing inflammation; (d) preventing and/or attenuating oxidative stress; (e) improving intestinal barrier; (f) reducing intestinal permeability; (g) promoting growth of *Bifidobacterium*; (h) increasing *Bifidobacterium* shunt pathway; (i) increasing NAD salvage pathway; and (j) combinations thereof.