DOWNLOAD PDF POTENTIAL ANTI-INFLAMMATORY AND ANTI-INFECTIOUS EFFECTS OF HUMAN MILK OLIGOSACCHARIDES.

Chapter 1 : Inhibiting inflammation with milk oligosaccharides - Children's Hospital Medical Center

There is increasing evidence of the local effects within the gastro intestinal tract and the systemic functions of human milk oligosaccharides (HMO). In addition to the vast majority of in vitro data, animal studies underline the high potential of HMO to influence very different processes. HMO.

Advanced Search Abstract Feeding infants breast milk of healthy mothers is associated with a lower incidence of infectious and allergic diseases. Although this effect is of multifactorial origin, it is widely accepted that the entire intestinal flora of breast-fed infants provides antiinfective properties and is an important stimulating factor for the postnatal development of the immune system. The effect of human milk on the postnatal development of the intestinal flora cannot be attributed to a single ingredient. It is generally accepted, however, that human milk oligosaccharides play a key role in this matter. Apart from their prebiotic effects, there is also evidence that human milk oligosaccharides act as receptor analogs to inhibit the adhesion of pathogens on the epithelial surface and interact directly with immune cells. Because of their complexity, oligosaccharides with structures identical to human milk oligosaccharides are not yet available as dietary ingredients. In the current search for alternatives, non-milk-derived oligosaccharides have gained much attention. As 1 example, a mixture of neutral galacto-oligosaccharides and long chain fructo-oligosaccharides have been identified as effective prebiotic ingredients during infancy. Furthermore, another class of oligosaccharides with a potential physiological benefit could be those found in animal milks. Most of the oligosaccharides detected in domestic animal milks have some structural features in common with human milk oligosaccharides. One important fact is the occurrence of sialic acids such as N-acetylneuraminic acids. However, total amounts and individual structures are still different from those in human milk oligosaccharides. Although these structural similarities between animal milk and human milk oligosaccharides are promising, further studies are needed to proove the equivalence of their function. Prebiotic effect of oligosaccharides There is a broad consensus that the intestinal flora plays an important physiological role for the host. Consequently, many attempts have been made to influence the intestinal flora by dietary interventions. In principle there are 2 major strategies for influencing the flora. One is the use of living bacteria added to the food, which must survive the gastrointestinal tract to be active in the colon probiotics 1. The second strategy is the use of dietary ingredients that are nondigestible, reach the colon, and can be used by health-promoting colonic bacteria prebiotics 2. More recently the last part of that definition has been revised. It is proposed that prebiotics have only to be resistant until they are fermented by intestinal i. Milk is a natural example of a prebiotic diet of mammals during infancy. There are several factors in milk that have been identified to influence the intestinal flora. Among these factors, the oligosaccharides are the most relevant component for the prebiotic effect of human milk 4 â€” 6. Compared with human milk, the concentration of oligosaccharides in the milk of the most relevant domestic mammals is smaller by a factor of 10 to 6. The composition of human milk oligosaccharides is very complex. The molecules are synthesized in the breast starting with lactose at the reducing end 5 , 6. This results in at least 4 groups of individually composed patterns of milk oligosaccharides based on genetic factors 7. Many different functions are attributed to human milk oligosaccharides 4 â€” 6 , 8 â€” 12 , which might explain the great variety of their structures. With respect to the influence of intestinal flora, the neutral fraction of human milk oligosaccharides seems to be the most relevant factor for the development of the intestinal flora typical for breast-fed infants 6 , Figure 1 Core structure of different oligosaccharides from milk and from galactooligosaccharides. Figure 1 View large Download slide Core structure of different oligosaccharides from milk and from galactooligosaccharides. Only a few studies on direct effects on immune function have been published so far. It is further discussed that human milk is involved in the generation of antiinflammatory mediators. In an in vitro study with human cord bloodâ€”derived T cells, human milk oligosaccharides affected the activation of T cells and cytokine production On the other hand, the acidic oligosaccharides might play an important role in the prevention of

adhesion of pathogenic bacteria on the intestinal epithelial surface 6 , Acidic oligosaccharides are also involved in reactions of the immune system such as the interaction with selectins, e. Fucosylation together with sialization of oligosaccharide may interfere with binding of selectins of the siglec family and affect important regulators of the immune system All of these effects combine to provide very effective protection against an intestinal infection and postnatal stimulation of the immune system by human milk. Composition of milk oligosaccharides of domestic animals Apart from the low concentration, the oligosaccharides in milk of commercially relevant domestic animals are much less complex and differ in structure. Although not identical, there are a few similar structural elements in the core molecules of the oligosaccharides from these animal milks Fig. In the neutral fraction of animal milk oligosaccharides, linkages to fucose are with few exceptions very rare, whereas linkages of galactose or N-acetylglucosamine are dominant. Sialic acid is the most important structural element in the acidic fraction of animal milk oligosaccharides. The relation differs between the species 6. Recent functional data on oligosaccharides The developments of new analytical techniques have significantly improved our knowledge about the structures of milk oligosaccharides 6 , Additionally, new preparation methods have been developed that allow purification of oligosaccharide structures, which is a prerequisite for identifying their biological effects More recently, also in animal milks, several different structures of oligosaccharides have been identified 6. However, there are still many questions remaining regarding the relation between the structure of oligosaccharides and their biological function. For the future it would be important to know which structural elements in human milk oligosaccharides are crucial for their effect. This will serve as a scientific basis for the selection of oligosaccharides from animal milk or other sources. Because of the complexity of the human milk oligosaccharides, it is most unlikely to find natural sources that contain oligosaccharides identical to human milk oligosaccharides. Therefore, available oligosaccharides have to be analyzed to identify those with functions similar to those of human milk oligosaccharides but that are different in their structure. Oligosaccharides from domestic animal milk could be a first choice of an acceptable and available source for molecules with biological functions close to those of human milk oligosaccharides. These functions could include prebiotic effects as well as antipathogenic effects and involvement in immune modulation. To achieve this goal, nonmilk oligosaccharides should also be considered. GOS derived from enzymatic synthesis based on lactose and FOS derived from vegetable plants are some nonmilk oligosaccharides for which the prebiotic effect has been proven in adults as well as in infants. The structure of GOS is based on lactose and has some similarities to the core molecules of human milk oligosaccharides Fig. In several clinical trials, it has been demonstrated that a mixture of GOS and FOS stimulates the entire intestinal flora of bottle-fed infants similarly to breast-feeding. This wasshown with respect to the counts of fecal bifidobacteria 20 , 21 , the distribution of the Bifidobacterium species 22 , the reduction of pathogens 23 , the fecal pattern of short-chain fatty acids 24 , the fecal pH 21 , 24 , as well as stool characteristics such as frequency and consistency 20 , 21 , Most recently, the results of animal experiments could be confirmed by clinical data in term infants. For the time being this clinically proven mixture is the only prebiotic oligosaccharide accepted by the EFSA for infant and follow-on formula The findings that oligosaccharides with a structure different from those found in human milk are able to mimic functions of human milk such as the important prebiotic effect indicate that different oligosaccharide sources can be used as functional ingredients. A better understanding of the relation between structure and biological function will provide a scientific basis for the selection of suitable oligosaccharides.

Chapter 2 : Galactooligosaccharides - The Source Natural Foods

Potential Anti-Inflammatory and Anti-Infectious Effects of Human Milk Oligosaccharides C. Kunz and S. Rudloff Abstract There is increasing evidence of the local effects within the gastro intest-.

Below is an example of isolating oligosaccharides from milk. Milk is first defatted by centrifugation to produce skimmed milk. The skimmed milk is then mixed with an organic solvent, such as acetone e. Upon centrifugation, the supernatant is collected and subjected to chromatography. Oligosaccharide-containing fractions are collected and pooled. If necessary, the oligosaccharides thus prepared can be concentrated by conventional methods, e. Milk oligosaccharides can also be isolated from skimmed milk by passing the skimmed milk through a 30, MWCO ultrafiltration membrane, collecting the diffusate, passing the diffusate through a MWCO ultrafilter, and collecting the retentate, which contains milk oligosaccharides. The glycoconjugates described herein, containing one or more milk-derived oligosaccharides, can be chemically synthesized by conjugating the oligosaccharide s to a backbone molecule e. The sugar and the backbone moieties can be associated via a covalent or noncovalent bond, or via other forms of association, such as entrapment e. The glycoconjugate described herein can contain one type of milk-derived oligosaccharide i. Alternatively, the glycoconjugate contains multiple types of milk-derived oligosaccharides. In one example, the milk-derived oligosaccharide e. Preferably, the reducing end sugar unit is N-acetylglucosamine. Peptide backbones suitable for making the glycoconjugate described above include those having multiple glycosylation sites e. Examples include, but are not limited to, amylase, bile salt-stimulated lipase, casein, folate-binding protein, globulin, gluten, haptocorrin, lactalbumin, lactoferrin, lactoperoxidase, lipoprotein lipase, lysozyme, mucin, ovalbumin, and serum albumin. Typically, a milk-derived oligosaccharide can be covalently attached to a serine or threonine residue via an O-linkage or attached to an asparagine residue via an N-linkage. To form these linkages, the sugar unit at the reducing end of the oligosaccharide is preferably an acetylated sugar unit, e. An oligosaccharide can be attached to a peptide e. In one example, a milk-derived oligosaccharide is linked to a backbone molecule via a linker. The oligosaccharide can be bonded to a linker by an enzymatic reaction, e. A number of glycosyltransferases, including fucosyltransferases, galactosyltransferases, glucosyltransferases, mannosyltransferases, galactosaminyltransferases, sialyltransferases and N-acetylglucosaminyltransferases, can be used to make the glycoconjugate described herein. More details about these glycosyltransferases can be found in U. Alternatively, the glycoconjugates described herein can be purified from milk by conventional methods e. One or more of the above-described milk oligosaccharides or glycoconjugates can be mixed with a pharmaceutically acceptable carrier to form a pharmaceutical composition. In one example, they are components of infant formulas. The oligosaccharides and glycoconjugates are effective in inhibiting inflammation and treating inflammation-associated diseases i. Inflammation is reaction of living tissue e. Exemplary inflammation-associated diseases, characterized by a local or systemic, acute or chronic inflammation, include inflammatory retinopathy e. In addition to treating the above-listed inflammatory diseases, the method of this invention is particularly effective in treating inflammatory disease of the digestive tract, including oesophatigis i. Inflammatory disease of the digestive tract also includes inflammatory bowel diseases e. To practice the method of this invention, an effective amount of the above-described pharmaceutical composition can be administered to a subject e. Effective amounts vary, as recognized by those skilled in the art, depending on route of administration, excipient usage, and co-usage with other active agents. A sterile injectable composition, e. The sterile injectable preparation can also be a sterile injectable solution or suspension in a non-toxic parenterally acceptable diluent or solvent, for example, as a solution in 1,3-butanediol. In addition, sterile, fixed oils are conventionally employed as a solvent or suspending medium e. Fatty acids, such as oleic acid and its glyceride derivatives are useful in the preparation of injectables, as are natural pharmaceutically-acceptable oils, such as olive oil or castor oil, especially in their polyoxyethylated versions. These oil solutions or suspensions can also contain a long-chain

alcohol diluent or dispersant, or carboxymethyl cellulose or similar dispersing agents. Other commonly used surfactants such as Tweens or Spans or other similar emulsifying agents or bioavailability enhancers which are commonly used in the manufacture of pharmaceutically acceptable solid, liquid, or other dosage forms can also be used for the purposes of formulation. A composition for oral administration can be any orally acceptable dosage form including, but not limited to, capsules, tablets, emulsions and aqueous suspensions, dispersions and solutions. In the case of tablets for oral use, carriers which are commonly used include lactose and corn starch. Lubricating agents, such as magnesium stearate, are also typically added. For oral administration in a capsule form, useful diluents include lactose and dried corn starch. When aqueous suspensions or emulsions are administered orally, the active ingredient can be suspended or dissolved in an oily phase combined with emulsifying or suspending agents. If desired, certain sweetening, flavoring, or coloring agents can be added. A nasal aerosol or inhalation composition can be prepared according to techniques well known in the art of pharmaceutical formulation. Suitable in vitro and in vivo assays can be used to preliminarily evaluate the anti-inflammation activity of a particular milk oligosaccharide or a combination of various milk oligosaccharides. For example, the oligosaccharide s can be tested in vitro for its ability of inhibiting secretion of pro-inflammatory cytokines e. The anti-inflammation activity can further be confirmed in an animal model e. Based on the results, an appropriate dosage range and administration route can also be determined. Without further elaboration, it is believed that one skilled in the art can, based on the above description, utilize the present invention to its fullest extent. The following specific example is therefore to be construed as merely illustrative, and not limitative of the remainder of the disclosure in any way whatsoever. All publications cited herein are incorporated by reference. Use of Human Milk Oligosaccharides for Inhibiting Intestinal Inflammation Preparation of Human Milk Oligosaccharides An oligosaccharide fraction was isolated from human milk following the method described in Chaturvedi et al. Briefly, pooled human milk was first defatted and then ethanol was added to precipitate proteins. The resultant solution was loaded onto a carbon column, which adsorbs oligosaccharides. The results thus obtained were standardized to the cell numbers i. As shown in FIG. The results thus obtained were standized to cell numbers as described above. Each OD value was normalized to the total protein amount of the corresponding organ culture. This pro-inflammatory response was significantly attenuated by HMOS. Take together, the results shown above indicate that milk oligosaccharides are effective in inhibiting inflammation. Each feature disclosed in this specification may be replaced by an alternative feature serving the same, equivalent, or similar purpose. Thus, unless expressly stated otherwise, each feature disclosed is only an example of a generic series of equivalent or similar features. From the above description, one skilled in the art can easily ascertain the essential characteristics of the present invention, and without departing from the spirit and scope thereof, can make various changes and modifications of the invention to adapt it to various usages and conditions. Thus, other embodiments are also within the claims. Claims 7 What is claimed is: The method of , wherein the composition is formulated for oral administration. The method of , wherein the composition further contains a pharmaceutically acceptable carrier and a lubricating agent. The method of claim 5 , wherein the composition further contains a sweetening agent, a flavoring agent, a coloring agent, or a combination thereof.

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Chapter 3 : Oligosaccharides from Milk | The Journal of Nutrition | Oxford Academic

Human milk contains a large variety of oligosaccharides (HMOs) with the potential to modulate the gut flora, to affect different gastrointestinal activities and to influence inflammatory processes.

Breast-feeding protects against respiratory syncytial virus infections. British Medical Journal, 2 , Breast-feeding and respiratory syncytial virus infection. British medical journal, , Elevated cytokine concentrations in the nasopharyngeal and tracheal secretions of children with respiratory syncytial virus disease. The Pediatric infectious disease journal, 18 2 , The Journal of Immunology, 9 , Simultaneous quantification of sialyloligosaccharides from human milk by capillary electrophoresis. Analytical biochemistry, 2 , Neutral oligosaccharide content of preterm human milk. British Journal of Nutrition, 82 05 , Denny Sanford Pediatric Symposia, Apr. De la Fuente et al. Vester Boler et al. De Vrese et al. Child Fetal Neonatal Ed. Von Nicolai et al. Office action for U. Final office action for U. Response to Final Office Action in U. Advisory Action in U. Parts , Wojtczak, A. Office Action for U. Response to Office Action for U. Letter requesting Interview with Examiner in U. Response after final office action for U. Applicant-Initiated Interview Summary for U. Notice of Allowance for U. Exam report in NZ Application , dated Feb. Office Action in U. Final Office Action in U. Communication for EP Appl. First Office Action in CN Communication for EP Application No. Final Office Action for U. Response to Final Office Action for U. Second Office Action in CN Response to Office Action in U. Non-final office action in U. Amendment with RCE for U. Request for Reconsideration in U.

Chapter 4 : Human colostrum oligosaccharides modulate major immunologic pathways of immature human

Immunological Effects of Human Milk Oligosaccharides. Frontiers in Pediatrics, Vol. 6, Issue., Potential anti-inflammatory and anti-infectious effects of human.

 Abstract The immature neonatal intestinal immune system hyperreacts to newly colonizing unfamiliar bacteria. The hypothesis that human milk oligosaccharides from colostrum cHMOS can directly modulate the signaling pathways of the immature mucosa was tested. Modulation of cytokine immune signaling by HMOS was measured ex vivo in intact immature fetal human intestinal mucosa. From the genes whose transcription was modulated by colostrum HMOS cHMOS , Ingenuity Pathway Analysis identified networks controlling immune cell communication, intestinal mucosal immune system differentiation, and homeostasis. The antigenic composition of the intestinal contents shifts rapidly after birth with the introduction of a plethora of novel antigens as dietary components, and as a consequence of early colonization by strains and species of microbiota novel to the newborn gut 2. This coincides with a period during which the immature neonatal intestinal mucosal immune system is hyperinflammatory 3. Subsequent immune maturation is required both for active responses to foreign antigens, and for proper control and regulation of such responses. Impaired immunological development due to preterm delivery, injury at the mucosal surface, pathogenic infection, and food allergy may disturb the ontogeny of homeostatic control of inflammatory processes, contributing to conditions such as necrotizing enterocolitis NEC 4 , 5 , pediatric inflammatory bowel diseases IBD 6 , Th2 disorders, and atopic dermatitis 6. Fortunately, human milk quenches inflammatory processes 7 , 8 and minimizes the incidence of many immune-based disorders 9. In early postnatal developing gut, milk enhances the signals that facilitate appropriate immune responses and antigenic memory 9. Moreover, human milk contains immune modulatory components and protects against development of IBD 10 , 11 , Human milk oligosaccharides HMOS are complex glycans containing a lactose moiety at the reducing end. Traditionally, up to known individual HMOS are subdivided into neutral and acidic oligosaccharides 13 , Some possess anti-inflammatory functions, including reduced leukocyte adhesion 15 , and some bind specifically to dendritic cells through the lectin receptor DC-SIGN Dendritic Cell-Specific Intercellular adhesion moleculeGrabbing Non-integrin The human milk oligosaccharide disialyllacto-N-tetraose reduces NEC-like inflammation in neonatal rats Some oligosaccharides observed in colostrum decline to undetectable levels as lactation proceeds The biologic activities of these colostrum-specific oligosaccharides had not been defined. Immature human intestine ex vivo was deemed the most relevant model for investigating effects of colostrum oligosaccharides on maturation- and inflammation-related signaling of immature intestinal mucosa of neonates. The hypothesis tested was that HMOS from colostrum directly modulate mucosal signaling in immature human intestine. This was investigated in human fetal intestine explants. Signaling was measured through RT-PCR array analysis of the cytokinerelated transcriptome, and shifts in functional patterns of expression were confirmation by antibody arrays of the corresponding proteome, and ELISA of IL-8 levels, a prototypic inflammatory cytokine of human intestinal mucosa. Immunomodulation by individual HMOS candidates was determined in cultured human intestinal epithelial cells. As shown in Supplemental Fig. This concentration represented basal expression of IL Only intestinal samples with low basal IL-8 expression retain the ability to respond to exogenous proinflammatory stimuli, and these quiescent intestinal tissues were used in these experiments. The screening criteria described in the Methods section identified 45 genes whose transcription was up-regulated by cHMOS and 11 genes whose transcription was down-regulated by cHMOS Table 1. The ten genes whose transcription was most up-regulated and down-regulated by the presence of cHMOS are listed in Fig. IL, usually considered an anti-inflammatory cytokine, also increased.

Chapter 5 : News Articles - Glycosyn LLC

Many human milk components are biologically active, including anti-inflammatory cytokines, chemokines, hormones, and growth factors 37, The natural mixture of human milk oligosaccharides alters cytokine production of T-cells from cord blood

Below is an example of isolating oligosaccharides from milk. Milk is first defatted by centrifugation to produce skimmed milk. The skimmed milk is then mixed with an organic solvent, such as acetone e. Upon centrifugation, the supernatant is collected and subjected to chromatography. Oligosaccharide-containing fractions are collected and pooled. If necessary, the oligosaccharides thus prepared can be concentrated by conventional methods, e. Milk oligosaccharides can also be isolated from skimmed milk by passing the skimmed milk through a 30, MWCO ultrafiltration membrane, collecting the diffusate, passing the diffusate through a MWCO ultrafilter, and collecting the retentate, which contains milk oligosaccharides. The glycoconjugates described herein, containing one or more milk-derived oligosaccharides, can be chemically synthesized by conjugating the oligosaccharide s to a backbone molecule e. The sugar and the backbone moieties can be associated via a covalent or noncovalent bond, or via other forms of association, such as entrapment e. The glycoconjugate described herein can contain one type of milk-derived oligosaccharide i. Alternatively, the glycoconjugate contains multiple types of milk-derived oligosaccharides. In one example, the milk-derived oligosaccharide e. Preferably, the reducing end sugar unit is N-acetylglucosamine. Peptide backbones suitable for making the glycoconjugate described above include those having multiple glycosylation sites e. Examples include, but are not limited to, amylase, bile salt-stimulated lipase, casein, folate-binding protein, globulin, gluten, haptocorrin, lactalbumin, lactoferrin, lactoperoxidase, lipoprotein lipase, lysozyme, mucin, ovalbumin, and serum albumin. Typically, a milk-derived oligosaccharide can be covalently attached to a serine or threonine residue via an O-linkage or attached to an asparagine residue via an N-linkage. To form these linkages, the sugar unit at the reducing end of the oligosaccharide is preferably an acetylated sugar unit, e. An oligosaccharide can be attached to a peptide e. In one example, a milk-derived oligosaccharide is linked to a backbone molecule via a linker. The oligosaccharide can be bonded to a linker by an enzymatic reaction, e. A number of glycosyltransferases, including fucosyltransferases, galactosyltransferases, glucosyltransferases, mannosyltransferases, galactosaminyltransferases, sialyltransferases and N-acetylglucosaminyltransferases, can be used to make the glycoconjugate described herein. More details about these glycosyltransferases can be found in U. Alternatively, the glycoconjugates described herein can be purified from milk by conventional methods e. One or more of the above-described milk oligosaccharides or glycoconjugates can be mixed with a pharmaceutically acceptable carrier to form a pharmaceutical composition. In one example, they are components of infant formulas. The oligosaccharides and glycoconjugates are effective in inhibiting inflammation and treating inflammation-associated diseases i. Inflammation is reaction of living tissue e. Exemplary inflammation-associated diseases, characterized by a local or systemic, acute or chronic inflammation, include inflammatory retinopathy e. In addition to treating the above-listed inflammatory diseases, the method of this invention is particularly effective in treating inflammatory disease of the digestive tract, including oesophatigis i. Inflammatory disease of the digestive tract also includes inflammatory bowel diseases e. To practice the method of this invention, an effective amount of the above-described pharmaceutical composition can be administered to a subject e. Effective amounts vary, as recognized by those skilled in the art, depending on route of administration, excipient usage, and co-usage with other active agents. A sterile injectable composition, e. The sterile injectable preparation can also be a sterile injectable solution or suspension in a non-toxic parenterally acceptable diluent or solvent, for example, as a solution in 1,3-butanediol. In addition, sterile, fixed oils are conventionally employed as a solvent or suspending medium e. Fatty acids, such as oleic acid and its glyceride derivatives are useful in the preparation of injectables, as are natural pharmaceutically-acceptable oils, such as olive oil or castor oil,

especially in their polyoxyethylated versions. These oil solutions or suspensions can also contain a long-chain alcohol diluent or dispersant, or carboxymethyl cellulose or similar dispersing agents. Other commonly used surfactants such as Tweens or Spans or other similar emulsifying agents or bioavailability enhancers which are commonly used in the manufacture of pharmaceutically acceptable solid, liquid, or other dosage forms can also be used for the purposes of formulation. A composition for oral administration can be any orally acceptable dosage form including, but not limited to, capsules, tablets, emulsions and aqueous suspensions, dispersions and solutions. In the case of tablets for oral use, carriers which are commonly used include lactose and corn starch. Lubricating agents, such as magnesium stearate, are also typically added. For oral administration in a capsule form, useful diluents include lactose and dried corn starch. When aqueous suspensions or emulsions are administered orally, the active ingredient can be suspended or dissolved in an oily phase combined with emulsifying or suspending agents. If desired, certain sweetening, flavoring, or coloring agents can be added. A nasal aerosol or inhalation composition can be prepared according to techniques well known in the art of pharmaceutical formulation. Suitable in vitro and in vivo assays can be used to preliminarily evaluate the anti-inflammation activity of a particular milk oligosaccharide or a combination of various milk oligosaccharides. For example, the oligosaccharide s can be tested in vitro for its ability of inhibiting secretion of pro-inflammatory cytokines e. The anti-inflammation activity can further be confirmed in an animal model e. Based on the results, an appropriate dosage range and administration route can also be determined. Without further elaboration, it is believed that one skilled in the art can, based on the above description, utilize the present invention to its fullest extent. The following specific example is therefore to be construed as merely illustrative, and not limitative of the remainder of the disclosure in any way whatsoever. All publications cited herein are incorporated by reference. Use of Human Milk Oligosaccharides for Inhibiting Intestinal Inflammation Preparation of Human Milk Oligosaccharides An oligosaccharide fraction was isolated from human milk following the method described in Chaturvedi et al. Briefly, pooled human milk was first defatted and then ethanol was added to precipitate proteins. The resultant solution was loaded onto a carbon column, which adsorbs oligosaccharides. The results thus obtained were standardized to the cell numbers i. As shown in FIG. The results thus obtained were standized to cell numbers as described above. Each OD value was normalized to the total protein amount of the corresponding organ culture. This pro-inflammatory response was significantly attenuated by HMOS. Take together, the results shown above indicate that milk oligosaccharides are effective in inhibiting inflammation. Each feature disclosed in this specification may be replaced by an alternative feature serving the same, equivalent, or similar purpose. Thus, unless expressly stated otherwise, each feature disclosed is only an example of a generic series of equivalent or similar features. From the above description, one skilled in the art can easily ascertain the essential characteristics of the present invention, and without departing from the spirit and scope thereof, can make various changes and modifications of the invention to adapt it to various usages and conditions. Thus, other embodiments are also within the claims.

Chapter 6 : Galactooligosaccharides References

Free milk oligosaccharides (OS) is a major component of mammalian milk. Swine are important agricultural species and biomedical models. Despite their importance, little is known of the OS profile of porcine milk. Herein, the porcine milk glycome was elucidated and monitored over the entire lactation.

December Issue Sugars in human milk, called human milk oligosaccharides HMOs , are associated with many beneficial effects, and as a result researchers have been attempting to synthesize these sugars. So far, researchers have mainly been able to synthesize relatively simple HMOs, but a new study describes a way to synthesize a wide variety of structurally complex HMOs. The study finds that the complex structures of HMOs affect how proteins bind to them, suggesting that these structures play an important role in the biological activity of HMOs. Human milk is rich in sugars, called oligosaccharides, which have been associated with many beneficial effects [1,2]. These human milk oligosaccharides HMOs form the third-largest component of human milk, and are known to modulate the immune system, protect against pathogens, and help establish the gut microbiome []. In the past decade, they have developed a variety of methods to synthesize these sugars [10,11]. But despite having identified hundreds of HMOs so far, researchers have only been able to synthesize a small number of them in large quantities, and the synthesized HMOs tend to have relatively simple structures. One alternative to synthesizing complex oligosaccharides is to extract them from cow milk or human milk by fractionation. Boons and others have thus been looking for ways to synthesize complex HMOs in sufficient quantities to investigate their biological mechanisms. In a new study, Boons and his colleagues describe a chemo-enzymatic strategy to synthesize a wide array of complex HMOs [12]. They previously used a different chemo-enzymatic approach to make asymmetric N-linked glycans [13]. The researchers found that the complex structures of HMOs affect how different proteins bind to them, suggesting that these structures play an important role in the biological activity of HMOs. This allowed the researchers to build complex asymmetric HMOs step-by-step, using a combination of glycosyltransferase and hydrolase enzymes. As a proof of principle, the researchers exploited the inherent selectivity of glycosyltransferase and hydrolase enzymes to create a library of 60 highly diverse HMOs with complex structures, which they used to develop a glycan microarray. They then used this microarray to test whether complex HMO structures led to differences in protein binding. Boons and his colleagues tested the binding of three glycan-binding proteins: The researchers found that complex HMO architectures had a large influence on how proteins recognized them, and the complexity of HMO structures affected the selectivity of protein binding in unanticipated ways. The new technique could provide researchers with a valuable tool to study HMOs. The newly-developed synthesis technique is well suited to studying the biological activity of individual HMOs, to find out which ones are beneficial and determine their functions. In the future, Boons is planning to create a much larger collection of HMOs and use them in additional glycan microarrays, which he hopes will help the research community study how these molecules behave in different biological systems. Being able to quickly study a wide variety of complex HMOs could help researchers identify HMOs that are useful as nutraceuticals or as therapeutics. However, using the new technique to produce HMOs at a very large scale for commercial purposes is likely to be very expensive. Oligosaccharides in human milk: A microbial perspective of human developmental biology. Cultivating healthy growth and nutrition through the gut microbiota. Potential anti-inflammatory and anti-infectious effects of human milk oligosaccharides. Adv Exp Med Biol. Glycan-dependent viral infection in infants and the role of human milk oligosaccharides. Protection of the neonate by the innate immune system of developing gut and of human milk. The role in the fine-tuning of innate immune responses. The human milk oligosaccharide disialyllacto-N-tetraose prevents necrotising enterocolitis in neonatal rats. Overcoming the limited availability of human milk oligosaccharides: Producing human milk sugars for use in formula. Synthesis of asymmetrical multiantennary human milk oligosaccharides. A general strategy for the chemoenzymatic synthesis of asymmetrically branched N-glycans.

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Chapter 7 : Human milk oligosaccharides for modulating inflammation - ABBOTT LABORATORIES

() Potential anti-inflammatory and anti-infectious effects of human milk oligosaccharides. Bioactive Components of Milk, Advances in Experimental Medicine and Biology, ed BÃ¶sze Z (Springer, New York), Vol , pp

Chapter 8 : USB2 - Inhibiting inflammation with milk oligosaccharides - Google Patents

This hypothesis is reinforced by recent research that has indicated dairy oligosaccharides may be powerful agents in reducing inflammation just as are the more complex oligosaccharides in human breast milk (12,13).

Chapter 9 : Synthesizing the Complex Sugars in Human Milk - International Milk Genomics Consortium

1. Introduction. Oligosaccharides are the third largest solid component of human milk following lactose and lipids, with concentrations reaching up to 50 g L âˆ’1 or more in colostrum to an average of g L âˆ’1 in mature milk (Kunz and Rudloff, , Kunz et al.,).