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(54) Title: METHOD AND COMPOSITION FOR PREVENTING OR TREATING DIARRHEA

(57) Abstract: Methods for preventing or treating diarrhea in a mammal by administering a therapeutically effective amount of a microbial exopolysaccharide, preferably gellan gum, to a mammal susceptible to or suffering from diarrhea.

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METHOD AND COMPOSITION FOR PREVENTING OR TREATING DIARRHEA CROSS REFERENCE TO RELATED APPLICATIONS

- [0001] This application claims priority to US Patent Application Serial No. 10/942,397, filed September 16, 2004, which is a continuation-in-part of and claims priority to U.S. Patent Application Serial No. 10/387,187, filed March 12, 2003, the disclosure of both of which are incorporated herein by this reference.

BACKGROUND OF THE INVENTION

Field of the Invention

- 10 [0002] This invention relates generally to methods and compositions for preventing or treating diarrhea and particularly to using microbial exopolysaccharides to prevent or treat diarrhea in a mammal.

Description of the Prior Art

- 15 [0003] All mammals require a healthy diet and proper digestion for continued growth and ordinary well being. However, gastrointestinal distress interferes with the ordinary digestion of food. Some of these problems can be quite serious and demand serious medical attention such as Crohn's disease; irritable bowel syndrome, other chronic conditions and the like. Others are of a less serious condition and can be essentially self-limiting such as food borne virus, intestinal flu and the like. Almost all
20 gastrointestinal disorders are accompanied by diarrhea, a loose watery stool which can be extremely unpleasant to the mammal harboring the condition or to a pet owner who must clean up after the pet evacuates, particularly if on a chronic basis.

- [0004] It has also been found that some pet foods tend to create or exacerbate diarrhea. For example, as described in U.S. Patent No. 6,280,779 issued August 28, 2001,
25 diarrhea can be a significant problem with pets consuming a "chunks and gravy" diet, hi particular, the presence of significant quantities of gum in a "chunks and gravy" diet, primarily chemically modified starches or gums, but even, to a lesser extent, ordinary natural starches and gums has been associated with diarrhea in pets. Despite numerous efforts to overcome diarrhea, there exists a need for new methods and compositions for
30 preventing or treating diarrhea.

SUMMARY OF THE INVENTION

- [0005] This invention provides methods and compositions for preventing or treating diarrhea in a mammal. The method comprises administering a therapeutically effective amount of one or more microbial exopolysaccharides to a mammal susceptible to or
35 suffering from diarrhea. The compositions comprise any microbial exopolysaccharide capable of preventing or treating diarrhea. Compositions comprising microbial

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exopolysaccharide exhibit surprisingly good results when used to prevent or treat diarrhea.

[0005A] The present invention provides a method for preventing or treating diarrhea in a mammal comprising administering a diarrhea preventing or treating amount of at least one microbial exopolysaccharide to a mammal susceptible to or suffering from diarrhea, wherein the microbial exopolysaccharide is selected from the group consisting of rhamosan, curdlan, scleroglucan, PS-10 gum, PS-21 gum, PS-53 gum, polysaccharides from *Alcaligenes* species, PS-7 gum, gellan gum, bacterial alginate, baker's yeast glycan, bacterial cellulose, 6-deoxy-hexose-containing polysaccharides, and combinations thereof.

[0005B] The present invention provides use of a diarrhea preventing or treating amount of at least one microbial exopolysaccharide in the manufacture of a medicament for the treatment of diarrhea in a mammal, wherein the microbial exopolysaccharide is selected from the group consisting of rhamosan, curdlan, scleroglucan, PS-10 gum, PS-21 gum, PS-53 gum, polysaccharides from *Alcaligenes* species, PS-7 gum, gellan gum, bacterial alginate, baker's yeast glycan, bacterial cellulose, 6-deoxy-hexose-containing polysaccharides, and combinations thereof.

[0005C] The present invention provides a kit when used for administering a microbial exopolysaccharide to a mammal comprising in separate containers in a single package or in separate containers in a virtual package, as appropriate, a microbial exopolysaccharide and at least one of (1) a different microbial exopolysaccharide, (2) one or more food components or compositions, (3) instructions for how to combine the microbial exopolysaccharides and food components to produce a food composition containing the microbial exopolysaccharides, (4) instructions for how to use the compositions of the present invention, particularly for the benefit of the mammal, (5) a gastrointestinal tract improving agent selected from the group consisting of probiotics and prebiotics, and (6) an anti-diarrhea drug.

[0005D] The present invention provides a kit when used for treating or preventing diarrhoea in a mammal comprising in separate containers in a single package or in separate containers in a virtual package, as appropriate, a microbial exopolysaccharide, wherein the microbial exopolysaccharide is selected from the group consisting of rhamosan, curdlan, xanthan gum, scleroglucan, PS-10 gum, PS-21 gum, PS-53 gum, polysaccharides from *Alcaligenes* species, PS-7 gum, gellan gum, bacterial alginate, dextran, pullulan, baker's yeast glycan, bacterial cellulose, 6-deoxy-hexose-containing polysaccharides, and combinations thereof, and at least one of (1) a different microbial exopolysaccharide, (2) one or more food components or compositions, (3)

instructions for how to combine the microbial exopolysaccharides and food components to produce a food composition containing the microbial exopolysaccharides, (4) instructions for how to use the compositions of the present invention, particularly for the benefit of the mammal, (5) a gastrointestinal tract
5 improving agent selected from the group consisting of probiotics and prebiotics, and (6) an anti-diarrhea drug.

[0005E] Throughout this specification the word "comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of
10 any other element, integer or step, or group of elements, integers or steps.

[0005F] Any discussion of documents, acts, materials, devices, articles or the like which has been included in the present specification is solely for the purpose of providing a context for the present invention. It is not to be taken as an admission that any or all of these matters form part of the prior art base or were common general
15 knowledge in the field relevant to the present invention as it existed before the priority date of each claim of this application.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

[0006] The term “anti-diarrhea drug” means any compound, composition, or drug useful for preventing or treating diarrhea.

[0007] The term “in conjunction” means that one or more of the compositions and compounds (e.g., anti-diarrhea drugs or composition components) of the present invention are administered to a patient (1) together in a food composition or (2) separately at the same or different frequency using the same or different administration routes at about the same time or periodically. “Periodically” means that the compositions, food compositions, and compounds are administered on a dosage schedule acceptable for a specific composition, food composition, and compound and that the food compositions are administered or fed to a patient routinely as appropriate for the particular patient. “About the same time” generally means that the compositions, composition components, anti-diarrhea drugs, and food compositions are administered at the same time or within about 72 hours of each other. In conjunction specifically includes administration schemes wherein anti-diarrhea drugs are administered for a prescribed period and the compositions are administered indefinitely.

[0008] The term “single package” means that the components of a kit are physically associated in or with one or more containers and considered a unit for manufacture, distribution, sale, or use. Containers include, but are not limited to, bags, boxes, bottles, shrink wrap packages, stapled or otherwise affixed components, or combinations thereof. A single package may be containers of individual food compositions physically associated such that they are considered a unit for manufacture, distribution, sale, or use.

[0009] The term “virtual package” means that the components of a kit are associated by directions on one or more physical or virtual kit components instructing the user how to obtain the other components, e.g., in a bag containing one component and directions instructing the user to go to a website, contact a recorded message, view a visual message, or contact a caregiver or instructor to obtain instructions on how to use the kit.

The Invention

[0010] In one aspect, the present invention provides methods for preventing or treating diarrhea in a mammal. The methods comprise administering a diarrhea preventing or treating amount of one or more microbial exopolysaccharides to a mammal susceptible to or suffering from diarrhea.

[0011] In another aspect, the invention provides compositions for preventing or treating diarrhea in a mammal. The compositions comprise a diarrhea preventing or treating amount of one or more microbial exopolysaccharides and optional pharmaceutically acceptable carriers.

[0012] The microbial exopolysaccharides useful in the present invention is any microbial exopolysaccharide capable of preventing or treating diarrhea. Examples of suitable microbial exopolysaccharides for use in the present invention generally include those microbial

exopolysaccharides synthesized from bacteria selected from the group consisting of *Sphingomonas paucimobilis*, *Agrobacterium biovar*, *Xanthomonas campestris*, *Alcaligenes* species, *Auricobasidium pullulans*, *Acetobacter xylinum*, *Sclerotium rolfsii*, *Schizophyllum commune*, *Saccharomyces cerevisiae* and *Sclerotium glaucum*. In some embodiments, the microbial exopolysaccharide is selected from the group consisting of rhamnan, curdlan, xanthan gum, scleroglucan, PS-10 gum, PS-21 gum, PS-53 gum, polysaccharides from *Alcaligenes* species, PS-7 gum, gellan gum, curdlan, bacterial alginate, dextran, pullulan, baker's yeast glycan, bacterial cellulose, 6-deoxy-hexose-containing polysaccharides, and combinations thereof.

[0013] In a preferred embodiment, the microbial exopolysaccharide comprises a gellan gum. Gellan gum is a linear polysaccharide made from fermentation by *Sphingomonas paucimobilis* (elodea) (ATCC31461). Industrial preparation of the gum can be carried out by inoculating *Sphingomonas paucimobilis* into a fermentation broth containing glucose, glucuronic acid and rhamnose to form a tetrasaccharide repeating unit in a ratio of 2:1:1. In its native form, gellan gum is highly acylated with 1.5 acylgroup, acetyl and glycerate, per repeating unit. Modifications of the acyl groups both in number and type can be made as long as the basic anti diarrhea activity of the gellan gum is not significantly diminished. These different forms can be obtained from CP Kelco under different tradenames including Gelrite®, K9A50 and other Kelco gellan gums including but not limited to, Kelcogel LT®, Kelcogel F, and Kelcogel LT100®. As used throughout the specifications "gellan" refers to the natural gum or acyl modified gum as long as the anti-diarrhea function is maintained.

[0014] Generally, the microbial exopolysaccharides are administered to the mammal in amounts of from about 0.05 to about 2 g/kg body weight, preferably from 0.3 to about 1.5 g/kg body weight. The microbial exopolysaccharides are administered to the mammal on a schedule suitable for the particular mammal, generally daily. When administered in a food, the microbial exopolysaccharide comprises from about 0.1 to about 4% by weight of the food, preferably from 0.2 to about 2% by weight of the food. The microbial exopolysaccharides should be present at concentrations that are not toxic or otherwise deleterious to a mammal's health. Unless otherwise specifically indicated, all weights for the compositions of the present invention are based on dry weight of a composition after all components and ingredients are admixed.

[0015] The microbial exopolysaccharides are administered to the mammal using any suitable means, e.g., oral, rectal, and the like. Preferably, the microbial exopolysaccharide is administered orally. The compositions are administered orally using any suitable form for oral administration, e.g., tablets, pills, suspensions, solutions, emulsions, capsules, powders, syrups, and palatable feed compositions (a confectionery for a human or a treat or flavored treat for an animal). In a preferred embodiment, the microbial exopolysaccharides and other elements are admixed during manufacture process used to prepare a food composition for consumption by the mammal. The microbial exopolysaccharide can be administered in a wet diet, either incorporated therein or on the surface of

any diet component, such as, by spraying or precipitation thereon. The microbial exopolysaccharide can be present in the nutritional diet per se or in a snack or a treat. It can also be present in the liquid portion of the diet such as water or another fluid. The microbial exopolysaccharide can be administered as a powder solid or as a liquid such as a gel. Any pharmaceutical carrier(s) can be employed such as water, glucose, sucrose and the like together with the microbial exopolysaccharide. Even when the cause of the diarrhea seems to be a food component, the causative component need not be removed completely or to any great extent from the diet for the microbial exopolysaccharide to be effective in combating the diarrhea.

[0016] This invention provides a variety of compositions containing microbial exopolysaccharides, e.g., foods, supplements, treats, and toys. In one embodiment, the composition is a food for animal consumption comprising one or more food components and one or more microbial exopolysaccharides. In a preferred embodiment, the food component is selected from the group consisting of meat, a meat by-product, a dairy product, and an egg product. Generally, the food component is sufficient to meet the nutritional needs of the mammal, e.g., a cat or a dog. Although both liquid and solid foods are provided, solid foods are typically preferred. Where the food is solid, the microbial exopolysaccharide may be coated on the food, incorporated into the food, or both. In another embodiment, the composition comprises an animal feed supplement. Supplements include, for example, a feed used with another feed to improve the nutritive balance or performance of the total. Possible supplements include compositions that are fed undiluted as a supplement to other feeds, offered free choice with other parts of an animal's ration that are separately available, or diluted and mixed with an animal's regular feed to produce a complete feed. The AAFCO, for example, provides a discussion relating to supplements in the American Feed Control Officials, Incorp. Official Publication, p. 220 (2003). Supplements may be in various forms including, for example, powders, liquids, syrups, pills, encapsulated compositions, and the like. In another embodiment, the composition comprises an animal treat. Treats include, for example, compositions that are given to an animal to entice the animal to eat during a non-meal time. Contemplated treats for canines include, for example, dog bones. Treats may be nutritional, wherein the composition comprises one or more nutrients, and may, for example, have a composition as described above for food. Non-nutritional treats encompass any other treats that are non-toxic. The microbial exopolysaccharide can be coated onto the treat, incorporated into the treat, or both. In a further embodiment, the composition comprises a toy. Toys include chewable and consumable toys. Possible toys for dogs include artificial bones. The microbial exopolysaccharides form a coating on the surface of the toy or on the surface of a component of the toy, are incorporated partially or fully throughout the toy, or both. In an embodiment, the microbial exopolysaccharide is orally accessible by the intended user. There a wide range of suitable toys currently marketed. See, e.g., U.S. Pat. No. 5,339,771 (and references disclosed in U.S. Pat. No. 5,339,771). See also, e.g., U.S. Pat. No.

5,419,283 (and references disclosed in U.S. Pat. No. 5,419,283). The invention encompasses both partially consumable toys (e.g., toys comprising plastic components) and fully consumable toys (e.g., rawhides and various artificial bones). The invention also encompasses toys for both human and non-human use, particularly for companion, farm, and zoo animal use, and particularly for dog or cat use.

[0017] The inclusion of a microbial exopolysaccharide in a mammal's diet is useful for reducing and/or preventing diarrhea. Specifically, the administration of microbial exopolysaccharides has been shown to prevent diarrhea in a mammal that has a tendency to have diarrhea from time to time and to reduce diarrhea in a mammal already experiencing diarrhea. In particular, for mammals experiencing diarrhea, the reduction in diarrhea can vary widely. For example, the using the compositions and methods of the present invention can result in a simple visual observation of reduction to a statistically significant reduction to a virtual elimination or rollback of diarrhea. Further, such beneficial effects have been observed in almost all etiologies that are at least partially characterized by diarrhea, including etiologies that are unknown or induced through a bacterial, viral (both preferably short term) or a dietary regimen.

[0018] In a further aspect, the present invention provides compositions having a beneficial effect on the gastrointestinal tract. The compositions comprise a diarrhea preventing or treating amount of one or more microbial exopolysaccharides and a gastrointestinal tract improving agent selected from the group consisting of probiotics and prebiotics. Probiotics are live microorganisms that have a beneficial effect in the prevention and treatment of specific medical conditions when ingested. Probiotics are believed to exert biological effects through a phenomenon known as colonization resistance. The probiotics facilitate a process whereby the indigenous anaerobic flora limits the concentration of potentially harmful (mostly aerobic) bacteria in the digestive tract. Other modes of action, such as supplying enzymes or influencing enzyme activity in the gastrointestinal tract, may also account for some of the other functions that have been attributed to probiotics. Prebiotics are nondigestible food ingredients that beneficially affect host health by selectively stimulating the growth and/or activity of bacteria in the colon. The prebiotic, fructooligosaccharide (FOS) is found naturally in many foods such as wheat, onions, bananas, honey, garlic, and leeks. FOS can also be isolated from chicory root or synthesized enzymatically from sucrose. FOS fermentation in the colon results in a large number of physiologic effects including increasing the numbers of bifidobacteria in the colon, increasing calcium absorption, increasing fecal weight, shortening of gastrointestinal transit time, and possibly lowering blood lipid levels. The increase in bifidobacteria has been assumed to benefit human health by producing compounds to inhibit potential pathogens, by reducing blood ammonia levels, and by producing vitamins and digestive enzymes. Probiotic bacteria such as Lactobacilli or Bifidobacteria are believed to positively affect the immune response by improving the intestinal microbial balance leading to enhanced antibody production and

phagocytic (devouring or killing) activity of white blood cells. *Bifidobacterium lactis* could be an effective probiotic dietary supplement for enhancing some aspects of cellular immunity in the elderly. Probiotics enhance systemic cellular immune responses and may be useful as a dietary supplement to boost natural immunity in otherwise healthy adults. Probiotics include many types of bacteria but generally are selected from four genera of bacteria: *Lactobacillus acidophilus*, *Bifidobacteria*, *Lactococcus*, and *Pediococcus*. The amount of probiotics and prebiotics to be administered to the animal is determined by the skilled artisan based upon the type and nature of the probiotic and prebiotic and the type and nature of the animal, e.g., the age, weight, general health, sex, and diet of the animal. The amount of probiotics and prebiotics to be administered to the animal is determined by the skilled artisan based upon the type and nature of the probiotic and prebiotic and the type and nature of the animal, e.g., the age, weight, general health, sex, extent of microbial depletion, presence of harmful bacteria, and diet of the animal. Generally, probiotics are administered to the animal in amounts of from about one to about twenty billion colony forming units (CFUs) per day for the healthy maintenance of intestinal microflora, preferably from about 5 billion to about 10 billion live bacteria per day. Generally, prebiotics are administered in amounts sufficient to positively stimulate the healthy microflora in the gut and cause these "good" bacteria to reproduce. Typical amounts are from about one to about 10 grams per serving or from about 5 percent to about 40 percent of the recommended daily dietary fiber for an animal. The probiotics and prebiotics can be made part of the composition by any suitable means. Generally, the agents are mixed with the composition or applied to the surface of the composition, e.g., by sprinkling. When the agents are part of a kit, the agents can be admixed with other materials or in their own package.

[0019] In another aspect, the invention provides the compositions of the present invention further comprising one or more anti-diarrhea drugs. Anti-diarrhea drugs useful in the invention are any anti-diarrhea drugs known to skilled artisans to be useful for combating diarrhea, e.g., loperamide, diphenoxylate, pancrelipase, and tincture of opium. Holistic anti-diarrhea drugs and compositions are also included in the present invention, e.g., peppermint and ginger. The anti-diarrhea drugs are administered to the patient using any method appropriate for the anti-diarrhea drug and in amounts known to skilled artisans to be sufficient to treat or prevent diarrhea. The anti-diarrhea drugs have a beneficial effect on the gastrointestinal tract by reducing the incidence or severity of diarrhea.

[0020] In a further aspect, the invention provides methods for preventing or treating diarrhea comprising administering in conjunction to a mammal susceptible to or suffering from diarrhea a diarrhea preventing or treating amount of one or more microbial exopolysaccharides and at least one of a gastrointestinal tract improving agent selected from the group consisting of probiotics, prebiotics, and anti-diarrhea drugs.

[0021] The methods and compositions of this invention are useful for a variety of human and non-human animals susceptible to or suffering from diarrhea, including avian, bovine, canine, equine,

feline, hircine, murine, ovine, and porcine animals. In some embodiment, the animal is a companion animal such as canine or feline, particularly a dog or a cat.

[0022] Specific suitable amounts for each component in a food or other composition containing microbial exopolysaccharides will depend on a variety of factors such as the species of animal consuming the composition; the particular components included in the composition; the age, weight, general health, sex, and diet of the animal; the animal's consumption rate; and the like.

[0023] In a further aspect, the present invention provides kits suitable for administering a microbial exopolysaccharide to a mammal. The kit comprises in separate containers in a single package or in separate containers in a virtual package, as appropriate, a microbial exopolysaccharide and at least one of (1) a different microbial exopolysaccharide, (2) one or more food components or compositions, (3) instructions for how to combine the microbial exopolysaccharides and food components to produce a food composition containing the microbial exopolysaccharides, (4) instructions for how to use the compositions of the present invention, particularly for the benefit of the mammal, (5) a gastrointestinal tract improving agent selected from the group consisting of probiotics and prebiotics, and (6) an anti-diarrhea drug. When the kit comprises a virtual package, the kit is limited to instructions in a virtual environment in combination with one or more physical kit components. The kit contains the microbial exopolysaccharides in amounts sufficient to prevent or treat diarrhea. Typically, the microbial exopolysaccharide and the other components are admixed just prior to consumption by a mammal. In one embodiment, the kit contains a packet containing one or more microbial exopolysaccharides and a container of food for consumption by an animal. The kit may contain additional items such as a device for mixing the microbial exopolysaccharides and ingredients or a device for containing the admixture, e.g., a food bowl. In another embodiment, the microbial exopolysaccharides are mixed with additional nutritional supplements such as vitamins and minerals that promote good health in an animal.

[0024] In another aspect, the present invention provides a means for communicating information about or instructions for (1) using the compositions of the present invention to prevent or treat diarrhea, (2) admixing and administering the microbial exopolysaccharide and the food components, and (3) using the kits of the present invention for preventing and treating diarrhea. The communicating means comprises a document, digital storage media, optical storage media, audio presentation, or visual display containing the information or instructions. Preferably, the communication is a displayed web site or a brochure, product label, package insert, advertisement, or visual display containing such information or instructions. Useful information includes one or more of (1) methods and techniques for combining and administering the microbial exopolysaccharides and/or other components and (2) contact information for mammals or their caregivers to use if they have a question about the invention and its use. Useful instructions include amounts for mixing and administration amounts and frequency. The communication means is useful

for instructing on the benefits of using the present invention and communicating the approved methods for administering the invention to an animal.

[0025] This invention is not limited to the particular methodology, protocols, and reagents described herein because they may vary. Further, the terminology used herein is for the purpose of describing particular embodiments only and is not intended to limit the scope of the present invention. As used herein and in the appended claims, the singular forms "a," "an," and "the" include plural reference unless the context clearly dictates otherwise, e.g., reference to "a microbial exopolysaccharide" includes a plurality of such microbial exopolysaccharides.

[0026] Unless defined otherwise, all technical and scientific terms and any acronyms used herein have the same meanings as commonly understood by one of ordinary skill in the art in the field of the invention. Although any methods and materials similar or equivalent to those described herein can be used in the practice of the present invention, the preferred methods, devices, and materials are described herein.

[0027] All patents, patent applications, and publications mentioned herein are incorporated herein by reference to the extent allowed by law for the purpose of describing and disclosing the compounds and methodologies reported therein that might be used with the present invention. However, nothing herein is to be construed as an admission that the invention is not entitled to antedate such disclosure by virtue of prior invention.

Examples

[0028] This invention can be further illustrated by the following examples of preferred embodiments thereof, although it will be understood that these examples are included merely for purposes of illustration and are not intended to limit the scope of the invention unless otherwise specifically indicated.

Example 1

[0029] Twelve adult domestic shorthair cats (eight males and four females) with chronic diarrhea were placed on a canned control and test diet. The diets were similar in composition except for the substitution of the 0.2% Kelgum with 1% gellan gum blend (37% gellan gum, 33% sucrose, 18% calcium lactate) or 0.4% pure gellan gum. During the study the cats which were normally on prednisone were weaned off the prednisone 5 days prior to starting the study. The composition of the diets is shown in Table 1.

Table 1

	Control	Test
Nutrient	% of diet	% of diet
Protein	8.24	7.94
Fat	9.58	9.85
Crude Fiber	0.3	0.2

Moisture	72.7	72.6
Ash	2.05	2.11
Calcium	0.5	0.5
Magnesium	0.024	0.024
Phosphorus	0.28	0.26
Phosphorus	0.28	0.26
Potassium	0.22	0.24
Sodium	0.073	0.094
Chloride	0.22	0.23

[0030] In a double crossover design, 6 cats were fed the control diet and 6 cats were fed a test diet for 14 days followed by a washout period of another 14 days when all cats in the study were fed a washout diet. The cats were then crossed over to either the control or test diet for another 14 days. Stools were observed and graded every day during the study. Stools were observed for the physical condition and graded based on the physical nature of the fecal matter. Grades were assigned a number ranging from 1 to 5 as follows:

- Grade 1: Greater than two-thirds of the feces in the defecation are liquid. The feces have lost all form, appearing as a puddle or squirt.
- Grade 2: Solid-liquid feces are an intermediate between soft and liquid feces. Approximately equal amounts of feces in defecation are soft and liquid.
- Grade 3: Greater than two-thirds of the feces in a defecation are soft. The feces retain enough form to pile but have lost their firm cylindrical appearance.
- Grade 4: Firm-soft feces are an intermediate between the grades of firm and soft. Approximately equal amounts of feces in a defecation are firm and soft.
- Grade 5: Greater than two-thirds of the feces in a defecation are firm. The feces have a cylindrical shape with little flattening.

[0031] Generally, Grades 1 and 2 are unacceptable while Grades 4 and 5 are preferred.

[0032] Results show that there was a significant decrease in the frequency of stool scores 1 and 2 with consumption of the test diet compared to control diet. In particular, 23% of the feces from cats consuming the control diet had a stool score of 1 or 2 whereas only 4% of the feces from cats consuming the test diet scored a 1 or 2. Further, there was a large increase in the frequency of stool scores rated 4 and 5 from cats consuming the test diet as compared to cats consuming the control diet. 49% of the feces from cats consuming the test diet rated a 4 or 5 whereas only 27% of the feces from cats consuming the control diet rated a 4 or 5. Prior to beginning the test diet, the average stool score was 2.7. With the test diet, the average stool score increased to 3.9.

Example 2

[0033] Twelve cats with chronic diarrhea were used in the study. Six cats were each fed test diets or control diets similar to those described in Example 1 for 14 days. The test diets differed from those described in Example 1 as they included 0, 0.2, 0.3 and 0.4% gellan gum in the formula respectively. Stools were observed daily and graded as described in Example 1 throughout the experiment. Table 2 shows the percent occurrence of the different types of stool within each diet.

Table 2

Dose of gellan (% formula)	Stool Rating				
	1	2	3	4	5
0.4	1%	2%	25%	39%	33%
0.3	0%	18%	34.5%	26%	18%
0.2	1%	17%	51%	18%	12%
0.1	0%	13%	48%	19%	20%
Control	13%	16%	47%	18%	1%

[0034] As shown below in Table 2, gellan gum at a concentration of 0.4% of the diet was able to prevent the incidence of diarrhea (stools 1-2) while at a concentration of 0.1 to 0.3% of the diet, gellan gum was able to reduce the incidence of diarrhea by 2 fold compared to control.

Example 3

[0035] Dogs fed a grocery brand chunks and gravy formula have been shown to have a significant incidence of diarrhea. This model was used to test the efficacy of gellan gum in reducing the occurrence of diarrhea in dogs. Dogs were fed the grocery brand chunks and gravy formula for 7 days in the control group. In the test group, the dogs were fed the same chunks and gravy formula with 0.4% gellan gum added to the food in the form of a gel. Stool were observed for 7 days and graded as described in Example 1. Table 3 shows the results of the test wherein adding gellan gum to the diet prevented the occurrence of diarrhea in this model.

Table 3

	Stool Rating				
	1	2	3	4	5
Control	24%	30%	24%	18%	5%
Control with 0.4% gellan	0%	0%	18%	48%	35%

Example 4

[0036] The experiment described in Example 3 was conducted using a different chunks and gravy formula for the model of canine diarrhea. Further, gellan gum was incorporated in the gravy formula at different levels. The gravy was formulated with 1% guar gum for the control and test diets. Stools were observed daily and graded as described in Example 1. The results are shown below:

Table 4

	Stool Rating				
	1	2	3	4	5
Control	18%	9%	16%	26%	31%
0.045% gellan	11%	9%	16%	28%	36%
0.1% gellan	0%	10%	15%	21%	54%
0.2% gellan	2%	11%	13%	23%	51%
0.4% gellan	0%	8%	9%	13%	70%

[0037] The results show that 0.1% gellan gum was able to decrease the incidence of diarrhea to 10% compared to 27% in the control. There were little to no incidence of a stool rating of 1 (watery diarrhea).

[0038] In the specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims. Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method for preventing or treating diarrhea in a mammal comprising administering a diarrhea preventing or treating amount of at least one microbial exopolysaccharide to a mammal susceptible to or suffering from diarrhea, wherein the
5 microbial exopolysaccharide is selected from the group consisting of rhamsan, curdlan, scleroglucan, PS-10 gum, PS-21 gum, PS-53 gum, polysaccharides from *Alcaligenes* species, PS-7 gum, gellan gum, bacterial alginate, baker's yeast glycan, bacterial cellulose, 6-deoxy-hexose-containing polysaccharides, and combinations thereof.
2. The method of claim 1 wherein the microbial exopolysaccharide comprises a
10 gellan gum.
3. The method of claim 1 or 2 wherein the microbial exopolysaccharide is administered in the form of a liquid, a solid, or a gel.
4. The method of any one of claims 1 to 3 wherein the microbial exopolysaccharide is administered orally.
- 15 5. The method of any one of claims 1 to 4 wherein the microbial exopolysaccharide is administered in the diet.
6. The method of any one of claims 1 to 5 wherein the microbial exopolysaccharide is administered in amounts of from about 0.05 to about 2 g/kg body weight.
- 20 7. The method of any one of claims 1 to 6 wherein the mammal is a canine or a feline.
8. The method of any one of claims 1 to 7 further comprising administering in conjunction at least one of a gastrointestinal tract improving agent selected from the group consisting of probiotics, prebiotics, and anti-diarrhea drugs.
- 25 9. Use of a diarrhea preventing or treating amount of at least one microbial exopolysaccharide in the manufacture of a medicament for the treatment of diarrhea in a mammal, wherein the microbial exopolysaccharide is selected from the group consisting of rhamsan, curdlan, scleroglucan, PS-10 gum, PS-21 gum, PS-53 gum, polysaccharides from *Alcaligenes* species, PS-7 gum, gellan gum, bacterial alginate,
30 baker's yeast glycan, bacterial cellulose, 6-deoxy-hexose-containing polysaccharides, and combinations thereof.
10. The use of claim 9 wherein the microbial exopolysaccharide comprises a gellan gum.
11. The use of claim 9 or 10 wherein the microbial exopolysaccharide is in the form
35 of a liquid, a solid, or a gel.

12. The use of any one of claims 9 to 11 wherein the microbial exopolysaccharide is in amounts of from about 0.05 to about 2 g/kg body weight.
13. The use of any one of claims 9 to 12 wherein the mammal is a canine or a feline.
14. The use of any one of claims 9 to 13 further comprising use of at least one of a
5 gastrointestinal tract improving agent selected from the group consisting of probiotics, prebiotics, and anti-diarrhea drugs in the manufacture of the medicament.
15. A kit when used for treating or preventing diarrhoea in a mammal comprising in separate containers in a single package or in separate containers in a virtual package, as appropriate, a microbial exopolysaccharide, wherein the microbial exopolysaccharide is
10 selected from the group consisting of rhamsan, curdlan, xanthan gum, scleroglucan, PS-10 gum, PS-21 gum, PS-53 gum, polysaccharides from *Alcaligenes* species, PS-7 gum, gellan gum, bacterial alginate, dextran, pullulan, baker's yeast glycan, bacterial cellulose, 6-deoxy-hexose-containing polysaccharides, and combinations thereof, and at least one of (1) a different microbial exopolysaccharide, (2) one or more food
15 components or compositions, (3) instructions for how to combine the microbial exopolysaccharides and food components to produce a food composition containing the microbial exopolysaccharides, (4) instructions for how to use the compositions of the present invention, particularly for the benefit of the mammal, (5) a gastrointestinal tract improving agent selected from the group consisting of probiotics and prebiotics, and (6)
20 an anti-diarrhea drug.
16. A method for preventing or treating diarrhea in a mammal comprising administering a diarrhea preventing or treating amount of at least one microbial exopolysaccharide to a mammal susceptible to or suffering from diarrhea, wherein the microbial exopolysaccharide is selected from the group consisting of rhamsan, curdlan,
25 scleroglucan, PS-10 gum, PS-21 gum, PS-53 gum, polysaccharides from *Alcaligenes* species, PS-7 gum, gellan gum, bacterial alginate, baker's yeast glycan, bacterial cellulose, 6-deoxy-hexose-containing polysaccharides, and combinations thereof substantially as hereinbefore described with reference to one or more of the Examples, excluding the comparative examples.
- 30 17. Use of a diarrhea preventing or treating amount of at least one microbial exopolysaccharide in the manufacture of a medicament for the treatment of diarrhea in a mammal, wherein the microbial exopolysaccharide is selected from the group consisting of rhamsan, curdlan, scleroglucan, PS-10 gum, PS-21 gum, PS-53 gum, polysaccharides from *Alcaligenes* species, PS-7 gum, gellan gum, bacterial alginate,
35 baker's yeast glycan, bacterial cellulose, 6-deoxy-hexose-containing polysaccharides,

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and combinations thereof substantially as hereinbefore described with reference to one or more of the Examples, excluding the comparative Examples.