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(54) Title: FOOD COMPOSITIONS INCORPORATING MEDIUM CHAIN TRIGLYCERIDES

(57) **Abrégé/Abstract:**

Food compositions comprising from about 1-60% protein, from about 1-50% carbohydrate, from about 1-40% MCT fat, and a maintaining amount of at least one MCT maintaining component, wherein the MCT from the MCT fat is integrally incorporated into the food composition and comprises from about 2-10% of the food composition. The inclusion of the MCT maintaining component permits increased amounts of MCT to be successfully and stably incorporated into the food compositions.



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(54) Title: FOOD COMPOSITIONS INCORPORATING MEDIUM CHAIN TRIGLYCERIDES

(57) Abstract: Food compositions comprising from about 1-60% protein, from about 1-50% carbohydrate, from about 1-40% MCT fat, and a maintaining amount of at least one MCT maintaining component, wherein the MCT from the MCT fat is integrally incorporated into the food composition and comprises from about 2-10% of the food composition. The inclusion of the MCT maintaining component permits increased amounts of MCT to be successfully and stably incorporated into the food compositions.

FOOD COMPOSITIONS INCORPORATING MEDIUM CHAIN TRIGLYCERIDES

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application Serial No. 60/921,412 filed April 02, 2007, the disclosure of which is incorporated herein by this reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates generally to food compositions and particularly to food compositions integrally incorporating relatively large amounts of medium chain triglycerides.

Description of Related Art

[0003] Medium chain triglycerides ("MCT" or "MCTs") are lipid molecules that have been included for various purposes in food compositions for animals or humans. MCTs have been added to "wet" foods such as canned food and other prepared food and have been used to some extent in, or as coatings on, dry food. Practical considerations appear to limit the amount of MCTs that can be used, particularly for dry foods. For example, while wet food compositions may incorporate a significant amount of MCTs, they may be subject to separation, flavor issues, and other problems. For dry foods, such as extruded and baked products, the compositions are strictly subject to limits wherein the MCTs can not be increased above a certain threshold in many products. MCTs have thus been used as a coating or surface application for such foods. Surface application, such as coating, poses practical problems for packaging and reduces consumer appeal. For example, consumption or administration of such food compositions is far more cumbersome if a coating must be poured on or mixed in at the time of consumption or if the dry food has an oily appearance or feel. In addition, large quantities of MCTs not integrally incorporated into the food matrix can cause problems with palatability and tolerance of such food compositions.

[0004] Chemically, medium chain triglycerides comprise a group of triglycerides having three medium chain length (about 6-12 carbon) fatty acid molecules esterified to a glycerol molecule. Such compositions are different, both physically and chemically, from the majority of fats typically used in food technology for formulating food products. MCTs tend to be shorter and have different functional properties for processing than their longer-chain counterparts. For example, MCTs are typically liquid at room temperature, unlike many other functional fats used by food technologists.

[0005] In addition to having different properties that must be considered for formulation of food compositions, MCTs pose other challenges for formulators. When attempting to formulate a food with a specified macronutrient content, addition of MCTs requires removal of other fat sources. Many food compositions are formulated such that the fat provides significant satiety, flavor, mouthfeel, texture, and other desirable functional qualities that the consumer is seeking from a particular food product. Thus, mere substitution of one fat for another is not a practical solution

because the formulation of a food product involves complex interactions between the various ingredients or components.

[0006] There is, therefore, a need for novel compositions and methods for solving the problems associated with incorporating MCTs into food compositions. Compositions and methods are needed to permit the inclusion of a relatively large amount of MCTs in a food composition, particularly a dry food composition, while (1) maintaining a predetermined macronutrient composition, (2) ensuring that the food composition maintains acceptable functional qualities while avoiding excessive fat mobilization or separation, (3) avoiding the need to apply the MCTs as an external coating but while allowing for the inclusion of flavor-enhancing and aroma-enhancing coatings to enhance the final product's acceptance, and (4) reducing the undesirable aspects associated with handling and packaging compositions containing MCTs.

SUMMARY OF THE INVENTION

[0007] It is, therefore, an object of the present invention to provide compositions and methods that permit the inclusion of a relatively large amount of MCTs in a food composition.

[0008] It is another object of the invention to provide compositions and methods that permit the inclusion of a relatively large amount of MCT in a food composition while maintaining a predetermined macronutrient composition.

[0009] It is a further object of the invention to provide compositions and methods that permit the inclusion of a relatively large of MCT in a food composition while ensuring that the food composition maintains acceptable functional qualities yet avoiding excessive fat mobilization or separation.

[0010] It is another object of the invention to provide compositions and methods that permit the inclusion of a relatively large amount of MCT in a food composition while avoiding the need to apply MCTs as an external coating yet allowing for the inclusion of flavor-enhancing and aroma-enhancing coatings to enhance the final product's acceptance.

[0011] It is another object of the invention to provide compositions and methods that permit the inclusion of a relatively large amount of MCT in a food composition while reducing the undesirable aspects associated with handling and packaging compositions containing MCTs.

[0012] These and other objects are achieved using novel food compositions containing from about 1-60% protein, from about 1-50% carbohydrate, from about 1-40% MCT fat, and a maintaining amount of at least one MCT maintaining component, wherein the MCT from the MCT fat is integrally incorporated into the food composition and comprises from about 2-10% of the food composition.

[0013] Other and further objects, features, and advantages of the present invention will be readily apparent to those skilled in the art.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

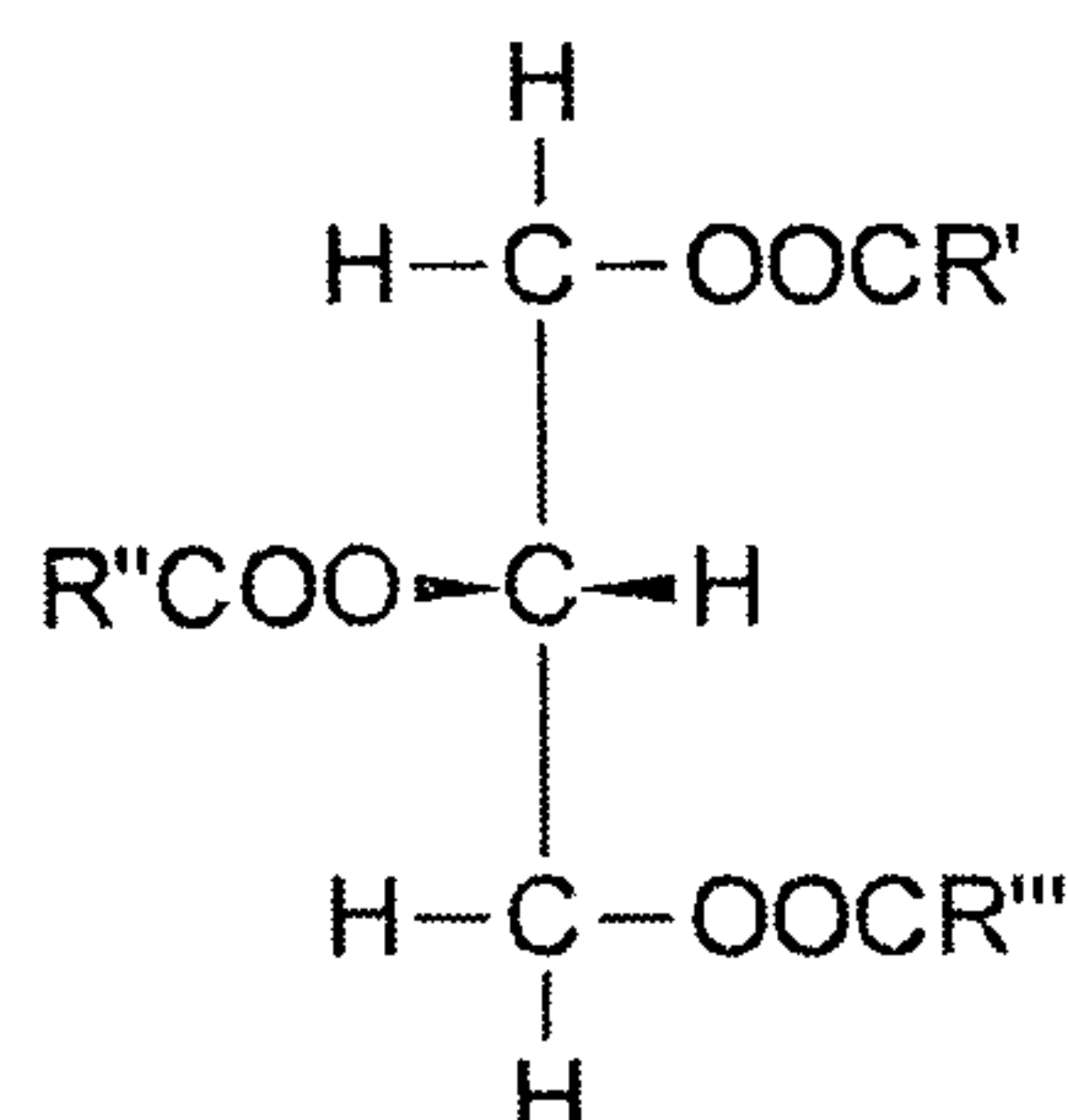
[0014] The term “food composition” includes any food, feed, snack, food supplement, treat, meal substitute, or meal replacement, whether intended for a human or an animal. Animal food includes food or feed intended for any domesticated or wild species. In preferred embodiments, a food for an animal represents a nutritionally complete food or dietary composition, e.g., a pelleted, extruded, or dry food. Examples of such animal foods include extruded pet foods such as foods for dogs and cats.

[0015] The term “food matrix” includes the physical structure of the food composition. For example, in a canned food, the matrix is the continuum of the food product that occupies the can. For a pelleted or extruded food, the matrix is that structure that forms the pellet or extruded shape. Where an ingredient or component, such as an MCT, is “integrally incorporated” into the food composition or matrix, that ingredient loses its identity and is mixed with the other ingredients or components such that it can no longer be readily distinguished as a distinct component but rather is a part of the matrix.

[0016] The term “integrally incorporated” means that a food ingredient or component is intimately admixed, blended, distributed, intermingled, or combined with other ingredients or components forming the matrix so as to become substantially less mobile, or even largely or completely integrated with, a part of, intrinsic to, or inseparable from, the bulk of the food matrix. For example, as used herein certain MCT are intrinsic to or integrally incorporated into the food matrix. These MCTs, especially in embodiments in which the food matrix is cooked or extruded, are distinguishable from MCT added extrinsically to the food composition, e.g., as a coating such as a spray-dried coating. The skilled artisan will appreciate that while the MCTs applied as a coating or otherwise may be relatively easy to remove, those MCTs that are integrally incorporated into the food’s matrix will normally require fairly rigorous means to remove, e.g., the application of chemical means or substantial physical forces such as heating. Such means generally alter or destroy the food matrix.

[0017] The term “maintaining amount” means an amount of a MCT maintaining component effective for maintaining MCTs integrally incorporated into a food composition.

[0018] The term “medium chain triglycerides” or “MCTs” means any glycerol molecule ester-linked to three fatty acid molecules, each fatty acid molecule having 5-12 carbons. MCTs may be represented by the following general formula:



where R', R'' and R''' are fatty acids having 5-12 carbons in the carbon backbone esterified to the a glycerol backbone. The structured lipids of this invention may be prepared by any process known in the art, such as direct esterification, rearrangement, fractionation, transesterification, or the like. For example, the lipids may be prepared from, or derived from, a source of vegetable oil, such as coconut oil, such as through a rearrangement process or the like. The length and distribution of the chain length may vary depending on the source oil. For example, MCTs containing 1-10% C6, 30-60% C8, 30-60% C10, 1-10% C10 are commonly derived from palm and coconut oils. MCTs containing greater than about 95% C8 at R1, R2 and R3 can be made by semi-synthetic esterification of octanoic acid to glycerin. Also useful herein are mixtures comprising MCTs with about 50% total C8 and/or about 50% total C10. Commercial sources for the foregoing MCT compositions are available and known to the skilled artisan. Such MCTs behave similarly and are encompassed within the term MCTs.

[0019] The term “MCT fat” means a fat suitable for use in food compositions that comprises at least one MCT.

[0020] The term “MCT maintaining component” means a compound or other substance capable of maintaining one or more MCTs integrally incorporated into a food composition.

[0021] The term “wellness of an animal” means the complete physical, mental, and social well being of the animal, not merely the absence of disease or infirmity.

[0022] The 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.

[0023] 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.

[0024] 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.

[0025] All percentages for weights expressed herein are by weight of the total food composition unless specifically stated otherwise.

The Invention

[0026] In one aspect, the invention provides food compositions comprising from about 1-60% protein, from about 1-50% carbohydrate, from about 1-40% MCT fat, and a maintaining amount of at least one MCT maintaining component, wherein the MCT from the MCT fat is integrally incorporated into the food composition and comprises from about 2-10% of the food composition. Preferably, the MCT comprises from about 4-10% of the food composition, most preferably from about 6-10% of the food composition. The invention is based upon the discovery that food compositions of the present invention cannot retain more than a few percent MCT in a stable manner without the inclusion of at least one MCT maintaining component. As a result, food compositions formulated or processed without these components have a tendency to be of low quality. For example, the fats readily separate or become unstable. Food compositions such as extruded foods often have improper density and volume attributes and may have low palatability. However, the inclusion of at least one MCT maintaining component can overcome these limitations and allow increased amounts of MCT to be successfully and stably incorporated into the food compositions while simultaneously improving the quality attributes of the food composition.

[0027] The protein, carbohydrate, fat, and other components in the food compositions comprise any of a variety of ingredients or combinations thereof selected for their contributions to the overall composition. Thus, a skilled artisan may choose from among natural, e.g., plant or plant-derived, animal or animal-derived, and microbial or microbially-derived, and synthetic ingredients or components. In particular embodiments, the ingredients may include cereal grains and fractions or components thereof, including corn, wheat, rice, barley, sorghum, millet, oats, rye, triticale, buckwheat, fonio, quinoa, lupines, soybean meal, soybean protein, soybean fiber, and the like. Also, the ingredients may include meat and meat by-products such as poultry such as chicken, lamb, sheep, veal, beef, pork, fish, shellfish, or other seafood. The ingredients may include other animal products or by-products such as dairy products or by-products derived from the milk of any mammal species, eggs from any source, vitamins, minerals, salts, sweeteners, sources of fiber whether soluble or insoluble, flavoring or other palatants, coloring, and functional ingredients such as emulsifiers, stabilizers, softeners, functional coatings, and the like. Other important components or ingredients include fats such as vegetable or animal fats generally available for formulating food compositions.

In one embodiment, the source of fat is a plant fat such as corn, soy, or canola oil. In another embodiment, an animal fat such as tallow is useful for providing calories from fat and providing an enticing flavor to meat-eating animals. Of course, combinations of any of the foregoing ingredients, such as fats, are known in the art and useful for optimizing the food compositions based on functional properties as well as price and availability.

[0028] In formulating the food compositions, the compositions may vary slightly to consider the price and availability of certain ingredients in the compositions and the batch to batch variation in the analysis of certain ingredients. Thus, a given composition may vary slightly from batch to batch, plant to plant, or even season to season depending on such factors. Notwithstanding such variation in specific ingredients selected for manufacturing a particular batch of a food composition, the overall composition (for example analysis of protein, carbohydrate, fat, fiber, or other component) may be held constant or at least substantially constant, e.g., in accordance with a label requirement such as a claim or guarantee of a minimum or maximum percent of a particular component.

[0029] The MCT maintaining component comprises one or more of a component that alters the structure of water in the composition, a component that binds fat in the food composition, or a component that emulsifies or stabilizes the fat in the food composition, or combinations thereof. Such components include components that bind water in a food matrix, bind fat, emulsify fat, stabilize emulsions of water and fat, or similarly maintain the MCT in association with the food matrix. By using one or more such components, the food matrix can contain from about 20-50% more MCT than a comparable formulation that simply has MCT added to the formulation or has one or more sources of fat replaced with MCT without the use of such components. Thus, these components share the property of allowing the food composition to retain a relatively large amount or percentage of MCT per unit weight or unit volume. Including one or more such components increases the actual retention of MCT in the food matrix and, in some embodiments, provides improvements in other functional properties such as maintaining desirable density, volume, texture, hardness, crunchiness, or the like in foods such as extruded food compositions.

[0030] In one embodiment, the MCT maintaining component is starch, fiber, gluten meal, protein, an emulsifier, or a stabilizer. Also useful for the food compositions are gums and gelling agents. All such components are known in the art for inclusion in food compositions. However, the use of such components in a food composition specifically for the purpose of maintaining added MCTs integrally incorporated into the food composition is not known. Such components may be from any source whether natural or synthetic. Natural source includes all such sources whether animal, vegetable, or microbial in nature. For example proteins useful herein are potentially obtained from wither animal or vegetable sources, with vegetable sources currently preferred. Such proteins need not be isolated or purified, although fractions or partially purified proteins are compatible for use herein. Starches, or starch-like molecules, as well as gums, can also be from a variety of

photosynthetic sources in the plant or microbial kingdom. Presently preferred are plant starches including those from any plant including tubers, vegetables, or seeds. Examples include corn, rice and other cereals, potato and other tubers, as well as cassava, manioc, tapioca, and others. Also included are purified and partially purified fractions, as well as partially-digested starch products, such as dextrans, maltodextrins and the like, whether branched or unbranched. Various sources of fiber are also compatible for use herein, including but not limited to cellulose, psyllium, citrus fiber and the like. Examples of these are described in more detail herein.

[0031] In one embodiment, the MCT maintaining component comprises a component, fraction, or ingredient derived from a cereal crop. The component can comprise a classified product, or an end-product or by-product of milling of a cereal crop or cereal grain. For purposes used herein, the cereal is comprehensive of all plants recognized as “cereal” crops, whether currently used in commercial agriculture or merely known practically or botanically as being a “cereal.” For example, “cereals” includes corn, wheat, rice, barley, sorghum, millet, oats, rye, triticale, buckwheat, fonio, quinoa, lupines, soybean meal, soybean protein, and soybean fiber. The skilled artisan will appreciate that in a given food composition, it not uncommon to use one or more such cereal products.

[0032] In another embodiment, the MCT maintaining component comprises gluten meal. Preferably the gluten meal for use herein comprises from about 60-95% protein. In various embodiments, the gluten meal comprises at least about 65%, 70%, 75%, 77%, 79% to about 80% protein, or more. The gluten meal can be as a complete or partial replacement for one or more other components in a formulation. For example, a primary or secondary cereal ingredient in a formulation can be replaced by the gluten meal. In one embodiment, the gluten meal is added at 5, 10, 15 or even 20%. In one presently preferred embodiment, the gluten meal is a commercially-available corn gluten meal added at up to about 14%.

[0033] In certain embodiments, the character of a food composition is known according to the identification of one or more of its cereal components, e.g., one composition may feature lamb and rice, chicken and rice, or the like. In such instances, it may be preferable to leave the primary or label identified cereal component as is in the formulation and replace a secondary or tertiary cereal component in the formulation with the functional component for maintaining the MCT integrally incorporated into the food. Alternatively, the skilled artisan can formulate the product replacing a portion or all of any of the cereal components present while preserving the overall character of the product.

[0034] In another embodiment, the MCT maintaining component comprises starch or a starch product. In one embodiment, the component is a starch obtained from a cereal product, e.g., rice starch, corn starch, or a combination thereof. The starch ingredient can be added to replace a portion or all of another cereal component in a base formula, for example, a primary or preferably secondary, tertiary (or lesser) cereal component. In various embodiments, one or more such starches

can be added at up to about 5%, alone or in combination. A functional starch ingredient, e.g., one or more starches, may also be used in combination with a functional gluten meal such a high-protein gluten meal having about 75% to 80% or more protein, to accomplish the function of maintaining the MCTs integrally incorporated into the food composition, e.g. in the food matrix.

[0035] In a further embodiment, the MCT maintaining component comprises fiber from soy. In one embodiment, the fiber is from soy cotyledons. Soy fiber can be added to a food composition or can be used to replace one or more ingredients in an existing formulation. The soy fiber can be added for example at up to about 5%.

[0036] In one embodiment, the food compositions comprise one or more of soy cotyledon fiber at up to 5%, starch from corn or rice at up to 5%, gluten meal having at least about 75% to about 80% protein at up to about 14%, or any combination thereof. Such compositions may be preferred by skilled artisans because they provide maximum flexibility in developing new compositions with the desired properties. For example, the artisan can take price and availability in a given market or manufacturing facility into consideration while considering the functional properties of maintaining the MCT integrally incorporated in the food composition and the effect of the formulation on flavor, texture, and processing properties such as extrusion properties.

[0037] In a preferred embodiment, the food compositions comprise a macronutrient composition suitable for the type of food being designed. In one embodiment, the food composition has from about 20-32% protein, about 30-50% carbohydrate, about 5-20% fat, and about 15-25% moisture. In another embodiment, the food composition is a pet food composition, e.g., a premium or super-premium pet food composition. In one embodiment, the pet food is formulated for canines and has a protein content of about 20-30%, preferably about 24-28%, and more preferably about 25-27%. In one embodiment the protein content of a dog food composition is about 26%. In another embodiment, the formulation is for felines and has a protein content of about 35-45%, preferably about 37-42%, and more preferably about 39-41%. In one embodiment the protein content of a cat food composition is about 40%.

[0038] In another aspect, invention provides food compositions comprising at least one MCT integrally incorporated into the food matrix as described herein and at least one MCT not integrally incorporated into the food matrix. Generally, the MCT not integrally incorporated into the food matrix is applied to the surface of the food composition, e.g., as a coating applied after the composition is produced, manufactured, formed, or shaped. The compositions comprise from about 2-15% total MCT (MCT integrally incorporated into the food composition plus MCTs not integrally incorporated into the food matrix). In various embodiments, the compositions comprise from about 4-15%, 6-15%, 8-15%, and 10-15% total MCT. Such compositions are useful for producing a significant quantity of MCTs for the consumer while not substantially impacting the perceived

quality of the composition, e.g. flavor, texture, etc., or its acceptance, e.g. palatability and mouthfeel.

[0039] In one embodiment, the food composition has from about 2-10% MCT integrally incorporated in the composition and from about 5-13% MCT not integrally incorporated in the composition. Preferably, the composition has 3-9%, 4-8%, 5-7% MCT incorporated integrally and any further MCTs applied to the surface of the composition. In one embodiment, the food composition is an extruded composition containing integrally incorporated MCTs and a coating of MCTs applied after extrusion. In various embodiments, the coating has about 2 to 7% MCTs. The coatings useful herein can further comprise one or more flavor enhancing agents, palatability enhancing agents, aroma enhancing agents, and color enhancing agents. For pet food applications, meat and/or fish flavorings are useful and can be combined with the MCTs. Also useful are palatants such as tallow and other compounds that enhance the overall palatability of the food.

[0040] In one embodiment, the food composition is a wet food such as a canned food, frozen food, or fresh food product. In one embodiment, the food composition is shelf stable and in another it must be refrigerated. In other embodiments, the food composition is an intermediate moisture product or a dry food product. Dry food products include a variety of foods of various moisture contents such that they are relatively shelf-stable and resistant to microbial or fungal deterioration or contamination. Presently preferred are dry food compositions that are extruded food products such as pet foods or snack foods for either humans or companion animals.

[0041] In a further aspect, the invention provides processes for manufacturing the food compositions of the present invention. The processes comprise (a) combining, directly or indirectly, at least a first portion of at least one MCT with a MCT maintaining component prior to a processing operation; (b) processing the food composition; and (c) adding a second portion of at least one MCT to the processed food composition as a coating or surface treatment.

[0042] In one embodiment, the processes are for manufacturing a food composition comprising from about 1-60% protein, from about 1-50% carbohydrate, from about 1-40% MCT fat, and a maintaining amount of at least one MCT maintaining component, wherein the MCT from the MCT fat is integrally incorporated into the food composition and comprises from about 2-10% of the food composition. Preferably the total MCT comprise about 2-15% of the food composition.

[0043] In one embodiment, the MCT is combined with one or more ingredients or combinations of ingredients prior to processing operation or manufacturing step. For example, the MCT could be combined with other liquid ingredients, or may be combined with dry ingredients. This combination is made prior to a processing operation involved in producing the food composition, such as a blending, heating, steaming, cooking, forming, or other processing operation.

[0044] The MCT maintaining components useful in the process are the same MCT maintaining components useful in the food compositions of the present invention, e.g., the starches, fibers, gluten meals, proteins, emulsifiers, stabilizers, gums, gelling agents, cereal crop, and fiber described herein.

[0045] The processes provided herein can be applied to any type of manufactured or processed food composition. In one embodiment, the food processing operation in step (a) is an extrusion step and the processing step in (b) is extruding the food composition. Any type of extrusion useful for food products is compatible herewith, such as single-, twin-, or multiple-screw extrusion processes, with or with configurations such as interrupted flights to improve intermixing, kneading, or the like. Various means of streaming product into an extrusion process are compatible for use herein. For example, all ingredients may combined into a single mix that is fed into the extruder, or certain sub-combinations of ingredients may be prepared ahead of time, e.g., for mixing immediately prior to extrusion or simultaneous mixing and extrusion. Moisture inputs such as via wet ingredients, water addition, or steam injection may be useful as well. The skilled artisan will know how to measure the moisture content going into and coming out of the extruder and will further know how to measure or assess the proper expansion, density, volume, texture, grain, and other such quality attributes of the final extruded food composition.

[0046] In one embodiment of the processes, additional MCTs are provided in the form of a coating or surface treatment. Such coating or treatment comprises at least a second portion of MCT and, optionally, one or more flavor-enhancing agents, palatability-enhancing agents, aroma-enhancing agents, or color-enhancing agents. By incorporating a first portion of MCT into the food composition before the extrusion or other processing step (e.g. cooking), the process of the invention allows incorporation of larger total MCT than would otherwise be possible. In addition, the inclusion of for example, the flavor and/or aroma-enhancing agents allows for a significant increase in the palatability of the food composition. One useful palatant for inclusion in a coating is tallow or another source of flavor, such as another flavorful fat. Meat extracts and fish extracts may also be very useful for such purposes where the food compositions are pet foods. In a preferred embodiment, the MCT in the coating comprise about 2 to 7% of the food composition. There are a variety of known means for applying such coatings or surface treatments, not limited to simple mixing, rolling, or bathing, spraying, injecting, spray drying, vacuum coating, vacuum injection, and the like.

[0047] In another embodiment, the invention provides methods for formulating food compositions comprising a fixed macro nutrient composition wherein up to 15% of the fat in the food formulation is replaced with one or more MCTs. The method comprises removing a portion of fat from the food compositing and replacing the removed fat with one or more MCTs.

[0048] In another aspect, the invention provides methods of formulating a food composition comprising MCT. The methods comprise (a) selecting a formula comprising ingredients for a food

composition that does not contain MCT; (b) determining an amount of MCT to be added to the food composition containing MCT; (c) determining a source and amount of fat in the formula for the food composition that does not contain MCT, to be replaced with the MCT in the food composition containing the MCT; (d) eliminating the source of fat from the formula in an amount equal to the amount of MCT to be added to the food composition containing MCT, so as to maintain the total fat concentration in the food composition containing the MCT substantially unchanged from the food composition not containing MCT; (e) replacing a least a portion of one or more cereal ingredients in the formula selected in step (a) with at least one MCT maintaining component, so as to maintain the total protein and carbohydrate concentration in the food composition containing the MCT substantially unchanged from the food composition not containing MCT; and (f) formulating the food comprising MCT by including MCT in the formula in place of the source of fat eliminated in step (d); and including the at least one MCT maintaining component in place of the one or more cereal ingredients.

[0049] In one embodiment, the formulation method entails modifying an existing product or formulation, such as a commercially-viable formulation, by replacing a fat source with a source of MCT while maintaining the fat content of the food composition substantially unchanged from that in the existing formula. Techniques for modifying existing formulae are known in the art. However, many formulas, especially for dry and intermediate moisture products cannot be readily modified simply by replacing an existing fat source with MCT, particularly where the concentration of MCT exceeds a certain threshold. Rather those MCT will destabilize the food and may readily separate, or alter the food composition properties or quality on further processing. According to the present invention, the additional step of including at least one ingredient that maintains the MCT integrally incorporated into the food composition, for example as a part of the food matrix that constitutes the core of the food composition, is useful for maintaining the MCT in a relatively stable association as a part of the food composition itself. In one embodiment, the total amount of MCT in the food product is from about 2% to about 15%.

[0050] The one or more cereal ingredients replaced in step (e) do not include a primary cereal ingredient in the food composition in certain embodiments. This is particularly useful where the primary cereal is involved in establishing the character of the food product, for example as a "rice product" or a "corn product", and it is not desirable to reduce the amount of primary cereal present. Product labels, consumer preferences, flavor, health concerns, or other reasons are all sufficient bases for not replacing the primary cereal ingredient in a food product formulation.

[0051] As with the food compositions and the processes provided herein the MCT maintaining component comprises any component or ingredient that is useful for retaining the MCT in the food composition, for example as part of the food matrix itself. Examples of ingredients or components

that are useful for such purposes are a starch, fiber, gluten meal, protein, an emulsifier, or a stabilizer.

[0052] The MCT maintaining components useful in the methods are the same MCT maintaining components useful in the food compositions of the present invention, e.g., the starches, fibers, gluten meals, proteins, emulsifiers, stabilizers, gums, gelling agents, cereal crop, and fiber described herein.

[0053] In one embodiment, the food composition produced using the methods comprises about 20 to 32% protein, about 30 to 50% carbohydrate, about 5 to 20% fat, and about 15 to 25% moisture. The food composition has about 2 to 10% MCT integrally incorporated therein and may optionally have a coating containing additional MCT.

[0054] In various embodiments, the food composition being reformulated is an extruded food product, e.g., an extruded snack food or an extruded pet food.

[0055] In one embodiment, the food composition further comprises a MCT coating applied after extrusion. The coating preferably provides about 2 to 7% additional MCT. In another embodiment, the coating further comprises one or more flavor-enhancing agents, palatability-enhancing agents, aroma-enhancing agents, and color-enhancing agents.

[0056] Preferably, the food composition comprises about 10-15% total MCT. The skilled artisan, given the methods provided, will be able to formulate and manufacture food compositions with significantly more MCTs than was possible before the present invention. This includes producing food compositions that maintain the formulation with a constant macro-nutrient profile, e.g. protein, carbohydrate, and fat amounts, while maintaining the desired functional properties of the food composition such as flavor, texture, volume, density, mouthfeel, palatability, and the like.

[0057] In another aspect, the present invention provides methods for promoting the health and wellness of an animal. The methods comprise feeding the animal food compositions of the present invention. In one embodiment, the compositions comprise from about 1-60% protein, from about 1-50% carbohydrate, from about 1-40% MCT fat, and a maintaining amount of at least one MCT maintaining component, wherein the MCT from the MCT fat is integrally incorporated into the food composition and comprises from about 2-10% of the food composition. Preferably, the MCT comprises from about 4-10% of the food composition, most preferably from about 6-10% of the food composition. In one embodiment, the food compositions further comprise at least one MCT not integrally incorporated into the food matrix. The method can comprise feeding the animal a combination of such food compositions.

[0058] In another aspect, the present invention provides a means for communicating information about or instructions for using MCTs in a food composition or using the food compositions of the present invention, including to promote the health and wellness of an animal and the benefits associated with the consumption of MCTs and the food compositions of the present invention. 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) the benefits of using MCTs to promote the health of an animal, particularly by preventing or treating disease, (2) the benefits of using MCTs to promote the wellness of an animal, (3) the benefits associated with consuming food compositions containing relatively large amounts of MCTs compared to food compositions containing relatively lower amounts of MCTs, i.e., the prior art compositions, (4) and contact information for consumers to use if they have a question about MCTs and food compositions containing MCTs invention and their use. Useful instructions include feeding instructions, feeding amounts, feeding frequency, and handling and storage instructions. The communication means is useful for instructing on the benefits of using the present invention and communicating the preferred methods for using the invention, particularly feeding the invention to an animal. Useful instructions include feeding instructions, feeding amounts, feeding frequency, and handling and storage instructions. The communication means is useful for instructing on the benefits of using the present invention and communicating the preferred methods for using the invention, particularly feeding the invention to an animal.

EXAMPLES

[0059] This invention can be further illustrated by the following examples 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

MCT Incorporation into a Pet Food Formulation

[0060] Formulations: Four formulations were prepared for incorporating MCT into a premium pet food formulation of an extruded Chicken and Rice dog food. The macronutrient density was maintained as constant among each of the formulae. Each formula provided the same amount of protein, carbohydrate, and fat per unit weight.

1. Control Formula: Various amounts of MCTs were substituted for an equivalent amount of tallow in the basic formula.

2. 5% Starch: Various amount of MCTS were substituted for an equivalent amount of tallow; simultaneously, starch from rice or corn was added at up to 5% in place of a secondary or tertiary cereal ingredient in the formula, such as wheat or corn meal.

3. 5% Fiber: Various amount of MCTS were substituted for an equivalent amount of tallow; simultaneously, fiber from soy cotyledons was added at up to 5% in place of a secondary or tertiary cereal ingredient in the formula, such as wheat or corn meal.

4. High Protein Gluten Meal: Various amount of MCTS were substituted for an equivalent amount of tallow; simultaneously, high protein gluten meal (80% protein) from corn was added at

up to 14% in place of a secondary or tertiary cereal ingredient in the formula, such as wheat or corn meal.

[0061] Palatability Studies: Palatability evaluation of the nutritionally complete food products was performed in panels of dogs. Panels consisting of a mix of breeds, distributed as equally as possible, including among sexes. Each dog was at least 12 months of age, however small breeds (e.g. terriers) were used at 10 months of age, if needed. Each experimental panel consisted of twenty to thirty canines. The test was conducted such that no discomfort or stress occurred at any time during the test. Any dogs with reduced food consumption were referred to the staff veterinarian for observation.

[0062] Diets were considered generally palatable and nutritionally adequate to meet the needs of the adult dog. All dogs were fed daily a specified quantity of food based on body weight and body condition. This amount was re-assessed monthly. A choice of two bowls with different products, each containing the dog's daily ration, were offered simultaneously. When it was determined (subjectively) that a dog has consumed its daily ration from one or both bowls, all food was removed and the remaining amount of each food was weighed. The maximum length of time the food compositions were offered to the dogs was 20 minutes.

[0063] The dogs were housed individually in kennel runs, and ample water was provided with an automatic watering system. Food intake was measured daily; body weight measured monthly. The results, which were statistically analyzed, are shown in Table 1.

[0064] Packaging Studies: The following test method for fat staining was used. Each packaged formulation was subjected to one hour of weighted vibration, followed by storage at 140 °F for 14 days. Products were packaged in 8" x 3" x 15" bags.

[0065] Processing Variations: Specific processing conditions were varied to assess requirements for proper cooking and density of the extruded product. Conditions varied included:

1. Extrusion Parameters: Extruder screw configuration and use of interrupted or high shear flights;
2. Moisture Control: Water and/or steam addition; and
3. Addition of MCTs to one or more wet or dry ingredients prior to extrusion.

[0066] Results: Initial results established that the control formulation could only retain or absorb a maximum of 6.6% MCT. Any attempt to incorporate MCT in excess of this amount resulted in high mobility of the fat. This separation was evident, for example, in the staining of the packages with oily/fatty material. Further comparative photographs showed the expansion volume of the product was greatly reduced upon the inclusion of the MCT in the control formula. (data not shown). The volume, pore size and density of the product were all significantly decreased based on visual inspection. Further, the palatability was significantly reduced relative to the control product without

MCT included. Restricting the opening on the extruder to about 0.25" was useful for all products with MCTs added.

[0067] Previous work showed that palatability decreases when MCTs were added to the outside of the product. The MCT maintaining components that help minimize the MCT mobility and increase the incorporation of the MCT into the matrix allow more MCT to be incorporated integrally or internally, and minimize the need to add MCT externally. This allows the use of palatability-enhancing coatings to be placed on the outside, including tallow and liquid or powdered animal digests.

[0068] It was observed that the original formula with 12.5% MCT compared to a reformulated product having 12.5% MCT along with, for example 5% rice or corn starch was not satisfactory in several aspects. The original formula with 12.5% MCT had a density of 451 g/l compared with the improved density of 386 g/l with the inclusion of the rice or corn starch.

[0069] The results of palatability studies are shown in Table 1. As can be seen, the inclusion of high MCT without the inclusion of one of the ingredients to keep the MCT from mobilizing, such as a starch, or gluten meal, resulted in significantly decreased palatability.

Table 1

Palatability Improvement

Chicken & Rice Palatability Improvement Using New Ingredients and New Coating System (2%
10L + 0.05% Casserole FL)

	Pal Ratios
Dog Adult C&R vs. Dog Adult C&R + 12.5% MCTs	31 : 69
Dog Adult C&R vs. Dog Adult C&R (5% Rice Starch) + 12.5% MCTs	33 : 67
Dog Adult C&R vs. Dog Adult C&R (5% Fibrin) + 12.5% MCTs	48 : 52
Dog Adult C&R vs. Dog Adult C&R (12.5% Corn Gluten Meal 80%) + 12.5% MCTs	43 : 57

These options had :

6.6 - 8.5% MCTs added internally

4.0 - 5.9% MCTs added externally

Total of 12.5% MCTs

The new ingredients allowed 1.35 - 3.25% more edible tallow to be added externally

(1) Edible tallow applied externally has been shown to improve palatability in dogs.

(2) Initial palatability tests, which included no edible tallow applied externally, showed poor palatability.

(3) The experimental ingredients tested allowed more edible tallow to be applied externally.

[0070] Referring to Table 1, the use of fiber (e.g. soybean cotyledon (5% Fibrin)) helped to expand the product and absorb MCTs in the food matrix. The use of starch appeared to accomplish the same result. The standard coating system without tallow did not help to improve palatability.

Moreover, these results show that the addition of 12.5% MCTs negatively impacts palatability. The last palatability test shows the effect of fat binders and ingredients that maintain the MCT integrally incorporated into the food matrix on palatability. Since these ingredients helped increase the amount of MCTs added internally, less MCTs were used externally in the form of a coating. Consequently, more tallow (4.4%) and liquid animal digest were applied externally, which helped improve palatability.

[0071] The effect of the special ingredients to maintain the MCT incorporated integrally into the matrix was also to better expand the kibble during extrusion, resulting in a less dense, preferred texture. This preferred texture could be seen to more open and “spongy” in appearance. The ingredients also increase significantly increase the internal absorption of MCTs for the test formulations. Whereas the control diet incorporated a maximum of 6.6% MCT, the food product with high-protein gluten meal added (14% Corn Gluten Meal (80% protein)) incorporated 8.5% MCTs internally, while 5% rice starch or soybean cotyledon fiber incorporated 8.1% MCT.

[0072] The accelerated packaging studies established that the MCT-containing food compositions without an ingredient added to better incorporate MCT into the food matrix showed greater staining of the package. This would clearly be undesirable to the consumer. However, the inclusion of the ingredients that aid in the incorporation of MCT into the matrix and provide enhanced expansion of the food product during extrusion reduced the discoloration and staining of the package. Further, a package with more desirable properties was a multi-ply SOS bag with heat-sealed bottom, having at least an inner ply comprising 40 lb. Natural Kraft/7 lbs. LDPE/0.000285” Aluminum Foil/10 lbs Surlyn, and an outer ply comprising 31 lb MFBK, treated with flourochemical, Clay coated to 38 lbs (Paper C/L 05).

[0073] 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.

CLAIMS

What is Claimed is:

1. A food composition comprising from about 1-60% protein, from about 1-50% carbohydrate, from about 1-40% MCT fat, and a maintaining amount of at least one MCT maintaining component, wherein the MCT from the MCT fat is integrally incorporated into the food composition and comprises from about 2-10% of the food composition.
2. The food composition of claim 1 wherein the MCT maintaining component comprises one or more of a component that alters the structure of water in the food composition, a component that binds fat in the food composition, or a component that emulsifies or stabilizes the fat in the food composition, or combination thereof.
3. The food composition of claim 1 wherein the MCT maintaining component is a starch, fiber, gluten meal, protein, an emulsifier, a stabilizer, a gum, or a gelling agent.
4. The food composition of claim 3 wherein the MCT maintaining component comprises a component from a cereal crop.
5. The food composition of claim 4 wherein the component from a cereal crop includes one or more of corn, wheat, rice, barley, sorghum, millet, oats, rye, triticale, buckwheat, fonio, quinoa, lupines, soybean meal, soybean protein, and soybean fiber.
6. The food composition of claim 1 wherein the MCT maintaining component comprises gluten meal.
7. The food composition of claim 6 wherein the gluten meal comprises from about 60-95% protein.
8. The food composition of claim 7 wherein the gluten meal is corn gluten meal added at up to about 14% of the food composition.
9. The food composition of claim 1 wherein the MCT maintaining component comprises starch or a starch product.
10. The food composition of claim 9 wherein the starch is rice starch or corn starch.
11. The food composition of claim 10 wherein the starch is added at up to about 5% of the food composition.
12. The food composition of claim 1 wherein the MCT maintaining component comprises fiber from soy.
13. The food composition of claim 12 wherein the fiber is from soy cotyledons.
14. The food composition of claim 13 wherein the fiber is added at up to about 5% of the food composition.
15. The food composition of claim 1 comprising from about 20-32% protein, from about 30-50% carbohydrate, from about 5-20% fat, and from about 15-25% moisture.

16. The food composition of claim 15 having about 5-8% MCT integrally incorporated into the food composition.
17. The food composition of claim 1 that is an extruded food composition.
18. The food composition of claim 1 further comprising one or more flavor-enhancing agents, palatability-enhancing agents, aroma-enhancing agents, and color-enhancing agents.
19. A food composition comprising from about 1-60% protein, from about 1-50% carbohydrate, from about 1-40% MCT fat, a maintaining amount of at least one MCT maintaining component, wherein the MCT from the MCT fat is integrally incorporated into the food composition and comprises from about 2-10% of the food composition, and at least one MCT not integrally incorporated into the food matrix.
20. The food composition of claim 19 comprising from about 10-15% total MCT.
21. A process for manufacturing a food composition comprising from about 1-60% protein, from about 1-50% carbohydrate, from about 1-40% MCT fat, and a maintaining amount of at least one MCT maintaining component, wherein the MCT from the MCT fat is integrally incorporated into the food composition and comprises from about 2-10% of the food composition; the process comprising:
 - (a) combining at least a first portion of the MCT with a MCT maintaining component prior to a processing operation;
 - (b) processing the food composition; and
 - (c) adding a second portion of the MCT to the processed food composition as a coating or surface treatment.
22. The process of claim 21 wherein the MCT maintaining component comprises a starch, fiber, gluten meal, protein, an emulsifier, or a stabilizer.
23. The process of claim 21 wherein the MCT maintaining component comprises a component from a cereal crop.
24. The process of claim 23 wherein the cereal includes one or more of corn, wheat, rice, barley, sorghum, millet, oats, rye, triticale, buckwheat, fonio, quinoa, lupines, soybean meal, soybean protein, and soybean fiber.
25. The process of claim 21 wherein the MCT maintaining component comprises gluten meal.
26. The process of claim 25 wherein the gluten meal comprises from about 60 to about 95% protein.
27. The process of claim 25 wherein the gluten meal comprises at least about 75% to about 80% protein.
28. The process of claim 25 wherein the gluten meal is corn gluten meal added at up to about 14%.
29. The process of claim 21 wherein the MCT maintaining component comprises starch.

30. The process of claim 29 wherein the ingredient is rice or corn starch.
31. The process of claim 30 wherein the starch is added at up to about 5%.
32. The process of claim 21 wherein the MCT maintaining component comprises fiber from soy.
33. The process of claim 32 wherein the fiber is from soy cotyledons.
34. The process of claim 32 wherein the fiber is added at up to about 5%.
35. The process of claim 21 wherein the at least one MCT maintaining component comprises one or more of soy cotyledon fiber at up to 5%, starch from corn or rice at up to 5%, gluten meal having at least about 75% to about 80% protein, at up to about 14%, or any combination thereof.
36. The process of claim 21 wherein the food composition comprises about 20 to 32% protein, about 30 to 50% carbohydrate, about 5 to 20% fat, and about 15 to 25% moisture.
37. The process of claim 36 wherein the food composition has about 2 to 10% MCT integrally incorporated into the food composition.
38. The process of claim 21 wherein the processing operation in step (a) is extrusion, and the processing step in (b) is extruding the food composition.
39. The process of claim 21 wherein the coating or surface treatment comprises at least a second portion of MCT, and optionally, one or more flavor-enhancing agent, palatability-enhancing agents, aroma-enhancing agents, and color-enhancing agents, wherein the MCT in the coating comprise about 2 to 7% of the food composition.
40. The process of claim 39 wherein the food composition comprises about 10-15% total MCT.
41. A method of formulating a food composition comprising MCT comprising:
 - (a) selecting a formula comprising ingredients for a food composition that does not contain MCT;
 - (b) determining an amount of MCT to be added to the food composition containing MCT;
 - (c) determining a source and amount of fat in the formula for the food composition that does not contain MCT, to be replaced with the MCT in the food composition containing the MCT;
 - (d) eliminating the source of fat from the formula in an amount equal to the amount of MCT to be added to the food composition containing MCT, so as to maintain the total fat concentration in the food composition containing the MCT substantially unchanged from the food composition not containing MCT;
 - (e) replacing a least a portion of one or more cereal ingredients in the formula selected in step (a) with at least one MCT maintaining component, so as to maintain the total

- protein and carbohydrate concentration in the food composition containing the MCT substantially unchanged from the food composition not containing MCT; and
- (f) formulating the food comprising MCT by including MCT in the formula in place of the source of fat eliminated in step (d); and including the at least one MCT maintaining component in place of the one or more cereal ingredients.
42. The method of claim 41 wherein the total MCT is from about 2%-15%.
 43. The method of claim 41 wherein the one or more cereal ingredients replaced in step (e) do not include a primary cereal ingredient in the food composition.
 44. The method of claim 43 wherein the at least one MCT maintaining component comprises a starch, fiber, gluten meal, protein, an emulsifier, or a stabilizer.
 45. The method of claim 44 wherein the MCT maintaining component comprises a component from a cereal crop.
 46. The method of claim 45 wherein the cereal includes one or more of corn, wheat, rice, barley, sorghum, millet, oats, rye, triticale, buckwheat, fonio, quinoa, lupines, soybean meal, soybean protein, and soybean fiber.
 47. The method of claim 44 wherein the MCT maintaining component comprises gluten meal.
 48. The method of claim 47 wherein the gluten meal comprises from about 60 to about 95% protein.
 49. The method of claim 47 wherein the gluten meal comprises at least about 75% to about 80% protein.
 50. The method of claim 49 wherein the gluten meal is corn gluten meal added at up to about 14%.
 51. The method of claim 44 wherein the MCT maintaining component comprises starch.
 52. The method of claim 45 wherein the ingredient is rice or corn starch.
 53. The method of claim 52 wherein the starch is added at up to about 5%.
 54. The method of claim 44 wherein the MCT maintaining component comprises fiber from soy.
 55. The method of claim 54 wherein the fiber is from soy cotyledons.
 56. The method of claim 55 wherein the fiber is added at up to about 5%.
 57. The method of claim 41 wherein the at least one MCT maintaining component comprises one or more of soy cotyledon fiber at up to 5%, starch from corn or rice at up to 5%, up to about 14% gluten meal having at least about 75% to about 80% protein, or any combination thereof.
 58. The method of claim 57 wherein the food composition comprises about 20 to 32% protein, about 30 to 50% carbohydrate, about 5 to 20% fat, and about 15 to 25% moisture.

59. The method of claim 58 wherein the food composition has about 2 to 8% MCT integrally incorporated therein.
60. The method of claim 59 wherein the food composition is an extruded food product.
61. The method of claim 60 further comprising the steps of
- (g) combining at least a first portion of the MCT with one or more other ingredients prior to extruding the food composition; and
 - (h) extruding the food composition.
62. The method of claim 61 further comprising the step of
- (i) applying a coating after the extrusion step, the coating comprising a second portion of MCT, and further comprising one or more of a flavor-enhancing agent, a palatability-enhancing agent, an aroma-enhancing agent, and a color-enhancing agent, wherein the MCT in the coating comprise about 2 to 7% of the food composition.
63. The method of claim 62 wherein the food composition comprises about 10-15% total MCT, including the MCT in the coating.
64. A method for promoting the health and wellness of an animal comprising feeding the animal a food composition of claim 1, a food composition of claim 19, or combination thereof.
65. A means for communicating information about or instructions for (1) the benefits of using MCTs to promote the health of an animal, particularly by preventing or treating disease, (2) the benefits of using MCTs to promote the wellness of an animal, (3) the benefits associated with consuming food compositions containing relatively large amounts of MCTs compared to food compositions containing relatively lower amounts of MCTs, (4) and contact information for consumers to use if they have a question about MCTs and food compositions containing MCTs invention and their use comprising a document, digital storage media, optical storage media, audio presentation, or visual display containing the information or instructions.
66. The communication means of claim 65 wherein the communication means is a displayed web site, a brochure, product label, package insert, advertisement, or visual display containing such information or instructions.

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PCT/US2008/004062

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 08/04062

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A21D 10/04 (2008.04)

USPC - 426/553

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

USPC: 426/553

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 426/96, 99, 417, 436, 450, 549, 618Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWest: PGPB, USPT, USOC, EPAB, JPAB; Google Scholar; Google Patents; Text: Medium chain triglyceride; MCT; food; carbohydrate; fat; protein; rice; corn meal; gluten meal; homogenize; integral; starch; emulsifier; cereal; flavor; water; alters; binds; fiber; soy; soya; cotyledon; moisture; replace (-ing)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 5,866,555 A (BELL et al.) 02 February 1999 (02.02.1999). col 2, ln 13-14; col 2, ln 21; col 2, ln 29-32; col 3, ln 14-18; col 2, ln 29-32; col 3, ln 50-60; col 2, ln 46; col 2, ln 25; col 2, ln 59; col 2, ln 48; col 2, ln 41-42; col 2, ln 60; col 2, ln 25	1, 3-5, 9-11 and 18 ----- 2, 6, 7, 8, 12-17, 19-63
Y	US 3,658,555 A (MENZ et al.) 25 April 1972 (25.04.1972). col 1, ln 6-7; col 2, ln 4-9	2
Y	US 6,004,926 A (SHIMIZU et al.) 21 December 1999 (21.12.1999). col 2, ln 53; col 3, ln 20	6-8, 25-28, 47- 50, 57-63
Y	US 2006/0035003 A1 (MCMINDES et al.) 16 February 2006 (16.02.2006). para [0050]; para [0040]; para [0068]; para [0023]	12-17, 32-34, 36-38, 54-56, 57-63
Y	US 5,891,490 A (MERABET) 06 April 1999 (06.04.1999). col 1, ln 67; col 4, ln 4-10	19-40
Y	WU et al. Evaluation of Corn Gluten Meal as a Protein Source in Tilapia Diets. J. Agric. Food Chem. Vol 1995, Vol 43, pg. 1585-1588. col 1, para 1	7, 8, 26-28, 48-50, 57-63
Y	US 6,060,094 A (NALUR) 09 May 2000 (09.05.2000). col 1, ln 7; col 2, ln 15-18; col 2, ln 25-27; col 4, ln 50	41-63



Further documents are listed in the continuation of Box C.



* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

18 July 2008 (18.07.2008)

Date of mailing of the international search report

25 JUL 2008

Name and mailing address of the ISA/US

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