



(51) International Patent Classification:

A23L 2/39 (2006.01) A23L 1/212 (2006.01)
A23L 1/29 (2006.01)

(21) International Application Number:

PCT/US2015/058269

(22) International Filing Date:

30 October 2015 (30.10.2015)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/072,857 30 October 2014 (30.10.2014) US

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: PEDIATRIC NUTRITIONAL COMPOSITIONS, METHOD OF MAKING AND USE

(57) Abstract: A pediatric nutritional powder and methods of making and using the pediatric nutritional powder are provided. The pediatric nutritional powder includes at least one fruit powder, a carbohydrate system, vitamins, minerals, at least one anti-caking agent, and optionally at least one vegetable powder.



WO 2016/070017 A1

PEDIATRIC NUTRITIONAL COMPOSITIONS, METHOD OF MAKING AND USECROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to and the benefit of U.S. Provisional Patent Application No. 62/072,857, filed October 30, 2014, the entire content of which is incorporated by reference herein.

FIELD

[0002] The present disclosure relates to nutritional powders. More particularly, the present disclosure relates to pediatric nutritional powders and methods of making and using the pediatric nutritional powders.

BACKGROUND

[0003] Proper nutrition is generally regarded as one of the key factors for achieving and maintaining good health. This is particularly true for children as they grow and develop. However, children can be picky eaters and often prefer foods and beverages that are lower in, or completely lack, certain of the essential nutrients needed to support optimal growth and development of children, such as calcium, vitamin D₃, fiber, and protein.

SUMMARY

[0004] Disclosed herein are pediatric nutritional powders and methods of making and using the pediatric nutritional powders. To illustrate various aspects of the present disclosure, several exemplary embodiments of pediatric nutritional powders and methods of making and using the pediatric nutritional powders are provided herein.

[0005] In one exemplary embodiment, a pediatric nutritional powder is provided. The pediatric nutritional powder comprises: at least one fruit powder and optionally at least one vegetable powder; a carbohydrate system comprising sugar, fiber, and a bulking agent; vitamins and minerals; and at least one anti-caking agent. The at least one fruit powder and the at least one vegetable powder, when present, comprises a total amount of at least about 40% by weight of the pediatric nutritional powder.

[0006] In one exemplary embodiment, a nutritional liquid comprising a liquid and a pediatric nutritional powder is provided. The nutritional liquid comprises a liquid and the pediatric nutritional powder mixed at a rate of about 85 grams to about 145 grams of the pediatric nutritional powder per liter of the liquid. The pediatric nutritional powder comprises: at least one fruit powder and optionally at least one vegetable powder; a carbohydrate system comprising sugar, fiber, and a bulking agent; vitamins and minerals; and at least one anti-caking agent. The at least one fruit powder and the at least one vegetable powder, when present, comprises a total amount of at least about 40% by weight of the pediatric nutritional powder.

[0007] In one exemplary embodiment, a method of making a pediatric nutritional powder is provided. The method comprises dry blending together at least one fruit powder, at least one anti-caking agent, and optionally at least one vegetable powder to form a first powder mixture. A bulking agent, vitamins, minerals, and optionally at least one high intensity sweetener is added to the first powder mixture and dry blended together to form a second powder mixture. Sugar and fiber are added to the second powder mixture and dry blended together to form a pediatric nutritional powder.

DETAILED DESCRIPTION

[0008] Disclosed herein are pediatric nutritional powders and methods of making and using the pediatric nutritional powders. While the present disclosure describes certain embodiments of the pediatric nutritional powders and methods in detail, the present disclosure is to be considered exemplary and is not intended to be limited to the disclosed embodiments.

Definitions

[0009] The term “pediatric nutritional powder” as used herein, unless otherwise specified, refers to a nutritional composition in the form of finely divided solid particles that are flowable or scoopable. The pediatric nutritional powder may be mixed with a liquid, such as milk or water, to form a nutritional liquid prior to consumption by a user. The pediatric nutritional powders described herein are designed for children (over 1 year of age to about 18 years of age, preferably over 2 years of age to about 13 years of age) and contain sufficient nutrients to potentially serve as a supplemental, primary, or sole source of nutrition. Although, the pediatric

nutritional powders described herein are designed for children, the powders may also be used and consumed by adults (*i.e.*, those over 18 years of age).

[0010] The term “fiber” as used herein, unless otherwise specified, refers to soluble dietary fiber. A non-limiting list of fiber includes fructooligosaccharide, galactooligosaccharide, inulin, sugar cane fiber, pectin, guar gum, and locust bean gum.

[0011] The term “sensory characteristic” as used herein, unless otherwise specified, refers to a property of a food or beverage such as mouthfeel, taste, color, appearance, and odor.

[0012] The term “serving” as used herein, unless otherwise specified, is any amount of the pediatric nutritional powder that is intended to be ingested by a subject in one sitting or within less than about one hour, particularly when the pediatric nutritional powder is mixed with milk. In certain exemplary embodiments, the pediatric nutritional powder is packaged as a single serving. In certain exemplary embodiments, the pediatric nutritional powder is packaged in a container containing multiple servings, wherein the container includes instructions on how to separate a single serving of the pediatric nutritional powder from the bulk pediatric nutritional powder.

Pediatric Nutritional Powders

[0013] The exemplary pediatric nutritional powders according to the present disclosure provide the nutrition children need as they grow and develop. In certain embodiments, a serving of the pediatric nutritional powder provides the equivalent of one full serving of fruit (*i.e.*, the equivalent to one-half cup of fruit). In certain embodiments, the pediatric nutritional powder is packaged in a container and labeled as containing one full serving of fruit per serving of the powder. In yet other exemplary embodiments, a serving of the pediatric nutritional powder provides the equivalent of one full serving of combined fruits and vegetables (*i.e.*, the equivalent to one-half cup of combined fruits and vegetables). In certain embodiments, the pediatric nutritional powder is packaged in a container and labeled as containing one full serving of combined fruits and vegetables per serving of the powder. Moreover, the exemplary pediatric nutritional powders described herein provide a good source of vitamins and minerals. In addition to nutritional benefits, the exemplary pediatric nutritional powders according to the

present disclosure exhibit desirable sensory characteristics and mixability when mixed with a liquid.

[0014] Pediatric nutritional powders according to the present disclosure comprise at least one fruit powder and optionally at least one vegetable powder; a carbohydrate system comprising sugar, fiber, and a bulking agent; vitamins and minerals; and at least one anti-caking agent. The at least one fruit powder and the at least one vegetable powder, when present, comprises a total amount of at least about 40% by weight of the pediatric nutritional powder.

Fruit Powders and Vegetable Powders

[0015] As discussed above, the pediatric nutritional powders according to the present disclosure comprise at least one fruit powder and optionally at least one vegetable powder in a total amount (*i.e.*, the sum of all fruit powder(s) and all vegetable powder(s), when vegetable powder is present) of at least about 40% by weight of the pediatric nutritional powder, *i.e.*, the pediatric nutritional powder comprises at least about 40% by weight of at least one fruit powder and optionally at least one vegetable powder. By the foregoing, it is intended that if no vegetable powder is present in the pediatric nutritional powder, then the total amount of the at least one fruit powder comprises at least about 40% by weight of the pediatric nutritional powder. Thus, in certain embodiments, the pediatric nutritional powders according to the present disclosure comprise at least one fruit powder. In other embodiments, the pediatric nutritional powders according to the present disclosure comprise at least one fruit powder and at least one vegetable powder. In certain embodiments, the total amount of the at least one fruit powder and the least one vegetable powder (when present) is at least about 40% by weight to about 65% by weight of the pediatric nutritional powder, *i.e.*, the pediatric nutritional powder comprises about 40% by weight to about 65% by weight of at least one fruit powder and at least one vegetable powder (when present). In certain embodiments, the total amount of the at least one fruit powder and at least one vegetable powder (when present) is at least about 40% by weight to about 60% by weight of the pediatric nutritional powder, *i.e.*, the pediatric nutritional powder comprises about 40% by weight to about 60% by weight of at least one fruit powder and optionally at least one vegetable powder. In certain embodiments, the total amount of the at least one fruit powder and at least one vegetable powder (when present) is at least about 50% by weight to about 65% by

weight of the pediatric nutritional powder *i.e.*, the pediatric nutritional powder comprises about 50% by weight to about 65% by weight of at least one fruit powder and optionally at least one vegetable powder.

[0016] In those embodiments where the pediatric nutritional powder comprises at least one fruit powder and at least one vegetable powder, the fruit and vegetable powders may be present in varying relative amounts. In certain embodiments, the total amount of fruit and vegetable powders in the pediatric nutritional powder comprises about 30% by weight to about 70% by weight of at least one fruit powder and about 70% by weight to about 30% by weight of at least one vegetable powder. In certain embodiments, the total amount of fruit and vegetable powders in the pediatric nutritional powder comprises about 40% by weight to about 60% by weight of at least one fruit powder and about 60% by weight to about 40% by weight of at least one vegetable powder. In certain embodiments, the total amount of fruit and vegetable powders in the pediatric nutritional powder comprises about 45% by weight to about 55% by weight of at least one fruit powder and about 55% by weight to about 45% by weight of at least one vegetable powder. In certain embodiments, the total amount of fruit and vegetable powders in the pediatric nutritional powder comprises about 50% by weight of at least one fruit powder and about 50% by weight of at least one vegetable powder.

[0017] The amount of the at least one fruit powder and the at least one vegetable powder (when present) can also be described in terms of the weight percentage of the overall pediatric nutritional powder. In certain embodiments, the pediatric nutritional powder comprises about 20% by weight to about 45% by weight of at least one fruit powder. In certain embodiments, the pediatric nutritional powder comprises about 20% by weight to about 40% by weight of at least one vegetable powder. In certain embodiments, the pediatric nutritional powder comprises about 20% by weight to about 45% by weight of at least one fruit powder and about 20% by weight to about 40% by weight of at least one vegetable powder.

[0018] In certain embodiments, the at least one fruit powder is entirely or almost entirely (*i.e.*, 95% by weight or greater) fruit. In other embodiments, the at least one fruit powder comprises fruit along with one or more additional ingredient such as flavoring, flow agents (anti-caking agents), bulking agents, natural or artificial high intensity sweeteners, emulsifiers, stabilizers,

and antioxidants. Non-limiting examples of particular ingredients that may be included in the foregoing additional ingredient(s) include, but are not limited to the following: rice powder, gum acacia, Stevia, acesulfame potassium, sucralose, modified food starch, silicon dioxide, and maltodextrin. In certain embodiments, the fruit powder comprises an amount of anti-caking agents such that additional anti-caking agents are not required to be added to the pediatric nutritional powder. In certain embodiments, the fruit powder comprises an amount of bulking agents such that additional bulking agents are not required to be added to the pediatric nutritional powder.

[0019] Generally, the types of fruit contained within (used to provide) the at least one fruit powder can vary. In certain embodiments of the present disclosure, the at least one fruit powder comprises at least one of: a pome fruit powder, a stone fruit powder, a berry powder, and a citrus powder. In certain embodiments, the at least one fruit powder comprises at least one pome fruit powder and at least one berry powder. The particular type of pome fruit, stone fruit, berry, or citrus contained within the at least one fruit powder can vary. In certain embodiments of the present disclosure, the at least one fruit powder comprises at least one of: apple powder; strawberry powder; banana powder; peach powder; mango powder; pomegranate powder; blueberry powder; raspberry powder; pineapple powder; grape powder; grape fruit powder; lemon powder; lime powder; orange powder; pear powder; plum powder; watermelon powder; and cherry powder. In certain embodiments of the present disclosure, the at least one fruit powder comprises apple powder in combination with one or more of strawberry powder, banana powder, peach powder, and mango powder. Various commercial sources of fruit powders are available, including, but not limited to, those available from North Bay Trading Co. (Brule, Wisconsin, www.northbaytrading.com), Van Drunen Farms (Mokena, Illinois, www.vandrunenfarms.com), and Z Natural Foods (West Palm Beach, Florida, www.znaturalfoods.com).

[0020] In those embodiments where at least one vegetable powder is present in the pediatric nutritional powder, the type of vegetable contained within (used to provide) the at least one vegetable powder can vary. In certain embodiments of the present disclosure, the at least one vegetable powder comprises at least one of: sweet potato powder; squash powder; pumpkin powder; carrot powder; asparagus powder; basil powder; beet powder; broccoli powder; brussel

sprout powder; cabbage powder; celery powder; collard greens powder; cauliflower powder; green bean powder; okra powder; spinach powder; and tomato powder. In certain embodiments of the present disclosure, the at least one vegetable powder comprises sweet potato powder. In certain embodiments of the present disclosure, the at least one vegetable powder comprises at least one of: sweet potato powder; pumpkin powder; carrot powder; tomato powder; and spinach powder. Various commercial sources of vegetable powders are available, including, but not limited to, those available from True Nutrition (www.truenutrition.com), Van Drunen Farms (Momence, Illinois, www.vandrunenfarms.com), and North Bay Trading Co. (Brule, Wisconsin, www.northbaytrading.com).

[0021] In certain embodiments, the at least one vegetable powder is entirely or almost entirely (*i.e.*, 95% by weight or greater) vegetable matter. In other embodiments, the at least one vegetable powder comprises vegetable matter along with one or more additional ingredient such as flavoring, flow agents (anti-caking agents), bulking agents, natural or artificial high intensity sweeteners, emulsifiers, stabilizers, and antioxidants. Non-limiting examples of particular ingredients that may be included in the foregoing additional ingredient(s) include, but are not limited to the following: rice flour, gum acacia, Stevia, acesulfame potassium, sucralose, modified food starch, silicon dioxide, and maltodextrin. In certain embodiments, the vegetable powder comprises an amount of anti-caking agents such that additional anti-caking agents are not required to be added to the pediatric nutritional powder. In certain embodiments, the vegetable powder comprises an amount of bulking agents such that additional bulking agents are not required to be added to the pediatric nutritional powder.

Carbohydrate System

[0022] As discussed above, the pediatric nutritional powders disclosed herein comprise a carbohydrate system comprising sugar, fiber, and a bulking agent. The amount of the carbohydrate system can vary in various embodiments according to the present disclosure. In certain embodiments, the pediatric nutritional powder comprises about 25% by weight to about 50% by weight of the carbohydrate system. In certain embodiments, the pediatric nutritional powder comprises about 30% by weight to about 40% by weight of the carbohydrate system.

[0023] As used herein, the term “sugar” should be understood to encompass monosaccharides and disaccharides. Thus, in the certain embodiments, the sugar of the carbohydrate system comprises at least one monosaccharide, at least one disaccharide, or a combination of the foregoing. In certain embodiments, the sugar of the carbohydrate system comprises at least one of: sucrose; glucose; fructose; lactose; and maltose. In certain embodiments, the sugar of the carbohydrate system comprises sucrose. It should be understood that the sugar of the carbohydrate system is separate from any sugar that may be provided by another component of the pediatric nutritional powder, such as the fruit powder or the vegetable powder.

[0024] In certain embodiments, the sugar of the carbohydrate system has an average particle size ranging from about 100 μm to about 350 μm , including from about 150 μm to about 250 μm . Controlling the average particle size of the sugar to within the foregoing ranges has been found to provide one or more of the following benefits: a decrease in powder particle breakdown (during the process of preparing the pediatric nutritional powder), enhancing homogeneity of the various ingredients of the pediatric nutritional powder, and enhancing mixability (when mixing the pediatric nutritional powder with a liquid such as milk to form a nutritional liquid). In certain embodiments, the sugar of the carbohydrate system comprises at least one of: sucrose; glucose; fructose; lactose; and maltose, and the sugar has an average particle size ranging from about 100 μm to about 350 μm . In certain embodiments, the sugar of the carbohydrate system comprises at least one of: sucrose; glucose; fructose; lactose; and maltose, and the sugar has an average particle size ranging from about 150 μm to about 250 μm .

[0025] The source of fiber in the carbohydrate system of the pediatric nutritional powders disclosed herein may vary. One or more than one source of fiber may be used in the carbohydrate system. In certain embodiments, the fiber of the carbohydrate system comprises an oligosaccharide, a polydextrose, or a combination of both. Common and suitable oligosaccharides for use as the fiber component of the carbohydrate system include fructooligosaccharide (FOS), galactooligosaccharide (GOS), and inulin. In certain embodiments, the fiber of the carbohydrate system comprises at least one of: fructooligosaccharide; galactooligosaccharide; and inulin. In certain embodiments, the fiber of the carbohydrate system comprises at least one of: fructooligosaccharide; galactooligosaccharide; inulin; polydextrose;

pectin; guar gum; locust bean gum; and cane sugar fiber. In certain embodiments, the fiber of the carbohydrate system comprises fructooligosaccharide.

[0026] The particular ingredient used as the bulking agent in the carbohydrate system of the pediatric nutritional powders disclosed herein may vary. One or more than one bulking agent may be used in the carbohydrate system. Generally the bulking agent functions as a filler and may also impart mouthfeel and viscosity. In certain embodiments, the bulking agent comprises at least one of: a polysaccharide, a starch, or a sugar alcohol/polyol (*e.g.*, sorbitol, mannitol, maltitol, erythritol, xylitol, and hydrogenated starch hydrolysates). In certain embodiments, the bulking agent comprises at least one of: maltodextrin; lactose; corn syrup solids; starch (hydrolyzed or intact); glycerol; sorbitol; mannitol; maltitol; erythritol; and xylitol. In certain embodiments, the bulking agent of the carbohydrate system comprises maltodextrin.

[0027] The relative amounts of the sugar, fiber and bulking agent that comprise the carbohydrate system of the pediatric nutritional powder may vary. In certain embodiments, about 30 weight % to about 70 weight % of the carbohydrate system comprises at least one sugar; in certain such embodiments, the carbohydrate system comprises about 40 weight % to about 60 weight % of at least one sugar. In certain embodiments, the sugar of the carbohydrate system comprises from about 10 weight % to about 25 weight % of the total weight of the pediatric nutritional powder, including from about 12 weight % to about 20 weight % of the total weight of the pediatric nutritional powder. In certain embodiments, the sugar of the carbohydrate system comprises no more than about 25 weight % of the total weight of the pediatric nutritional powder, including no more than about 20 weight %, no more than about 15 weight %, and also including no more than about 12.5 weight % of the total weight of the pediatric nutritional powder.

[0028] In certain embodiments, the total amount of sugar in the carbohydrate system is limited to an amount such that the total amount of sugar in the pediatric nutritional powder contributes no more than 60% of the total calories provided by the pediatric nutritional powder; in certain such embodiments, the total amount of sugar contributes about 45% to about 60% of the total calories provided by the pediatric nutritional powder. In certain embodiments, the total amount of sugar in the carbohydrate system is limited to an amount such that the total amount of sugar in

the pediatric nutritional powder comprises no more than about 50 weight % of the total weight of the pediatric nutritional powder; in certain such embodiments, the total amount of sugar comprises about 35 weight % to about 50 weight % of the total weight of the pediatric nutritional powder.

[0029] In certain embodiments, the total amount of sugar in the carbohydrate system is limited to an amount such that the total amount of sugar in the pediatric nutritional powder contributes no more than 25% of the total calories provided by the pediatric nutritional powder; in certain such embodiments, the total amount of sugar contributes about 15% to about 25% of the total calories provided by the pediatric nutritional powder, including about 18% to about 23% of the total calories provided by the pediatric nutritional powder. In certain embodiments, the total amount of sugar in the carbohydrate system is limited to an amount such that the total amount of sugar in the pediatric nutritional powder comprises no more than 25 weight % of the total weight of the pediatric nutritional powder; in certain such embodiments, the total amount of sugar comprises about 15 weight % to about 25 weight % of the total weight of the pediatric nutritional powder, including about 18 weight % to about 23 weight % of the total weight of the pediatric nutritional powder.

[0030] In certain embodiments, about 25 weight % to about 50 weight % of the carbohydrate system comprises at least one fiber; in certain such embodiments, the carbohydrate system comprises about 30 weight % to about 40 weight % of at least one fiber. In certain embodiments, about 5 weight % to about 20 weight % of the carbohydrate system comprises at least one bulking agent; in certain such embodiments, the carbohydrate system comprises about 10 weight % to about 15 weight % of at least one bulking agent. In certain embodiments, the carbohydrate system comprises: about 30 weight % to about 60 weight % of at least one sugar; about 25 weight % to about 50 weight % of at least one fiber; and about 5 weight % to about 20 weight % of at least one bulking agent.

Vitamins and Minerals

[0031] The exemplary pediatric nutritional powders described herein provide a good source of vitamins and minerals. Exemplary vitamins suitable for use in the pediatric nutritional powders include, but are not limited to, vitamin A, vitamin D, vitamin E, vitamin K, vitamin B₁, vitamin

B₂, niacinamide, pantothenic acid, folic acid (folate), vitamin B₆, vitamin B₁₂, vitamin C, and biotin. Exemplary minerals suitable for use in the pediatric nutritional powders described herein include, but are not limited to, calcium, magnesium, potassium, phosphorus, selenium, chromium, chloride, molybdenum, manganese, iodine, copper, iron, zinc, and combinations thereof. In certain embodiments, the pediatric nutritional powder provides, per serving, about 10% of the Daily Value (DV) for each of vitamin C (~6 mg), vitamin B₁ (~0.15 mg), vitamin B₂ (~0.17 mg), vitamin B₃ (~2 mg NE), pantothenic acid (~1 mg), vitamin B₆ (~0.2 mg), vitamin B₁₂ (~0.6 mcg), biotin (~30 mcg), folate (~40 mcg), calcium (~100 mg), iodine (~15 mcg), magnesium (~40 mg), phosphorus (~100 mg), selenium (~7 mcg), chromium (~12 mcg), molybdenum (~7.5 mcg), manganese (~0.2 mg), copper (~0.2 mg), iron (~1.8 mg), and zinc (~1.5 mg).

Anti-caking Agent

[0032] As discussed above, the pediatric nutritional powder comprises at least one anti-caking agent. Generally, the anti-caking agent functions to retard clumping or caking of the powder over time and enables easy flow of the powder from a container. (Anti-caking agents are also referred to as flow agents). The particular ingredient(s) utilized for the at least one anti-caking agent may vary, and generally any anti-caking agent (or flow agent) that is known or otherwise suitable for use in a nutritional powder is suitable for use herein. In certain embodiments, the at least one anti-caking agent comprises at least one of: rice flour; calcium silicate; silicone dioxide; aluminum calcium silicate; magnesium silicate; tricalcium silicate; sodium aluminosilicate; sodium calcium aluminosilicate; aluminum stearate; calcium stearate; magnesium stearate; zinc stearate; calcium phosphate; magnesium phosphate; magnesium carbonate; zinc oxide; and starch.

[0033] The amount of the at least one anti-caking agent that is utilized in the pediatric nutritional powder may vary. In certain embodiments, the pediatric nutritional powder comprises at least one anti-caking agent in a total amount of about 0.1% by weight to about 4% by weight, including about 0.2% by weight to about 3% by weight (based upon the total weight of the pediatric nutritional powder).

Protein

[0034] In certain embodiments, the pediatric nutritional powder is essentially free of protein. By essentially free of protein it is meant that no more than about 5% by weight, preferably no more than about 3%, no more than about 2%, or no more than about 1% by weight of the pediatric nutritional powder comprises protein. In embodiments where the pediatric nutritional powder is essentially free of protein, the powder is free of any protein component ingredient (*e.g.*, whey protein concentrate). As those of skill in the art will understand a small amount of incidental protein may be present in the pediatric nutritional powder that is essentially free of protein as a result of being present in small quantities in various ingredients such as the vegetable powder. For example, certain sweet potato powders may contain up to about 4% by weight protein. Embodiments which are essentially free of protein may yield liquid nutritionals with improved sensory characteristics (such as improved mouthfeel), and have improved (easier) mixing properties.

[0035] In certain embodiments, the pediatric nutritional powder includes (further comprises) at least one protein component. The type of protein component that is utilized may vary. However, in certain embodiments, the at least one protein component comprises a source of milk protein; in certain such embodiments, the at least one protein component comprises at least one of: whey protein concentrate, whey protein isolate, milk protein concentrate, milk protein isolate, nonfat dry milk, whey, acid casein, sodium caseinate, calcium caseinate, and potassium caseinate. In certain embodiments, the at least one protein component comprises whey protein concentrate. In certain embodiments, the at least protein component comprises at least one of: soy protein concentrate, soy protein isolate, pea protein concentrate, pea protein isolate, collagen protein, potato protein, rice protein, wheat protein, canola protein, quinoa protein, mycoprotein, hydrolyzed yeast, gelatin, glycomacropeptides, and proteins expressed by microorganisms (*e.g.*, bacteria and algae). In those embodiments where the pediatric nutritional powder includes at least one protein component, the amount of the at least one protein component can vary. In certain embodiments, the pediatric nutritional powder comprises about 10 % by weight to about 35% by weight of at least one protein component, including about 15% by weight to about 30% by weight, and about 20% by weight to about 25 % by weight of the at least one protein component. In certain embodiments, when soy protein isolate comprises a portion of the protein component, the amount of soy protein isolate comprises no more than 10% by weight of the

protein component, preferably no more than 5% by weight of the protein component. In certain embodiments, when milk protein concentrate comprises a portion of the protein component, the amount of milk protein concentrate comprises no more than 10% by weight of the protein component, preferably no more than 5% by weight of the protein component.

[0036] In those embodiments where the pediatric nutritional powder is mixed with milk to provide a nutritional liquid, the milk will provide protein to the resulting nutritional liquid. In certain of the foregoing embodiments, when the pediatric nutritional is essentially free of protein, the resulting nutritional liquid will provide up to about 40 grams of protein per liter of nutritional liquid, including about 1 gram to about 40 grams, about 5 grams to about 35 grams, about 10 grams to about 25 grams, about 20 grams to about 40 grams, or about 25 grams to about 35 grams of protein per liter of nutritional liquid. In certain of the foregoing embodiments, when the pediatric nutritional comprises a protein component, the resulting nutritional liquid will provide from about 35 grams to about 70 grams of protein per liter of nutritional liquid, including about 40 grams to about 65 grams, about 45 grams to about 65 grams, about 50 grams to about 60 grams, or about 55 grams to about 70 grams of protein per liter of nutritional liquid.

High Intensity Sweeteners

[0037] In certain embodiments, the pediatric nutritional powder includes (further comprises) at least one high intensity sweetener. In certain such embodiments, the at least one high intensity sweetener comprises a natural high intensity sweetener. In other such embodiments, the at least one high intensity sweetener comprises an artificial sweetener, optionally in combination with a natural sweetener. Various natural and artificial high intensity sweeteners may be utilized in certain embodiments of the pediatric nutritional powders disclosed herein. The particular ingredient(s) utilized for the at least one high intensity sweetener (natural or artificial) may vary, and generally any high intensity sweetener that is known or otherwise suitable for use in a nutritional powder is suitable for use herein. In certain embodiments, the at least one high intensity sweetener comprises a natural high intensity sweetener comprising at least one of: Stevia (an extract from *Stevia rebaudiana*), monk fruit, *luo han guo* (*Siraitia grosvenorii*), and glycyrrhizin (an extract from licorice root). In certain embodiments, the at least one high intensity sweetener comprises an artificial sweetener comprising at least one of saccharin,

aspartame, acesulfame potassium (Ace-K), sucralose, neotame, and advantame. In certain embodiments, the at least one high intensity sweetener comprises at least one of: Stevia (an extract from *Stevia rebaudiana*), monk fruit, *luo han guo* (*Siraitia grosvenorii*), glycyrrhizin (an extract from licorice root), saccharin, aspartame, acesulfame potassium (Ace-K), sucralose, neotame, and advantame.

[0038] In those embodiments where the pediatric nutritional powder includes at least one high intensity sweetener, the amount of the at least one high intensity sweetener can vary. In certain such embodiments, the pediatric nutritional powder comprises up to about 0.35% by weight of at least one high intensity sweetener (based upon the total weight of the pediatric nutritional powder). In certain embodiments, the pediatric nutritional powder comprises about 0.05% by weight to about 0.35% by weight of at least one high intensity sweetener (based upon the total weight of the pediatric nutritional powder), including about 0.1% by weight to about 0.31% by weight of at least one high intensity sweetener (based upon the total weight of the pediatric nutritional powder).

Colorant

[0039] In certain embodiments, the pediatric nutritional powder includes (further comprises) at least one colorant. In certain such embodiments, the at least one colorant comprises a natural colorant. In certain embodiments, the at least one colorant comprises at least one of: a red colorant, a purple colorant and an orange colorant. Various natural and artificial colorants may be utilized in certain embodiments of the pediatric nutritional powders disclosed herein. The particular ingredient(s) utilized for the at least one colorant (natural or artificial) may vary, and generally any colorant that is known or otherwise suitable for use in a nutritional powder is suitable for use herein. In certain embodiments, the at least one colorant comprises at least one of: beet extract, red cabbage extract, elderberry extract, hibiscus extract, and red cochineal; preferably any of the foregoing are utilized in powder (dry) form. In certain embodiments, the at least one colorant comprises beet extract (*i.e.*, beet juice powder).

[0040] The amount of the at least one colorant that is utilized in certain embodiments of the pediatric nutritional powders disclosed herein can vary. In certain such embodiments, the pediatric nutritional powder comprises about 0.05% by weight to about 0.5% by weight of at

least one colorant (based upon the total weight of the pediatric nutritional powder). In certain embodiments, the pediatric nutritional powder comprises about 0.1% by weight to about 0.3% by weight of at least one colorant (based upon the total weight of the pediatric nutritional powder).

Flavorant

[0041] In certain embodiments, the pediatric nutritional powder includes (further comprises) at least one flavorant. Any flavorant that is known or otherwise suitable for use in nutritional powders or other oral products may be used in the pediatric nutritional powders described herein, provided that such flavorant is also compatible with the other selected ingredients.

[0042] Such flavorants may be natural or synthetic and can be provided by a single or multiple flavored materials. In certain embodiments, the flavorant comprises a combination of several ingredients to provide the desired flavor association.

[0043] Non-limiting examples of suitable flavorants include enzyme-modified flavors (*e.g.*, dairy flavors), fermentation flavors (*e.g.*, dairy flavors), reaction flavors (*e.g.*, chocolate, caramel), natural extracts (*e.g.*, fruit, vegetable, vanilla), and combinations thereof. Preferred for use herein include fruit flavors.

[0044] Non-limiting examples of other specific flavors suitable for use herein include butter pecan flavor, orange, lemon, lime, apricot, grapefruit, apple, grape, strawberry, pineapple, banana, peach, melon, apricot, ume, cherry, raspberry, blueberry, butter, vanilla, mint, peppermint, spearmint, allspice, cinnamon, nutmeg, floral flavors, sweet potato, pumpkin, cabbage, carrot, celery, mushroom, tomato, and combinations thereof.

[0045] The amount of the at least one flavorant that is utilized in certain embodiments of the pediatric nutritional powders disclosed herein can vary. In certain such embodiments, the pediatric nutritional powder comprises about 0.1% by weight to about 8% by weight of at least one flavorant (based upon the total weight of the pediatric nutritional powder). In certain embodiments, the pediatric nutritional powder comprises about 1% by weight to about 6% by weight of at least one flavorant (based upon the total weight of the pediatric nutritional powder).

Probiotics

[0046] In certain embodiments, the pediatric nutritional powder includes (further comprises) at least one probiotic. Various probiotics may be utilized in certain embodiments of the pediatric nutritional powders disclosed herein. The particular ingredient(s) utilized for the at least one probiotic may vary, and generally any probiotic that is known or otherwise suitable for use in a nutritional powder is suitable for use herein. In certain embodiments, the probiotic of the pediatric nutritional powder comprises at least one of: a strain of *Bifidobacterium* and a strain of *Lactobacillus*, any of which may be either active or inactive. Exemplary probiotics suitable for use in the pediatric nutritional powders include, but are not limited to, *Lactobacillus acidophilus*, *Bifidobacterium lactis*, and *Bifidobacterium animalis lactis*.

[0047] The amount of the at least one probiotic that is utilized in certain embodiments of the pediatric nutritional powders disclosed herein can vary. In certain such embodiments, the pediatric nutritional powder comprises about 0.01% by weight to about 0.1% by weight of at least one probiotic (based upon the total weight of the pediatric nutritional powder). In certain embodiments, the pediatric nutritional powder comprises about 0.01% by weight to about 0.04% by weight of at least one probiotic (based upon the total weight of the pediatric nutritional powder).

Caloric Density

[0048] Depending upon the particular ingredients that are utilized in the pediatric nutritional powder as well as their relative concentrations, the caloric density of the pediatric nutritional powder will vary. In certain embodiments, the pediatric nutritional powder has a caloric density ranging from about 3.5 kcal/gram to about 4.5 kcal/gram, including from about 3.75 kcal/gram to about 4 kcal/gram.

Servings, Fruit and Vegetables

[0049] As discussed above, in certain exemplary embodiments, a serving of the pediatric nutritional powder provides the equivalent of at least one full serving of fruit (*i.e.*, one-half cup of fruit). In certain other embodiments, a serving of the pediatric nutritional powder provides the equivalent of one full serving of combined fruits and vegetables (*i.e.*, one-half cup of combined fruits and vegetables). When the pediatric nutritional liquid is mixed with milk or another liquid

to form a nutritional liquid, a serving of the nutritional liquid (in certain embodiments) is about 4 fluid ounces (about 120 mL) to about 12 fluid ounces (about 355 mL), including about 6 fluid ounces (about 175 mL) to about 8 fluid ounces (about 240 mL). The at least one full serving of fruit, or at least one full serving of combined fruits and vegetables (*i.e.*, one-half serving of fruits and one-half serving of vegetables) is provided by the at least one fruit powder or at least one fruit powder and at least one vegetable powder, respectively.

[0050] The particular amount (*e.g.*, in grams) of fruit powder, vegetable powder or both that is required to constitute a serving will depend upon the type(s) of fruit or vegetable utilized in the powder. As is well-understood in the field of human nutrition, while a full serving of fruit generally constitutes $\frac{1}{2}$ cup of fresh fruit and a full serving of vegetables generally constitutes $\frac{1}{2}$ cup of fresh or cooked vegetables (1 cup for leafy greens), the weight (*e.g.*, in grams) of fruit or vegetable in $\frac{1}{2}$ cup varies depending upon the particular fruit or vegetable. The serving size in grams for various fruits and vegetables is publicly available from various sources including the United States Department of Agriculture (USDA), which provides the information at <http://ndb.nal.usda.gov/ndb/>. Non-limiting examples of the amount (in grams) of $\frac{1}{2}$ cup (*i.e.*, a serving) of certain of the fruits and vegetables mentioned herein is as follows: apple (raw, without skin, slices), 55 grams; banana (raw, slices), 75 grams; peach (raw, slices), 77 grams; sweet potato (raw and unprepared, cubes), 66.5 grams; mango (raw, pieces), 83 grams; and strawberry (halves), 76 grams. When a fruit or vegetable is converted to a powder, the amount (in grams) that constitutes a serving (based on the USDA guidelines, as previously discussed) will vary depending upon the amount (in grams) of the particular fruit or vegetable according to the USDA guidelines as well as the amount of liquid removed from the fruit or vegetable to produce the powder. Non-limiting examples of the serving size for certain of the fruit powders and vegetable powders disclosed herein can be calculated using the following conversion factors (listed as fresh to dry): apple powder, about 4.5 to 1; banana powder, about 3 to 1; peach powder, about 11 to 1; strawberry powder, about 11 to 1; pineapple powder, about 7.5 to 1; blueberry powder, about 8 to 1; mango powder, about 6 to 1; pomegranate powder, about 6.5 to 1; spinach powder, about 10 to 1; tomato powder, about 4.5 to 1; sweet potato powder, about 6 to 1; carrot powder, about 10 to 1; spinach powder, about 10 to 1, pumpkin powder, about 4 to 1; and kale powder, about 8 to 1. As a non-limiting example, while 55 grams of apple (raw,

without skin, slices) constitutes a serving of fruit, about 12 grams of apple powder would constitute a serving of fruit.

[0051] In certain embodiments, the pediatric nutritional powder contains a sufficient amount of at least one fruit powder such that when the pediatric nutritional powder is packaged and labeled, the labeling indicates that the pediatric nutritional powder provides a full serving of fruit in each serving of the pediatric nutritional powder. In certain embodiments, the pediatric nutritional powder contains a sufficient amount of at least one fruit powder and at least one vegetable powder such that when the pediatric nutritional powder is packaged and labeled, the labeling indicates that the pediatric nutritional powder provides a full serving of combined fruits and vegetables in each serving of the pediatric nutritional powder.

Physical Properties

[0052] The exemplary pediatric nutritional powders described herein exhibit desirable physical properties including, but not limited to, average particle size, viscosity (when mixed with milk or another liquid), and color (when mixed with milk or another liquid). Certain ingredients utilized in the exemplary pediatric nutritional powders can affect the physical properties of the powder and nutritional liquid made therefrom after mixing the powder with milk or another liquid. Certain of these physical properties can impact the overall hedonics and sensory characteristics of the nutritional liquid made from the pediatric nutritional powder.

[0053] In certain embodiments, the pediatric nutritional powder has an average particle size ranging from about 125 μm to about 215 μm . In certain embodiments, the pediatric nutritional powder has an average particle size ranging from about 140 μm to about 210 μm , including from about 150 μm to about 200 μm , about 160 μm to about 190 μm , or about 170 μm to about 190 μm .

[0054] A wide variety of conventional methods may be used to determine the average particle size of the pediatric nutritional powder. For example, the average particle size may be determined using laser diffraction analysis. An exemplary apparatus for performing the laser diffraction analysis is a HELOS Model 1005 (available from Sympatec GmbH, Clausthal-Zellerfeld, Germany). The powder is dispersed into an air stream and passed through a laser

beam (*e.g.*, a He-Ne laser operating at 632.8 nm). The particles diffract the photons of the laser at different angles, depending on the size of the particle. A detector with semicircular ring elements detects the diffracted photons. The intensity of the detected photons and the angle of detection are used to calculate the number, area, and volume-weighted particle size in the sample, and a particle size distribution can be determined. From this distribution, an average particle size, based on the number, area, or volume of particles, can also be calculated.

[0055] In certain embodiments, the pediatric nutritional powder when mixed with milk (or another liquid) at a rate of about 85 grams to about 145 grams of powder per liter of milk (or another liquid) has a viscosity of about 10 centipoise (cP) to about 65 cP. In certain embodiments, the pediatric nutritional powder when mixed with milk (or another liquid) at a rate of about 85 grams to about 145 grams of powder per liter of milk (or another liquid) has a viscosity of about 15 cP to about 50 cP. In certain embodiments, the pediatric nutritional powder when mixed with milk (or another liquid) at a rate of about 85 grams to about 145 grams of powder per liter of milk (or another liquid) has a viscosity of about 15 cP to about 20 cP.

[0056] A wide variety of conventional methods may be used to determine the viscosity of the pediatric nutritional powder mixed with milk (or another liquid). For example, the viscosity may be determined by using a viscometer, such as a Brookfield LV Series viscometer at 60 RPM using a LV#1 spindle.

[0057] Certain ingredients can cause the pediatric nutritional powder to exhibit a higher viscosity when mixed with a liquid, which may lead to unfavorable hedonic and sensory characteristics. For example, including certain protein components, such as soy protein isolate and milk protein concentrate, in the pediatric nutritional powder can result in a higher viscosity when mixed with a liquid as compared to a pediatric nutritional powder that is essentially free of soy protein isolate and milk protein concentrate. However, including certain other protein components, such as whey protein concentrate, preferably agglomerated whey protein concentrate, in the pediatric nutritional powder does not significantly affect the viscosity when mixed with a liquid as compared to a pediatric nutritional powder that is essentially free of protein. In addition, gums and gum systems that are commonly used in powder products can increase the viscosity when the powder is mixed with a liquid. Accordingly, in certain

embodiments, the pediatric nutritional powder is essentially free of gums including, but not limited to, guar gum, cellulose gum, carrageenan, and xanthan gum. By essentially free of gums it is meant that no more than about 2% by weight, preferably no more than about 1%, more preferably no more than about 0.5% by weight, or even more preferably no more than about 0.05% by weight of the pediatric nutritional powder comprises a gum.

[0058] In certain embodiments, the pediatric nutritional powder when mixed with milk (or another liquid) at a rate of about 85 grams to about 145 grams of powder per liter of milk (or another liquid) has a color corresponding to a Hunter “L” value of about 40 to about 60, a Hunter “a” value of at least 10, and a Hunter “b” value of no more than about 20. In certain embodiments, the pediatric nutritional powder when mixed with milk (or another liquid) at a rate of about 85 grams to about 145 grams of powder per liter of milk (or another liquid) has a color corresponding to a Hunter “L” value of about 45 to about 55, a Hunter “a” value of about 12 to about 20, and a Hunter “b” value of about 10 to about 20. In certain embodiments, the amount and type of colorant in to the pediatric nutritional powder may be adjusted such that the Hunter “Lab” values achieve a desired color based on the flavor of the pediatric nutritional powder. For example, a pediatric nutritional powder having a strawberry flavor may include a colorant in an amount such that when the pediatric nutritional powder is mixed with milk the resulting nutritional liquid has a red hue.

[0059] The Hunter “Lab” color values may be determined using a Hunter ColorFlex 45/0 system, which is a spectrophotometer that measures color the way the human eye sees it. The instrument is configured to measure reflectance using Hunter “Lab” scale, Illuminant C and a 2 degree observer. The basic principle revolves around a three dimensional graph with axes L, a, and b all crossing at point 0.00. The “L” value measures lightness (100.00) to darkness (0.00). The “a” value measures red when the results is a positive number, gray when 0.00, and green when the result is negative. The “b” value measures yellow when the result is a positive number, gray when 0.00, and blue when the result is negative.

[0060] In certain embodiments of the pediatric nutritional powder, including a colorant, such as beet juice powder, can increase the hedonics of the resulting nutritional liquid when the pediatric

nutritional powder is mixed with a liquid. Past hedonic studies in children have linked more intense appealing nutritional liquid coloring with higher overall acceptability scores.

Sensory Characteristics

[0061] In certain embodiments, the pediatric nutritional powder is formulated such that a nutritional liquid made therefrom (*e.g.*, by adding milk or another liquid at a rate of about 100 grams of the pediatric nutritional powder per liter of milk or other liquid) has improved sensory characteristics such as mouthfeel, synthetic sweetener sensation, and throat catch. In certain such embodiments, the improvement in sensory characteristics is as compared to a pediatric nutritional powder having the same formulation except for containing about 10 weight % soy protein isolate, having sugar with an average particle size of at least about 400 μm , and having about 18 weight % of at least one fruit powder (but no vegetable powder). Generally, the mouthfeel of a nutritional liquid can be measured by various means, including, by use of a sensory panel comprised of at least 4 individuals, and using a rating system of 0 to 3 in $\frac{1}{2}$ increments, with 0 being threshold, $\frac{1}{2}$ being very slight, 1 being slight, 1-1/2 being slight to moderate, 2 being moderate, 2-1/2 being moderate to strong, and 3 being strong. In certain embodiments, the pediatric nutritional powder is formulated such that a nutritional liquid made therefrom (*e.g.*, by adding milk or another liquid) has an improved sensory characteristic comprising a mouthfeel (particulate) of $\frac{1}{2}$ to no more than 2, including $\frac{1}{2}$ to 1. In certain embodiments, the pediatric nutritional powder is formulated such that a nutritional liquid made therefrom (*e.g.*, by adding milk or another liquid) has an improved sensory characteristic comprising a synthetic sweetener sensation of 1. In certain embodiments, the pediatric nutritional powder is formulated such that a nutritional liquid made therefrom (*e.g.*, by adding milk or another liquid) has an improved sensory characteristic comprising a throat catch of $\frac{1}{2}$ to no more than 1-1/2, including $\frac{1}{2}$ to 1.

Methods of Using the Pediatric Nutritional Powders

[0062] The exemplary pediatric nutritional powders described herein are intended to be mixed with a liquid to provide a nutritional liquid for consumption. The nutritional liquid is consumed by an individual, preferably a child. It should be understood that the pediatric nutritional powder that is mixed with the liquid to provide the nutritional liquid may be any one embodiment or

combination of the various embodiments or sub-embodiments of the pediatric nutritional powder described herein. The liquid and the pediatric nutritional powder may be mixed by any conventional method. For example, the liquid and the pediatric nutritional powder can be mixed with a spoon, mixed using a standard kitchen blender, or mixed by shaking a closed container containing the liquid and the pediatric nutritional powder.

[0063] In one exemplary embodiment, the nutritional liquid comprises milk and a pediatric nutritional powder mixed at a rate of about 85 grams to about 145 grams of the pediatric nutritional powder per liter of milk. In certain exemplary embodiments, the milk and the pediatric nutritional powder are mixed at a rate of about 90 grams to about 140 grams of the pediatric nutritional powder per liter of milk, including about 100 grams to about 135 grams of the pediatric nutritional powder per liter of milk, about 110 grams to about 130 grams of the pediatric nutritional powder per liter of milk, about 110 grams to about 120 grams of the pediatric nutritional powder per liter of milk, and also including about 90 grams to about 115 grams of the pediatric nutritional powder per liter of milk. A wide variety of milk types may be utilized including, but not limited to, non-human animal milk (*e.g.*, bovine milk, sheep milk, goat milk) such as 2% (fat) milk, 1% (fat) milk, skim milk, and whole milk; soy milk; rice milk; coconut milk; and almond milk.

[0064] In certain exemplary embodiments, the pediatric nutritional powder is mixed with a liquid other than milk at a rate of about 85 grams to about 145 grams of the pediatric nutritional powder per liter of liquid, including a rate of about 90 grams to about 140 grams of the pediatric nutritional powder per liter of liquid, including about 100 grams to about 135 grams of the pediatric nutritional powder per liter of liquid, about 110 grams to about 130 grams of the pediatric nutritional powder per liter of liquid, about 110 grams to about 120 grams of the pediatric nutritional powder per liter of liquid, and also including about 90 grams to about 115 grams of the pediatric nutritional powder per liter of liquid. For example, in certain embodiments, the pediatric nutritional powder is mixed with water. In certain embodiments, the pediatric nutritional powder is mixed with a fruit juice. Exemplary fruit juices include, but are not limited to, orange juice, apple juice, grape juice, and pineapple juice.

[0065] While the composition of the pediatric nutritional powder is discussed extensively herein, it should be understood that the nutritional liquid that is made by mixing the pediatric nutritional powder and a liquid (milk or another liquid) will necessarily contain the same components as the pediatric nutritional powder in addition to any components present in the liquid (*e.g.*, when the liquid is milk additional carbohydrate, protein, vitamins and minerals, and possibly fat) will be present in the nutritional liquid. Thus, the discussion of the composition and components of the pediatric nutritional powder should be understood to apply equally to the nutritional liquids as well as to the methods for making the nutritional powder.

Methods of Making the Pediatric Nutritional Powders

[0066] The exemplary pediatric nutritional powders described herein are generally made by dry blending together the various ingredients that comprise the pediatric nutritional powder. However, the hygroscopic nature of certain ingredients (*e.g.*, fruit powder, vegetable powder) utilized in the exemplary pediatric nutritional powders can create a number of issues. For example, the hygroscopic ingredients can cause clumping and poor powder flow characteristics. In addition, methods typically used to enhance powder dispersion and mixability in liquids (*e.g.*, agglomeration) can result in unacceptably high moisture levels when used with powders containing hygroscopic ingredients.

[0067] It has been determined that when making the exemplary pediatric nutritional powders described herein, the order of addition of the various ingredients comprising the pediatric nutritional powders is an important aspect to overcome the issues associated with the hygroscopic nature of certain ingredients. Accordingly, in one exemplary embodiment, a method of making a pediatric nutritional powder comprises: a) dry blending together at least one fruit powder, at least one anti-caking agent, and optionally at least one vegetable powder to form a first powder mixture; b) adding a bulking agent, vitamins, minerals, and optionally at least one high intensity sweetener to the first powder mixture and dry blending together to form a second powder mixture; and c) adding sugar and fiber to the second powder mixture and dry blending together to form a pediatric nutritional powder.

[0068] In certain embodiments, a ribbon blender is used to dry blend the various ingredients comprising the pediatric nutritional powder. In other embodiments, a V-blender is used to dry

blend the various ingredients comprising the pediatric nutritional powder. Generally, any type of blender for dry blending the various ingredients comprising the pediatric nutritional powder may be utilized so long as the blender is able to blend the various ingredients while also preserving powder integrity.

[0069] Any one of the previously described fruit powders, anti-caking agents, and vegetable powders, or any combinations thereof, may be dry blended together to form the first powder mixture. For example, in certain embodiments, apple powder, strawberry powder, banana powder, and calcium silicate are dry blended together to form the first powder mixture. In certain embodiments, apple powder, strawberry powder, banana powder, sweet potato powder, and calcium silicate are dry blended together to form the first powder mixture. In certain embodiments, apple powder, sweet potato powder, peach powder, mango powder, and calcium silicate are dry blended together to form the first powder mixture.

[0070] In certain embodiments, the dry blending together of at least one fruit powder, at least one-anti caking agent, and optionally at least one vegetable powder is performed for about 1 minute to about 5 minutes, including for about 2 minutes to about 5 minutes, about 3 minutes to about 5 minutes, or about 4 minutes to about 5 minutes.

[0071] Any one of the previously described bulking agents, vitamins, minerals, and optional high intensity sweetener, or any combinations thereof, may be added to the first powder mixture and dry blended together to form the second powder mixture. For example, in certain embodiments, maltodextrin, a vitamin/mineral premix, Stevia extract, and monk fruit extract are added to the first powder mixture and dry blended together to form the second powder mixture. In certain embodiments, the vitamin/mineral premix comprises at least one of: vitamin A; vitamin C; vitamin E; thiamine; riboflavin; niacinamide; pyridoxine; folic acid; vitamin B₁₂; biotin; vitamin B₆; potassium; magnesium; zinc; selenium; copper; manganese; chromium; and molybdenum. In certain embodiments, the bulking agent, vitamins, minerals, and optional high intensity sweetener are pre-blended together for about 30 seconds to about 90 seconds prior to being added to the first powder mixture.

[0072] As mentioned above, the exemplary methods comprise adding sugar and fiber to the second powder mixture and dry blending together to form the pediatric nutritional powder. Any one of the previously described sugars and fibers, or any combinations thereof, may be added to the second powder mixture to form the pediatric nutritional powder. In certain embodiments, the sucrose having an average particle size of about 100 μm to about 350 μm (*e.g.*, very fine granulated sugar, Baker's sugar) and fructooligosaccharide powder are added to the second powder mixture to form the pediatric nutritional powder. In certain embodiments, sucrose having an average particle size of about 400 μm to about 450 μm (*e.g.*, fine granulated sugar) and fructooligosaccharide powder are added to the second powder mixture to form the pediatric nutritional powder.

[0073] In certain embodiments, the method further comprises adding at least one colorant to the second powder mixture. In certain embodiments, the method further comprises adding at least one flavorant to the second powder mixture. In certain embodiments, the method further comprises adding at least one colorant and at least one flavorant to the second powder mixture. Any one of the previously described colorants and flavorants, or any combinations thereof, may be added to the second powder mixture along with the sugar and fiber. In certain embodiments, beet juice powder, natural strawberry flavor, and natural banana flavor are added to the second powder mixture. In certain embodiments, natural orange flavor, natural banana flavor, and natural pineapple flavor are added to the second powder mixture.

[0074] In addition to the order of addition of the various ingredients comprising the pediatric nutritional powder, it has been determined that the total time for dry blending the various ingredients can impact the characteristics of the pediatric nutritional powder. For example, extensive dry blending times can cause a breakdown of the powdered ingredients, which can impact characteristics such as dispersibility, flowability, mixability, and homogeneity, as well as cause powder stratification. Moreover, the particle size of the sugar utilized in the method can also lead to a breakdown of the powdered ingredients, such as the fruit powders and vegetable powders.

[0075] Accordingly, in certain embodiments, the total time for dry blending the various ingredients to form the pediatric nutritional powder is about 15 minutes to about 30 minutes. In

certain embodiments, the total time for dry blending the various ingredients to form the pediatric nutritional powder is about 18 minutes to about 30 minutes, including about 22 minutes to about 30 minutes, about 25 minutes to about 30 minutes, about 27 minutes to about 30 minutes, or about 30 minutes. Such total times for dry blending may lead to less powder breakdown and provide a pediatric nutritional powder that exhibits desirable characteristics such as dispersibility, flowability, mixability, and homogeneity.

[0076] Using a sugar having an average particle size of about 400 μm to about 450 μm (*e.g.*, fine granulated sugar) led to extensive breakdown of the other powdered ingredients and resulted in stratification and poor homogeneity. On the other hand, using a sugar having an average particle size of about 100 μm to about 350 μm (*e.g.*, very fine granulated sugar, Baker's sugar) assisted in reducing the breakdown of the other powdered ingredients and provided a homogenous powder. However, it was determined that using a sugar having an average particle size of less than about 90 μm , even less than about 20 μm (*e.g.*, powdered sugar, confectionary sugar) created lumps in the pediatric nutritional powder due to the hygroscopic nature of the sugar having such a particle size, which has a greater surface area. These results were unexpected since the sugar having the smallest particle size was expected to yield the most homogenous powder.

EXAMPLES

[0077] The following examples describe and demonstrate exemplary embodiments of the pediatric nutritional powders described herein. The examples are provided solely for the purpose of illustration and are not to be construed as limitations of the present disclosure, as many variations thereof are possible without departing from the spirit and scope of the present disclosure.

Example 1

[0078] Example 1 illustrates an exemplary embodiment of a strawberry-banana flavored pediatric nutritional powder described herein. The pediatric nutritional powder of Example 1 is essentially free of protein and a serving size of 20 grams provides the equivalent of one serving of combined fruits and vegetables. All ingredient amounts listed in Table 1 are listed as grams per 100 grams of the pediatric nutritional powder.

TABLE 1	
INGREDIENTS	Example 1
	Amount (g/100 g)
Sweet Potato Powder (with processing aids - maltodextrin, corn starch, and sunflower lecithin)	28.48
Bakers Sugar (very fine granulated sugar) ¹	19.98
Apple Powder (35% Rice Flour, 2% sunflower lecithin)	17.37
Fructooligosaccharide Powder	12.99
Strawberry Powder (with silicon dioxide)	5.75
Maltodextrin	4.55
Natural Flavors (strawberry and banana)	4.60
Banana Powder	3.75
Vitamin/Mineral Premix	1.10
Natural Color (beet juice powder)	0.90
Anti-Caking Agent	0.45
Natural High Intensity Sweeteners	0.10

¹ Sucrose with an average particle size of 150-250 μm .

[0079] A sensory evaluation was performed on the pediatric nutritional powder of Example 1. Samples used in the sensory evaluation were prepared by mixing 20 grams of the pediatric nutritional powder with 6 fluid ounces of 1% milk using a blender.

[0080] A panel of four certified flavor profilers evaluated the samples for the intensity of various tastes and characteristics. For example, the profilers provided scores for the following characteristics: fullness, balance, sweet, salt, sour, bitter, banana, berry, milk, other fruity, cereal, particulate mouthfeel, synthetic sweetener sensation, drying, throat catch, thick mouthfeel, astringency, orange vegetable (carrot, sweet potatoes), and appearance. The samples were at room temperature (*e.g.*, about 20 °C to 23 °C) when tasted by the profilers. After tasting, each profiler assessed the various characteristics of the sample using a scoring system set forth in Table 2 below and the results were then averaged. The results are shown in Table 3.

TABLE 2	
Scale	Description
) (	Threshold
$\frac{1}{2}$	Very Slight
1	Slight
$1 \frac{1}{2}$	Slight to Moderate
2	Moderate
$2 \frac{1}{2}$	Moderate to Strong
3	Strong

TABLE 3	
Characteristic	Sample Prepared Using Pediatric Nutritional Powder of Example 1
Fullness	1 1/2
Balance	1 1/2
Sweet	1 1/2
Salt	1/2
Sour	1
Bitter	--
Banana	1 1/2 (candy, ripe)
Berry	1 (red, cooked)
Milk	1 (low fat)
Other Fruity	--
Cereal	1/2
Particulate Mouthfeel	1 1/2 (most soft pulp with some hard particles)
Synthetic Sweetener Sensation	1
Drying	1
Throat catch	1/2
Thick Mouthfeel	1 1/2
Astringency	--
Orange Vegetable (Carrot, Sweet Potatoes)	1
Appearance	Dark pink particulates with small yellow particles in grainy purplish pink liquid with brown cast.

[0081] In addition to the sensory evaluation, a hedonic evaluation was performed on the pediatric nutritional powder of Example 1 by a panel of children. The testing protocol and the results of the hedonic evaluation are described below.

Testing Protocol

[0082] A total of 41 children (ages 4-10 years) served as the panelists for the hedonic evaluation of the samples. The panelists were asked to rate overall acceptability of each sample on a 5-point Hedonic scale (1 = Do not like at all, 5 = Like Very Much). The panelists were also asked if the sample tasted like a smoothie. Testing was conducted as interviews with the panelists.

[0083] A mixing rate of 20 grams of the pediatric nutritional powder of Example 1 per 6 fluid ounces of 1% milk was used to prepare the samples. The samples were prepared by blending in a standard kitchen blender on a high speed for 25 seconds and then resting for 50 seconds to allow foam to settle. Samples were evaluated within 5 minutes upon preparation. Samples were served at a refrigerated temperature (*e.g.*, about 1 °C to 5 °C). Panelists were served approximately 3/4 fluid ounces of each sample. Samples were served in 5 oz. plastic cups coded

with 3-digit random numbers. Standard white lighting was used. The samples were served in first position to all panelists.

Results

[0084] The results of the hedonic evaluation indicated that the samples prepared with the pediatric nutritional powder of Example 1 received an average “overall liking” score of 3.6. An average overall liking score of at least 3.5 on the 5-point Hedonic scale indicates that a sample being evaluated possesses a “kid approved taste.” Accordingly, the samples prepared using the pediatric nutritional powder of Example 1 exhibited a “kid approved taste” by receiving an average overall liking score of 3.6. In addition, 93% of the panelists indicated that the sample tasted like a smoothie.

Example 2

[0085] Example 2 illustrates an embodiment of a tropical fruit punch flavored pediatric nutritional powder described herein. The pediatric nutritional powder of Example 2 is essentially free of protein and a serving size of 20 grams provides the equivalent of one serving of combined fruits and vegetables. All ingredient amounts listed in Table 4 are listed as grams per 100 grams of the pediatric nutritional powder. Ingredients that appear in both Tables 1 and 4 are the same as those of Table 1, unless indicated to the contrary.

TABLE 4	
INGREDIENTS	Example 2
	Amount (g/100 g)
Sweet Potato Powder	28.45
Bakers Sugar (very fine granulated sugar) ¹	20.00
Apple Powder	16.83
Fructooligosaccharide Powder	14.00
Mango Powder	9.45
Maltodextrin	5.32
Natural Flavor	2.30
Peach Powder	2.00
Vitamin/Mineral Premix	1.10
Anti-Caking Agent	0.45
Natural High Intensity Sweeteners	0.10

¹ Sucrose with an average particle size of 150-250 μm .

Example 3

[0086] Example 3 illustrates an exemplary embodiment of a strawberry-banana flavored pediatric nutritional powder described herein. The pediatric nutritional powder of Example 3 is essentially free of protein and a serving size of 20 grams provides the equivalent of one serving of combined fruits and vegetables. All ingredient amounts listed in Table 5 are listed as grams per 100 grams of the pediatric nutritional powder. Ingredients that appear in both Tables 1 and 5 are the same as those of Table 1, unless indicated to the contrary.

TABLE 5	
INGREDIENTS	Example 3
	Amount (g/100 g)
Sweet Potato Powder	28.48
Fine Granulated Sugar ¹	19.98
Apple Powder (35% Rice Flour)	17.36
Fructooligosaccharide Powder	12.99
Strawberry Powder	5.74
Maltodextrin	5.01
Natural Flavor	4.60
Banana Powder	3.75
Vitamin/Mineral Premix	1.10
Natural Color (beet juice powder)	0.45
Anti-Caking Agent	0.45
Natural High Intensity Sweeteners	0.10

¹ Sucrose with an average particle size of about 430 μm .

Example 4

[0087] Example 4 illustrates an embodiment of a tropical fruit punch flavored pediatric nutritional powder described herein. The pediatric nutritional powder of Example 4 is essentially free of protein and a serving size of 20 grams provides the equivalent of one serving of combined fruits and vegetables. All ingredient amounts listed in Table 6 are listed as grams per 100 grams of the pediatric nutritional powder. Ingredients that appear in both Tables 1 and 6 are the same as those of Table 1, unless indicated to the contrary.

TABLE 6	
INGREDIENTS	Example 4
	Amount (g/100 g)
Sweet Potato Powder	28.45
Fine Granulated Sugar ¹	20.00
Apple Powder	16.83

Fructooligosaccharide Powder	14.00
Mango Powder	9.45
Maltodextrin	5.32
Natural Flavor	2.30
Peach Powder	2.00
Vitamin/Mineral Premix	1.10
Anti-Caking Agent	0.45
Natural High Intensity Sweeteners	0.10

¹ Sucrose with an average particle size of about 430 μm .

Example 5

[0088] Example 5 illustrates an exemplary embodiment of a strawberry-banana flavored pediatric nutritional powder described herein. A serving size of 26 grams of the pediatric nutritional powder of Example 5 contains 5 grams of protein and provides the equivalent of one serving of combined fruits and vegetables. All ingredient amounts listed in Table 7 are listed as grams per 100 grams of the pediatric nutritional powder. Ingredients that appear in both Tables 1 and 7 are the same as those of Table 1, unless indicated to the contrary.

TABLE 7	
INGREDIENTS	Example 5
	Amount (g/100 g)
Whey Protein Concentrate	23.08
Sweet Potato Powder	21.88
Fine White Granulated Sugar ¹	16.77
Apple Powder	12.96
Fructooligosaccharide Powder	10.77
Strawberry Powder	4.42
Banana Powder	2.88
Natural Flavor	1.85
Calcium Carbonate	1.73
Vitamin/Mineral Premix	1.67
Maltodextrin	0.65
Anti-Caking Agent	0.48
Natural Color	0.35
Natural High Intensity Sweeteners	0.31
Malic Acid	0.19

¹ Sucrose with an average particle size of about 430 μm .

Example 6

[0089] Example 6 illustrates an exemplary embodiment of a strawberry-banana flavored pediatric nutritional powder described herein. A serving size of 26 grams of the pediatric nutritional powder of Example 6 contains 5 grams of protein and provides the equivalent of one serving of fruit. All ingredient amounts listed in Table 8 are listed as grams per 100 grams of the pediatric nutritional powder. Ingredients that appear in both Tables 1 and 8 are the same as those of Table 1, unless indicated to the contrary.

TABLE 8	
INGREDIENTS	Example 6
	Amount (g/100 g)
Apple Powder	23.08
Soy Protein Isolate	20.77
Fine White Granulated Sugar ¹	16.77
Strawberry Powder	11.54
Fructooligosaccharide Powder	10.77
Banana Powder	5.77
Maltodextrin	4.73
Natural Flavor	1.85
Calcium Carbonate	1.73
Vitamin/Mineral Premix	1.67
Anti-Caking Agent	0.48
Natural Color	0.35
Natural High Intensity Sweetener	0.31
Malic Acid	0.19

¹ Sucrose with an average particle size of about 430 μm .

Example 7

[0090] Example 7 illustrates an exemplary embodiment of a strawberry-banana flavored pediatric nutritional powder described herein. A serving size of 26 grams of the pediatric nutritional powder of Example 7 contains 5 grams of protein and provides the equivalent of one serving of fruit. All ingredient amounts listed in Table 9 are listed as grams per 100 grams of the pediatric nutritional powder. Ingredients that appear in both Tables 1 and 9 are the same as those of Table 1, unless indicated to the contrary.

TABLE 9	
INGREDIENTS	Example 7
	Amount (g/100 g)
Apple Powder	23.08
Milk Protein Concentrate	23.08
Fine White Granulated Sugar ¹	16.77
Strawberry Powder	11.54
Fructooligosaccharide Powder	10.77
Banana Powder	5.77
Maltodextrin	2.42
Natural Flavor	1.85
Calcium Carbonate	1.73
Vitamin/Mineral Premix	1.67
Anti-Caking Agent	0.48
Natural Color	0.35
Natural High Intensity Sweetener	0.31
Malic Acid	0.19

¹ Sucrose with an average particle size about 430 μm .

Example 8

[0091] Example 8 illustrates an exemplary embodiment of a strawberry-banana flavored pediatric nutritional powder described herein. A serving size of 26 grams of the pediatric nutritional powder of Example 8 contains 5 grams of protein and provides the equivalent of one serving of fruit. All ingredient amounts listed in Table 10 are listed as grams per 100 grams of the pediatric nutritional powder. Ingredients that appear in both Tables 1 and 10 are the same as those of Table 1, unless indicated to the contrary.

TABLE 10	
INGREDIENTS	Example 8
	Amount (g/100 g)
Whey Protein Concentrate	24.46
Apple Powder	23.08
Fine White Granulated Sugar ¹	16.77
Strawberry Powder	11.54
Fructooligosaccharide Powder	10.77
Banana Powder	5.77
Natural Flavor	1.85
Calcium Carbonate	1.73
Vitamin/Mineral Premix	1.67
Maltodextrin	1.04
Anti-Caking Agent	0.48
Natural Color	0.35
Natural High Intensity Sweetener	0.31

Malic Acid	0.19
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¹ Sucrose with an average particle size of about 430 μm

Example 9

[0092] Example 9 illustrates the sensory performance of exemplary embodiments of pediatric nutritional powders compared to a commercially available nutritional powder, which served as the control. In this example, sensory data was collected for test samples of two separate exemplary pediatric nutritional powders mixed with milk and a control sample of a commercially available nutritional powder mixed with milk. The formulation details of the two test pediatric nutritional powders utilized in this example correspond to the pediatric nutritional powders of Example 3 (test pediatric nutritional powder #1) and Example 4 (test pediatric nutritional powder #2). Information regarding the control nutritional powder is provided in Table 11.

TABLE 11
Control Powder Contains: Soy Protein Isolate, Fruit Powder, Sugar ¹ , Gum System (guar gum, cellulose gum, carrageenan, xanthan gum)
Amount Per 30.2 grams of Powder
Calories: 110
Calories from Fat: 10
Fat (grams): 1
Carbohydrate (grams): 16
Dietary Fiber (grams): 5
Sugars (grams): 9
Protein (grams): 10
Fruit Serving: 1/2 (the fruit powder provides the equivalent to 1/2 serving of fruit per 30.2 grams of powder)

¹ Sucrose with an average particle size of about 430 μm .

[0093] In preparing the control sample, 15.1 grams of the control nutritional powder was mixed with 6 fluid ounces of 1% milk using a spoon. For test sample #1, 20 grams of the test pediatric nutritional powder #1 was mixed with 6 fluid ounces of 1% milk using a spoon. Similarly, for test sample #2, 20 grams of the test pediatric nutritional powder #2 was mixed with 6 fluid ounces of 1% milk using a spoon.

[0094] A panel of four certified flavor profilers evaluated the samples for the intensity of various tastes and characteristics. For example, the profilers provided scores for the following

characteristics: fullness, balance, sweet, salt, sour, bitter, banana, berry, milk, mineral salt, cereal, particulate mouthfeel, synthetic sweetener sensation, drying, throat catch, gelatinous mouthfeel, tropical (orange peel, pineapple, overripe mango), vanilla cream, and appearance. The samples were at room temperature (*e.g.*, about 20 °C to 23 °C) when tasted by the profilers. After tasting, each profiler assessed the various characteristics of the sample using a scoring system set forth in Table 12 below and the results were then averaged. The results are shown in Table 13.

TABLE 12	
Scale	Description
) (	Threshold
1/2	Very Slight
1	Slight
1 1/2	Slight to Moderate
2	Moderate
2 1/2	Moderate to Strong
3	Strong

TABLE 13			
Characteristic	Control Sample	Test Sample #1	Test Sample #2
Fullness	1 1/2	1 1/2	1 1/2
Balance	1	1 1/2	1
Sweet	1 1/2	1 1/2	2
Salt	1/2	1/2	1/2
Sour	1	1	1
Bitter	--	--	1/2
Banana	1 1/2 (candy, ripe)	1 1/2 (candy, ripe)	1/2
Berry	1 1/2 (red, cooked)	1 1/2 (red, cooked)	--
Milk	1 1/2 (cultured)	1 (low fat)	1 (low fat)
Mineral salt	1	--	--
Cereal	--	1/2	1/2
Particulate Mouthfeel	2 1/2	1	1
Synthetic Sweetener Sensation	1 1/2	1	1
Drying	1	1	1
Throat catch	2	1/2	1/2
Gelatinous Mouthfeel	1	--	--
Tropical (orange peel, pineapple, overripe mango)	--	--	2
Vanilla Cream	--	--	1
Citrus Rind Mouth Irritation	--	--	1/2
Appearance	White large particulates in grainy pink liquid with gray cast.	Dark pink particulates with small yellow particles in grainy purplish pink liquid with brown cast.	Tan yellow with brown particles.

[0095] The results of the sensory evaluation indicate that test sample #1 had a more balanced taste profile as compared to the control sample. In addition, both test sample #1 and #2 exhibited lower scores than the control sample with respect to the following negative sensory characteristics: Milk (1.5 (cultured) vs. 1 (low fat)); Particulate Mouthfeel (2.5 vs. 1); Synthetic Sweetener Sensation (1.5 vs. 1); Throat Catch (2 vs. 1/2); and Gelatinous Mouthfeel (1 vs. 0).

Example 10

[0096] Example 10 illustrates the hedonic responses of a panel of children who tasted each of the samples described above in Example 9, namely, the control sample, test sample #1, and test sample #2.

Testing Protocol

[0097] A total of 34 children (ages 4-10 years) served as the panelists for the hedonic evaluation of the samples. The panelists were asked to rate overall acceptability of each sample on a 5-point Hedonic scale (1 = Do not like at all, 5 = Like Very Much). The panelists were also asked to select the sample they preferred. Testing was conducted as interviews with the panelists. Water and crackers were used to rinse the mouth between each tasting of the samples.

[0098] As in Example 9, the control sample was prepared by mixing 15.1 grams of the control nutritional powder with 6 fluid ounces of 1% milk using a spoon, test sample #1 was prepared by mixing 20 grams of the test pediatric nutritional powder #1 with 6 fluid ounces of 1% milk using a spoon, and test sample #2 was prepared by mixing 20 grams of the test pediatric nutritional powder #2 with 6 fluid ounces of 1% milk using a spoon. All samples were mixed with a spoon until the powder dissolved. The samples were served at a refrigerated temperature (*e.g.*, about 1 °C to 5 °C). Panelists were served approximately 3/4 ounce of each sample. Samples were served in 5 fluid ounces plastic cups coded with 3-digit random numbers. Standard white lighting was used.

[0099] The control sample and test sample #1 were presented as a paired test and were presented using a Balanced Complete Block Design of all possible orders and combinations.

Analysis of Variance and the Fisher LSD test were used to analyze the hedonic data. Preference was determined using a 2-sample binomial test for preference (2-tailed). Significance was determined at the 95% confidence level. The test sample #2 was measured monadically.

Results

[00100] The results of the testing, including an “overall liking” score and preference, are presented below in Table 14.

TABLE 14		
Sample	Average Overall Liking* (n=34)	Preference* (n=34)
Control Sample	3.0	12
Test Sample #1	3.2	22
p value	0.31	0.12
LSD	n/a	n/a
Scale	1 = Do Not Like at All 5 = Like Very Much	
Sample	Average Overall Liking (n=34)	
Test Sample #2	2.5	
Scale	1 = Do Not Like at All 5 = Like Very Much	

*Average Overall Liking scores and Preference scores for the control sample and test sample #1 were not significantly different at the 95% confidence level.

[00101] The results of the hedonic testing indicate that all samples received overall liking scores of less than 3.5, which is the baseline score necessary for “kid approved taste.” However, test sample #1 received a slightly higher overall liking score compared to the control sample (3.2 vs. 3.0), but the difference between the score was not statistically significant. Similarly, test sample #1 received a higher preference score compared to the control sample (22 vs. 12), but the difference between the score was not statistically significant.

Example 11

[00102] Example 11 illustrates the sensory performance of embodiments of pediatric nutritional powders compared to a commercially available nutritional powder, which served as the control. In this example, sensory data was collected for test samples of two separate exemplary pediatric nutritional powders mixed with milk and a control sample of a commercially available nutritional powder mixed with milk. The formulation details of the two test pediatric

nutritional powders utilized in this example correspond to the pediatric nutritional powders of Example 6 (test pediatric nutritional powder #3) and Example 7 (test pediatric nutritional powder #4). The control nutritional powder was the same as that used in Example 9 and is described in Table 11.

[00103] In preparing the control sample, 15.1 grams of the control nutritional powder was mixed with 6 fluid ounces of 1% milk using a spoon. For test sample #3, 26 grams of the test pediatric nutritional powder #3 was mixed with 6 fluid ounces of 1% milk using a spoon. Similarly, for test sample #4, 26 grams of the test pediatric nutritional powder #4 was mixed with 6 fluid ounces of 1% milk using a spoon.

[00104] A panel of five certified flavor profilers evaluated the samples for the intensity of various tastes and characteristics. For example, the profilers provided scores for the following characteristics: fullness, balance, sweet, salt, sour, bitter, banana, berry, cultured milk, mineral salt, cereal, particulate mouthfeel, synthetic sweetener sensation, drying, throat catch, gelatinous mouthfeel, and appearance. The samples were at room temperature (*e.g.*, about 20 °C to 23 °C) when tasted by the profilers. After tasting, each profiler assessed the various characteristics of the sample using a scoring system set forth in Table 15 below and the results were then averaged. The results are shown in Table 16.

TABLE 15	
Scale	Description
) (	Threshold
1/2	Very Slight
1	Slight
1 1/2	Slight to Moderate
2	Moderate
2 1/2	Moderate to Strong
3	Strong

TABLE 16			
Characteristic	Control Sample	Test Sample #3	Test Sample #4
Fullness	1 1/2	1 1/2	1 1/2
Balance	1	1	1
Sweet	1 1/2	1 1/2	2
Salt	1/2	1/2	1/2
Sour	1	1	1
Bitter	--	--	1/2
Banana	1 1/2 (candy)	1 1/2 (green floral)	1 1/2 (cooked)
Berry	1 1/2 (red, cooked)	1 (red, cooked)	1 (red, cooked)
Cultured Milk	1 1/2	1 1/2	1
Mineral salt	1	--	--
Cereal	--	--	1 1/2 (toasted, bran)
Particulate Mouthfeel	2 1/2	2 1/2	2 1/2
Synthetic Sweetener Sensation	1	2	2
Drying	1	1	1
Throat catch	2	2	2
Gelatinous Mouthfeel	1	1	1
Appearance	White large particulates in grainy pink liquid with gray cast.	White particulates with small yellow, orange, green particles in grainy pink liquid with gray and tan cast	White, dark pink particles with small yellow, orange, green particles in grainy purplish pink liquid with gray cast

Example 12

[00105] Example 12 illustrates the hedonic responses of a panel of children who tasted each of the samples described above in Example 11, namely, the control sample, test sample #3, and test sample #4.

Testing Protocol

[00106] A total of 43 children (ages 4-10 years) served as the panelists for the hedonic evaluation of the samples. The panelists were asked to rate overall acceptability of each sample on a 5-point Hedonic scale (1 = Do not like at all, 5 = Like Very Much). The panelists were also asked to rank the samples in order from most favorite to least favorite. Testing was conducted as interviews with the panelists. Water and crackers were used to rinse the mouth between each tasting of the samples.

[00107] As in Example 9, the control sample was prepared by mixing 15.1 grams of the control nutritional powder with 6 fluid ounces of 1% milk using a spoon, test sample #3 was prepared by mixing 26 grams of the test pediatric nutritional powder #3 with 6 fluid ounces of 1% milk using

a spoon, and test sample #4 was prepared by mixing 26 grams of the test pediatric nutritional powder #4 with 6 fluid ounces of 1% milk using a spoon. All samples were mixed with a spoon until the powder dissolved. The samples were served at a refrigerated temperature (*e.g.*, about 1 °C to 5 °C). Panelists were served approximately 3/4 ounce of each sample. Samples were served in 5 fluid ounces plastic cups coded with 3-digit random numbers. Standard white lighting was used.

[00108] The samples were presented using a Balanced Complete Block Design of all possible orders and combinations. Analysis of Variance and the Fisher LSD test were used to analyze the hedonic data. Friedman's Analysis of Rank was used to analyze the rank data. Significance was determined at the 95% confidence level.

Results

[00109] The results of the testing, including an "overall liking" score and rank, are presented below in Table 17.

TABLE 17		
Sample	Average Overall Liking*	Rank*
Control Sample	2.8	1.9
Test Sample #3	2.7	2.2
Test Sample #4	2.7	1.9
p value	0.81	0.32
LSD	n/a	n/a
Scale	1 = Do Not Like at All 5 = Like Very Much	1 = Most Favorite 3 = Least Favorite

*Average Overall Liking scores and Rank scores for the samples were not significantly different at the 95% confidence level.

Example 13

[00110] Example 13 illustrates an exemplary embodiment of a strawberry-banana flavored pediatric nutritional powder described herein. The pediatric nutritional powder of Example 13 is essentially free of protein and a serving size of 20 grams provides the equivalent of one serving of combined fruits and vegetables. All ingredient amounts listed in Table 18 are listed as grams per 100 grams of the pediatric nutritional powder.

TABLE 18	
INGREDIENTS	Example 13
	Amount (g/100 g)
Sweet Potato Powder (with processing aids - maltodextrin, corn starch, and sunflower lecithin)	28.50
Apple Powder (35% Rice Flour, 2% sunflower lecithin)	17.38
Fructooligosaccharide Powder	13.00
Bakers Sugar (very fine granulated sugar) ¹	12.50
Maltodextrin	12.05
Strawberry Powder (with silicon dioxide)	5.75
Natural Flavors (strawberry and banana)	4.50
Banana Powder	3.75
Vitamin/Mineral Premix	1.10
Natural Color (beet juice powder)	0.90
Anti-Caking Agent	0.45
Natural High Intensity Sweeteners	0.12

¹ Sucrose with an average particle size of 150-250 μm .

[00111] The terminology as set forth herein is for description of the embodiments only and should not be construed as limiting the disclosure as a whole. All references to singular characteristics or limitations of the present disclosure shall include the corresponding plural characteristic or limitation, and vice versa, unless otherwise specified or clearly implied to the contrary by the context in which the reference is made. Unless otherwise specified, “a,” “an,” “the,” and “at least one” are used interchangeably. Furthermore, as used in the description and the appended claims, the singular forms “a,” “an,” and “the” are inclusive of their plural forms, unless the context clearly indicates otherwise.

[00112] The pediatric nutritional powders and corresponding methods of the present disclosure can comprise, consist of, or consist essentially of the essential elements of the disclosure as described herein, as well as any additional or optional element described herein or which is otherwise useful in nutritional powder applications.

[00113] All percentages, parts, and ratios as used herein are by weight of the total formulation, unless otherwise specified. All such weights as they pertain to listed ingredients are based on the active level and, therefore, do not include solvents or by-products that may be included in commercially available materials, unless otherwise specified.

[00114] All ranges and parameters, including but not limited to percentages, parts, and ratios, disclosed herein are understood to encompass any and all sub-ranges assumed and subsumed

therein, and every number between the endpoints. For example, a stated range of “1 to 10” should be considered to include any and all sub-ranges beginning with a minimum value of 1 or more and ending with a maximum value of 10 or less (*e.g.*, 1 to 6.1, or 2.3 to 9.4), and to each integer (1, 2, 3, 4, 5, 6, 7, 8, 9, and 10) contained within the range.

[00115] Any combination of method or process steps as used herein may be performed in any order, unless otherwise specified or clearly implied to the contrary by the context in which the referenced combination is made.

[00116] To the extent that the term “includes” or “including” is used in the specification or the claims, it is intended to be inclusive in a manner similar to the term “comprising” as that term is interpreted when employed as a transitional word in a claim. Furthermore, to the extent that the term “or” is employed (*e.g.*, A or B) it is intended to mean “A or B or both.” When the applicants intend to indicate “only A or B but not both” then the term “only A or B but not both” will be employed. Thus, use of the term “or” herein is the inclusive, and not the exclusive use. Also, to the extent that the term “in” or “into” is used in the specification or the claims, it is intended to additionally mean “on” or “onto,” respectively.

[00117] While the present application has been illustrated by the description of embodiments thereof, and while the embodiments have been described in considerable detail, it is not the intention of the applicants to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. Therefore, the application, in its broader aspects, is not limited to the specific details, the representative compositions and processes, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of the present disclosure.

WHAT IS CLAIMED IS:

1. A pediatric nutritional powder comprising:
at least one fruit powder and optionally at least one vegetable powder;
a carbohydrate system comprising sugar, fiber, and a bulking agent;
vitamins and minerals; and
at least one anti-caking agent;
wherein the at least one fruit powder and the at least one vegetable powder, when present, comprises a total amount of at least about 40% by weight of the pediatric nutritional powder.
2. The pediatric nutritional powder claim 1, wherein the pediatric nutritional powder is essentially free of protein.
3. The pediatric nutritional powder of claim 1, further comprising at least one protein component.
4. The pediatric nutritional powder of claim 3, wherein the at least one protein component comprises whey protein concentrate.
5. The pediatric nutritional powder of any one of claims 1-4, wherein the fruit powder comprises at least one of: apple powder; strawberry powder; banana powder; peach powder; mango powder; pomegranate powder; blueberry powder; raspberry powder; pineapple powder; grape powder; grape fruit powder; lemon powder; lime powder; orange powder; pear powder; plum powder; watermelon powder; and cherry powder.
6. The pediatric nutritional powder of any one of claims 1-5, wherein the vegetable powder comprises at least one of: sweet potato powder; squash powder; pumpkin powder; carrot powder; asparagus powder; basil powder; beet powder; broccoli powder; brussels sprout powder; cabbage powder; celery powder; collard greens powder; cauliflower powder; green bean powder; okra powder; spinach powder; and tomato powder.

7. The pediatric nutritional powder of any one of claims 1-6, wherein the anti-caking agent comprises at least one of: rice flour; calcium silicate; silicone dioxide; aluminum calcium silicate; magnesium silicate; tricalcium silicate; sodium aluminosilicate; sodium calcium aluminosilicate; aluminum stearate; calcium stearate; magnesium stearate; zinc stearate; calcium phosphate; magnesium phosphate; magnesium carbonate; zinc oxide; and starch.
8. The pediatric nutritional powder of any one of claims 1-7, further comprising at least one high intensity sweetener.
9. The pediatric nutritional powder of claim 8, wherein the high intensity sweetener comprises a natural high intensity sweetener.
10. The pediatric nutritional powder of claim 8, wherein the high intensity sweetener comprises an artificial high intensity sweetener.
11. The pediatric nutritional powder of any one of claims 1-10, wherein the sugar comprises at least one of: sucrose; glucose; fructose; lactose and maltose; and wherein the sugar has an average particle size ranging from about 100 μm to about 350 μm .
12. The pediatric nutritional powder of any one of claims 1-11, wherein the fiber comprises at least one of: fructooligosaccharide; galactooligosaccharide; inulin; polydextrose; pectin; guar gum; locust bean gum; and sugar cane fiber.
13. The pediatric nutritional powder of any one of claims 1-12, wherein the bulking agent comprises at least one of: a maltodextrin; a polyol; and lactose.
14. The pediatric nutritional powder of any one of claims 1-13, wherein the fruit powder comprises about 20% to about 45% by weight of the pediatric nutritional powder.
15. The pediatric nutritional powder of any one of claims 1-14, wherein the vegetable powder comprises about 20% to about 40% by weight of the pediatric nutritional powder.

16. The pediatric nutritional powder of any one of claims 1-15, wherein the carbohydrate system comprises about 30% to about 40% by weight of the pediatric nutritional powder.

17. The pediatric nutritional powder of any one of claims 1-16, wherein the anti-caking agent comprises about 0.2% to about 3% by weight of the pediatric nutritional powder.

18. The pediatric nutritional powder of any one of claims 1-17, wherein the sugar of the carbohydrate system comprises no more than 25% by weight of the pediatric nutritional powder.

19. The pediatric nutritional powder of any one of claims 1-18, wherein the pediatric nutritional powder is packaged in a container and labeled as containing a full serving of combined fruits and vegetables per serving of the powder.

20. The pediatric nutritional powder of any one of claims 1-19, wherein the pediatric nutritional powder is packaged in a container and labeled as containing a full serving of fruit per serving of the powder.

21. The pediatric nutritional powder of any one of claims 1-20, further comprising at least one colorant.

22. The pediatric nutritional powder of any one of claims 1-21, further comprising at least one probiotic.

23. The pediatric nutritional powder of any one of claims 1-22, wherein the pediatric nutritional powder product has a caloric density ranging from about 3.5 kcal/gram to about 4.5 kcal/gram.

24. A nutritional liquid comprising:

a liquid and a pediatric nutritional powder mixed at a rate of about 85 grams to about 145 grams of the pediatric nutritional powder per liter of liquid, wherein the pediatric nutritional powder comprises:

at least one fruit powder and optionally at least one vegetable powder;

a carbohydrate system comprising sugar, fiber, and a bulking agent;

vitamins and minerals; and

at least one anti-caking agent;

wherein the at least one fruit powder and the at least one vegetable powder, when present, comprises a total amount of at least about 40% by weight of the pediatric nutritional powder.

25. The nutritional liquid of claim 24, wherein the liquid comprises milk.

26. The nutritional liquid of any one of claims 24-25, wherein the pediatric nutritional powder is essentially free of protein.

27. The nutritional liquid of any one of claims 24-25, wherein the pediatric nutritional powder further comprises at least one protein component.

28. The nutritional liquid of claim 27, wherein the at least one protein component comprises whey protein concentrate.

29. The nutritional liquid of any one of claims 24-28, wherein the fruit powder comprises at least one of: apple powder; strawberry powder; banana powder; peach powder; mango powder; pomegranate powder; blueberry powder; raspberry powder; pineapple powder; grape powder; grape fruit powder; lemon powder; lime powder; orange powder; pear powder; plum powder; watermelon powder; and cherry powder.

30. The nutritional liquid of any one of claims 24-29, wherein the vegetable powder comprises at least one of: sweet potato powder; squash powder; pumpkin powder; carrot powder;

asparagus powder; basil powder; beet powder; broccoli powder; brussels sprout powder; cabbage powder; celery powder; collard greens powder; cauliflower powder; green bean powder; okra powder; spinach powder; and tomato powder.

31. The nutritional liquid of any one of claims 24-30, wherein the anti-caking agent comprises at least one of: rice flour; calcium silicate; silicone dioxide; aluminum calcium silicate; magnesium silicate; tricalcium silicate; sodium aluminosilicate; sodium calcium aluminosilicate; aluminum stearate; calcium stearate; magnesium stearate; zinc stearate; calcium phosphate; magnesium phosphate; magnesium carbonate; zinc oxide; and starch.

32. The nutritional liquid of any one of claims 24-31, wherein the pediatric nutritional powder further comprises at least one high intensity sweetener.

33. The nutritional liquid of claim 32, wherein the high intensity sweetener comprises a natural high intensity sweetener.

34. The nutritional liquid of any one of claims 24-33, wherein the sugar comprises at least one of: sucrose; glucose; fructose; and maltose; and wherein the sugar has an average particle size ranging from about 100 μm to about 350 μm .

35. The nutritional liquid of any one of claims 24-34, wherein the fiber comprises at least one of: fructooligosaccharide; galactooligosaccharide; inulin; and polydextrose.

36. The nutritional liquid of any one of claims 24-35, wherein the bulking agent comprises at least one of: maltodextrin; a polyol; and lactose.

37. The nutritional liquid of any one of claims 24-36, wherein the fruit powder comprises about 20% to about 45% by weight of the pediatric nutritional powder.

38. The nutritional liquid of any one of claims 24-37, wherein the vegetable powder comprises about 20% to about 40% by weight of the pediatric nutritional powder.

39. The nutritional liquid of any one of claims 24-38, wherein the carbohydrate system comprises about 30% to about 40% by weight of the pediatric nutritional powder.

40. The nutritional liquid of any one of claims 24-39, wherein the anti-caking agent comprises about 0.2% to about 3% by weight of the pediatric nutritional powder.

41. The nutritional liquid of any one of claims 24-40, wherein the sugar of the carbohydrate system comprises no more than 25% by weight of the pediatric nutritional powder.

42. The nutritional liquid of any one of claims 24-41, wherein the pediatric nutritional powder is packaged in a container and labeled as containing a full serving of combined fruits and vegetables.

43. The nutritional liquid of any one of claims 24-42, wherein the pediatric nutritional powder further comprises at least one colorant.

44. The nutritional liquid of any one of claims 24-43, wherein the pediatric nutritional powder further comprises at least one probiotic.

45. The nutritional liquid of any one of claims 24-44, wherein the nutritional liquid has a color corresponding to a Hunter L value of about 40 to about 60, a Hunter a value of at least 10, and a Hunter b value of no more than about 20.

46. A method of making a pediatric nutritional powder, the method comprising:

a) dry blending together at least one fruit powder, at least one anti-caking agent, and optionally at least one vegetable powder to form a first powder mixture;

b) adding a bulking agent, vitamins, minerals, and optionally at least one high intensity sweetener to the first powder mixture and dry blending together to form a second powder mixture;

c) adding sugar and fiber to the second powder mixture and dry blending together to form a pediatric nutritional powder.

47. The method of claim 46, wherein the dry blending of a) is performed for about 1 minute to about 5 minutes.

48. The method of any one of claims 46-47, wherein the bulking agent, vitamins, minerals, and optional high intensity sweetener are pre-blended together for about 30 seconds to about 90 seconds prior to being added to the first powder mixture.

49. The method of any one of claims 46-48, wherein c) further comprises adding at least one colorant and at least one flavorant to the second powder mixture.

50. The method of any one of claims 46-49, wherein the fruit powder comprises at least one of: the fruit powder comprises at least one of: apple powder; strawberry powder; banana powder; peach powder; mango powder; pomegranate powder; blueberry powder; raspberry powder; pineapple powder; grape powder; grape fruit powder; lemon powder; lime powder; orange powder; pear powder; plum powder; watermelon powder; and cherry powder.

51. The method of any one of claims 46-50, wherein the vegetable powder comprises at least one of: sweet potato powder; squash powder; pumpkin powder; carrot powder; asparagus powder; basil powder; beet powder; broccoli powder; brussels sprout powder; cabbage powder; celery powder; collard greens powder; cauliflower powder; green bean powder; okra powder; spinach powder; and tomato powder.

52. The method of any one of claims 46-51, wherein the anti-caking agent comprises at least one of: rice flour; calcium silicate; silicone dioxide; aluminum calcium silicate; magnesium silicate; tricalcium silicate; sodium aluminosilicate; sodium calcium aluminosilicate; aluminum stearate; calcium stearate; magnesium stearate; zinc stearate; calcium phosphate; magnesium phosphate; magnesium carbonate; zinc oxide; and starch.

53. The method of any one of claims 46-52, wherein a total time for completing a) - c) is about 15 minutes to about 30 minutes.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/058269

A. CLASSIFICATION OF SUBJECT MATTER

INV. A23L2/39 A23L1/29 A23L1/212
ADD.

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)

A23L A23B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data, BIOSIS, FSTA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2006/103514 A1 (COUNCIL SCIENT IND RES [IN]; NAIDU MADENENI MADHAVA [IN]; RAGHAVAN BAS) 5 October 2006 (2006-10-05)	1-3,7, 11, 13-18, 24,26, 27, 31-34, 36,37, 39-41,45 46-53
A	claims 1,2,6,10,11; examples 1,2 -----	
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A	example 4 ----- -/-	46-53



Further documents are listed in the continuation of Box C.



See patent family annex.

* 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

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"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

22 December 2015

Date of mailing of the international search report

15/01/2016

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2015/058269

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	abstract -----	46-53
X	DATABASE WPI Week 201304 Thomson Scientific, London, GB; AN 2012-R34386 XP002752482, & CN 102 669 784 A (NINGXIA TIANRUI IND GROUP MODERN AGRIC) 19 September 2012 (2012-09-19)	1-3,5-7, 14,15, 17,18, 21,24, 26,27, 29-31, 34, 36-41, 43,45
A	abstract -----	46-53
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X	DATABASE GNPDP [Online] MINTEL; May 2014 (2014-05), Vitaz Food & Beverages: "Clear Lychee Instant Fruit Drink Mix", XP002752484, Database accession no. 2434877 the whole document -----	1,2,7, 11,14, 15,17, 21,23, 24,26, 29,31, 34, 37-40, 43,45
X	DATABASE GNPDP [Online] MINTEL; June 2014 (2014-06), Globenatural Internacional: "Passion Fruit Flavor Peruvian Pisco Sour Mixer", XP002752485, Database accession no. 2468225 the whole document ----- -/--	1-3,11, 14,15, 17,21, 23,24, 26,29, 31,34, 37-40, 43,45

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International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE GNPD [Online] MINTEL; November 2013 (2013-11), Töpfer: "Stage 3 Organic Follow-Up Formula", XP002752486, Database accession no. 2243049	24-41, 43-45
A	the whole document -----	46-53
X	DATABASE GNPD [Online] MINTEL; December 2013 (2013-12), Milupa: "Milk with Five Fruits for Infants and Small Children", XP002752487, Database accession no. 2246804	24-41, 43-45
A	the whole document -----	46-53
X	DATABASE GNPD [Online] MINTEL; June 2014 (2014-06), Dumex: "Plain Flavoured Stage 4 Growing Up Instant Milk Product", XP002752488, Database accession no. 2467715	1-45
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X,P	WO 2015/069678 A1 (ABBOTT LAB [US]) 14 May 2015 (2015-05-14) claims; tables 1-3 -----	1,2,5-53
A	British Sugar: "Screened White Sugars", anonymous 27 January 2009 (2009-01-27), pages 1-4, XP002752490, Retrieved from the Internet: URL: http://www.britishsugar.co.uk/files/pr oductpdfs/screened_sugars_lo.aspx [retrieved on 2015-12-21] table; pages 2-3 ----- -/--	11,34

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2015/058269

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 2012/263861 A1 (JIMENEZ MENDOZA DIMAS [MX]) 18 October 2012 (2012-10-18) claim 1; example 2 -----	1-53

INTERNATIONAL SEARCH REPORT

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International application No

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