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Immunity Boosting Health Drink Mixes: A Patent Based Review

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Health drink mixes are granulated or powdered beverages that require little effort to reconstitute before utilization. They have been used for a long time as flavor enhancers in beverages.From traditional drink mixes to the latest; their ingredients have been served clearly in this article. The changing ingredients focus on the fact that now they are not seen as only taste enhancers because researches have brought them to a new level. A literature study revealed that along with the use of nutritious ingredients, efforts have been made to reduce artificial sweeteners, preservatives, colors, and flavors in them. But many more improvements are yet to be done.The aim of this systematic review is a detailed study of thecomposition of health drink mixes and giving ideas about advancement in health drink mixes for health freaks that need to be sound through wholesome products especially forimmunity boosting.Since patent-based data is the most reliable and comprehensive, this analysis focuses on patents from the previous years that strive to boost immunity through the use of a variety of plant-based substances in the production of health drink mixes.

Keywords: Health Drink Mixes, Immunity Boosters, Milk Additives, Nutritional Supplements

A Beverage is any sort of fluid for human consumption that satisfies thirst. Beverages are generally, separated into alcoholic and non-alcoholic beverages. Alcoholic beverages are beverages the contain ethyl alcohol for example beer, wine, cider, whiskey, etc. While beverages without ethyl alcohol are called non-alcoholic beverages for example water, milk, tea, coffee, juice, and soft drinks that can be carbonated or non-carbonated.[1]

Milk is a nutrient-rich natural beverage. It is the primary nourishment for warm-blooded animals. It contains 87.7% water, 4.9% carbohydrates, 3.3% protein, 3.4% fat, 0.7% vitamins and minerals. All 20 essential minerals are present in itto some extent.[2] It plays an important role in the human diet because of its extraordinary health benefits. Calcium, phosphorous, and vitamin D present in it help to build andmaintain healthy bones. Protein helps to build or repair muscle tissue. Potassium maintains blood pressure. Vitamin B12 strengthens our immune system.[3] From the growth years of kids to the old age of the elderly; milk has been considered an easy means of nutrition. This is the reason it is also considered as "Complete food". Butdespite all these health benefits, milk is not a favorite drink of growing children because many of them don't find it tasty or they don't like its smell. Its fat content may be a concern for some diet-conscious adults.[4] There is nothing more satisfying than turning milk into a nutrient-packed, healthy, yet still delicious beverage option. That way, drink mixes may have a significant task to carry out. There are some drink mixes already available in the market for example Horlicks, Bournvita, Boost, Complan, Amul pro, and so on.[5] These are malt-based beverage mixes. These drink mixes make milk more appealing. But now, just making milk more appealing will not work. Because, due to a hectic lifestyle these days, people are unable to find time to take essential nutrients. This leads to poor immune systems and health. So, they are looking for options that meet the need of the body while saving their time. This vigilance forces organizations to encourage these types of discoveries. Many efforts have been made to make drink mixes more health enhancers without affecting their taste.Some natural products such as dietary fibers, polyphenols, vitamins, minerals, fatty acids, protein, and peptides are incorporated as powder mixes into beverages to enhance their nutritional value nowadays.[6] Some fruit, vegetable-based, cocoa-based, malt or cereal-based drink mixes are also in the market.[7, 8] Fruits and vegetablesare fundamental segments of the human diet. They are a phenomenal wellspring of basic nutrients and minerals. They are high in fiber and antioxidants which protect us from many diseases. Phytochemicals present in fruits and vegetables are

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exceptionally beneficial for the heart, skin, lungs, and different body parts.[9] Fruits or vegetable-based health drink mixes offer booze and nutrition at the same time. Avocado powdered drink mix containingmalt dextrin and milk solids are likewise the appealing option of customary wellbeing drinks.[10] Flavonoids extracted from citrus peel is mixed with Fructo-oligosaccharidesare also an attractive option as a drink.[11] Drink prepared using orange peel and green tea extract is also a new and interesting beverage with health benefits.[12] Honey powder drink mix is a completely natural beverage with medicinal properties.[13]

Besides fruits and vegetables, plants also give us beans and grains. Plant-based drink mixes are in high demand because they are nutrient-packed. Cocoa is a powder made by grinding dried cocoa beans. It is one of the favorite ingredients of drink mixes because of its aroma. It is rich in polyphenols, flavanols, antioxidants, calcium, zinc and iron. These bioactive components helped humans in dietary lacks as well as hacks, colds, respiratory issues, and depression.[14] Cocoa is bitter Thus, sweeteners play a major role in cocoa-based beverages. Sugar also improves the solubility of cocoa powder in water or hot milk. Natural sugars are a more advantageous choice than conventionally prepared sugars because of obvious healthcare benefits.[15] Carob is mildly sweet so it is a good cocoa substitute. Roasted carob-based health drink mix is highly acceptable because of low sugar and fat content.[16] Just like beans, grains and cereals also deliver a variety of medical advantages. Cereals such as, wheat, maize, barley, millet, buckwheat, oats, and red rice are rich in dietary fiber, phenolic content, vitamin B, iron, magnesium, and selenium. These drink mixes encourage digestion[17]. Sorghum is a cereal grain also called Indian millet. Sorghum flour, skimmed milk, cocoa powder, and xanthan gum incorporated powder drink mix is also a healthy option[18]. These health drink mixes are a helpful bridge to connect the nutrition gap. They are satisfying, refreshing, and invigorating. People are becoming aware of their health. So, the interest in health-booster and eco-friendly drink options is arriving at a pinnacle. Research done in this direction is part of this article. This paper reviews the recently issued patents on health drink mixes and gives collective information on ingredients used in their production.The patent-based analysis in this review can clarify the intellectual property situation in the field of health drink mixes produced to boost immunity through the use of a variety of plant-based ingredients, and it will provide a realistic view of this area, which could be beneficial for the food sector in the coming years for drink mix commercial viability**.**

Patented Inventions in Health Drink Mixes

Knowing the ingredients in health drink mixes is the most important aspect of determining their nutritional value. Table 1 shows patents on health drinks, as well as basic ideas about the invention.

Traditional Malt-based Drink Mixes

Horlicks was the first-ever malted milk to be patented under patent application no. US 278967 during 1883. It was made by James and William Horlicks. This product was made for infants and consumed by mixing it with water.[19] But, after gaining popularity, they made another health drink mix for people of all ages in 1899 under patent application no. US 627119. Wheat, beef, chocolate, and cocoa were used as the mainingredients in the product at that time.[20]Nowadays, Horlicks is manufactured in many other countries using malted wheat, malted barley, dried whey, milk solids, sugar, calcium carbonate, palm oil, and salt. Like Horlicks, Bournvita is also a popular malt-based beverage consumedin many countries.This was the first health drink mix of that time that was made by forming a slurry of all ingredients and then the slurry was dried to form granules. In US0114826, Ambeskar *et al.* had claimed the improved technology of this invention in which the whole process was done in one vessel that helped in cost reduction. Other than this, a sugar solution was added instead of crystalline sugar that maintained the moisture content. [21]

Cocoa-based Drink Mixes

Most drink mixes contain cocoa powder as a flavor enhancer although it is not very much soluble in liquids. So to overcome this problem, health drink mix powder containing soluble cocoa powder and cocoa extract with a high amount of polyphenols was patented in 2013 with patent application no. US 8609174. Increasing solubility of cocoa powder along with decreasing bromine and caffeinated content was also another great advantage of this application.[22]As cocoa is in high demand because of its desirable flavor, so it is expensive and its beverages need a high amount of sugar content. So, cocoa replacers would always be welcomed to enhance the nutritional value along with the reduction in the cost of the food

Table 1 — Patents on health drink mixes

Patent No.	Assignee/Company	Ingredients used	Publication year	Category
US 278,967A	William Horlicks, (US)	Malted barley, wheat, and fresh cow milk	1883	Malt-based
US 627,119A	William Horlicks, (US)	Whole wheat, malt (barley), cocoa, beef, sodium chloride, bicarbonates of potash and soda	1899	Malt-based
US 2012/0114826A1	Cadbury UK Limited, West Midlands (GB)	Malt extract powder, malt dextrin, cocoa powder, milk powder/dairy creams, whey powder, salt, caramelized sugar syrup, some flavors, and natural colors	2012	Malt-based
US 8,609,174 B2	Barry Calebaut AG, Zurich (CH)	Soluble cocoa powder and sugar	2013	Cocoa-based
US 2015/ 0342214 A1	Givaudan, S.A., Vernier (CH)	Roasted wheat and/or malted barley	2015	Cocoa-based
US 9,788,558 B2	Nestec S.A. Vevey (CH)	Malt, cocoa, protein component some stabilizing agents such as, sodium hexametaphosphate and hydrocolloid components	2017	Cocoa-based
US 2018 / 0206516 A1	Nestec S.A. Vevey (CH)	Soluble agglomerated chocolate powder	2018	Cocoa-based
US 2018 / 0125107 A1	Int'l Agriculture Group, LLC, US	Roasted green banana flour	2018	Cocoa-based
US 2010/ 0040757A1	Dorcas, CN	Liquid base, coffee component, saccharide, ginseng and protein content	2010	Herb-based
US 7,879,383 B2	Council of Scientific and Industrial Research, India	Rosemary extract, sucrose, organic acid and sodium benzoate	2011	Herb-based
US 8,329,232 B2	Beijing Tang-An Nutrition & Healthcare Products Co. Ltd., Beijing (CN)	Water extract or powder form of cinnamon	2012	Herb-based
US 2017 / 0296614 A1	Koppla Ltd. DBA: Koppla Nutrients, New York (US)	*Melissa species* extract, *Avena species* extract, *Tilia species* extract, a unique blend of citrus components and *Panax species*	2017	Herb-based
US 2018 / 0339009 A1	Kenneth Bariahtaris, Morristown (US)	Edible turmeric powder	2018	Herb-based
US 2019 / 0105361 A1	InfinitusCompany Ltd. Jiang Men (CN)	Inulin, Chinese herbs including *Ganoderma, Coicis semen, Poria, Atractylodis macrocephalae Rhizoma, Cuscutae semen, Polygonati rhizoma, Ophiopogonis radix, Glycyrrhizae radix Et Rhizoma, Lycii fructus, Schisandrae chinensis fructus* and *Stevioside*	2019	Herb-based
US 7,658,963 B1	Meiji Seika Kaisha, Ltd., Tokyo (JP)	Black currant anthocyanin concentrate, granulated sugar, sodium citrate, spice and water	2010	Fruit-based
US 2012/ 0263861 A1	Quinasa, S.A.P.I. De C.V., Mexico (MX)	Dehydrated avocado, prickly pears, mango powder, oats, protein content, monounsaturated vegetal fat content, raw fiber content	2012	Fruit-based
US 2013/ 0209652A1	Nestec S.A., Vevey (CH)	Fruit or vegetable pulp powder and sugar powder	2013	Fruit-based
US 2016/ 0174597 A1	Int'l Foodstuffs Company LLC, Sharjah (AE)	Mango powder, a fat, protein component, non-starchy carbohydrates, stabilizers	2016	Fruit-based
AU 2016/ 102117 A4	Tania Sorrenti	Natural fruits, vegetables powder or herbs	2017	Fruit-based
CN102763878A	Beijing Zhongke Biotech Co., Ltd.	Maca extract, asparagus extract, vitamin complex, and mineral substances, complex amino acid	2013	Vegetable-based
US 2018/ 0213835A1	Oatly AB, MALMÖ	Oats, potato protein, rapeseed oil, vanilla essence, sodium chloride, di and tricalcium phosphate, calcium carbonate	2018	Vegetable-based

(*Contd.*)

Table 1 — Patents on health drink mixes (*Contd.*)

Patent No.	Assignee/Company	Ingredients used	Publication year	Category
US 2018/ 0125910A1	Kieu Hoang, Westlake Village, CA (US)	Maca root	2018	Vegetable-based
US 10,293,016 B2	Qinhuangdao Changsheng Agrotech Development Co. Ltd., Hebei (CN)	Asparagus powder, asparagus saponin, polysaccharide, polyphenol and flavones	2019	Vegetable-based
US 2011/ 0111114A1	The Quaker Oats Company, Chicago (US)	Grains, Vitamin E, β-glucan, thickeners, artificial sweeteners and salt	2011	Cereal-based
US 8.241,696 B2	The Quaker Oats Company, Chicago (US)	Dried agglomerated grain powder, milk/water, flavoring agents, coloring agents, sweeteners, salt, vitamins and minerals	2012	Cereal-based
US 8,802,177 B2	The Quaker Oats Company, Chicago IL (US)	Whole oat or barley flour, sugar, maltodextrin,mixedtocopherols	2014	Cereal-based
DK2285237T3	Nestec S.A., Vevey (CH)	Rice flour, fruit powder, milk solids, vitamins, sugars and flavors	2015	Cereal-based
CN104585829A	Liu Baixi	Rice, corn residue, soybean, wheat, barley, sorghum rice, millet, diced ginger, black sesame, walnut kernels, white sugar, and sodium benzoate	2015	Cereal-based
US 9,510,614 B2	The Quaker Oats Company, Chicago, IL (US)	Soluble whole grain oat flour, granulated sugar, maltodextrin, and antioxidants	2016	Cereal-based
BRPI0911423B1	Nestec S.A. Vevey (CH)	Cereal based flakes, cocoa component, milk solid, sugars, fruit powder, sweeteners, flavors	2017	Cereal based
WO2017093538A1	Nestec S.A. Vevey (CH)	Oat flour is mixed with rice or wheat flour with calcium carbonate, tocopherol, dipotassium phosphate	2017	Cereal based
US 2019 / 0191730 A1	Glucanova AB , Lund (SE)	Oat bran, α-amylase, β- amylase, β-glucanase and xylanase	2019	Cereal-based
CN112931621A	Shenchi Modern Agricultural Industry Shanxi Lu'an Shigejie Zhihua BiotechCo Ltd.	Oatmeal, skim milk powder, puffed corn flour, medium-chain triglyceride, resistant dextrin, crystalline fructose, concentrated whey protein, concentrated milk protein, soybean protein isolate, peony seed oil powder, freeze-dried crushed red dates, soybean peptide powder, guar gum, quinoa flour, buckwheat flour	2021	Cereal-based
US 2014/ 0113031A1	Taylor D. Lee, Paramus, NJ (US)	Whey protein isolate, milled chia, hemp protein, wheatgrass powderand goji powder Secondary ingredients: maca powder, pea protein, flax seed powder, pomegranate powder	2014	Seed-based
CN104146313A	Li Taihe	Flaxseed as main component Other ingredients: white granulated sugar, fructose corn syrup, lecithin, artificial sweetener (aspartame), tea polyphenols, flavoring agent, and fruit juice concentrate	2014	Seed-based
US 9,386,795 B2	Angelo Morini, Windermere, FL (US)	Free-flowing Chia seed powder	2016	Seed-based
CN110693012A	*Feng Yancheng*	Millet flour, wheat flour, black sesame flour, yam flour, jujube flour and medlar flour	2020	Seed-based
US 7,767,245 B2	Ray and Terry's Health Products, Inc., (US)	Soy protein isolate, whey protein, egg white powder, fiber blend, chocolate, vanilla flavor, vitamin-mineral mix, cocoa, soy lecithin, flax meal	2010	Meal-replacer
US 8,518,469 B2	Kraft Foods Group Brands LLC, Northfield, IL (US)	Whey protein, a soluble fiber component such as inulin, and an optional high-intensity sweetener	2013	Meal-replacer

(*Contd.*)

Table 1 — Patents on health drink mixes (*Contd.*)

Patent No.	Assignee/Company	Ingredients used	Publication year	Category
CN104921128A	Shao Suying	Dietary fiber, fruit vegetable powder, plant extracts, konjacglucomannan, albumen powder, tea extract, spice extract, Chinese herbal medicine extract, wheat sprout powder, bamboo charcoal powder, salt, compound amino acid, malt extract, B-complex and mineral matter, sweetener, melon draws extract	2015	Meal-replacer
US 9,693,577 B2	Abbott Laboratories, US	Soluble calcium protein (calcium HMB), soluble citrate, a soluble phosphate, and one chelating agent, HMB is amino acids metabolite	2017	Meal-replacer
CN107594514A	Bright dairy & food Co Ltd.	WPC, Eva milk protein, soybean protein isolate skimmed milk, maltodextrin, inulin, coconut oil, fruits and vegetable powder, and DHA	2018	Meal-replacer
US 2018/ 0279662A1	Abbott Laboratories, Abbott Park, IL(US)	Agglomerated whey protein concentrate, short-chain fructooligosaccharides, milk protein concentrate, magnesium phosphate, tri calcium phosphate, micronized docosahexaenoic acid water dispersible vitamin A, D, E, K premix	2018	Meal-replacer
US 9,861,122 B2	AMT Group, LLC Niles	Flavors, colors, water, propylene glycol, glycerol, high-intensity sweetener, citric acid	2018	Meal-replacer
US 2019 / 0281877 A1	Twin Cups, LLC, Santa Barbara, CA (US)	Dairy-based protein is whey protein and non-dairy-based is canola, soybean, and hemp proteins	2019	Meal-replacer
US 10,602,763 B2	DSM IP Assets B.V., Heerlen (NL)	Soluble iron in the form of ferric pyrophosphate	2020	Meal-replacer
US 2020/ 0022394 A1	Jost Chemical Co., St. Louis Mo (US)	Free-flowing powder of fatty acids	2020	Meal-replacer
CN110915925 A	Tianjin Vigor, Biotech Co., Ltd. (CN)	Soy protein isolate, whole milk powder, meal replacement premixed powder, iso-malto-oligosaccharide, guar gum, kidney bean extract, potato extract, vegetable and fruit granules, vitamins	2020	Meal-replacer
CN110800995A	Fangyi Zhu	Green-kernel black beans, Chinese yam, red lotus seed, black sesame, coix seed, brown rice, black rice	2020	Meal-replacer
CN112971043A	Maoyun Li	Beef powder, potato powder, corn powder, soybean powder, sesame seeds, red date powder, walnut powder	2021	Meal-replacer
CN104770824A	Qingdao Jinmaigurun Food Co Ltd	Walnuts, Chinese yam, almond, gorgon fruit, apple, lotus seed, red dates, black sesame seed, barley, flaxseed, carrots, black and brown rice are mixed with rock candy	2015	Some other drink mixes
US 2019 / 0230951 A1	Hayashibara Co. Ltd. Okayama - shi , Okayama (JP)	Different plant extracts and branched α-glucan	2019	Some other drink mixes

product. Many cocoa replacers such as carob powder, malted wheat, or barley are commercially well known. These are cheap as well as caffeine-free but achieving exact dark color using these alternatives is the main difficulty. In US 0342214, roasted wheat and barley were used as partial cocoa replacers and a major advantage of this invention was it introduced a powder mix with exact desirable dark color, flavor, and reduced off-taste.[23]Cocoa is not just a flavor enhancer, but also a nutrient-packed ingredient that can be used in many nutritional supplements. One such initiative was patented under patent application no. US 9788558 in which protein such as whey protein, casein, or their combination with cocoa enhanced the nutritional value of ready-to-drink beverage.[24]Solubility of powder was limited to hot diluents; its solubility in cold liquid was still creatingproblemsasunmixed products gathered at the bottom of the glass or jar.US 0206516 disclosed an idea of soluble agglomerated chocolate powder that solved the solubility issue by keeping its flow ability.[25]Invention patented in 2018 with application no. US 0125107 disclosed another good cocoa alternate. In this research, green banana flour under certain conditions was used as a cocoa replacer.After adjusting roasting time and temperature green banana flour acted as a natural cocoa substitutewith enhanced sensory attributes.[26]

Herb-based Drink Mixes

Using herbs as the main ingredient in drink mixes is also in trend these days. Herbs are plants with aromatic properties used as flavor enhancers in food products and can act as disease protectors for the heart, blood vessel, and mind. In US 0040757, A health drink was composed using ginseng, soy, whey protein, in which liquid base was water and organic vanilla was used as a flavoring agent.Due to the medicinal properties of ginseng, this drink was used as a stress reliever and energy booster.[27] Similarly, the drink mix usingrosemary concentrate was patented in 2012 with patent application no. US 7879383. As the fat content is a major concern all over the world.This invention did not use edible oil as it upgrades the calories. Another advantage was, extraction was carried out at neutral pH using water as a solvent which maintains maximum bioactivity of extractives.[28] Cinnamon is a popular spice used in many foods as an active ingredient because of its aroma and various health benefits. It has anti-diabetic properties too. The powder form of water extract of cinnamon was developed in one research that was licensed in 2012 with application no.US 8329232. The advantage of this invention was cinnamon extract obtained was low in coumarin and cinnamaldehyde content.[29] Despite health benefits, undesirable flavors such as the sour and bitter or earthy taste of these herbs and spices reduce their consumption. In US 0296614, their pungent flavor was neutralized using citrus components. Another advantage of this research was extraction done during the whole process conducted using non-toxic extracting solvent.[30] Turmeric is an Asian spice that is used to enhance flavor and color in food items. It has anti-cancer, anti-bacterial, and anti-microbial properties. Edible turmeric extract was made to consume as a night drink during 2018 and this research was licensed under patent application no.US 0339009.[31]In US 0105361, Chinese herbs were used in the production of a health drink. Major benefits of this powder formulation were its immunity-boosting nature, upgraded storage time, and suitability for large-scaleproduction.[32]

Fruits-based Drink Mixes

Like herbs, fruits and vegetables have been anexhaustible part of beverage mixes. Fresh black currant fruit or its dried form both are the powerhouse of vitamins, minerals, antioxidants and are also helpful in lowering blood pressure. Black currant also contains anthocyanins a natural coloring pigment. Various studies have been done on black currant anthocyanins but in extract, the amount of black currant anthocyaninsis very low as well as it generally contains organic acids which increase the acidity of food in which they are incorporated. Therefore, patent licensed during 2010 with application no. US 7658963 revealed the process that improved the quantity and quality of black currant anthocyaninswith excellent storage stability without using harmful substances such as organic solvents. The product made was highly acceptable in terms of visual functions, blood fluidity, and quite helpful in lowering the blood pressure of the body.[33] In application number US 0263861, dehydrated powder form of fruits like mango, avocado, the prickly pear was also incorporated ina beverage, and research was patented in 2012. This invention introduced a tasty food product that solved the overweight, obesity, and malnutrition problem.[34]Many powdered beverages are there in the market made up of using fruit pulp. But, when these drink mixes are reconstituted, they often make lumps. So, to overcome this issue one patent was filed and licensed in 2013 under application no. US 0209652 disclosed the fact that how the selection of the appropriate size of the pulp and sugar particles affect the lump formation. By adjusting size a novel beverage came into the picture that inhibited the lump formation after its reconstitution.[35] The problem using dried mango powder was itscolor stability, due to large surface areaoxidation occurs and its color changes from orange to brown. This problem was solved when spray-dried functional fat-filled natural mango powder was made in 2016 and patented under application no.US 0174597. This product was highly acceptable in terms of taste, aroma, and mean life.[36] There is a problem in beverage mixes that is the high amount of sugar content. As people are becoming more health-conscious, they are trying to limit or eliminate the sugar content in their diet. So, in this direction,one research was patented during2017 under application no. AU 102117 in which powder form of real fruits, vegetables, and herb extract containing low sugar content was composed. This sachet did not contain any artificial coloring or flavoring agent and preservative.[37]

Vegetable-based Drink Mixes

Vegetables are an important part of our diet. So, it is not at all possible to ignore vegetables during the preparation of the beverage mix.Asparagus is a

nutrient-packed spring vegetable. It is an excellent wellspring of fiber, vitamin A, B, C, E, K and folacin. It contains chromium that upgrades the capacity of insulin to move glucose from the circulatory system into cells. Health drinks mix containing asparagus not only used as a healthy beverage but also as medicine. One invention was patented under patent application no.CN 102763878, in which a ready-to-drink mix was made using both maca and asparagus that claimed to improve the immunity and sleep disorder.[38] In 2018, a vegetable-based drink mix was patented under patent application no.US 0213835. In this invention, potato protein was used instead of animal protein. Vegetable-based protein is much safer than milk or animal-based protein because excessive use of that protein can harm the heart. The resulting drink was more effective in the recovery of muscle glycogen after physical exercises.[39] *Maca* is a vegetable belonging to the Brassicaceae family. It is a rich source of calcium, potassium, iron, zinc, manganese, iodine, vitamin C, vitamin B2 which helps to boost energy and mood. In US0125910, ahealth drink mix was made and patented in which maca was used as an active ingredient. Novel drink mix formulation was a rich source of protein as it contains a total of 837 proteins.[40]Another formulation was licensed in US 10293016 in which asparagus extract was used to develop a powder mix. It claimed that its consumption by adding to milk helped in reducing mental stress.[41]

Cereal-based Drink Mixes

Cereals are a nutritionally important source of proteins, dietary fibers, vitamins, minerals, and carbohydrates. One cereal-based drink mix was composed and licensed under application no.US 0111114, in which oatmeal was cooked without enzymes, unlike conventional methods where enzymes are added to avoid the formation of starches. Other cereals such as, wheat, maize, rice, spelled, barley, millet, milo, rye, ergotises, wild rice, and buckwheat could also replace oatmeal in this research.[42] While talking about cereals, a picture with a bowl and spoon came into mind. Having such a kind of meal is a very time-consuming process. Therefore, research done in this direction introduced a novel concept of drinkable grain powder, and this idea was published in 2012 under patent application no.US 8241696.[43] Rice is one of the best cereal grains that can be used as a drink mix. Many attempts have been made in the past ten years for increasing the solubility of cereals to avoid sedimentation. The process of preparing soluble oat or barley flour using a continuous cooker in which gelatinize and dextrinize took place in one step was patented in 2014 under patent application no.US 8802177 this invention gave a highly acceptable product with improved solubility.[44] Rice-based drink mix is healthy and nutritious for people of all ages. So, one such drink mix was composed and patented in 2014 with application no. DK 2285237. In this research, cereal content was increased in such a manner that after reconstitution it didn't produce any sensory changes in the liquid.[45]In most cases, one or two types of cereals were used as an ingredient in the milk additives. But, in 2015 a patent was published under application no. CN 104770824 in which five different types of cereals were used for the composition of the drink mix. The main advantage of this drink was it was highly nutritious and very low in sugar content and synthetic additives.[46] Oat is a rich source of water-soluble β-glucan which reduces cholesterol and boosts immunity. But a proper amount of β-glucan cannot be served in food due to its low concentration in oats. If to upgrade the quantity, commercial β-glucan is added during production, this increases the cost of the product. Therefore, two ideas were patented in this direction during 2016 and 2017. In the first invention, a soluble whole grain oat flour drink mix was patented under application no. US 9510614. In this mix, soluble oat flour preserved its soluble β-glucan. This instant powder could be used in dips, bakery products, ice-creams, and yogurt.[47] While talking about solubility, imagine a scenario where a drink mix is easily soluble in cold liquid too, with no lumps, and can be consumed in soft drinks. In BR 0911423, one such idea was licensed and introduced a product whose production was done by enzymatic hydrolysis method.[48] In 2017, research patented with application no.WO093538 claimed a formulation that introduced a β-glucan rich product. Other than this, research claimed that due to cooking extrusion of dry mix, even high content of oat mix worked very well with a low amount of water.[49] Problem with oat drinks is the storage of these drinks is very difficult because particles settled down at the bottom.One invention patented in 2019 under application no.US 0191730 solved this problem.In this study, the appropriate size of oat bran was selected, and by adjusting the size suspension stability of the product was improved.[50]In CN 112931621A, the anti-fatigue nutritious powder

was patented using cereals as a basic ingredient, which is intended to alleviate the sub-health condition of tiredness by supplementing energetic substances, maintaining metabolism, enhancing bodily functions. The basic ingredients of this formulation were oatmeal and cornflour powder, as well asvitamin A acetate, cholecalciferol, dl-alpha-tocopheryl acetate, thiamine hydrochloride, riboflavin, pyridoxine hydrochloride, L-sodium ascorbate, nicotinic acid, D-calcium pantothenate, calcium carbonate, ferric pyrophosphate, and zinc gluconatewhich, appeared to improve people's overall health.[51]

Seed-based Drink Mixes

Seeds are great sources of fiber, vitamins, minerals, and antioxidants. Daily consumption of a handful of seeds can boost immunity that can help us to fight many health issues. One patent, filed under application number US 0113031 disclosed the composition of nutritious shake using chia seeds, wheatgrass, hempseed, and goji seeds. The introduced product was not only a health booster but also easily digestible.This product was formulated to meet the nutrition goals of the human body.[52]Like chia, flaxseed is also a healthy addition to the diet. They are a rich source of omega-3 fatty acids which may help in lowering cholesterol levels. Flaxseed supplemented health drink mix formulation was patented under patent application number CN 104146313 in which a product rich in alpha-linoleic acid was observed that prevents the hardening of blood vessels.[53]The problem with chia seeds is when it added to liquid their mucilage produces gel. So, to solve this issue one research was conducted in 2016. In US9386795, the composition of powder drink mix using the free-flowing powder form of chia seeds was patented. The advantage of this research was, the product showed non-mucilaginous, non-oily properties.[54] In CN 110693012, a nutritious drink mix with the characteristics of millet and dark sesame seed powder was composed and patented. It was claimed that this product can improve the stomach health index of people resulting in good metabolism.[55]

Meal ReplacerDrink Mixes

Working for hours in one place and because of odd eating habits, one has to bear the problem of obesity. Losing weight is a very hard and long process. People use many supplements for fat loss. Nourishing the body with essential minerals and vitamins is also very important during weight loss. Many supplements claim to help in this journey. But most of the beverages in the current market are inadequate in giving nutrition to people. One well-known approach to control calories without giving up sustenance is with a supper replacement drink that is balanced in nourishment while simultaneously being low in calories. Under application number US 7767245, the composition of the meal replacer powder mix was patented and it was a useful nutritious weapon to fight hunger. The advantage of this research was it did not include artificial ingredients.[56] In another study, a cold liquid soluble powdered beverage mix that contained low calories and carbohydrates but high protein and fiber content was composed and published in 2013 under patent application number US 8518469. It proved to be a treasure for health-conscious people.[57] In 2015, natural plants having weight-losing properties were taken in the composition of nutritional supplement and the idea was licensed under application number CN 104921128. It comprised of fruit-vegetable powder and Chinese herbs and spices that upgraded the taste of the product. Along with weight loss, the product showed excellent potential in expelling toxins and lift the sleep quality.[58] The body-building craze has been increasing day by day in youth. Some nutritional supplements are made to fulfill their desire. Calcium-HMB is used as a nutritional ingredient to build or maintain healthy muscles. Calcium enriched drink mix was composed and licensed in 2017 under application number US 9693577 which satisfied the fitness freaks completely.[59] A DHA and B-complex containing meal replacement powder was also made and licensed under patent application number CN 107594514 during 2018 and was claimed to be very useful for overweight teenagers.[60] Despite all health benefits, the undesirable flavor of nutritional supplements when they are reconstituted has always been a matter of concern. One research done in this direction gave a nutritional powder that fulfills nutritional needs without affecting organoleptic properties of liquid was licensed in 2018 under application number US 0279662.[61] It is believed that powder drink mixes are very stable as they have a long shelf life.[71] But, the liquid form of novel milk additive was patented in 2018 under application number US 9861122.The product when added to milk enhanced its flavor and color. The mean life of this liquid solution was quite

good even without preservatives.[62] In another study, in US 0281877 dairy or non-dairy-based high protein additive in liquid form was made. It when added to milk or water creates a great smooth texture and pleasant mouthful.[63]Just like vitamins, minerals help to build bones and regulate heart rhythm. Iron is essential for blood production. It carries oxygen through the blood to the rest of the body. Iron deficiency cause anemia. A step was taken to fill this gap in 2020. In US 10602763, the composition of an iron supplemented beverage was patented. In which soluble and bio-available iron was used andproduct formed was cheap and it did not affect the original taste of beverage.[64] Like iron, omega-3 fatty acids are essential for human growth. Our body cannot synthesize these essential fatty acids so should be taken intothe diet. The free-flowing salt type fatty acid composition was also patented in 2020 under patent application number US 0022394. The advantage of this research was a product rich in fatty acid showed excellent solubility in liquids.[65] In CN 110915925, another such meal replacer milkshake was composed that showed excellent fat-reduction effects on weight-losing people.[66] In CN 110800995, nutritious powder that claimed to enrich the blood nourished the liver, toxify kidney, and also had good taste and quality was made and patented.[67]A brewing-type nutritional meal replacement powder and a method of preparation were disclosed in one invention patented under application no. CN 112971043A. The nutritional meal replacement powder disclosed by the invention includes beef powder as the primary protein source, sweet potato powder, corn powder, and soybean powder as the primary dietary fiber sources, red date powder, sesame powder, and walnut powder as the primary nutrient element sources, and sugar powder as the primary taste regulator. When mixed with freshly boiled water at 40°C, the nutritional meal replacement powder showed good dissolving properties, because it was highly nutritious, it solved the problem of a lack of nutritional balance.[68]

Other Drink Mixes

During baking, many phytochemicals are lost. To overcome this problem, 18 types of natural ingredients were mixed to make an instant health drink *via* a ripe method which claimed to enhance immunity thus keep the various diseases away. This research was licensed during 2015 under application number CN 104770824. The advantage of this method was it retained the quantity of phytochemicals.[69]Plant extracts are being used as a beverage mix but the problem with them is; during powdering their aroma is deteriorated. Plant-based drink mixes were composed and patented in US 0230951, and admixing of branched-glucan mixture and pulverization were performed while retaining its flavor.Another advantage of this invention was, powder showed excellent solubility in liquids.[70]

In this review, an attempt has been made to cover the most relevant patent applications which tryto give a clear picture of ingredients used in different drink mixes. The patents have been reviewed on basis of ingredients and divided into 9 major categories. Figure 1 shows the number of patents covered in each category. Out of 52 reviewed patents, 13 patents were licensed as meal replacer drink mixes so they secured the first position with 25% and contributed the highest share in the literature review. Rest 75% distributed as, 19.23% cereal-based mixes secured their second position with 10 applications, 11.53% herb based secured the third position with 6, 9.62% of cocoa and fruit-basedmixes both secured the fourth position with 5 applications each, 7.69% seed and vegetable-basedmixes secured the fifth position with 4, 5.77% traditional malt-based mixes secured the sixth positionwith 3 and 3.85% otherdrink mixessecured the seventh position with 2 applications. Figure 2 describes the distribution of patent applications among different assignees. There are 13 different assignees thatenjoy26.92 % of the total share with 14 patent applications. William Horlicks captured 2 patents. Nestec S.A. Vevey (Switzerland), which is the world's leading Nutrition and Health Company, captured an 11.53% share with 6 patents.Quaker Oats Company availed 7.69% with 4 and Abbott Laboratories availed 3.85 % share with 2 patent applications. 26 other popular companies, institutes, and labscaptured a collective share of 50% as they claimed only one patent each.

Are Health Drink Mixes Healthy?

A literature study revealed that the cause of significantconcern in drink mixes is sugar content, salt, preservatives, and artificial flavoring and coloring agents.[71] Traditional malt-based beverage mixes just provide flavor and sugar. Many of these mixes claim to be full of nutrition. Regardless of whether these mixes have protein or nutrients and minerals, buttheir quantityis very low that does not affect much. Unsweetened Cocoa beverages require sugar content comparable to soft drinks. In case if these drink mixes are committing your well-being, the

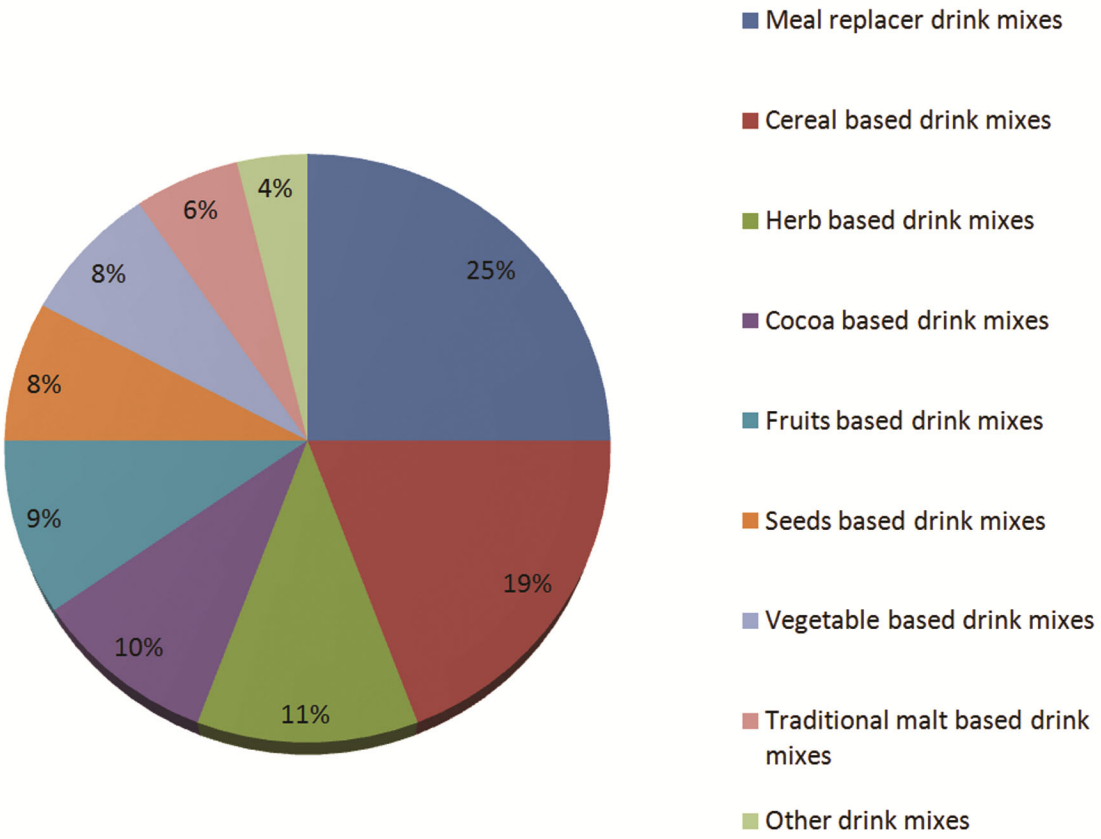

Fig. 1 — Patents reviewed under different categories

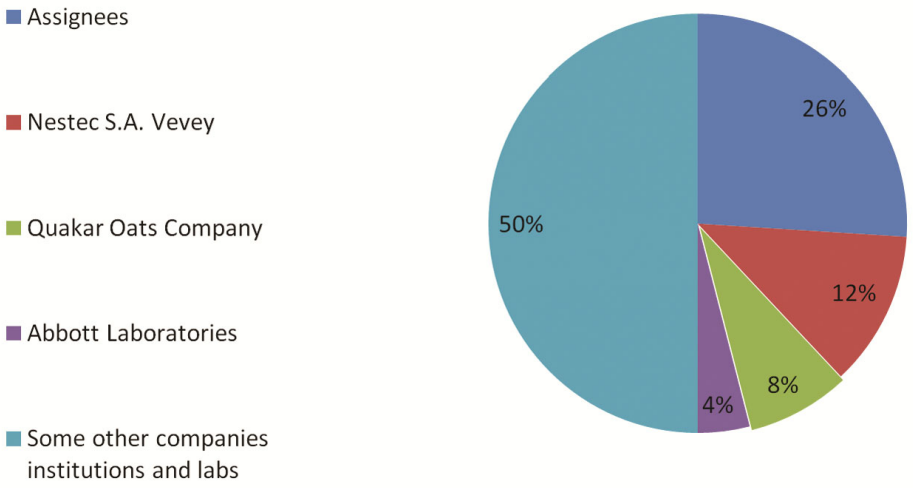

Fig. 2 —Companies/labs/institutions that captured majorities of patent applications

negative perspective invalidates the advantage. Protein powdered mixes contain a dehydrated form of Protein. Protein powders are generally made from milk, soy, or plants and can help in health andfitness goals. But most of these supplements contain stimulants that can be harmful.

As the world is becoming aware of its health that way health drink mixes are becominga witness to own progress. Many steps have been taken toimprove the nutritional value of drink mixes. Many drink mixes were made using herbs, spices, fruits, vegetables, and cerealswith a considerable amount of nutrients. Some

of them were nutrition enhancers and some weresupposed to ward off diseases. But when it comes to secondary ingredients such as sweeteners, preservatives, colorants, and flavors much work has not been done for their improvement. If significant improvements are made in this direction, then a new outline can be given to this topic. A lot of effort has gone into making drink mixes health enhancers. However, based on research studies, it would not be incorrect to state that efforts in two directions are required to make them the best.

Selection of Basic Ingredients

When choosing the primary ingredients for a health drink mix, it should be kept in mind that they should be nutritious, and if they're plant-based, that's even better. Introducing organic compounds can add more value to the mixes. Fruits and vegetables are part of our balanced diet. But after consuming them, their residues are treated as waste and thrown away. Focusing on fruit and vegetable waste such as peels/seeds as they are rich sources of many phytochemicals can be subject to highlight. Seeds such as, chia, poppy, hempseed, sunflower, safflower, pumpkin, and herbs like ashwagandha, shatavri, giloy, and holy basil, may also be added as ingredients to improve human health.

Selection of Natural Sweeteners, Preservatives, Colorantand Flavoring agents

Various peels contain a reasonable amount of natural sugar which can be extracted and used as natural sweeteners during the production of milk additives. Color and flavors are also important features that enhances the appeal and acceptability of beverages. Extracting food colorant and flavoring agents from waste peels is an attractive topic nowadays.Natural colorants such as carotenoids, lutein, anthocyanins, chlorophyll, betalain and many more have been extracted from fruit and vegetable residues. Citrus, mango, papaya, banana, apple peel, apricot and peach kernels, etc. have unique aroma can be used as natural flavoring agents. Many plants extract for example pomegranate peel extract, citrus peel oil can also use as natural preservatives.

Conclusion

For every individual who is more health-conscious looks out for the ingredients of the product. Consumers thoroughly study the health trends and compare them with what they are consuming. In this article, the ingredients used in the production of powdered mixes have been mentioned.It can be concluded that there is a need for simultaneous advancement in both primary and secondary ingredients of drink mixes.Some of the beverage mixes should contain a considerable amount of macro and micro-nutrients along with acceptable taste. A nutritious and tasty beverage mix without artificial flavors, colors, sweeteners, and preservatives may prove capable to attract customers. The use of the residues of fruits and vegetables and nutritious seeds in the preparation of drink mixes is also been suggested. Natural bioactive products extracted from these waste residues can replace the artificial colorants, preservatives, and flavoring agents in powdered mixes. It will also be a great help in the waste disposal problem. Utilizing waste food residue will not only address the environmental issues yet additionally emphatically influences human health and economy. In such pandemics as COVID-19, it becomes especially important to boost our immunity to fight the deadly viruses. Health is the key factor which affects the growth of any nation so the scope of this kind of research shall never end and we shall require such kind of health mixes till mankind is on earth.

References

1 Sani A M, Rahbar M& Sheikhzadeh M, *Traditional beverages in different countries: Milk-based beverages*,*Milk-Based Beverages: Volume 9: The Science of Beverages* (Elsevier Inc., 2019).

2 Pereira P C, Milk nutritional composition and its role in human health, *Nutrition,*30(2014) 619.

3 Cashman KD, Milk minerals (including trace elements) and bone health, *International Dairy Journal,*16(2006) 1389.

4 Bowman S A, Beverage choices of young females: Changes and impact on nutrient intakes, Journal of the American Dietetic Association, 102 (2002) 1234.

5 Lodhi S& Vadnere G P,*Health-Promoting Ingredients in BeveragesValue-Added Ingredients and Enrichments of Beverages,* (Elsevier Inc., 2019).

6 Kasapoğlu K N, Daşkaya-Dikmen C, Yavuz-Düzgün M, Karaça A C& Özçelik, B,Enrichment of Beverages With Health Beneficial Ingredients,*Value-Added Ingredients and Enrichments of Beverages,* 2019.

7 Tomke P D & Rathod V K,Additionally Added Ingredients and Enrichment of Beverages: An Overview,*Value-Added Ingredients and Enrichments of Beverages* (Elsevier Inc., 2019).

8 Özer B H& Kirmaci H A, Functional milks and dairy beverages,*International Journal of Dairy Technology,* 63 (2010) 1.

9 Rodriguez-Casado A, The Health Potential of Fruits and Vegetables Phytochemicals: Notable Examples,*Critical Reviews in Food Science and Nutrition,* 56 (2016) 1097.

10 Dantas D, Pasquali M A, Cavalcanti-Mata M, Duarte M E & Lisboa H M, Influence of spray drying conditions on the properties of avocado powder drink, *Food Chemistry,* 266 (2018) 284.

11 Kim J K, Baik M Y Hahm Y T & Kim B Y, Development and optimization of a drink utilizing citrus (Citrus unshiu) peel extract, *Journal of Food Process Engineering,* 35 (2012) 557.

12 Rasouli Ghahroudi F, Mizani M, Rezaei K & Bameni Moghadam M, Mixed extracts of green tea and orange peel encapsulated and impregnated on black tea bag paper to be used as a functional drink, *International Journal of Food Science & Technology,* 52 (2017) 1534.

13 Tomczyk M, Zaguła G, & Dżugan M, A simple method of enrichment of honey powder with phytochemicals and its potential application in isotonic drink industry, *Lwt,* 125 109204 (2020).

14 Araujo Q R De, *et al.* Cocoa and Human Health: From Head to Foot—A Review, *Critical Reviews in Food Science and Nutrition,* 56 (2016) 1.

15 Belščak-Cvitanović A, *et al.* Physical properties and bioactive constituents of powdered mixtures and drinks prepared with cocoa and various sweeteners, *Journal of Agricultural and Food Chemistry,* 58 (2010) 7187.

16 Srour N, Daroub H, Toufeili I & Olabi A, Developing a carob-based milk beverage using different varieties of carob pods and two roasting treatments and assessing their effect on quality characteristics, *Journal of the Science of Food and Agriculture,* 96 (2016) 3047.

17 Fernandes C G, Sonawane S K & Arya S S, Cereal based functional beverages: A review, *Journal of Microbiology, Biotechnology and Food Sciences,* 8 (2018) 914.

18 Queiroz V A V *et al.* A low calorie and nutritive sorghum powdered drink mix: Influence of tannin on the sensorial and functional properties, *Journal of Cereal Science,*79 (2018) 43.

19 Horlicks W, Granulated food for infant and process of preparing the same, US 278967, (1883).

20 Horlicks W, Malted food product and method of making the same, US 627119, (1899).

21 Ambeskar S, Bhogle P, Suri K M& Bhatia A, Dried malted beverage product, US 0114826A, 1(2012).

22 Blondeel I, Clercq D D, Bernaert H& Leclerc C, Method of producing soluble cocoa product from cocoa powder, US 8609174B, 2 (2013).

23 Ommeren E V, Corda G, Bakker J & Dahan C, Process for providing a cocoa replacer based on a material selected from roasted wheat, roasted and/or malted barley, US 0342214A, 1 (2015).

24 Pascual T B, Sher A A, Ready to drink beverages and method of making thereof, US 9,788,558B, 2 (2017).

25 Montes B C, Wooster T J, Jaccard D & Lefait H, Soluble agglomerated chocolate powder, US 0206516A, 1 (2018).

26 Moragne M, Morales H W, Skea D H, Vasquez J C & CogswellT S, Natural cocoa alternative and method of producing same, US 0125107A, 1 (2018).

27 Chin D, Health beverage and additive mixture for preparing the same, US 0040757A, 1 (2010).

28 Borse B B, Ramlakshmi K, Sulochanamma G & Raghavan B, Rosemary herbal beverage powder and process, US 7879383 B, 2 (2011).

29 Nanzheng C, Luo L & Kong J, Process for preparing water extract of Cinnamon, US 8329232B, 2 (2012).

30 Sosenko R, Mascaro D, Parisi P & Ennis G, Herbal extract composition, US 0296614A, 1 (2017).

31 Bariahtaris K, Turmeric health additive and method for making same, US 2018 / 0339009A, 1 (2018).

32 He R, Zhao H & Tang Q, Powder formulation having a function of enhance immunity and method of preparing the same, US 2019/0105361A, 1, (2019).

33 Matsumoto H, Tominaga S, Kishi M, Kawakami T, Tokunaga T & Hirayama M, Compositions for foods and process for producing the same and functional foods and drinks containing the same, US 7658963 B, 1(2010).

34 Mendoza D J, Dried, powdered avocado, mango, prickly pear and oats-based food composition and tablets, US0263861A, 1(2012).

35 Du S Z, Liao Y, Bai H& Sun ZW, Powdered beverage comprising sugar and fruit or vegetable pulp, US0209652A, 1(2013).

36 Kumar V, Varade M P, Kamble A P & Quijano J A, Functional fat-filled mango powder composition and products made thereof, US 0174597A, 1 (2016).

37 Sorrenti T, Powdered food and liquid soluble product using real fruit, vegetable, and herbal ingredient combinations, AU 2016102117A, 4 (2017).

38 Zhao B, Wang Q&Yang Y, Functional health maca drink and production method thereof,CN102763878A, (2013).

39 Triantafyllou A, Vegetable health drink, US 0213835A, 1 (2018).

40 Hoang K, Method of producing beverage on the basis of juice and powder of maca root, US 0125910A, 1 (2018).

41 Haung Y, Cheng L& Yuan Q, Use of instant asparagus powder in food, medicine,and health food, US 10,293,016 B, 2(2019).

42 Spadarogrant V, Thompson M, FriendKE& Tsao TF, Grain-based powder, US0111114 A, 1(2011).

43 Chung Y, Smith J & Ali Z, Hydrolyzed, spray dried, agglomerated grain powder and drinkable food products, US8241696B, 2 (2012).

44 Chatel R, Chung Y & French J, Soluble oat or barley flour and method of making utilizing continuous cooker, US 8,802,177B, 2 (2014).

45 Xia D J& Pierre W, Rice-based instant drink, DK 2285237T, 3 (2015).

46 BaixiL, Five cereal health drink and method of preparation thereof, CN 104770824A, (2015).

47 Carder G D, Chung Y, Deutsch R G, Feito J, French J, Lee M, Miller M J, Ramage H& Chatel RE, Food product prepared with soluble whole grain oat flour, US 9510614B,2 (2016).

48 Dai J X & Wuersch P, Cereal flakes, cereal-based powder compositions, methods for the preparation of an instant beverage and the manufacture of cereal flakes, BR PI 0911423B, 1(2017).

49 Dupart J P, RuffinoL&Savoy J L, Oat-based product and process of manufacture, WO 093538A, 1 (2017).

50 Rascon A, Method of preparing a liquid oat base and product prepared by this method, US 0191730A, 1 (2019).

51 Feng G, Li H, Wang S, Liu W, Yuan S & Wei L, Cereal nutrition powder with anti-fatigue function, CN112931621A, (2021).

52 Lee T D, Nutritional Shake, US0113031A, 1 (2014).

53 Si C, Junyi H & Taihe L, Flaxseed drink, CN104146313A, (2014).

54 Morini A, Reconstitutable and water-soluble chia product and related method of manufacture. US 9,386,795B, 2 (2016).

55Yanchang F, Mixed powder and preparation method thereof, CN 110693012A,17(2020).

56 Grossman T& Kurzweil R C, Meal replacement beverage US 7767245 B, 2 (2010).

57 Macdonald J L, Chase M W & Spelman K P, Powdered beverage composition, US 8518469B, 2 (2013).

58 Suying S, Fruit-vegetable powder and preparation method thereof, CN 104921128A, (2015).

59 Helmke C, Johns P & Kensler A, Method of preparing a nutritional powder comprising spray dried HMB, US 9693577B, 2 (2017).

60 Wenliang C, Hongxin J, Zhenmin L, Xiaoyang Q, Miya S & Zhiyuan X Total-nutrient meal replacement powder for teenager population and preparation method thereof, CN 107594514A, (2018).

61 Gupta R, Patel G &Dewille N, Nutritional supplement powder, US 0279662 A, 1 (2018).

62 Kang Y, Farinella J, Frothingham K, Kozlowski J, LynchH& Higgs J, Shelf-stable, preservative free, liquid beverage enhancer product, US 9861122B, 2 (2018).

63 Bennett C, Carey N & Israelachvili J, High-protein food additives, US 0281877A, 1(2019).

64 Steiger G, Process for iron supplementation of beverages, US10,602,763B, 2 (2020).

65 Gleason J, Caskey D, Bruton E, Bandrowsky T & Jost D, Fatty acid composition and method for fortifying nutritional products with same fatty acids. US 2020/ 0022394A, 1 (2020).

66 Shiying L, Liangjun L, Xiukai Z, Qinghai X & Xiaoyu C, Meal replacement milkshake solid beverage containing fruit and vegetable particles and having high protein and satiety and fat reduction effects, CN 110915925A, 27(2020).

67 Fangyi D, Qi-tonifying and blood-nourishing nutritional powder and preparation method thereof, CN 110800995A,18 (2020).

68 Li M, Brewing type nutritional meal replacement powder and preparation method thereof, CN 112971043A, (2021).

69 Xubo Z, Instant health drink powder capable of benefiting qi and nourishing blood, CN 104770824A, (2015).

70 Inoue S & Watanabe H M, Powdery plant extract for beverages and process for producing the same, US 2019/0230951 A1, 2019.

71 Çopur Ö U, İncedayıB & KarabacakA Ö,Technology and Nutritional Value of Powdered Drinks, *Production and Management of Beverages* (2019).