

## AIR Scientific Monograph

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### Ingredients

#### Botanicals

[Aloe Vera Leaf Gel](#)  
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[Black Currant](#)  
[Cranberry](#)  
[Dog Rose](#)  
[Lemon](#)  
[Lycium Berry](#)  
[Maca Root](#)

#### Vitamins

[Vitamin C](#)  
[Vitamin D](#)

#### Minerals

[Zinc](#)

#### Other Ingredients

**Molasses**  
**Sugar**  
**Cranberry Flavor**

[Reference](#)

### Aloe Vera Leaf Gel (*Aloe vera*)



Spencer Wing, Mozo190, Pixabay, Stan Shebs Wikipedia 2006

- The gel from the inner leaf is known to activate self-cleaning systems of the body and remove toxins, has been shown to have antibacterial actions.
- Has strong anti-inflammatory properties due to its plant sterols lupeol, campesterol, and beta-sitosterol.
- Has strong antifungal (antimycotic) effects: suppresses bactericidal inflammation in human leukocytes (a type of white blood cell of the immune system).
- Cleans and dilates the capillaries and veins; improves blood circulation.
- Promotes rapid healing of ulcers in ulcerative colitis, and first and second-degree burns.
- Improves skin conditions of seborrheic dermatitis, psoriasis, erythema (raised bumps on the skin), and skin abrasions.
- Used for improving the condition of alveolar osteitis or “dry socket” after tooth extraction.
- Stimulates motor activity (muscular movement and actions).

- Normalizes pH, the acid/alkaline balance in the body, as well as secretions of the gastrointestinal tract; has been applied in a wide range of gastrointestinal (the stomach and intestines) ailments.
- Has been shown to lower blood pressure and blood cholesterol levels.
- Has been applied in the treatment of angina pectoris, which is an inadequate blood supply to the heart accompanied by severe chest pain, and often pain that spreads to the arms, shoulders and neck.
- Enhances immunity to infectious diseases; has been shown to have the capacity to reverse the initial onset of genital herpes.
- Normalizes overall metabolism; used in improving type 2 diabetic conditions, for it contains beneficial mucopolysaccharides along with various amino acids, enzymes and vitamins (Grundmann, 2012) (Surjushe, 2008).

### Amla Berry Fruit (*Phyllanthus emblica* L.)



Lalithamba – Wikimedia Commons 2010

- Native to India and Southeast Asia.
- Plays an important role in India traditional medicine for anxiety and burning sensations of the skin and eyes.
- High in vitamin C and potent, antioxidant secondary metabolites, the polyphenols.
- Anti-hyperlipidemia (high blood lipids), antidiabetic, anticancer, anti-inflammatory.
- Digestive tract and neurological protecting actions, including improving conditions in diabetic neuropathy and restoring blood glucose and proper insulin levels.
- Found to improve anemia, male reproductive system.
- Contains gallic acid, ascorbic acid and phenolic phytochemical compounds that aid the immune system and digestion.
- Improves liver and cardiovascular states of health including atherosclerosis (hardening of the arteries), found to limit LDL cholesterol oxidative damage and improve total cholesterol, and reduce the inflammatory marker C-reactive protein (CRP).
- Various research has shown *P. emblica* L. to be anti-hyperglycemic, hypoglycemic.
- Contains phenolic acids, including hydroxybenzoic acids:4-hydroxybenzoic acid, coumaric acid, gallic acid, protocatechuic acid, syringic acid, and vanillic acid.
- Contains the hydroxycinnamic acids caffeic acid and chlorogenic acid.
- Contains the flavonoid compounds flavonols, flavanones, and flavan-3-ols, and various flavonol and quercetin derivatives.
- Contains the flavones apigenin, luteolin, and myricetin.
- Contains tannins, an important group of phenolic compounds, including ellagitannins, tannic acid, ellagic acid and derivatives.
- Also found to contain the alkaloids phyllantine and phyllantidine.

- Amla has been shown to improve the body's antioxidant defenses, which play a role in limiting the formation of reactive oxygen species (ROS) free radicals, and thereby prevent oxidative damage and lipid peroxidation, while improving cell oxygenation and therefore cell functions. The body's antioxidant defenses include mobilizing glutathione GSH, and the enzymes catalase (CAT), GSH reductase, glutathione peroxidase (GPx), and superoxide dismutase (SOD).
- Research indicates that such a boost to the body's defenses against the above damaging free radicals may prevent oxidative damage to lung cells in smokers, and be useful in metabolic syndrome (health conditions associated with obesity).
- Research indicates amla's phytochemical compounds' biological effects, in addition to its antioxidant actions, as follows:
  - Cardioprotective actions: polyphenols, gallic acid, myricetin, kaempferol, emblicanin A and B, punigluconin, pedunculagin, chebulagic acid, geraniin, ellagic acid, corilagin.
  - Antidiabetic actions: ellagic acid.
  - Anticancer activity: pyrogallol, emblicanin A and B.
  - Anti-inflammatory compounds: emblicanin A and B, gallic acid, corilagin, ellagic acid, pedunculagin, quercetin, rutin, mucic acid, beta-glucogallin.
  - Neuroprotective compounds: emblicanin A and B, punigluconin, pedunculagin, rutin, gallic acid, polyphenols.
  - Gastrointestinal protective actions: gallic acid, tannins, and polyphenols which were shown to inhibit clarithromycin-resistant *Helicobacter pylori*, the microorganism known to cause gastric ulcers.
- Researchers found amla extract tablets reduced gastroesophageal reflux problems of regurgitation and heartburn compared to the placebo group.
- Other studies found amla's bioactive compounds to aid in reducing oxidative actions leading to neurodegenerative diseases (Gul, et. al., 2022).

### **Black Currant (*Ribes nigrum* L.)**



H. Zell - Wikimedia Commons 2009

- Native to central Europe and Northern Asia.
- Studies show black currant to be anti-inflammatory, antioxidant and anti-free radical, and antimicrobial.
- Biochemical constituents include anthocyanins, flavonols, phenolic acids, and polyunsaturated fatty acids.

- Studies indicate black currant use against cardiovascular, hypertension, and neurodegenerative conditions, nephrolithiasis (kidney stones), and diabetic neuropathy (Gopalan, et. al., 2012).
- Contains pectins, organic acids.
- Other studies have shown black currant's anthocyanins' antioxidant properties to reduce risk of various non-communicable, chronic diseased conditions, such as cardiovascular, eye, autoimmune, and abnormal blood plasma lipids.
- The polyunsaturated fats in the seeds of the fruit have been shown to help in autoimmune conditions, and the active biochemical compounds have demonstrated anti-inflammatory, immunomodulatory, chemopreventive, antimicrobial and anti-tumor actions (Oczkowski, 2021).
- Black currant extracts were tested for their destructive effects against two highly damaging free radicals formed in the body, superoxide and hydroxyl, which are involved in aging and serious diseases such as cancer.
- Black currant extracts were found to convert free radicals from volatile compounds into stable molecules (Jia, et. al., 2014).
- The polyphenolic and anthocyanin compounds in BC have been shown to inhibit the actions of pathogenic (illness-causing) bacteria *Salmonella enterica* serovar Typhimurium.
- BC's proanthocyanidins have proven to:
  - Aid asthma and other air-way related problems by disrupting the pathways of inflammatory proteins, including cytokines, cyclooxygenase, and prevent the modulating effects of immune cell signaling that mobilize inflammatory actions.
  - Proanthocyanidins have demonstrated antioxidant activity against free radical damage from ultrasound irradiation through protecting against DNA damage
  - In both human and animal studies, BC demonstrated increases in athletic performance: in endurance-trained athletes, moderate-intensity cycling and other athletes such as high intensity repeated sprints showed reduced strain on fatigued tissues that can otherwise result in stress-related injuries.
- The flavonoid compounds in BC have been well documented to protect the retinal cells of the eyes from cell death, which are highly prone to oxidative stress injury.
- Human intervention studies have shown improvements in cognitive performance, proper blood flow, and blood glucose modulation (Cortez, 2019).

## Cranberry (*Vaccinium oxycoccos*)



Christian Fischer 2006 Wikipedia

- Also known as the European cranberry, *V. oxycoccos* has been used in Eastern Europe, Finland, Sweden, and Russia.
- Cranberry contains 8,000-10,000 phytochemical compounds, particularly high levels of phenolics such as anthocyanins, flavonoids, and phenolic acids.
- Contains a variety of phenolic acids: catechins, triterpenoids, hydroxycinnamic acid, three classes of flavonoids including flavonols, anthocyanins, and proanthocyanidins.
- *V. oxycoccos* is known for its main organic acids citric and quinic acid, as well as its high vitamin C content, and along with its great concentrations of the aforementioned biochemicals, are very important antimicrobials.
- Potent amounts of the abundant antioxidant, anti-free radical phenolic compounds in the European cranberry (*V. oxycoccos*) are higher than in the American cranberry variety (*Vaccinium macrocarpon*). Those phenolics include: trans-resveratrol, benzoic, chlorogenic, *p*-coumaric, and caffeic acids; and flavonoids quercetin, epicatechin, and isorhamnetin.
- Antioxidant effects include: inhibiting oxidative and inflammatory free radical damage of the body's cells and tissues as the result of oxidative stress. Free radical molecules typically are missing electrons at the atomic level, and thus scavenge electrons from healthy cells, rendering them prone to malfunctions, and lead to the formation of obstructive plaques, micro scarring, or damage DNA that in turn cause mutations that may lead to cancer (Pham-Huy, 2008).
- *V. oxycoccos*' high levels of flavonoids, particularly quercetin, are natural antimicrobial complexes that prevent infections of illness-causing bacteria through their anti-adhesive properties that prevent bacteria from adhering to cell surfaces and thus stunt their ability to multiply to infectious levels.
- The polyphenol proanthocyanidins also prevent bacteria adhesion to cell membranes.
- European cranberry's phytochemical compounds have been found to be effective against *Escherichia coli*, *Salmonella typhimurium*, *Enterococcus faecalis*, *Listeria monocytogenes*, *Staphylococcus aureus*, and *Bacillus subtilis*, as well as *Streptococcus agalactiae*, *Streptococcus pneumoniae*, *S. enterica* sv. *Typhimurium*, and *Lactobacillus rhamnosus*.
- In addition to being proven against bacterial growth, the polyphenols in cranberry fruit extracts have also been studied for their effective antifungal and antiviral activities.
  - Quercetin has been studied for its anti-inflammatory, antibacterial, antifungal and anticancer effects.
  - Resveratrol was shown to be antibacterial and antifungal.
  - Anthocyanidins demonstrated antibacterial and cardioprotective attributes.
  - Proanthocyanidins were shown to be cardioprotective, and effective against urinary tract infection.

- In *in vivo* (live human test subjects) and meta studies on women's urinary tract infections, type-A proanthocyanidins prevented *E. coli* adherence to epithelial cells in tissues of the urinary tract.
- Proanthocyanidins in concert with other have also been associated with preventing the motility of bacteria and preventing the formation of biofilm such as in cataracts.
- Studies indicated that *V. oxycoccos*, once digested and absorbed into the body's cells, inhibited the formation and proliferation of oral, breast, colon, and prostate cancers, and caused cancer cell self-destruction or apoptosis (Jurikova, et. al., 2018).

### Dog Rose (*Rosa canina* L.)



Trish Steel Wikipedia Commons 2009

- Widespread in the subtropical, temperate environments of Europe, Asia, North America, and the Middle East, *R. canina* L. has been used against the common cold, flu, skin conditions such as itching and eczema, cough, gastrointestinal problems, infections, inflammatory conditions, and chronic pain.
- Research found potent antioxidant activity from polyphenolic, phenolic acid, and flavonoid compounds as well as the beneficial organic acids: gallic, protocatechuic, vanillic, chlorogenic, syringic, *p*-coumaric, ferulic, sinapic, cinnamic, quercetin, rutin, and rosmarinic acid.
- Those biochemical compounds in *R. canina* L have been shown to contain antioxidant, anti-inflammatory, chemopreventive, antimutagenic, and anticarcinogenic actions, as well as anti-obesity, antidiabetic, antinociceptive (blocking pain), antiulcerogenic, and antiproliferative properties.
- Clinical trials reveal that constituents in dog rose fruits (rosehips) reduce osteoarthritis pain and other symptoms.
- *R. canina* L was tested for its effective antibacterial activity against various strains of *Staphylococcus*, *Streptococcus*, *Escherichia coli*, and *Pseudomonas* bacteria (Polumackanycz, et. al., 2020).
- The Iranian physician Avicenna (980-1037 AD) listed dog rose for ulcers, improving dental gum conditions.
- Modern day researchers found the rose hip to be a source of vitamin C, and anti-inflammatory for gingivitis, bleeding or swollen gums, and preventing scurvy.
- Leaves have been shown to relieve the common cold, influenza and cough, while being used for urolithiasis (stones that form in the ureters, bladders, and urethra), asthma, and bronchitis.

- Dog rose seeds were found to be effective against osteoarthritis (degeneration of cartilage and changes in bone formation), rheumatism (inflammation of the joints, muscles or other fibrous tissues), and gout (arthritic pain and swelling in the joints).
- Characteristics of phenolic compounds and dog rose's ascorbic acid (a form of vitamin C) include antimutagenic and anticarcinogenic actions, and as a potent antioxidant, is also involved in the synthesis of hormones and neurotransmitter communications in the nervous system.
- Studies also found that dog rose's flavonoids and their antioxidant properties are important for neutralizing and controlling the destructive actions of oxygen free radicals.
- Extracts of *R. canina* L. were found to be effective for destroying *Escherichia coli*, *Pseudomonas aeruginosa* and the fungi *Aspergillus niger*, *Fusarium culmorum*, and *Alternaria alternata*.
- Dog rose's phenolic compounds and other antioxidants were found to reduce fasting blood glucose and total serum cholesterol in type 2 diabetes test subjects.
- In diabetic test animals, researchers found that rose hip extracts of *R. canina* L. decreased serum glucose levels, LDLs and total cholesterol, triglycerides, urea, uric acid, creatinine, and alkaline phosphatase, along with increased serum HDL cholesterol levels.
- Researchers also showed that rosehip extracts of *R. canina* L. improved the function and proliferation of pancreatic  $\beta$ -cells.
- Other studies indicated the heart-healthy compounds had antihyperlipidemic actions in diabetes individuals, and reduced the risk of cardiovascular conditions in obesity.
- Other studies showed rosehip extracts resulted in reduced blood pressure.
- Dog rosehip powder was tested against individuals with osteoarthritis of the hip and knee, and compared to the placebo group, test subjects experienced considerable reduction of pain, and another experiment resulted in the same result, as well as improvements in mood, feelings of well-being, and quality of sleep.
- Other clinical trials also confirmed improvements in osteoarthritis, rheumatoid arthritis, and other types of joint degenerative conditions, with results much greater than glucosamine, a supplement known for improving joint mobility.
- A major anti-inflammatory compound in dog rose known as galactolipid has been shown to inhibit inflammatory proteins cyclooxygenase-1 (COX-1) and cyclooxygenase-2 (COX2).
- Rosehip extract containing xanthophyll esters and flavonoids was shown to be effective as an antiproliferative against in-vitro colorectal cancer and human breast cancer cell lines.
- Other researchers showed that rosehip seed compounds have anti-obesity and anti-diabetic properties, and protect fatty acid oxidation in the liver and skeletal muscles.
- The active glycosidic flavonoid compound, trans-tiliroside in *Rosa canina* L. demonstrated an inhibitory effect on weight gain in mice, and in a randomized, double blind, placebo-controlled clinical trial, rosehip extract showed a possible inhibitory effect on lipid or fat accumulation in fat cells and a decrease in abdominal visceral fat, body weight, and basal metabolic index (BMI).
- Volunteer test subjects who drank rose hip tea for three weeks showed improvements in increased beneficial bacteria in the bowel, and reduced abdominal pain in irritable bowel syndrome (IBS).
- Other studies with rodents showed decreased urinary calcium oxalate calculi in the kidneys (kidney stones), and hepatoprotective (liver) effects against toxicity (Selahvarzian, 2018).

## Lemon (*Citrus limon*)



Hans Braxmeier - Pixabay

- Contains vitamins A, B1 (thiamine), B2 (riboflavin), D and vitamin P (flavonoids).
- Contains vitamin C, which contributes to the prevention of high cholesterol levels, which can result in atherosclerosis, the narrowing and hardening of the arteries, or artery abnormalities that impair blood and oxygen to the heart such as the formation of clots that can lead to a heart attack, or angina or chest pain, stroke or mini-strokes as a result of blood vessel ruptures that form obstructive clots and prevent oxygen and blood flow to the heart, brain or other areas.
- A study that compared three study groups whose intakes of apples, fresh lemon juice, and both apple and lemon juice resulted in the drinkers of only lemon juice having the most reduction in LDL cholesterol levels. (Tajoda, et al., 2013).
- Contains beneficial, bioactive components such as citric acid, protective antioxidant polyphenols, and ascorbic acid (vitamin C).
- Studies show that the flavonoids in lemon help in regulating systolic blood pressure.
- Lemon's citric acid has been found to help the body generate calcium citrate, an absorbable form of calcium, out of poorly absorbed inorganic salts such as calcium phosphate or calcium carbonate, thereby promoting absorption in the intestinal tract.
- Lemon's citric acid has been found to promote better absorption of the essential minerals calcium and magnesium, which contribute to proper blood pressure (Kato, et. al., 2014).
- Lemons contain flavonoids or a class of flavonone glycosides such as eriocitrin, hesperidin and naringin, and a class of flavone glycosides such as diosmin, and 6,8 C-diglucosyldiosmetin, all of which have a number of positive health effects in preventing lifestyle-related diseases.
- Lemon flavonoids are reported to have anti-inflammatory, anticancer, and antiviral properties due to their antioxidant activities, as well as demonstrated effects on lipid and glucose metabolism.
- Lemon flavonoids hesperidin and naringin have been shown to decrease blood plasma and hepatic (liver) cholesterol and triacylglycerol (triglyceride) levels by inhibiting hepatic enzymes involved in the production of cholesterol and triacylglycerol.
- Lemon flavonoids also have been shown to improve conditions of hyperglycemia (elevated blood glucose) in type-2 diabetes through their glucose-regulating enzymes, helping to prevent obesity through those modulating effects in glucose metabolism.
- It is thought that other lemon polyphenolic compounds additionally may help improve insulin resistance where too much sugar builds up in the blood by stimulating the uptake of glucose into the cells out of the blood, and suppressing the accumulation of fat in body tissues such as under the skin and in the liver (Fukuchi, et. al., 2008).



- Lemon juice has been found to be effective against the proliferation of the illness-causing bacteria *Staphylococcus aureus*, *Enterococcus faecalis*, and *Salmonella spp*, as well as the antibiotic-resistant *Pseudomonas aeruginosa*.
- Lemon juice concentrations have also been found to be effective against fungal strains *Candida albicans*, *Aspergillus niger*, and *Penicillium spp*. (Oikeh, et. al., 2016).

### **Lycium Berry** (Goji Berry, Wolfberry) (*Lycium barbarum*)



Sten Porse Wikipedia 2002

- Mostly grown in China, Tibet, and other areas of Asia, with reported outstanding bioactive attributes.
- *Lycium barbarum* contains a potent amount of phenolic compounds such as phenolic acids, flavonoids, carotenoids (including zeaxanthin,  $\beta$ -carotene, neoxanthin, and cryptoxanthin), and organic acids known for their antioxidant, antimicrobial, anti-inflammatory, prebiotic, immunomodulatory, and anticancer actions.
- Goji berry contain concentrations of antioxidants, essential fats, essential amino acids, dietary fibers, and essential vitamins and trace minerals.
- Asian folk medicine has used *L. barbarum* for improving eye health and blood quality, and against diabetes, chronic cough, dizziness, and tuberculosis.
- Research has found that the above compounds in *Lycium* berries' inhibitory actions work effectively against oxidative scavenging free radicals such as reactive oxygen species (ROS) and other radicals.
- Researchers also have identified phenolic compounds, including quercetin, isoquercitrin, chlorogenic acid, ferulic acid, *p*-coumaric acid, caffeic acid, isorhamnetin, cinnamic acid, and rutin, isoquercitrin, and chlorogenic acid.
- Researchers also listed beneficial water-soluble polysaccharides: homogeneous polysaccharides, pectin polysaccharides, acidic heteropolysaccharides, and arabinogalactans including arabinose, glucosamine, galactose, glucose, xylose, mannos, fructose, ribose, galacturonic acid and glucuronic acid.
- *Lycium* berries also contain important organic acids citric, succinic, and oxalic acids, as well as the antioxidants vitamin C and vitamin E tocopherols that protect against membrane lipidic peroxidation of essential polyunsaturated fatty acids, including linoleic acid, oleic acid, and palmitic acid.
- Various studies found goji berry activities also include anti-tumor, antimicrobial, hypoglycemic, hypolipidemic, anti-mutagenic, immunomodulatory actions.
- Other researchers demonstrated goji berry's prebiotic, anti-aging, anti-fatigue, and neuroprotective activities of phenolic acids, flavonoids, carotenoids, and tannins, with

their correlations of improved liver, kidney, eyesight, immune system, circulatory system, and longevity.

- The phenolic compounds and flavonoids, carotenoids, tocopherols, polysaccharides, ascorbic acid, and tannins in *Lycium* and other fruits and vegetables stimulate the antioxidant production and defenses in the body, delaying, inhibiting, or preventing free radicals from damaging DNA, lipids, and critical proteins.
- Phenolic compounds are proven to actually donate missing electrons at the atomic level and prevent free radical electron confiscation while enhancing the body's natural antioxidant enzyme defenses such as superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), and malondialdehyde (MDA).
- Researchers showed how the immunomodulatory properties of goji berries increased the proliferation and recognition/elimination capacities of the body's natural killer (NK) cells, which innate purpose is to control tumors and microbial infections by preventing them from spreading and causing more tissue damage.
- Other researchers assessed just how a goji berry extract prevented an in vitro human breast cancer cell lineage from proliferating, and caused their death and self-destruction apoptotic effect.
- Another study observing the effects of goji polysaccharide solutions on hepatoma (liver cancer) cells, cervical cancer cells, and human breast cancer cells also reportedly resulted in the halting and self-destruction (apoptosis) of cancer cell growth.
- Their phytochemical compounds already mentioned have been shown to disrupt the cell membranes of pathogenic (illness-causing) microbes, exposing their inner bodies to damaging enzymes and metabolic incapacitation and leading to their cell death.
- A main phenolic acid in *Lycium barbarum* is chlorogenic acid, which has demonstrated bacteriostatic (halting of growth and reproduction) and bactericidal actions on *Klebsiella pneumoniae*, *Salmonella abony*, *Pseudomonas aeruginosa*.
- Compounds in *L. barbarum* help the body produce specific immune factors that promote the immune system's natural killer T cells, and B lymphocytes, which produce antibodies that recognize and attack invading bacteria, viruses, and toxins.
- Goji berry has been shown to help regulate inflammatory proteins such as cytokines and cell adhesion molecules, and the proliferation of active immune cells.
- The variety of proteoglycans and polysaccharides arabinose, galactose, glucose, xylose, rhamnose, mannose, and galacturonic acid was shown to improve immune responses against vaccines and increase humoral immunity, which is the process of adaptive immunity related to the production of B lymphocyte antibodies.
- Researchers found that the presence of goji berry extracts that included polysaccharides and phenolic compounds had a positive modulating effect on gut microbiota by assisting in the cultivation of aerobic beneficial bacteria, Bifidobacterium and Lactobacillus.
- Since *L. barbarum* has proven to protect against free radical oxidative stress and inflammation, there has been an association between its polyphenolic content and neuroprotective effects against Alzheimer's disease, anxiety, and reactions to stress.
- Constituents in goji berry have antihyperglycemic properties, and have been shown to help maintain normal blood glucose levels in type 2 diabetes.
- *Lycium barbarum* has also demonstrated antihyperlipidemic effects of lowered triglyceride levels and low density lipoprotein (LDL) and overall cholesterol levels (Teixeira, 2023).

## Maca Root (*Lepidium meyenii*)



- A Peruvian root of the Brassica (mustard, turnip, cabbage, garden cress, and water cress) family that has been cultivated for over 2,000 years, and grows in harshest, coldest regions.
- Scientific evidence has shown maca's energizing, fertility-enhancing and sexual functioning properties, and protects against osteoporosis, benign prostatic hyperplasia, helps improve memory and learning, and protects the skin against ultraviolet radiation.
- Contains free fatty acids linoleic, palmitic, and oleic acids, the essential amino acids histidine, leucine, phenylalanine, lysine, valine, methionine, and isoleucine, threonine, as well as amino acids arginine, glycin, alanine, glutamic acid, serine, tyrosine, hydroxyproline, proline, sarcosine, and aspartic acid.
- Mineral content includes iron, calcium, copper, zinc, and potassium.
- Secondary metabolites specific only to maca include macaridine, macaenes (essential fatty acids), macamides, and maca alkaloids.
- Maca contains hormone precursor compounds known as sterols, including beta-sitosterol, campesterol, and stigmasterol, plus its unique aromatic glucosinolate glucotropaeolin.
- Experimental rodents given maca resulted in increased sperm count and sperm motility, was anti-stress, prevented prostatic hyperplasia, reversed osteoporosis, showed neuroprotective effects, protection against UV radiation, improved antioxidant activity, and lipid and glucose metabolism. Maca also showed an increase in male sexual behavior, increased embryo survival, increased the number of offsprings, and improved memory and learning.
- Maca consumption in men and women aged 35-75 years was assessed for health status, fractures, hepatic (liver) and kidney functions, and blood hemoglobin values, and maca consumption correlated with higher health status scores.
- Maca showed lower rates of fractures, and lower signs and symptoms of chronic mountain sickness.
- Maca is associated with low body mass index (less body fat), lowering systolic blood pressure to normal levels, maintaining normal hepatic and kidney functions, normal lipid profiles and normal blood sugar levels.
- Researchers showed maca extracts retaining their viable secondary metabolites (active phytonutrient components) had a positive effect on sexual dysfunction in healthy menopausal women, and sexual desire health adult men.
- In another study, healthy men received maca for four months and subsequently showed an increase in seminal volume, sperm count, and sperm motility, while serum hormone levels luteinizing hormone (LH) (stimulates testosterone production), follicle stimulating hormone (FSH) (stimulates testicular growth and sustains maturing sperm cells), prolactin, estradiol, and testosterone were not affected.
- Studies show maca positively affects depression and anxiety.

- Maca extract administration improved time and performance in cycling athletes.
- One study reported assessment of maca's positive effects on metabolic syndrome through tests on lipoprotein lipids and serum glucose.
- Systolic blood pressure was shown to be lower in those consuming maca, thought to probably be due to its high potassium content, and therefore thought to be useful in those with hypertension or high blood pressure.
- A randomized double-blind study on patients with osteoarthritis, 1500 mg and 300 mg cat's claw was applied for eight weeks and improved pain, stiffness and movement.
- With centuries of indigenous use in the Central Andes of Peru, there have been no reported toxic effects, and with years of *in vivo* (live test subjects) and *in vitro* (laboratory cell cultures) studies performed have showed no toxicity including no liver toxicity, its safe use as a nourishing food has long been confirmed (Gonzales, 2012).

## Vitamins

### Vitamin C (as ascorbic acid) 20 mg 22% DV/VD

- Acts as an antioxidant, protecting cells from free radical damage of scavenging molecules such as toxins, pollutants, other damaged cells, processed foodstuffs, or illness-causing organisms.
- Is needed to make the critical protein known as collagen, of which connective tissues are composed.
- Is needed for the repair of injuries, and to improve the absorption of calcium and iron.
- Plays a major role in optimizing immune system functioning.
- Essential in collagen synthesis, amino acid (tyrosine and carnitine) and neurotransmitter synthesis
- Essential in catabolism or the process of breaking down proteins, fats, carbohydrates, and other molecules during digestion.
- Functions as a reducing agent in enzyme actions.
- As an antioxidant, protects against cellular free radical damage, including preventing oxidation (loss of electrons in atoms and being subject to degeneration) in lipids.
- Involved in neurotransmitter synthesis by maintaining mineral cofactors for enzymes that produce the neurotransmitters norepinephrine and serotonin, important for nerve tissue and brain functions, as well as hormone and steroid functions and hormone-releasing actions.
- Helps regulate actions with iron (Fe) and copper (Cu).
- Assists minerals in bone matrix synthesis.
- Improves absorption of folacin (a form of folic acid).
- May be beneficial in increasing the desirable HDL cholesterol and protecting blood vessels against hardened arteries.
- May be beneficial against cataracts (Gilbert, 2023).

### **Vitamin D** (as cholecalciferol) 1.5 mcg 8% DV/VD

- A natural form of vitamin D known as cholecalciferol (Vitamin D<sub>3</sub>) is formed after the skin is exposed to sunlight, particularly from wavelengths of the ultraviolet range.
- Photons from the sun are absorbed through the skin cell plasma membranes, causing sebaceous glands under the skin to form 7-dehydrocholesterol, a precursor to precholecalciferol, which is then converted to cholecalciferol.
- When excreted at the skin's surface, is reabsorbed and distributed among cells in the epidermis and dermis layers of the skin.
- This form of natural vitamin D<sub>3</sub> is gradually diffused into the bloodstream as needed.
- Dietary vitamin D<sub>3</sub> ingested through the digestive system is only 50% absorbable.
- Needed for functions and processes in cells of the:
  - Bones, intestine, kidneys, liver, pancreas.
  - Macrophages (a type of immune cell).
  - Thyroid and parathyroid glands.
  - Brain, lung, cardiac muscle, skeletal muscles, cartilage.
- Helps balance blood calcium levels in the body.
- Aids intestinal calcium absorption.
- Functions like a steroid hormone, and is involved in influencing gene transcription into newly forming cells.
- Helps mediate signal transduction pathways or intracellular signaling communications (Gilbert, 2023).

### **Mineral**

#### **Zinc** (as zinc citrate) .5 mg 5% DV/VD

- Zinc appears in more enzyme complexes than any of the other trace minerals combined, and is important for the structural integrity and function of every enzyme.
- Those enzyme actions are important in DNA synthesis and regulating RNA, and for maintaining optimal red blood cell synthesis, good night vision, and protein digestion.
- Helps maintain the structure of the important antioxidant, superoxide dismutase (SOD), and helps in the digestion and absorption of folate (folic acid, a B vitamin).
- Important for:
  - Proper tissue growth and cell replication, proper bone formation and maintaining healthy skin.
  - Cell survival in preventing abnormal programmed cell death or apoptosis.
  - Maintaining immune system functioning.
  - Regulating carbohydrate metabolism, as it is found in the pancreatic Beta cells associated with insulin secretion.
  - Influencing the basic or basal metabolic rate (BMR).
  - Maintaining taste acuity (Gilbert, 2023)

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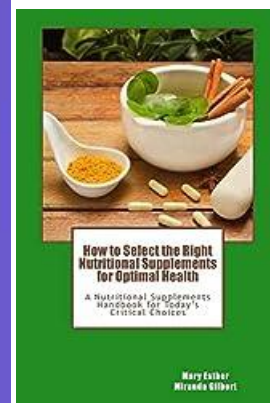
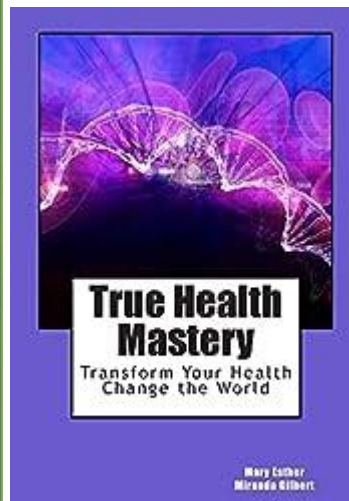
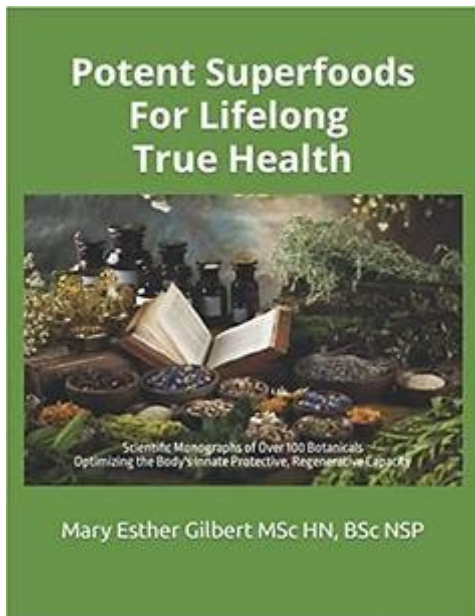
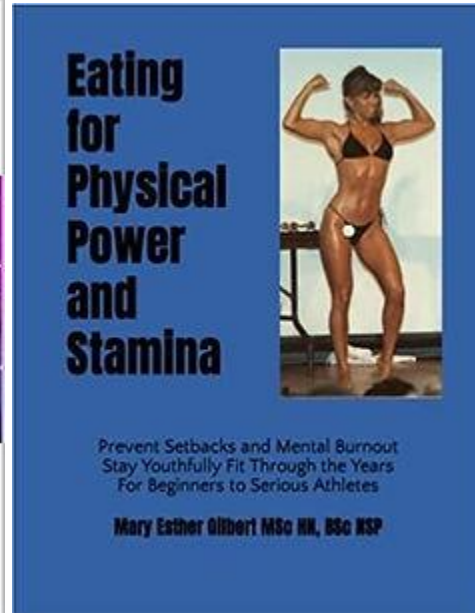
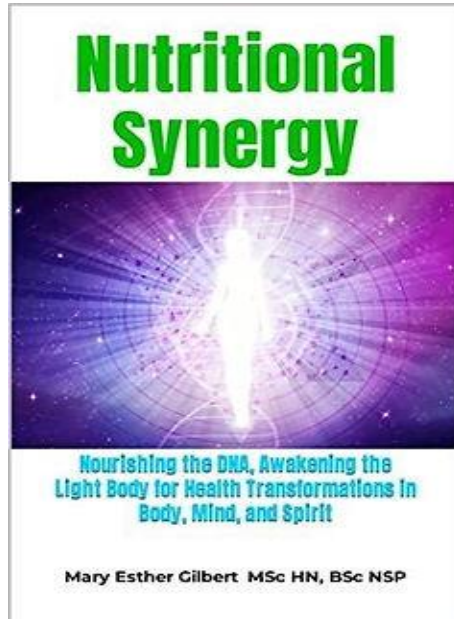
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