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HIGHLIGHTS

A profound explanation of why eating green (wild) edible plants promote health and longevity

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Abstract

From 1970, research evidence has accumulated that the Mediterranean diet promotes health and longevity. Its main components include local (wild) green vegetables, citrus fruits, and olive oil (extra virgin). Since the 1990s, *experimental research* on phytochemicals to explain why plant food is healthy and promotes longevity *has grown exponentially*. Nowadays, molecular biology provides deep explanations for many experimentally found health-promoting properties of plant species and their phytochemicals. The specialized approach is OK because it is the way research progresses. Mainly, nutritional researchers concentrate on a particular group of compounds such as flavonoids, phenolic compounds, carboxylic acids, fatty acids, and so forth. Science outside the research on nutrition deals with the same chemical compounds but which nutritional researchers generally do not follow. Plant biologists have found that all photosynthesizing plants share many compounds and ions. They are vital to plants. Some of the compounds and ions are also vital to humans. Plant biologists make a distinction between minerals, primary metabolites, and secondary metabolites. This distinction applies partly to humans. Plant minerals and primary metabolites often are essential to humans. Plant secondary metabolites are often not vital to humans but experimental research has shown that they promote health and longevity. Eating local wild edible plants (WEP) also promotes sustainability. WEPs are an ecosystem service. I have found 52 compounds and ions that all green edible plants share, promoting human health, well-being, and longevity, and I present the evidence in this paper.

KEYWORDS

food-and-nutrition, green edible plants, health, sustainable diets, the Mediterranean diet, wild edible plants (WEPs)

1 | INTRODUCTION

According to Jacob & Albuquerque (2021), interest inwild and cultivated food plants grows. This theme integrates the frontiers of knowledge of various areas, such as nutrition, plant biology, public health, and humanities.

Cannataro et al. (2021) state, "Angel Keys, a biologist and physiologist who based his conclusions on his studies focusing on the dietary habits of people living in Southern Italy, was the first to present the phrase 'Mediterranean diet' to the popular imagination, investing it with a scientific and cultural meaning." I agree with all other points in this claim, but the first name of Dr. Keys is Ancel, not Angel, according to Keys (1980), Keys and Keys (1975), Montani (2021), and the Seven countries' website. This official website integrates the history and achievements of the Seven countries study between 1947 and 2020, https://www.sevencountriesstudy.com/about-the-study/.

"The Mediterranean diet varies by country and region, so it has a range of definitions" (Cannataro et al., 2021). According to Lassale et al. (2019), Marrelli et al. (2020), and Dinu et al. (2018), the Mediterranean diet is one of the best-studied dietary patterns used in the countries surrounding the Mediterranean. Salehi et al. (2020) present an overview of how the Mediterranean diet and its wild edible plant diet protect the quality of life, healthy aging, and longevity. According to Gehlich et al. (2020), frequent consumption of fruits and vegetables correlates with improved health outcomes, including physical, cognitive, and mental health. This association results from many longitudinal epidemiological research programs found at least from the 1980s. Because minerals and antioxidants did not explain the health-promoting effects of fruit and vegetable consumption, researchers have searched and found other health-promoting compounds and phytochemicals of edible plants.

Cannataro et al. (2021), García-Montero et al. (2021), and Åhlberg (2020) state that the original Mediterranean diet includes local vegetables (both wild and cultivated), onions, wild edible plants (WEP), citrus fruits, pomegranates, berries (if available), legumes, walnuts, oregano, other spices, whole-grain foods, fish, other seafood, monounsaturated fats of olive oil, and polyunsaturated fats of WEP.

According to Cannataro et al. (2021), "The Mediterranean diet represents one of the first examples of a positive correlation between diet and cardiovascular health." García-Montero et al. (2021) maintain that the Mediterranean diet is a model of healthy eating to prevent non-communicable diseases, including obesity, type 2 diabetes, cardiovascular diseases, and some types of cancer. Furthermore, they state that diet is the greatest immune system modulator. Therefore, the Mediterranean diet promotes a healthier immune system.

According to Cannataro et al. (2021), "We chose six polyphenols—(1) Naringenin, (2) Apigenin, (3) Kaempferol, (4) Hesperidin, (5) Ellagic Acid and (6) Oleuropein—present in Mediterranean food." Åhlberg (2020) states that these compounds are also in several WEP with globally extensive distributions reaching outside the Mediterranean area.

From the following research articles, I have found information about what is common to all plants: Hasanuzzaman et al. (2020), Huang et al. (2020), Šamec et al. (2021, p. 826), Marchiosi et al. (2020), Kumar and Goel (2019), Andresen et al. (2018), and Harborne (2000). When I found other chemical constituents of plants that I guessed based on my biology studies at the university, whether all edible plants share them, I tried as keywords <the name of phytochemical>, <plant metabolism>, and <plant biology>. I integrated and developed ideas deeper and broader using Google Scholar, PubMed, Europe PMC, SpringerLink, and ScienceDirect. I found research evidence that **every green edible plant contains 52 health-promoting constituents (compounds and ions)**.

According to Šamec et al. (2021), for example, all plants use polyphenols in abiotic stress response. There are over 8000 different polyphenols. They share common properties, which I describe in detail. Šamec et al. (2021) state that the structure of **polyphenols** varies extensively. However, their **common feature** is the presence of more than one hydroxyl substituent, attached directly to one or more aromatic or benzene rings. **Polyphenolic compounds are molecules with similar biological activity**, and especially in biological studies, researchers measure total polyphenol content as a marker of biological activity.

1.1 | Levels of explanations on why green plants (vegetables) are healthy

1.1.1 | The level of minerals and vitamins

According to Nashawaty et al. (2021), epidemics of nutritional deficiency disorders caused by a lack of vitamins and minerals were still common in the 19th century in Western countries and claimed many victims. Fortunately, advances in nutrition have led to improved diets and a decline in the incidence of these disorders. Scientific knowledge of minerals in nutrition comes partly from the 19th century of vitamins and the 20th century. According to Trüeb (2020) and Mozaffarian et al. (2018), researchers identified all vitamins between 1913 and 1948.

Curtis and Whelan (2019) have written a book about the wild food plants of Ireland. Unfortunately, there are few minerals (four mentions), vitamins (14 remarks), and nothing of phytochemicals.

Nyerges (2019) wrote a book on Californian WEP. There are only 15 mentions of vitamins, mainly A and C, and nothing about minerals of WEP. There is nothing about phytochemicals.

Following Åhlberg (2020 and 2021b), I present eight examples of the best wild edible plants that have 1) extensive distributions, 2) long history of use, and 3) phytochemical and toxicological research to guarantee that they promote health.

1.1.2 | The name-dropping level of listing minerals, vitamins, and phytochemicals

According to Yeung et al. (2019), research on wild and cultivated edible plants may be divided roughly into two different phases: The 20th century and the 21st century: In the 20th-century, research focused on minerals and vitamins. In the 21st century, the research focus of WEP has been on phytochemicals and other compounds that plants produce to protect themselves and which often, not always, happen to promote human health and longevity.

The research on phytochemicals started about 30 years ago. It has grown exponentially. Most research on phytochemicals in nutrition is from the 21st century.

It is a common practice to do name dropping of some minerals, vitamins, and phytochemicals. Without any more profound knowledge, the reader may become impressed but confused.

For example, Harford (2019) wrote a book on edible and medicinal wild plants of Britain and Ireland. Harford (2019) names phytochemicals in connection with some plants, such as flavonoids, phenols,

FIGURE 1 Stinging nettle (*Urtica dioica*) shoots in spring. According to Åhlberg (2021), shoots contain at least 147 health-promoting ions and compounds, of which at least 32 prevent Alzheimer's disease. Photo courtesy of the publisher Wild Edibles and the author Mauri Åhlberg

FIGURE 2 Flowering yarrow (*Achillea millefolium*) in summer. According to Åhlberg (2021), the aerial parts of the yarrow contain at least 132 health-promoting ions and compounds, of which at least 24 prevent Alzheimer's disease. Photo courtesy of the publisher Wild Edibles and the author Mauri Åhlberg

rutin, and so forth. Nothing is detailed about how they promote health, according to empirical research.

1.1.3 | A profound level of using experimental research results of health-promoting effects minerals, vitamins, and phytochemicals

A profound level is (1) to give proper research references for each health-promoting mineral, vitamin, primary metabolite, and secondary metabolite (phytochemical); (2) to make explicit is the knowledge created by experiments or not; (3) what kinds of health claims researchers make? I rarely trust only one research report. Researchers test earlier results and build upon the most relevant, valid, and reliable research.

I trust on careful reviews, in which the reader can check every main claim. For example, Yeun et al. (2019) researched antioxidants in natural dietary sources. They tried to find all research papers on this theme. The oldest research article was from 1957. The number of research articles grew slowly until the beginning of the 21st century. Then it has grown exponentially. Almost all phytochemicals are antioxidants. Rarely is antioxidant the only property of a phytochemical. Usually, those phytochemicals that researchers have experimentally tested have many other health-promoting properties. Zhang et al. (2019) realized a gap between the high dosage demands of phytochemicals in vitro studies and the low bioavailability of most phytochemicals in actual human metabolism. In real life, humans eat in their food mixtures of nutrients, including phytochemicals. Combinations of phytochemicals exert synergistic effects in the human body, increasing antioxidant capacity and anti-inflammatory effects, interacting with the gut microbiome, and targeting the same and different signaling pathways. According to Coman and Vodna (2020, p. 483), recent evidence suggests that the real benefit of a diet rich in fruits and vegetables stems from the synergistic effects of the complex mixture of phytochemicals present in foods rather than from isolated compounds.

According to Leitzmann (2016), there are "epidemiological data that point to the excellent health potential of phytochemicals in humans." A high dietary intake of phytochemicals with wild edible vegetables, fruits, berries, nuts, legumes, and whole-grain is associated with a reduced risk for cancer, cardiovascular, and other diseases.

Tardío et al. (2016) has detailed species-specific tables of 38 Mediterranean species: mainly minerals, vitamins, and lipids. Phytochemicals are tabled in many species at the group level: phe-

FIGURE 3 Flowering self-heal (*Prunella vulgaris*) in summer. According to Åhlberg (2021), the aerial parts of self-heal contain at least 124 health-promoting ions and compounds, of which at least 27 prevent Alzheimer's disease. Photo courtesy of the publisher Wild Edibles and the author Mauri Åhlberg

FIGURE 4 Flowers and fruits (rose hips) of rugosa rose (*Rosa rugosa*). According to Åhlberg (2021), Rosa rugosa petals contain at least 124 health-promoting ions and compounds, of which at least 28 prevent Alzheimer's disease. According to Åhlberg (2021a), rose hips of Rosa rugosa contain at least 122 health-promoting ions and compounds, of which at least 32 prevent Alzheimer's disease. Photo courtesy of the publisher Wild Edibles and the author Mauri Åhlberg

nolics (total) and flavonoids. Sometimes more specifically: phenolic acids, hydroxycinnamic acids, and anthocyanins. Strangely, some well-researched plants like stinging nettle (*Urtica dioica*) have no phytochemicals tabled in this pioneering and otherwise excellent book.

Åhlberg (2020) lists health-promoting minerals, vitamins, and other compounds like phytochemicals of over 90 species that have (1) a long history of use, (2) globally extensive distribution, and (3) phytochemical and toxicological research according to which these species are safe to consume. Furthermore, he describes each chemical constituent according to the latest empirical research, dating mainly from 2016 to 2020.

The following review summarizes 52 health-promoting chemical constituents that all green edible plants share.

1.2 | Descriptions of health-promoting chemical constituents that all green edible plants share, whether they are cultured or wild

The starting point of my research is WEP, but the results also apply to cultivated edible plants. I describe each compound and ion in its

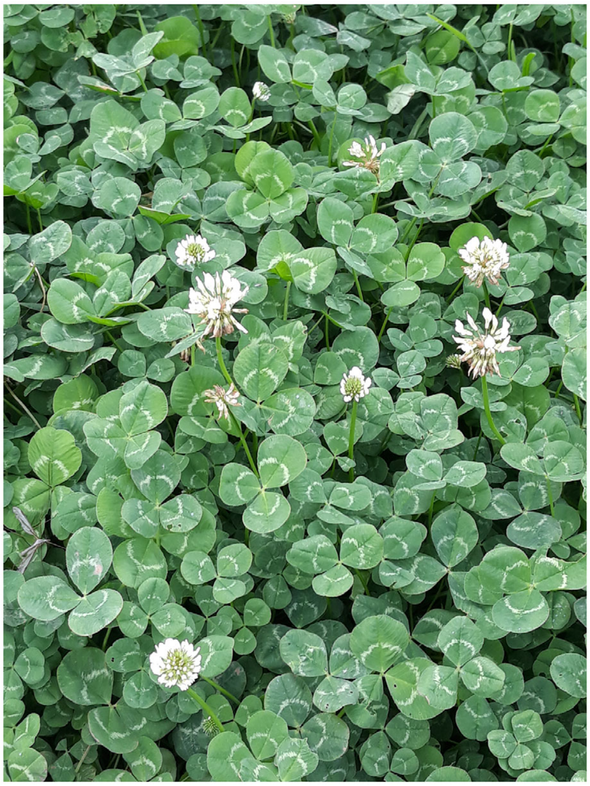

FIGURE 5 Flowering white clovers (*Trifolium repens*). According to Åhlberg (2021), aerial parts of white clover contain at least 124 health-promoting ions and compounds, of which at least 26 prevent Alzheimer's disease Photo courtesy of the publisher Wild Edibles and the author Mauri Åhlberg

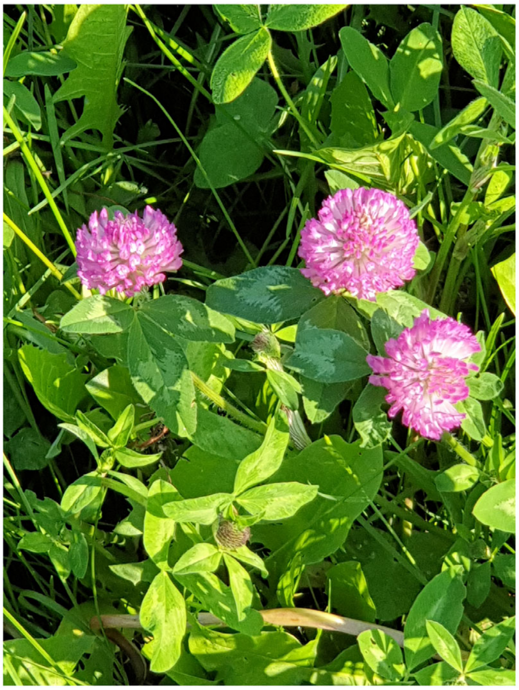

FIGURE 6 Flowering red clover (*Trifoliumpratense*). According to Åhlberg (2021), aerial parts of red clover contain at least 122 health-promoting ions and compounds, of which at least 27 prevent Alzheimer's disease. Photo courtesy of the publisher Wild Edibles and the author Mauri Åhlberg

FIGURE 7 Flowering fireweed (*Epilobium angustifolium*). According to Åhlberg (2021), aerial parts of red clover contain at least 122 health-promoting ions and compounds, of which at least 27 prevent Alzheimer's disease. Photo courtesy of the publisher Wild Edibles and the author Mauri Åhlberg

FIGURE 8 Flowering dandelion (*Taraxacum officinale*). According to Åhlberg (2021), aerial parts of dandelion contain at least 115 health-promoting ions and compounds, of which at least 21 prevent Alzheimer's disease. Photo courtesy of the publisher Wild Edibles and the author Mauri Åhlberg

vignette, which I divide into two parts: (1) What the compound or ion means **for humans** and (2) its role **in plants**. The first part is needed because I intend to promote human nutrition, health, and longevity. The second part is necessary because it contains evidence that all green plants need the same ions and compounds in their lives. For maximum credibility, all references are inside each vignette.

In the following vignettes of 52 compounds and ions, I explain (1) what constituents all green edible plants have, (2) their role in human health, and (3) their role in plants' lives. The references are more convincing when attached to their chemical constituent (an ion, a primary, or a secondary metabolite). Research literature inside vignettes is separate from the references of the main body of the text. Inside the vignettes, the references follow Åhlberg (2020). Only part of the constituents is in Åhlberg (2020). Åhlberg (2020) did not show interest in the role of phytochemicals and other constituents in plants. It is an innovation in this article. Many phytochemicals and other constituents are new findings in the literature of WEP. I have checked and updated all vignettes.

Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Alpha-linolenic acid (1/52)	**For humans**: According to Saini and Keum (2018), Stark et al. (2008), and Guil-■Guerrero and Torija-■Isasa (2016, p. 174), alpha-linolenic acid is an omega-3-polyunsaturated fatty acid. Alpha-linolenic acid has the following health-promoting properties: (1) an essential fatty acid for human health; (2) cardioprotective; (3) anti-inflammatory; (4) neuroprotective; (5) anticancer; and (6) in general, promotes health and prevents chronic diseases. According to Gammone et al. (2019), omega-3 polyunsaturated fatty acids have the following health-promoting properties: (1) essential in numerous cellular functions, such as signaling, cell membrane fluidity, and structural maintenance; (2) regulate the nervous system; (3) regulate blood pressure; (4) regulate hematic clotting; (6) control glucose tolerance; (6) inflammatory; and (7) antioxidant. **WEP often contain more omega-3 polyunsaturated fatty acids than omega-6 polyunsaturated fatty acids**. According to Stark et al. (2008, p. 326), alpha-linolenic acid is abundant in plant foods such as walnuts, canola oil, flaxseeds, and **green leafy vegetables. WEP have primarily green leaves**. **In plants**: According to He and Ding (2020, pp. 1–2), He et al. (2020, pp. 1–3), and Fouillen et al. (2013, pp. 334–335), all green land plants have at least the following unsaturated fatty acids: (1) oleic acid, (2) linoleic acid, and (3) alpha-linolenic acid. All green WEP have these three health-promoting fatty acids. He and Ding (2020, pp. 1–2), He et al. (2020, pp. 1–3), and Fouillen et al. (2013, pp. 334–335) add that oleic acid, linoleic acid, and alpha-linolenic acid are (1) ingredients and modulators of cellular membranes, (2) reserve of carbon and energy, (3) stocks of extracellular barrier constituents, (4) precursors of various bioactive molecules, and (5) regulators of stress signaling. **Fouillen, L. et al. 2013. The lipid world concept of plant lipidomics. Advances in Botanical Research 67, 2013, 331–376**. **Gammone, M. et al. 2019. Omega-3 polyunsaturated fatty acids: benefits and endpoints in sport. Nutrients, volume 11, article 46, 1–16**. **Guil-Guerrero, J. L. & Torija-Isasa, M. E. (2016). Fatty acid profiles of Mediterranean wild edible plants. In M. Sánchez-Mata & J. Tardío (Eds.) Mediterranean Wild Edible Plants (pp. 173–186). New York: Springer**. **He, M. et al. 2020a. Plant unsaturated fatty acids: biosynthesis and regulation. Frontiers in Plant Science, volume 11, article 390, 1–13**. **He, M. & Ding, N. 2020b. Plant unsaturated fatty acids: multiple roles in stress response. Frontiers in Plant Science, volume 11, article 562785, 1–15**. **Saini, R. & Keum, Y. 2018. Omega-3 and omega-6 polyunsaturated fatty acids: Dietary sources, metabolism, and significance—A review. Life Sciences 203, 255–267**. **Stark, A. et al. 2008. Update on alpha-linolenic acid. Nutrition Reviews 66(6), 326–332**.
Antheraxanthin (2/52)	**For humans**: According to Aziz et al. (2020) and Thomas and Johnson (2018), antheraxanthin and other xanthophylls have the following health-promoting properties: (1) neuroprotective, (2) protect retina, (3) vital to eyesight, and (4) heal wounds. **In plants**: According to Goss and Latowski (2021), xanthophylls are inside chloroplasts of higher green plants. They protect chlorophylls and photosynthesis from light damages. **All green WEP have the following xanthophylls: violaxanthin, antheraxanthin, and zeaxanthin**. **Aziz, E. et al. 2020. Xanthophyll: Health benefits and therapeutic insights. Life Sciences, volume 240, article 117104, 1–12**. **Goss, R. & Latowski, D. 2021. Lipid dependence of xanthophyll cycling in higher plants and algae. Frontiers in Plant Science, volume 11, article 455, 1–22**. **Thomas, S. & Johnson, E. 2018. Xanthophylls. Advances in Nutrition 9(2), 160–162**.
Ascorbic acid, and its salts, ascorbates (3/52)	**For humans**: According to Baenas et al. (2019) and van Gorkom et al. (2019), ascorbic acid (**Vitamin C**) has many biochemical functions, such as (1) an antioxidant, neutralization of free radicals; (2) in the absorption of iron from the intestine; and (3) a cofactor in many enzymatic reactions, the synthesis, and protection from oxidation of collagen, catecholamines, cholesterol, amino acids, and some peptide hormones. **In plants**: According to Li et al. (2021), Smirnoff (2018), Ali et al. (2017), and Gallie (2013), for green plants, ascorbic acid (1) is an antioxidant, (2) is essential for the regulation of photosynthesis, (3) takes part in photoprotection, (4) takes part in cell expansion, (5) takes part in plant development, (6) leaves are a good source of ascorbate but dry seeds and dormant buds have little or no ascorbate. **Ali, R. et al. 2017. Physiological studies on the interactive effects of lead and antioxidants on *Carum carvi* plant. Egyptian Journal of Botany 57(2), 317–333**. **Gallie, D. 2013. Ascorbic acid: a multifunctional molecule supporting plant growth and development. Scientifica, volume 2013, article 795964, 1–24**. **Li, Y. et al. 2021. Benefiting others and self: Production of vitamins in plants. Journal of Integrative Plant Biology 63(1), 210–227**. **Smirnoff, N. 2018. Ascorbic acid metabolism and functions: A comparison of plants and mammals. Free Radical Biology and Medicine 122, 116–129**.

(Continues)

Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Beta-carotene (4/52)	**For humans**: According to Coronel et al. (2019, p. 11), and Amesa (2018), beta-carotene has the following health-promoting properties: (1) anti-obesity decreases obesity by promoting fatty acid oxidation in adipocytes and other tissues, (2) **the primary precursor of Vitamin A** and retinoic acid, and (3) promotes general health and longevity. **In plants**: According to Sun et al. (2018, p. 62), every chloroplast in green plants contains beta-carotene. The chloroplast carotenoids such as beta-carotene are in the thylakoid membranes for light-harvesting and photoprotection. **Every green wild edible plant has** beta-carotene. According to Sun et al. (2018, p. 59), plants produce, among others, the following carotenoids: lycopene, alpha-carotene, **beta-carotene,** antheraxanthin, lutein, neoxanthin, violaxanthin, and zeaxanthin. According to Bulda et al. (2008), plant seeds contain carotenes (including beta-carotene), xanthophylls, and chlorophyll. Humans get beta-carotene from their food. The primary producer of beta-carotene is green plants. According to Li et al. (2021), most beta-carotene accumulates in leaves. **Ames, B. 2018. Prolonging healthy aging: Longevity vitamins and proteins. PNAS 115(43), 10836–10844**. **Bulda, O. et al. 2008. Spectrophotometric measurement of carotenes, xanthophylls, and chlorophylls in extracts from plant seeds. Russian Journal of Plant Physiology 55(4), 544–551**. **Coronel, J. et al. 2019. β-carotene in obesity research: technical considerations and current status of the field. Nutrients 11(842), 1–19**. **Li, Y. et al. 2021. Benefiting others and self: Production of vitamins in plants. Journal of Integrative Plant Biology 63(1), 210–227**. **Sun, T. et al. 2018. Carotenoid metabolism in plants: the role of plastids. Molecular Plant 11, 58–74**.
Beta-sitosterol (5/52)	**For humans**: According to Babu and Jayaraman (2020), Esposito et al. (2019), and Trautwein and Demonty (2007, p. 259), beta-sitosterol promotes human health in the following ways: (1) antioxidant, (2) antimicrobial, (3) anti-inflammatory, (4) regulates immune response, (5) protects from respiratory diseases,(6) hepatoprotective, (7) lowers blood fat (lipid) level, (8) protects from fatty liver, (9) anticancer, (10) antidiabetic, (11) sedative, (12) analgesic, (13) antipyretic (reduces fever), (14) anti-arthritic, and (15) wound healing. **In plants**: According to Babu and Jayaraman (2020) and Harborne (2000), the cell wall of **all green plants contains phytosterols, of which 65% is beta-sitosterol**. Therefore, all green WEP contain beta-sitosterol. **Babu, S. & Jayaraman, S. 2020. An update on beta-sitosterol: A potential herbal nutraceutical for diabetic management. Biomedicine & Pharmacotherapy, volume 131, article 110702, 1–8**. **Esposito, S. et al. 2019. Therapeutic perspectives of molecules from *Urtica dioica* extracts for cancer treatment. Molecules 24, article 2753, 1–23**. **Harborne, J. B. (2000). Arsenal for survival: secondary plant products. Taxon 49(3), 435–449**. **Sayeed, M. et al. 2016. Critical analysis on characterization, systemic effect, and therapeutic potential of beta-sitosterol: a plant-derived orphan phytosterol. Medicines, volume 3, article 29, 1–25**. **Trautwein, E. & Demonty. I. 2007. Phytosterols: natural compounds with established and emerging health benefits. OCL 14(5), 259–266**.
Biotin (6/52)	**For humans**: According to The National Institutes of Health (2021), biotin (also called **Vitamin B7 and Vitamin B8**) is (1) a cofactor for five enzymes that catalyze critical steps in the metabolism of fatty acids, glucose, and amino acids; (2) takes part in gene regulation; (3) takes part in cell signaling; and (4) biotin also has other vital roles in human metabolism. According to Tardy et al. (2020), biotin takes part in all cells' energetic metabolism, including the brain and nerve cells. Biotin participates in the nervous system's normal functioning. Sirithanakorn and Cronan (2021) and Alban (2011) state that **biotin is a universal and essential cofactor in plants and humans**. Human cells cannot produce biotin. According to Alban (2011), human intestinal microbiota creates biotin, many foods contain biotin. **In plants**: Biotin is (1) is an essential cofactor for CO_2-manipulating enzymes and (2) takes part in the crucial metabolic processes such as fatty acid and carbohydrate metabolism. According to Li et al. (2021), biotin (Vitamin B7) serves as a cofactor for enzymes involved in carbohydrate and fatty acid metabolism. Biotin is a part of the compound that participates in gene regulation, mitotic and meiotic chromosome condensation, and DNA repair by rearrangement of chromatin structure. All plants produce biotin. **All WEP contain biotin**. **Alban, C. 2011. Biotin (Vitamin B8) synthesis in plants. Advances in Botanical Research 59, 39–66**. **Li, Y. et al. 2021. Benefiting others and self: Production of vitamins in plants. Journal of Integrative Plant Biology 63(1), 210–227**. **Sirithanakorn C. & Cronan J. 2021. Biotin, a universal and essential cofactor: Synthesis, ligation and regulation. FEMS Microbiology Reviews, published online 11 Jan 2021**. **Tardy, A. et al. 2020. Vitamins and minerals for energy, fatigue, and cognition: a narrative review of the biochemical and clinical evidence. Nutrients, volume 12, article 228, 1–35**. **The National Institutes of Health. (2021). *Biotin. Fact Sheet for Health Professionals.* Retrieved from**https://ods.od.nih.gov/factsheets/Biotin-HealthProfessional/

(Continues)

Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Caffeic acid (7/52)	**For humans**: According to Ekeuku et al. (2021), Kępa et al. (2018), and Habtemariam (2017), caffeic acid has the following health-promoting properties: (1) one of the most potent antioxidants, (2) anti-inflammatory, (3) antimicrobial, (4) anticancer, (5) **prevents Alzheimer's disease,** and (6) prevents bone diseases. **In plants**: According to Riaz et al. (2019, p. 9) and Hüner and Hopkins (2008), **all plants synthesize caffeic acid**. It is a primary precursor for lignin synthesis in plants. Caffeic acid is actively involved in plant physiology and mechanisms of (1) stress tolerance primarily utilized by plants for (2) the synthesis of lignin, which ultimately thickened cell walls, (3) plants become resistant to sodium ions, and (4) plant become resistant to heavy metal stress, (5) it also reconciles the absorption of high energy radiations in mesophyll cells under drought stress. **Ekeuku, S. et al. 2021. Effects of caffeic acid and its derivatives on bone: a systematic review. Drug Design, Development and Therapy 15, 259–275**. **Habtemariam, S. 2017. Protective effects of caffeic acid and the Alzheimer's brain: An update. Mini Reviews in Medicinal Chemistry 17(8), 667–674**. **Hüner, N. & Hopkins, W. 2008. Introduction to plant physiology. New York: Wiley** **Kępa, M. et al. 2018. Antimicrobial potential of caffeic acid against *Staphylococcus aureus* clinical strains. BioMed Research International, volume 2018, article 7413504, 1–9**. **Riaz, U. et al. 2019. Prospective roles and mechanisms of caffeic acid in counter plant stress: a mini review. Pakistan Journal of Agricultural Research, volume 32(1), 8–19**.
Calcium (8/52)	**For humans**: According to Kirk et al. (2021), National Institutes of Health (2021), Zoroddu (2019), Beto (2015), and Peacock (2010): (1) Calcium is an essential nutrient necessary for many functions in the human health. Calcium is the most abundant mineral in the body; 99% is in teeth and bone. Only 1% is in blood serum. (2) The blood serum calcium level is tightly regulated to remain within normal range by a complex metabolic process. (3) Humans need adequate calcium levels throughout the life cycle. (4) Calcium metabolism involves other nutrients, including protein, Vitamin D, and phosphorus. Calcium metabolism is a collaborative effort between calcium, phosphorus, Vitamin D, and protein. Calcium consumed in natural food contains many other nutrients and should be the primary method of intake. (5) Calcium is an essential component of bone health. Inadequate intake may change bone mineral density, particularly in the elderly. (6) Bone formation and maintenance is a lifelong process. (7) Research has shown that adequate calcium intake can reduce the risk of fractures, osteoporosis, and diabetes. (8) Calcium takes part in vascular contraction. (9) Calcium takes part in vasodilation. (10) Calcium takes part in muscle functions. (11) Calcium takes part in nerve transmission. (12) Calcium takes part in intracellular signaling. (13) Calcium takes part in hormonal secretion. (14) Calcium plays a role in maintaining normal body weight and decreasing the risk of obesity. (15) According to Huang et al. (2020, p. 826), both green flowering plants and humans need calcium (Ca). Humans need four times more calcium (Ca) than plants. It is difficult to get enough calcium (Ca) only from WEP. The Mediterranean diet provides enough calcium, Vitamin D, phosphorus, and protein when humans eat fish, goat cheese, yogurt, nuts, seeds, and WEP. **In plants**: According to Taneja and Upadhyay (2021), García-Caparrós et al. (2018), Karthika et al. (2018), White and Broadley (2003), calcium (Ca) is a crucial plant nutrient. Calcium is a divalent cation ($Ca2+$). **Calcium has many vital roles in the plants' life**: (1) Calcium takes part in cell walls and membranes' structures. Calcium is a constituent of the middle lamella of cell walls. Thus, calcium takes part in the maintenance of membrane integrity in cell walls and membranes. (2) Calcium takes part in the control of plant development. (3) Calcium is a counter-cation for inorganic and organic anions in the vacuole. (4) Calcium is an intracellular messenger in the cytosol. (5) Calcium is a messenger in metabolic regulation, and (6) Calcium is a cofactor of enzymes involved in the metabolism of adenosine triphosphate (ATP) and phospholipids. ATP is necessary for energy production in cells. Phospholipids in plant cells have a crucial role in transporting materials and maintaining the structure of plants. **Beto, J. 2015. The role of calcium in human aging. Clinical Nutrition Research 4, 1–8**. **García-Caparrós, P. et al. 2018. Ion homeostasis and antioxidant defense toward salt tolerance in plants. In Hasanuzzaman, M. et al. (Eds.) Plant Nutrients and Abiotic Stress Tolerance. Singapore: Springer Nature, 415–436**. **Huang S. et al. 2020. Plant nutrition for human nutrition: hints from rice research and future perspectives. Molecular Plant 13, 825–835**. **Karthika, K. et al. 2018. Biological functions, uptake and transport of essential nutrients in relation to plant growth. In Hasanuzzaman, M. et al. (Eds.) Plant Nutrients and Abiotic Stress Tolerance. Singapore: Springer Nature, 1–50**. **Kirk, B. et al. 2021. Nutrients to mitigate osteosarcopenia: the role of protein, vitamin D and calcium. Current Opinion in Clinical Nutrition and Metabolic Care 24 (1), 25–32**. **Peacock, M. 2010. Calcium metabolism in health and disease. Clinical Journal of the American Society of Nephrology 5, S23–S30**. **Taneja, M. & Upadhyay, S. 2021. An introduction to the calcium transport elements in plants. In Upadhyay, S. (Ed.) Calcium Transport Elements in Plants. London: Academic Press, 1–18**. **The National Institutes of Health. (2021). *Calcium. Fact sheet for health professionals.* Retrieved from** https://ods.od.nih.gov/factsheets/Calcium-HealthProfessional/ **White, P. & Broadley, M. 2003. Calcium in plants. Annals of Botany 92, 487–511**. **Zoroddu, M. & 2019. The essential metals for humans: a brief overview. Journal of Inorganic Biochemistry 195, 120–129**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Carotenoids (9/52)	**For humans**: According to Fakhr et al. (2020), Park et al. (2020), Woodby et al. (2020), Elvira-Torales et al. (2019), and Metličar et al. (2019), carotenoids have the following health-promoting properties: (1) antioxidant, (2) anti-inflammatory, (3) anticancer, reduce the risk of cancer, (4) reduce cardiovascular diseases, (5) reduce macular degeneration, (6) antidiabetic capacity, (7) modulate gene expression, (8) neuroprotective, (9) prevent Alzheimer's disease, (10) anti-obesity, and (11) promote skin health both internally and externally. **In plants**: According to Maoka (2020), Sun et al. (2018), and Cogdell and Gardiner (1993), **green plants need both chlorophylls and carotenoids**. Carotenoids are essential pigments in photosynthetic organs along with chlorophylls. All **WEP have carotenoids**. Carotenoids act (1) as photo-protectors, (2) antioxidants, (3) color attractants, and (4) precursors of plant hormones in the non-photosynthetic organs of plants. According to Fernández-Marín et al. (2017, p. 1) and Bulda et al. (2008), plant seeds contain **carotenoids**, xanthophylls, and chlorophylls. **Bulda, O. et al. 2008. Spectrophotometric measurement of carotenes, xanthophylls, and chlorophylls in extracts from plant seeds. Russian Journal of Plant Physiology 55(4), 544–551**. **Cogdell, R. & Gardiner, A. 1993. Functions of carotenoids in photosynthesis. Methods in Enzymology 214, 185–193**. **Fakhr, S. et al. 2020. Attenuation of Nrf2/Keap1/ARE in Alzheimer's disease by plant secondary metabolites: A mechanistic review. Molecules, volume 25, article 4926, 1–45**. **Fernández-Marín, B. et al. 2017. Seed carotenoid and tocochromanol composition of wild Fabaceae species is shaped by phylogeny and ecological factors. Frontiers in Plant Science, volume 8, article 1428, 1–16**. **Maoka, T. 2020. Carotenoids as natural functional pigments. Journal of Natural Medicines 74, 1–16**. **Park, H. et al. 2020. Anti-apoptotic effects of carotenoids in neurodegeneration. Molecules, volume 25, article 3453, 1–19**. **Sun T. et al. 2018. Carotenoid metabolism in plants: the role of plastids. Molecular Plant 11, 58–74**. **Woodby, B. et al. 2020. Skin health from the inside out. Annual Review of Food Science and Technology 11, 235–254**.
Chloride (10/52)	**For humans**: According to Strohm et al. (2018): (1) Chloride (Cl^-) is an essential ion for human metabolism; (2) chloride (Cl^-) produces hydrochloric acid (HCl) in the parietal cells of the stomach; (3) chloride (Cl^-) is a component of gastric juice; (4) hydrochloric acid (HCl) takes part in the process of digesting food; and (5) hydrochloric acid (HCl) takes part in the defenses against unspecific pathogens. Most plant and animal food contain chlorides. **In plants**: According to Huang et al. (2020, p. 826), chlorine and its ions, chlorides, are essential nutrients to plants. All plant tissues have chlorides in their tissues. **All WEP contain chlorides**. Rosales et al. (2020): Chloride (Cl^-) has beneficial macronutrient functions: (1) improve plant growth, (2) improve tissue water balance, (3) improve plant water relations, (4) improve photosynthesis, (5) improve water-use efficiency, (6) increase plant biomass, (7) improves nitrogen use efficiency, (8) facilitates NO_3^- utilization and improves nitrogen use efficiency in plants. **Huang S. et al. 2020. Plant nutrition for human nutrition: hints from rice research and future perspectives. Molecular Plant 13, 825–835.** https://doi.org/10.1016/j.molp.2020.05.007 **Rosales, M. et al. 2020. Chloride improves nitrate utilization and NUE in plants. Frontiers in Plant Science, volume 11, article 442, 1–13**. **Strohm, D. et al. 2018. Revised reference values for the intake of sodium and chloride. Annals of Nutrition and Metabolism 72(1), 12–17**.
Chlorophylls (11/52)	**For humans**: According to Hayes and Ferruzzi (2020), Lachowicz et al. (2018, p. 1270), and Ferruzzi and Blakeslee (2007, pp. 6–9), chlorophylls have the following health-promoting properties: (1) antioxidant, (2) cancer prevention, has anticancer and antimutagenic effects, (3) regulation of detoxification, and (4) can help prevent degenerative diseases. Hayes and Ferruzzi (2020) present detailed molecular biological mechanisms of how these properties emerge. **In plants**: According to Ke et al. (2021), chlorophylls participate in the absorption and transformation of light energy and the primary photochemical reaction. In photosynthesis, plants create oxygen and glucose with light energy from carbon dioxide and water. Therefore, chlorophyll is an essential photosynthetic pigment. So far, five kinds of chlorophylls have been identified, including chlorophylls a, b, c, d, and f, named according to the discovery order. According to Cai et al. (2021), (1) chlorophylls are one of the most abundant organic pigments on the earth; (2) the chemical structures of chlorophylls significantly affect the absorption of light and energy transfer efficiency. In addition, chlorophylls interact with chloroplasts for light harvesting. According to Bulda et al. (2008), plant seeds contain carotenoids, xanthophylls, and **chlorophylls**. **Bulda, O. et al. 2008. Spectrophotometric measurement of carotenes, xanthophylls, and chlorophylls in extracts from plant seeds. Russian Journal of Plant Physiology 55(4), 544–551**. **Cai, J. et al. 2021. Chlorophylls derivatives: Photophysical properties, assemblies, nanostructures and biomedical applications. Materials Today, In Press, Corrected Proof, Available online 29 January 2021**. **Hayes, M., and Ferruzzi, M. 2020. Update on the bioavailability and chemopreventative mechanisms of dietary chlorophyll derivatives. Nutrition Research 81, 19–37**. **Ke, W. et al. 2021. Chlorophylls. In Gao, K. et al. (Eds.) Research Methods of Environmental Physiology in Aquatic Sciences. Singapore: Springer, 95–106**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Citric acid (12/52)	**For humans**: According to Donno et al. (2018, p. 6), citric acid is an antioxidant. According to Schnarrenberger and Martin (2002, p. 869), humans also have the citric acid cycle in their cells' mitochondria. According to Granchi et al. (2019, p. 22), (1) salts of citric acid are citrates. Citrate is an essential metabolite and plays a pivotal role in maintaining the acid-base balance, (2) citrate is a necessary bone component, (3) citrate serves to preserve the integrity of the skeletal nano-and microstructures, (4) osteoblasts produce citrate and influence their differentiation and functionality, (5) bone tissue is the primary source of citrate and is a leading actor in maintaining citrate homeostasis. **In plants**: According to Braun (2021) and Schnarrenberger and Martin (2002), the citric acid cycle is a central element of higher-plant for carbon, protein, and fatty acid metabolism. The citric acid cycle happens inside mitochondria, which provides energy for plant metabolism. **All WEP have citric acid**. According to Kumar and Dubey (2019), the citric acid cycle produces biomolecules, such as secondary metabolites (phytochemicals). **Braun, H. 2021. Enzymes: The two roles of complex III in plants. eLife, Plant Biology Structural Biology and Molecular Biophysics, volume 10, article e65239**. **Donno, D. et al. 2018. New findings in *Prunus padus* L. fruits as a source of natural compounds: characterization of metabolite profiles and preliminary evaluation of antioxidant activity. Molecules, volume 23, article 725, 1–18**. **Granchi, D. et al. 2019. Role of citrate in pathophysiology and medical management of bone diseases. Nutrients, volume11, article 2576, 1–30**. **Kumar, P. & Dubey, K. 2019. Citric acid cycle regulation: backbone for secondary metabolite production. In Gupta, V. & Pandey, A. (Eds). New and Future Developments in Microbial Biotechnology and Bioengineering. Microbial Secondary Metabolites Biochemistry and Applications. Amsterdam: Elsevier, 165–181**. **Schnarrenberger, C. & Martin, W. 2002. Evolution of the enzymes of the citric acid cycle and the glyoxylate cycle of higher plants: A case study of endosymbiotic gene transfer. European Journal of Biochemistry 269, 868–883**.
Copper (13/52)	**For humans**: According to Kaler (2021), copper (Cu) is an essential trace element. Copper participates as a cofactor for many enzymes in the critical cellular processes. **In plants**: According to Andresen et al. (2018), copper (Cu) is a trace metal that is essential for all plants. Therefore, a**ll WEP contain copper (Cu)**. **Andresen, E. et al. 2018. Trace metal metabolism in plants. Journal of Experimental Botany 69(5), 909–954**. **Kaler, S. 2021. Inherited disorders of human copper metabolism. In Pyeritz, R. et al. (Eds.) Emery and Rimoin's Principles and Practice of Medical Genetics and Genomics (Seventh Edition). Metabolic Disorders. London: Academic Press, 413–443**.
Dietary fibers (prebiotics) (14/52)	**BACKGROUND**: According to Spacova et al. (2020), trillions of microbes inhabit the human body; collectively, they are the human microbiota. These microbes create complex ecosystems, which continually impact human health. For example, intestinal microbes (probiotics) need dietary fibers (prebiotics) to produce vitamins and phytochemicals. According to Wang et al. (2020), plenty of phenolic compounds are part of the plant cell structures. According to Wang et al. (2020, pp. 3335–3336), intestinal microbes cause fermentation of plant cell structures and relieve more phytochemicals for the human body than the free phytochemicals from the same plants. **For humans**: According to Spacova et al. (2020), Yegin et al. (2020), Mohanty et al. (2018, p. 155), and Veronese et al. (2018), dietary fibers (prebiotics) have the following health-promoting properties: (1) Dietary fibers are food for intestinal microbiota (probiotics). That is why dietary fibers are also called prebiotics. In addition, the consumption of dietary fibers from vegetables, including WEP, is associated with higher intakes of vitamins, minerals, and phytochemicals; (2) promote mental health; (3) anti-diarrhea; (4) promotes bowel function; (5) promote bone mineralization; (6) reduce the risk of several chronic diseases; (7) reduce the risk of type 2 diabetes; (8) antibacterial; (9) immune-modulatory effect, (10) anticancer (including pancreatic, gastric, esophageal, colon, endometrial, breast, and renal cancer); (11) remove cholesterol, (12) lower risk of cardiovascular diseases; (13) anti-obesity; (14) facilitate mineral absorption; (15) regulate lipid metabolism; (16) anti-inflammatory; and (17) promote intake of health-promoting compounds, such as phytochemicals and antioxidants from the intestine. **In plants**: According to Yegin et al. (2020), dietary fibers are plant polysaccharides resistant to digestion. Plant polysaccharides have limited absorption in the human small intestine. However, they are partially or wholly fermentable in the large intestine. According to Zeng et al. (2017), "Polysaccharides are the principal components of plant cell walls and comprise their structural framework." **Spacova, I. et al. 2020. Future of probiotics and prebiotics and the implications for early career researchers. Frontiers in Microbiology, volume 11, article 1400, 1–10**. **Veronese, N. et al. 2018. Dietary fiber and health outcomes: an umbrella review of systematic reviews and meta-analyses. The American Journal of Clinical Nutrition 107, 436–444**. **Wang, Z. et al. 2020. Review of distribution, extraction methods, and health benefits of bound phenolics in food plants. Journal of Agricultural and Food Chemistry 68, 3330–3343**. **Yegin, S. et al. 2020. Dietary fiber: a functional food ingredient with physiological benefits. In Preuss, H. & Bagchi, D. (Eds.) Dietary Sugar, Salt and Fat in Human Health. London: Academic Press, 531–555**. **Zeng, Y. et al. 2017. Visualizing chemical functionality in plant cell walls. Biotechnology for Biofuels, volume 10, article 263, 1–16**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Flavonoids (15/52)	**For humans**: According to Devi et al. (2021), Rufino et al. (2021), Nam et al. (2020), Uddin et al. (2020), Hernández-Rodríguez et al. (2019), Reis Ballard and Maróstica Junior (2019), and Sanches et al. (2019), flavonoids in WEP have the following health-promoting properties: (1) antioxidant, (2) anti-inflammatory, (3) anti-viral, (4) antibacterial, (5) protect in many ways cardio-vascular system, (6) anti-obesity, (7) anticancer, (8) increase endogenous antioxidants and the activity of antioxidant enzymes, (9) maintain oxidative stress levels below a critical point in the body, (9) suppress oxidants, (10) anti-Alzheimer, prevent and alleviate neurodegenerative disorders, (11) alleviate immunological disorders, (12) alleviate metabolic disorders, (13) antidiabetic, (14) improve testosterone production, contributing to normal spermatogenesis and preventing age-related degenerative diseases associated with testosterone deficiency, (15) extremely safe, with low toxicity and structural diversity, (16) can chelate metal ions (detoxification), (17) form various synergistic complexes, in which health-promoting properties increase in comparison with free flavonoids. **In plants**: According to Alseekh et al. (2020), (1) researchers have described over 8000 plant flavonoids. According to Hutchings (2020, p. 142) and Brunetti al. (2018), flavonoids are vital for the growth control and UV protection of green plants. **All green land plants, including WEP, have flavonoids**. **Alseekh, S. et al. 2020.The style and substance of plant flavonoid decoration; towards defining both structure and function. Phytochemistry, volume 174, article 112347, 1–15**. **Brunetti, C. et al. 2018. Modulation of phytohormone signaling: a primary function of flavonoids in plant–environment interactions. Frontiers in Plant Science, volume 9, article 1042, 1–8**. **Devi, S. et al. 2021. Flavonoids: potential candidates for the treatment of neurodegenerative disorders. Biomedicines, volume 9, article 99, 1–20**. **Hutchings, J. 2020. Evolution and human's attraction and reaction to colour: Food and health. Color Research and Application 46, 140–145**. **Martin, L. & Touaibia, M. 2020. Improvement of testicular steroidogenesis using flavonoids and isoflavonoids for prevention of late-onset male hypogonadism. Antioxidants, volume 9, article 237, 1–17**. **Nam, G. et al. 2020. Multiple reactivities of flavonoids towards pathological elements in Alzheimer's disease: structure–activity relationship. Chemical Science, volume 11, article 10243, 10243–10254**. **Rufino, A. et al. 2021. Flavonoids as antiobesity agents: A review. Medicinal Research Reviews 41(1), 556–585**. **Uddin, M. et al. 2020. Molecular insight into the therapeutic promise of flavonoids against Alzheimer's disease. Molecules, volume 25, article 1267. 1–29**.
Folic acid, folates (16/52)	**For humans**: According to the National Institute of Health (2019d), Centeno Tablante et al. (2019), and Kohlmeier (2015, p. 620), in **humans** (folates, folic acid, **Vitamin B9**) functions as a coenzyme to synthesize nucleic acids (DNA and RNA) and metabolism of amino acids. It also has other vital roles in human metabolism. Sources include dark green wild vegetables. In rich and developing countries, people who do not eat enough green plants suffer a lack of folates. **In plants**: According to Li et al. (2021), Aiyswaraya et al. (2020), and Ravanel et al. (2011): (1) **All green plants produce folates**. (**2**) Folates are coenzymes and electron donors in major cellular processes. (3) Folates take part in the formation of essential biomolecules, such as (a) DNA (nucleic acids), (b) a transfer RNA, (c) pantothenate (Vitamin B5), and (d) amino acids. **Aiyswaraya, K. et al. 2020. Review on folate in crop plants. International Journal of Current Microbiology and Applied Sciences 9(3), 2831–2836**. **Li, Y. et al. 2021 Benefiting others and self: Production of vitamins in plants. Journal of Integrative Plant Biology 63(1), 210–227**. **Ravanel, S. et al. 2011. Metabolism of folates in plants. Advances in Botanical Research 59, 67–106**.
Glutathione (17/52)	**For humans**: According to Mari et al. (2020), Minich and Brown (2019), and Pizzorno (2014), glutathione takes part in (1) critical physiological processes; (2) maintenance of redox balance; (3) reduction of oxidative stress; (4) direct chemical neutralization of singlet oxygen, hydroxyl radicals, and superoxide radicals; (5) the maintenance of appropriate mitochondrial redox environment; (6) mitochondrial function and maintenance of mitochondrial DNA (mtDNA; (7) cofactor for several antioxidant enzymes; (8) the maintenance of appropriate mitochondrial redox environment; (9) enhancement of metabolic detoxification; (10) neutralization of free radicals produced in liver metabolism of chemical toxins; (11) regulation of the immune system; (12) neuroprotection; (13) transportation of mercury out of cells and the brain; (14) cancer prevention; and (15) regeneration of Vitamins C and E. The variation of glutathione levels of cultivated plants is wide. According to Minich and Brown (2019, pp. 10–12), different plant species have different glutathione amounts. Researchers have found that, for example, asparagus, avocado, cucumber, green beans, and spinach have more glutathione than other researched plants. I have found no research on glutathione levels of WEP. Probably, WEP have similarly wide variations in glutathione levels. For optimal quantities of different health-promoting compounds, such as glutathione, it is wise to eat traditional Mediterranean-style boiled wild vegetable mixtures. According to Drinkwater et al. (2015), short boiling reduces very little glutathione quantity. **In plants**: According to Hasanuzzaman et al. (2020, pp. 16–17), all plant cells have glutathione. Glutathione is an antioxidant and contains sulfur.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Glutathione (17/52) (Continues)	Glutathione is a part of the plant's antioxidant defense system, which has several antioxidants. According to Foyer (2001), ascorbic acid and glutathione are the major antioxidants in plant cells. **Drinkwater, J. et al. 2015. Effects of cooking on rutin and glutathione concentrations and antioxidant activity of green asparagus (*Asparagus officinalis*) spears. Journal of Functional Foods 12, 342–353**. **Foyer, C. 2001. Prospects for enhancement of the soluble antioxidants, ascorbate and glutathione. BioFactors 15, 75–78**. **Hasanuzzaman, M. et al. 2020. Regulation of ROS metabolism in plants under environmental stress: a review of recent experimental evidence. International Journal of Molecular Sciences, volume 21, article 8695, 1–42**. **Mari, M. et al. 2020. Mitochondrial glutathione: recent insights and role in disease. Antioxidants, volume 9, article 909, 1–21**. **Minich, M. & Brown, B. 2019. A review of dietary (phyto)nutrients for glutathione support. Nutrients, volume 11, article 2073, 1–20**. **Pizzorno, J. 2014. Glutathione! Integrative medicine (Encinitas, Calif.) 13(1), 8–12**.
Iron (18/52)	**For humans**: Iron (Fe) is an essential trace metal in human metabolism. According to Briguglio et al. (2021), most body iron (Fe) circulates bound to specific proteins and mainly serves to synthesize hemoglobin for new red blood cells. The central element of the hemoglobin molecule is iron (Fe). The minor part of iron is in other tissues, such as muscles. Plants contain much iron (Fe), but plants' non-heme iron is much less bioavailable than the heme iron from animal tissues such as liver, meats, eggs and fishes, meats yolk of chicken eggs fishes, such as herrings. **In plants**: According to Andresen et al. (2018), iron (Fe) is an essential trace metal for all plants. **All WEP contain iron (Fe)**. **Andresen, E. et al. 2018. Trace metal metabolism in plants. Journal of Experimental Botany 69(5), 909–954**. **Briguglio, M. et al. 2021. The central role of iron in human nutrition: from folk to contemporary medicine. Nutrients, volume 12, article 1761, 1–17**.
Lignins (19/52)	**For humans**: According to Vinardell and Mitjans (2017), lignins promote health in the following ways: (1) antioxidant, (2) anti-obesity, (3) anti-diabetes, (4) anti-thrombosis, (5) anti-viral, and (6) anticancer. **In plants**: According to Polo et al. (2020) and Cesarino et al. (2012), lignin is a hydrophobic and heterogeneous biopolymer fundamental for (1) the development of an efficient water transport system in plants, (2) conferring structural robustness, (3) conferring impermeability to conduits, (4) essential for plant stiffness, (5) the plant cell wall contains lignin, mainly in vessels and fibers, 6) lignin forms chemical bonds with hemicellulose, which adheres to cellulose microfibrils, (7) lignin's ability to resist degradation due to its chemically complex structure makes this polymer an effective defensive barrier against herbivores and pathogens, (8) lignin provides physical support for plants to stand upright, (9) lignin is essential for plant growth and development, for example, plant cell walls, (10) lignin gives plants physical support to stand upright, and (11) lignin enables long-distance water transport and solutes by waterproofing the vascular tissue. **Cesarino, I. et al. 2012. An overview of lignin metabolism and its effect on biomass recalcitrance. Brazilian Journal of Botany 35(4), 303–311**. **Polo, C. et al. 2020. Correlations between lignin content and structural robustness in plants revealed by X-ray ptychography. Scientific Reports, volume 10, article 6023, 1–11**. **Vinardell, M. & Mitjans, M. 2017. Lignins and their derivatives with beneficial effects on human health. International Journal of Molecular Sciences, volume 18, article 1219, 1–15**.
Linoleic acid (20/52)	**For humans**: According to Guil■Guerrero and Torija■Isasa (2016, p. 174), linoleic acid is an omega-6-polyunsaturated fatty acid. It is an essential fatty acid for human health. **In plants**: According to He and Ding (2020, pp. 1–2), He et al. (2020, pp. 1–3), and Fouillen et al. (2013, pp. 334–335), **all green land plants have at least the following unsaturated fatty acids**: (1) oleic acid, (2) linoleic acid, and (3) alpha-linolenic acid. **All green WEP have these three health-promoting fatty acids**. Oleic acid, linoleic acid, and alpha-linolenic acid are (1) ingredients and modulators of cellular membranes, (2) reserve of carbon and energy, (3) stocks of extracellular barrier constituents, (4) precursors of various bioactive molecules, and (5) regulators of stress signaling. **Fouillen, L. et al. 2013. The lipid world concept of plant lipidomics. Advances in Botanical Research 67, 2013, 331–376**. **Guil-Guerrero, J. L. & Torija-Isasa, M. E. (2016). Fatty acid profiles of Mediterranean wild edible plants. In M. Sánchez-Mata & J. Tardío (Eds.), Mediterranean Wild Edible Plants (pp. 173–186). New York: Springer**. **He, M. et al. 2020. Plant unsaturated fatty acids: biosynthesis and regulation. Frontiers in Plant Science, volume 11, article 390, 1–13**. **He, M. & Ding, N. 2020. Plant unsaturated fatty acids: multiple roles in stress response. Frontiers in Plant Science, volume 11, article 562785, 1–15**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Lutein (21/52)	**For humans**: According to Fuad et al. (2020), Stringham et al. (2019), and Calvo (2005), lutein has the following health-promoting properties: (1) antioxidant, (2) anti-inflammatory, (3) hepatoprotective, (4) vital to healthy eyes, prevention of eye diseases, (5) prevents osteoarthritis, (6) cancer prevention, (7) prevention of cardiovascular diseases, (8) neuroprotective, (9) prevents Alzheimer's disease, and (10) vital to healthy cognitive brain function. Fuad et al. (2020, p. 1772) present biomolecular mechanisms for eight of these properties. Lutein and zeaxanthin are essential dietary carotenoids for the macula in the eye, protecting against the development of age-related macular degeneration and cataracts. Moreover, these compounds have other health-promoting effects, including **immune enhancement** and reduced risk of developing degenerative diseases such as cancer and cardiovascular diseases. Humans get lutein from their food. The primary producer of lutein is green plants. **In plants**: According to Sun et al. (2018, p. 62), every chloroplast in green plants contains lutein. The chloroplast carotenoids such as lutein are in the thylakoid membranes for light-harvesting and photoprotection. **Therefore, every green wild edible plant has lutein**. **Calvo, M. 2005. Lutein: a valuable ingredient of fruit and vegetables. Critical Reviews in Food Science and Nutrition 45, 671–696**. **Fuad, N. et al. 2020. Lutein: A comprehensive review on its chemical, biological activities and therapeutic potentials. Pharmacognosy Journal 12(6S), 1769–1778**. **Stringham, J. et al. 2019. Lutein across the lifespan: from childhood cognitive performance to the aging eye and brain. Current Developments in Nutrition 3(7), 1–8**. **Sun, T. et al. 2018. Carotenoid metabolism in plants: the role of plastids. Molecular Plant 11, 58–74**.
Manganese (22/52)	**For humans**: According to The National Institutes of Health (2021), Balachandran et al. (2020), and Martins et al. (2020), manganese (1) is an essential trace element that is naturally present in many foods, (2) is a cofactor for many enzymes. In addition, manganese participates in (3) amino acid metabolism, (4) cholesterol metabolism, (5) glucose metabolism, (6) carbohydrate metabolism, (7) reactive oxygen species scavenging, (8) bone formation, (9) reproduction, (10) immune response, (11) in blood clotting, (12) manganese is essential for numerous vital processes, including nerve and brain development and cognitive functioning. According to Martins et al. (2020), the diet is the primary source of manganese (Mn) intake for humans. A balanced diet like the Mediterranean diet is the best because excess quantities of manganese (Mn) are toxic. Plant-based foods are the best sources of manganese (Mn) in the diet. According to Huang et al. (2020, p. 826), plants have 400 times more manganese (Mn) than in the human body. The unit is mg/kg. **In plants**: According to Huang et al. (2020) and Lidon (2004), plants require manganese (Mn) uptake from the soil for their physiological processes and growing. According to Lidon (2004), manganese (Mn) is an essential micronutrient that plays a primary role in activating several enzymes leading to various secondary products, such as lignin and flavonoids. In addition, manganese participates in the photosynthesis, biosynthesis of fatty acids and proteins. According to Tavanti et al. (2021), plants treated with micronutrients such as manganese (Mn) show higher tolerance to abiotic stress and better nutritional status. In addition, micronutrients such as manganese (Mn), at low concentrations, can elicit and activate antioxidative enzymes, non-oxidizing metabolism, as well as sugar metabolism to mitigate damage by oxidative stress. **Balachandran, R. et al. 2020. Brain manganese and the balance between essential roles and neurotoxicity. Journal of Biological Chemistry 295(19), 6312–6329**. **Huang S. et al. 2020. Plant nutrition for human nutrition: hints from rice research and future perspectives. Molecular Plant 13, 825–835**. **Lidon, F. et al. 2004. Manganese accumulation in rice: implications for photosynthetic functioning. Journal of Plant Physiology 161, 1235–1244**. **Martins, A. et al. 2020. Manganese in the diet: bioaccessibility, adequate intake, and neurotoxicological effects. Journal of Agricultural and Food Chemistry 68(46), 12893–12903**. **The National Institutes of Health. (2021). *Manganese. Fact Sheet for Health Professionals.* Retrieved from** https://ods.od.nih.gov/factsheets/Manganese-HealthProfessional/ **Tavanti, T. et al. 2021. Micronutrient fertilization enhances ROS scavenging system for alleviation of abiotic stresses in plants. Plant Physiology and Biochemistry 160, 386–396**.
Magnesium (23/52)	**For humans**: According to Dominguez et al. (2021), Barbagallo et al. (2021), The National Institutes of Health (2021), and Veronese et al. (2020), magnesium (Mg) is an abundant mineral in the body. Magnesium (Mg) has a crucial role in cellular homeostasis and organ functioning. According to Dominguez et al. (2021), traditionally, magnesium (Mg) is presented as a cofactor to 300 regulatory enzymes. This information comes from an old research article by Ebel and Günther (1980). According to Barbagallo et al. (2021, p. 2), Dominguez et al. (2021), and de Baaij et al. (2015**), two new reliable sources list over 600 enzyme systems that regulate diverse biochemical reactions in the body, in which magnesium (Mg) is a cofactor. These 600** enzyme systems regulate various biochemical reactions in the body, including (1) energy production in cells, (2) protein synthesis, (3) DNA and RNA nucleic acid synthesis, (4) synthesis of the antioxidant glutathione, (5) Mg ions participate in the transport of calcium (Ca) and potassium (K) ions through cell membranes, (6) muscle contraction, (7) nerve impulse conduction, (8) blood glucose control, (9) blood pressure regulation, (10) structural development of bone, and (11) normal heart rhythm.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Magnesium (23/52) (continues)	According to Barbagallo et al. (2021, p. 4), magnesium's (Mg) intestinal absorption tends to fall with age, and this decline may be one of the possible causes of Mg deficit with aging. Magnesium is naturally present in many foods, including green WEP and a dietary supplement. **In plants**: All green WEP have magnesium (Mg) because magnesium is a central atom in the chlorophyll molecule. Thus, the darker is the green color in plants, the more the plant probably contains chlorophyll and magnesium. According to Kleczkowski and Igamberdiev (2021), (1) much of total cellular magnesium (Mg) is required to synthesize chlorophyll in photosynthetic tissues, (2) the rest of magnesium (Mg) participates in other vital processes in the cells, (3) many plant enzymes require the binding of magnesium (Mg) for activity and regulation in processes such as phloem loading, leaf senescence, stomata opening, and ionic balance of the cell. According to Huang et al. (2020, p. 826), green plants are a good magnesium source. **WEP as a part of the Mediterranean diet provide plenty of magnesium**. **Barbagallo, M. et al. 2021. Magnesium in aging, health, and diseases. Nutrients, volume 13, article 463, 1–20**. **de Baaij, H. et al. 2015. Magnesium in man: implications for health and disease. Physiological Reviews 95, 1–46**. **Dominguez, L. et al. 2021. Magnesium and Hypertension in Old Age. Nutrients, volume 13, article 13, 1–32**. **Ebel, H. & Günther, T. 1980. Magnesium metabolism: A review. Journal of Clinical Chemistry and Clinical Biochemistry 18, 257–270**. **Huang S. et al. 2020. Plant nutrition for human nutrition: hints from rice research and future perspectives. Molecular Plant 13, 825–835**. **Kleczkowski, L. & Igamberdiev, A. 2021. Magnesium signaling in plants. International Journal of Molecular Science, volume 22, article 1159, 1–23**. **The National Institutes of Health. (2021). *Magnesium. Fact Sheet for Health Professionals*. Retrieved from** https://ods.od.nih.gov/factsheets/Magnesium-HealthProfessional/
Melatonin 24/52	According to Cardinali (2021), all researched aerobic organisms have melatonin. **For humans**: According to Cardinali (2021), Cheng et al. (2021), Fatemeh et al. (2021), Hossain et al. (2021), Nous et al. (2021), Mihardja et al. (2020), and Pourhanifeh et al. (2020), melatonin has the following health-promoting properties: (1) antioxidant, (2) inflammatory, (3) chronobiotic, regulation of circadian rhythm, (4) antidiabetic, (5) prevents malignancies, (6) cytoprotective, (7) prevents cardiovascular diseases, 98) anti-aging, (9) antihypertensive, (10) regulates/modulates sleep, (11) modulates the immune system, (12) prevents osteoporosis, (13) anti-obesity, (14) prevents metabolic syndrome, (15) prevents neurodegenerative diseases like Alzheimer's disease. **In plants**: According to Shi et al. (2017), melatonin is an essential pleiotropic molecule with multiple physiological and cellular actions in plants. In 1958, researchers found melatonin in the bovine pineal gland. In 1995, researchers discovered melatonin in higher plants. According to Arnao and Hernández-Ruiz (2021) and Nawaz et al. (2021), melatonin in plants is a multi-regulatory molecule in stress situations. Thus, melatonin protects against individual biotic stressors (fungi, bacteria, viruses) and abiotic stressors such as drought, waterlogging, extreme temperatures, salinity, alkalinity, and chemical pollutants in soils (e.g., heavy metals, pesticides, among others), UV radiation, and combinations of the same. Melatonin acts as a plant hormone in all these situations, protects against stress, and stimulates plant growth, photosynthesis, germination, and other biochemical and physiological processes. According to Cheng et al. (2021), the quantity of melatonin varies between species and cultivars. For example, according to Cheng et al. (2021), yarrow (*Achillea millefolium*) has melatonin 340 ng/g and self-heal (*Prunella vulgaris*) 34 ng/ g. **Arnao, M. & Hernández-Ruiz, J. 2021. Melatonin as a plant biostimulant in crops and during post-harvest: a new approach is needed. Online Version of Record before inclusion in an issue. Published online 17 May 2021**. **Cardinali, D. 2021. Melatonin and healthy aging. Vitamins and Hormones 115, 67–88**. **Cheng, G. et al. 2021. Plant-derived melatonin from food: a gift of nature. Food & Function 12(7), 2829–2849**. **Fatemeh, G. et al. 2021. Effect of melatonin supplementation on sleep quality: a systematic review and meta-analysis of randomized controlled trials. Journal of Neurology, published online 08 January 2021**. **Hossain, F. et al. 2021. Exploring the multifunctional role of melatonin in regulating autophagy and sleep to mitigate Alzheimer's disease neuropathology. Ageing Research Reviews, volume 67, article 101304, 1–14**. **Mihardja, M. et al. 2020. Therapeutic potential of neurogenesis and melatonin regulation in Alzheimer's disease. Annals of the New York Academy of Sciences. Published online 22 July 2020**. **Nawaz, K. et al. 2021. Melatonin as master regulator in plant growth, development and stress alleviator for sustainable agricultural production: current status and future perspectives. Sustainability, volume 13, article 294, 1–25**. **Nous, A. et al. 2021. Melatonin levels in the Alzheimer's disease continuum: a systematic review. Alzheimer's Research & Therapy, volume 13, article 52, 1–12**. **Pourhanifeh, M. et al. 2020. Melatonin: new insights on its therapeutic properties in diabetic complications. Diabetology & Metabolic Syndrome, volume, volume 12, article 30, 1–20**. **Shi, H. et al. 2017. Editorial: Melatonin in plants. Frontiers in Plant Science, volume 8, article 1666, 1–2**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Molybdenum (25/52)	**For humans**: According to Belaidi and Schwarz (2017), molybdenum (Mo) is an essential trace element for humans. To date, researchers have found four molybdenum-dependent enzymes in humans. These enzymes have a molybdenum cofactor in the active center. In humans, the most crucial molybdenum enzyme catalyzes the terminal step in cysteine catabolism—the oxidation of cytotoxic sulfite into sulfate. Therefore, a deficiency of the molybdenum cofactor results in the loss of activities of all molybdenum-dependent enzymes, leading to severe neurodegeneration and death. **In plants**: According to Andresen et al. (2018), molybdenum (Mo) is a trace metal essential for all plants. **All WEP contain molybdenum (Mo)**. **Andresen, E. et al. 2018. Trace metal metabolism in plants. Journal of Experimental Botany 69(5), 909–954**. **Molybdenum cofactor in humans: health, disease, and treatment. In Collins, J. (Ed.) Molecular, Genetic, and Nutritional Aspects of Major and Trace Minerals. London: Academic Press, 399–410**.
Neoxanthin (26/52)	**For humans**: According to Meléndez-Martínez (2019), Sircelj et al. (2018), and Terasaki et al. (2007), neoxanthin has the following health-promoting properties: (1) antioxidant, (2) promotes immunity, (3) prevents cancers, (4) prevents cardiovascular diseases, (5) prevents bone diseases, (6) prevents skin diseases, and (7) prevents eye diseases. **In plants**: According to Sun et al. (2018, p. 62), every chloroplast in green plants contains neoxanthin. The chloroplast carotenoids such as neoxanthin are in the thylakoid membranes for light-harvesting and photoprotection. **Every green wild edible plant has neoxanthin**. Humans get neoxanthin from their food. The primary producer of neoxanthin is green plants. **Meléndez-Martínez, A. 2019. An overview of carotenoids, apocarotenoids, and vitamin A in agro-food, nutrition, health, and disease. Molecular Nutrition Food Research. First published online: 12 June 2019**. **Sircelj, H. et al. 2018. Lipophilic antioxidants in edible weeds from agricultural areas. Turkish Journal of Agriculture and Forestry 42, 1–10**. **Sun, T. et al. 2018. Carotenoid metabolism in plants: the role of plastids. Molecular Plant 11, 58–74**.
Niacin (27/52)	**For humans**: Humans need niacin and the related compounds nicotinamide adenine dinucleotide (NAD) and NADP /Nicotinamide Adenine Dinucleotide Phosphate) created by plants. According to Noctor et al. (2011, p. 158), in relatively **unprocessed foods, particularly meats, NAD (Nicotinamide Adenine Dinucleotide) and NADP (Nicotinamide Adenine Dinucleotide) provide the most significant part of humans' available niacin**. According to the National Institutes of Health (2021), **for humans**, niacin (nicotinic acid, **Vitamin B3**) has the following health-promoting properties: (1) many vital and complex roles in human metabolism, (2) human body tissues transform absorbed niacin into the coenzyme NAD, and (3) more than 400 enzymes require NAD to catalyze reactions in the human body, which is more than for any other vitamin-derived coenzyme. According to Noctor et al. (2011, p. 157), good niacin sources are, for example, potato, peas, tuna, and liver. **In plants**: According to Noctor et al. (2011), plants can produce niacin and related compounds NAD and NADP. All cells of every organism have these compounds. **WEP contain niacin and related compounds NAD and NADP**. NAD and NADP are central compounds in cell redox and energy metabolism. According to Li et al. (2021), niacin and nicotinamide are precursors for the compound that participates in fatty acid and carbohydrate metabolism. According to Li et al. (2021), NAD+ is also a critical metabolite in cellular signaling reactions as it takes part in creating compounds like cyclic ADP (Adenosine diphosphate) -ribose. ADP -ribosylation participates in cellular processes, such as DNA repair, stress response, cell cycle control, and determining chromatin structure. **Li, Y. et al. 2021. Benefiting others and self: Production of vitamins in plants. Journal of Integrative Plant Biology 63(1), 210–227**. **Noctor, G. et al. 2011. Biosynthesis of NAD and its manipulation in plants. Advances in Botanical Research 58, 153–201**. **The National Institutes of Health 2021. *Niacin. Fact sheet for health professionals*. Retrieved from**https://ods.od.nih.gov/factsheets/Niacin-HealthProfessional/
Nickel (28/52)	**For humans**: According to Zambelli and Ciurli (2013) and Zambelli et al. (2016), nickel (Ni) is a necessary trace element for human health, especially nickel (Ni) is essential for health-promoting microorganisms that colonize the human guts. **In plants**: According to Andresen et al. (2018), nickel (Ni) is an essential trace metal for all plants. **All WEP contain nickel (Ni)**. **Andresen, E. et al. 2018. Trace metal metabolism in plants. Journal of Experimental Botany 69(5), 909–954**. **Zambelli B. & Ciurli S. 2013. Nickel and human health. In Sigel A. et al. (Eds.) Interrelations between Essential Metal Ions and Human Diseases. Metal Ions in Life Sciences, vol 13. Dordrecht: Springer, 321–357**. **Zambelli, B. et al. 2016. Nickel impact on human health: An intrinsic disorder perspective. Biochimica et Biophysica Acta (BBA)–Proteins and Proteomics 1864(12), 1714–1731**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Nitrates (29/52)	**For humans**: According to Butler (2015), Bryan and Ivy (2015), Sindelar and Milkowski (2012), Bahra et al. (2012), and Bryan et al. (2012), **nitrates and nitrites from plants are harmless to healthy adults, even indispensable nutrients**. According to the reviews of Raubenheimer et al. (2019) and Lundberg et al. (2018, p. 9), nitrates and nitrites that come from plant food have the following health-promoting properties: (1) lower blood pressure, (2) improve endothelial function, (3) increase exercise performance, (4) reverse of metabolic syndrome, (5) antidiabetic, (6) counteract inflammation, and (7) promote homeostasis of the immune and vascular systems. Karwowska and Kononiuk (2020) present a balanced overview of both benefits and possible dangers of nitrates in the human body. The threats are mainly due to the use of nitrates and nitrites in meat products. Avoiding processed meat products and using Mediterranean-style boiled wild vegetable mixtures, benefits of nitrates can be optimized and risks minimized. **In plants**: According to Hou et al. (2020), Wang et al. (2019), Noguero and Lacombe (2016), Stitt et al. (2002), and Stitt (1999), (1) plant roots assimilate nitrate, nitrogen (N), from the soil; (2) nitrate is translocated to leaves, where nitrates take part in amino acid and protein synthesis; (3) nitrate (NO_3^-) is an essential source of nitrogen for plant development and metabolism; (4) nitrogen takes part in leaf photosynthesis; (5) nitrogen takes part in synthesizing numerous cellular components, such as (a) chlorophyll and (b) nucleic acids; (6) nitrates take part in the pH regulation; (5) nitrates take part in the sugar supply of the leaves; (6) nitrate is also a signal molecule controlling many physiological processes, plant growth, and crop yield; (7) nitrate participates in the regulation of lateral roots development and architecture; (8) nitrate participates in the regulation of leaf development; (9) nitrate participates in the flowering induction, and (10) nitrate participates in seed dormancy regulation; (11) nitrate is a signal molecule that can trigger widespread changes in gene expression, resulting in changes in nitrogen and carbon metabolism to facilitate the uptake and assimilation of nitrate; (12) nitrogen contributes to plant defense responses by the regulation of primary metabolites of plants, such as carbohydrates, amino acids, and lipids; 13) nitrogen affects the mechanical strength of cell walls by changing the amount of plant cellulose and lignin to prevent pathogen penetration and limit disease development. **Hou, W. et al. 2020. Diagnosis of nitrogen nutrition in rice leaves influenced by potassium levels. Frontiers in Plant Science, volume 11, article 165, 1–13**. **Noguero, M. & Lacombe, B. 2016. Transporters involved in root nitrate uptake and sensing by *Arabidopsis*. Frontiers in Plant Science, volume 7, article 1391, 1 - 7. Stitt, M. 1999, Nitrate regulation of metabolism and growth. Current Opinion in Plant Biology 2(3), 178–186**. **Stitt, M. et al. 2002. Steps towards an integrated view of nitrogen metabolism. Journal of Experimental Botany 53(370), 959–970**. **Wang, M. &al. 2019. Plant primary metabolism regulated by nitrogen contributes to plant–pathogen interactions. Plant and Cell Physiology 60(2), 329–342**.
Oleic acid (30/52)	**For humans**: According to Granado-Casa and Didac (2019), oleic acid is the primary monounsaturated fatty acid present in olive oil and nuts, two essential foods in the Mediterranean diet. According to Gavahiana et al. (2019, p. 222), oleic acid is a vital compound in extra virgin olive. It promotes healthy bacterial diversity in the gut. WEP often contain oleic acid. According to Granado-Casa and Didac (2019) and Sales-Campo et al. (2013), oleic acid has the following health-promoting properties: (1) prevents metabolic syndrome, (2) prevents high blood pressure, (3) prevents overweight (obesity), (4) prevents hyperglycemia, (5) prevents atherogenic lipid profile, (6) prevents insulin resistance, (7) prevents inflammation, (8) prevents prothrombotic alterations, (9) bactericidal, (10) fungicidal, (11) anticancer, and (12) attenuation of the effects of autoimmune diseases. **In plants**: According to He and Ding (2020, pp. 1–2), He et al. (2020, pp. 1–3), and Fouillen et al. (2013, pp. 334–335), all green land plants have at least the following unsaturated fatty acids: (1) oleic acid, (2) linoleic acid, and (3) alpha-linolenic acid. **Thus, all green WEP have these three health-promoting fatty acids**. Oleic acid, linoleic acid, and alpha-linolenic acid are (1) ingredients and modulators of cellular membranes, (2) reserve of carbon and energy, (3) stocks of extracellular barrier constituents, (4) precursors of various bioactive molecules, and (5) regulators of stress signaling. **Fouillen, L. et al. 2013. The lipid world concept of plant lipidomics. Advances in Botanical Research 67, 2013, 331–376**. **He, M. et al. 2020. Plant unsaturated fatty acids: biosynthesis and regulation. Frontiers in Plant Science, volume 11, article 390, 1–13**. **He, M. & Ding, N. 2020. Plant unsaturated fatty acids: multiple roles in stress response. Frontiers in Plant Science, volume 11, article 562785, 1–15**.
Pantothenate (31/52)	**For humans**: According to Webb and Smith (2011), **for humans**, pantothenate (**Vitamin B5**) is widespread in all foodstuffs. Plants synthesize pantothenate**. WEP contain pantothenate**. Plants are an excellent dietary source of pantothenate. In foods, the highest levels of pantothenate are in meat, dairy products, and mushrooms. **In plants**: According to Li et al. (2021) and Webb and Smith (2011), pantothenate is an essential metabolite for all organisms. Plants produce it. Humans need plant-created pantothenate. **Every WEP contains pantothenate**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Pantothenate (31/52) (Continues)	According to Li et al. (2021) and Webb and Smith (2011), pantothenate and its derivates take part (1) in central carbohydrate and lipid metabolism; (2) in many secondary metabolite biosynthetic pathways; (3) pantothenate is a precursor of compounds that serve as enzymes involved in lipid biosynthesis and catabolism; 4) pantothenate is a precursor of compounds that act in secondary metabolite biosynthesis, for example, lignin biosynthesis; (5) pantothenic acid promotes the vegetative and reproductive development of plants. Edible fruits, flowers, and seeds contain more pantothenate than young leaves of edible plants. **Li, Y. et al. 2021. Benefiting others and self: Production of vitamins in plants. Journal of Integrative Plant Biology 63(1), 210–227**. **Webb, M. & Smith, A. 2011. Pantothenate biosynthesis in higher plants. Advances in Botanical Research 58, 203–255**.
Phenolic acids (32/52)	**For humans**: According to Kumar and Goel (2019), Călinoiu and Vodnar (2018), and Szwajgier et al. (2018), phenolic acids have the following health-promoting properties: (1) antioxidants, (2) anticancer, (3) anti-inflammatory, (4) antimicrobial, (5) antidiabetic, (6) neuroprotective, and (7) prevent Alzheimer's disease. According to Marchiosi et al. (2020) and Kumar and Goel (2019), phenolic acids are among the most widely distributed phenolic compounds in plants. They are ubiquitous in both wild and cultured edible plants. Phenolic acids have essential biological roles. Many of them take part in the biosynthesis of structural components of the cell wall. Others are crucial for defense responses to pathogens and herbivores. Marchiosi et al. (2020, p. 893) divide simple phenolic acids into three groups: **Group 1**: benzoic acid and benzoic acid derivates, for example, (a) benzoic acid, (b) gallic acid, (c) protocatechuic acid, (d) p-hydroxybenzoic acid, and (e) salicylic acid. **Group 2**: cinnamic acid and cinnamic acid derivatives, for example, (a) cinnamic acid, (b) p-coumaric acid, (c) caffeic acid, (d) ferulic acid, and (e) sinapic acid. **Group 3**: others, for example, (a) catechol, (b) pyrogallol, and (c) chlorogenic acid. **Călinoiu, L. & Vodnar, D. 2018. Whole grains and phenolic acids: a review on bioactivity, functionality, health benefits and bioavailability. Nutrients, volume 10(11), article 1615. 1–31**. **Kumar, N. & Goel, N. 2019. Phenolic acids: Natural versatile molecules with promising therapeutic applications. Biotechnology Reports, volume 24, article e00370, 1–10**. **Marchiosi, R. et al. 2020. Biosynthesis and metabolic actions of simple phenolic acids in plants. Phytochemistry Reviews 19, 865–890**. **Szwajgier, D. et al. 2018. Phenolic acids exert anticholinesterase and cognition-improving effects. Current Alzheimer Research 15(6), 531–543**.
Phenolic compounds (33/52)	**For humans**: According to Zeb (2020), Soto-Vaca et al. (2012), Hamaguchi et al. (2009), and Wojdyło et al. (2007), plant phenolic compounds have the following health-promoting properties: (1) antioxidants, (2) may help prevent or delay the onset of many diseases, (3) anti-inflammatory (can alter the expression of genes in the inflammatory pathway), (3) antibacterial, (4) antihyperlipidemic, (5) anticancer, (6) cardioprotective, (7) antidiabetic, (8) neuroprotective, (9) prevent Alzheimer's disease, and (10) anti-aging. **In plants**: According to de la Rosa et al. (2019), all edible plant tissues have phenolic compounds. They are "ubiquitously distributed" secondary metabolites. **All WEP contain phenolic compounds**. According to Maoka (2020), Hutchings (2020, p. 142), and Lin et al. (2016), phenolic compounds act as (1) antioxidants, (2) structural polymers (lignin), (3) in photosynthesis, (4) attractants (flavonoids and carotenoids), (5) UV screens (flavonoids), (6) vital in green plants in growth control (flavonoids), (7) signal compounds (salicylic acid and flavonoids), and (8) defense chemicals (tannins and phytoalexins). According to Wojdyło et al. (2007, p. 641), major phenolic compounds include (1) apigenin, (2) caffeic acid, (3) p-coumaric acid, (4) ferulic acid, (5) isorhamnetin, (6) kaempferol, (7) luteolin, (8) myricetin, and (9) quercetin. **de la Rosa, L. et al. 2019, Phenolic Compounds. In Yahia, E. (Ed.) Postharvest Physiology and Biochemistry of Fruits and Vegetables. Cambridge: Woodhead Publishing, 253–271**. **Hamaguchi, T. et al. 2009. Phenolic compounds prevent Alzheimer's pathology through different effects on the amyloid-beta aggregation pathway. The American Journal of Pathology 175(6), 2557–2565**. **Hutchings, J. 2020. Evolution and human's attraction and reaction to colour: Food and health. Color Research and Application 46, 140–145**. **Lin, D. et al. 2016. An overview of plant phenolic compounds and their importance in human nutrition and management of type 2 diabetes. Molecules 21(10), article 1374, 1–19**. **Maoka, T. 2020. Carotenoids as natural functional pigments. Journal of Natural Medicines 74, 1–16**. **Zeb, A. 2020. Concept, mechanism, and applications of phenolic antioxidants in foods. Journal of Food Biochemistry, volume 44, article e13394, 1–22**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Phosphorus (34/52)	**For humans**: According to Peacock (2021) and The National Institutes of Health (2021), **organic phosphorus (P)** takes part in essential cellular functions. These include (1) a part of the body's vital energy source, ATP, (2) maintenance of genetic information with nucleotides DNA and RNA, (3) intracellular signaling via cyclic adenosine monophosphate, (4) membrane structural integrity, (5) takes part in the regulation of gene transcription, (6) takes part in enzyme activation, and (7) takes part in intracellular energy storage. In addition, many proteins and sugars in the body are phosphorylated. **Inorganic phosphorus (P)** is in the human body as a weak acid, phosphoric acid, which has the following health-promoting properties: (a) takes part in the maintenance of normal pH in extracellular fluid, (b) over 80% of the body phosphorus is present in the form of calcium phosphate crystals (apatite) that confer hardness to bone and teeth, and (c) function as the significant phosphorus reservoir. Phosphorus is present in most foods and closely parallels protein content. About 30% of dietary phosphorus is consumed as animal flesh and as vegetables. A further 30% is consumed as dairy products, most of which is inorganic phosphorus. **In plants**: According to Dissanayaka et al. (2021), inorganic phosphate (P) is an essential macronutrient required for many fundamental processes in plants, including (1) photosynthesis, (2) respiration, (3) synthesis of nucleic acids (DNA and RNA), (4) synthesis of proteins, and (5) synthesis of cellular membrane phospholipids. **Dissanayaka, D. et al. 2021. Recent insights into the metabolic adaptations of phosphorus-deprived plants. Journal of Experimental Botany, volume 72(2), 199–223**. **Peacock, M. 2021. Phosphate metabolism in health and disease. Calcified Tissue International 108, 3–15**. **The National Institutes of Health. (2021).** ***Phosphorus. Fact Sheet for Health Professionals.*** **Retrieved from** https://ods.od.nih.gov/factsheets/Phosphorus-HealthProfessional/
Phylloquinone (35/52)	**For humans**: According to Chen et al. (2019), phylloquinone (**Vitamin K**) is a family of fat-soluble compounds, phylloquinone, and menaquinone. According to Li et al. (2021), most green vegetables contain high concentrations of phylloquinone (Vitamin K1). According to Chen et al. (2019), humans get most Vitamin K1 from dark-green leafy vegetables, while the latter, vitamin K2, is obtained from dairy products, meat, and eggs. According to the National Institutes of Health (2018) and Gilles et al. (2017), phylloquinone (Vitamin K) has an active role in (1) hemostasis (blood clotting), (2) bone metabolism, and (3) other vital physiological functions. **In plants**: According to Gu et al. (2021), Meyer et al. (2020), and Oostende et al. (2011), all green plants synthesize phylloquinone (Vitamin K1). **All green WEP have phylloquinone**. In plants, phylloquinone participates in the metabolism of tocopherols and chlorophyll. Phylloquinone is a lipophilic naphthoquinone found predominantly in chloroplasts. Phylloquinone takes part in (1) electron transport and (2) folding proteins. **Gilles J. et al. 2017. Phylloquinone (vitamin K1): occurrence, biosynthesis and functions. Mini-Reviews in Medicinal Chemistry 17(1), 1028–1038**. **Gu, X. et al. 2021. Plasma membrane phylloquinone biosynthesis in non-photosynthetic parasitic plants. Plants Physiology. Published online 30 January 2021, 1–40**. **Li, Y. et al. 2021. Benefiting others and self: Production of vitamins in plants. Journal of Integrative Plant Biology 63(1), 210–227**. **Meyer, G. et al. 2020. Convergent evolution of plant specialized 1,4-naphthoquinones: metabolism, trafficking, and resistance to their allelopathic effects. Journal of Experimental Botany, volume 72, no. 2 pp. 167–176. Advance access publication, 1 December 2020, 167–176**. **Oostende, C. et al. 2011. Vitamin K_1 (phylloquinone): function, enzymes and genes. Advances in Botanical Research 59, 229–261**. **The National Institutes of Health. (2021).** ***Vitamin K. Fact Sheet for Health Professionals.*** **Retrieved from** https://ods.od.nih.gov/factsheets/VitaminK-HealthProfessional/
Phytosterols (36/52)	**For humans**: According to Babu and Jayarama (2020) and Ogbe et al. (2015), phytosterols are plant steroid compounds like animal cholesterol in structure and functions. Several animal and human studies show that phytosterols have the following health-promoting properties: (1) antioxidant, (2) anticancer, (3) antidiabetic, (4) antimicrobial, (5) immunomodulatory, (6) lower blood cholesterol level, and (7) lower "bad" LDL (low-density lipoprotein)-cholesterol levels. The cholesterol-lowering effect of phytosterols is due to the direct inhibition of cholesterol absorption through the displacement of cholesterol from mixed micelles. Saturated phytosterols (stanols) are more efficient in lowering cholesterol levels than sterols (unsaturated). **In plants**: According to Babu and Jayarama (2020), phytosterols are essential components of the plant cell wall. **All WEP have phytosterols**. **Babu, S. & Jayarama, S. 2020. An update on β-sitosterol: A potential herbal nutraceutical for diabetic management. Biomedicine & Pharmacotherapy, volume 131, article 110702, 1–8**. **Ogbe, R. et al. 2015. A review on dietary phytosterols: Their occurrence, metabolism and health benefits. Asian Journal of Plant Science and Research 5(4), 10–21**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
plant proteins (37/52)	**For humans**: According to Guyomarc'h et al. (2021), Itkonen et al. (2021), Merra et al. (2021), Loveday (2020), and Krajcovicova-Kudlackova et al. (2005), (1) plant proteins lack essential amino acids needed in human nutrition. (2) Eating WEP in the Mediterranean diet provides a mixture of healthy animal and plant proteins. (3) Plant proteins of plant food prevent degenerative diseases. **In plants**: According to Covarrubias et al. (2020), Fan et al. (2018), and Figueroa-Macías et al. (2021), all plants have varying amounts of plant proteins. Every plant cell has plant protein. The amount of protein varies from plant tissue to another tissue and from growth stages to mature structures. **Covarrubias, A. et al. 2020. The functional diversity of structural disorder in plant proteins. Archives of Biochemistry and Biophysics, volume 680, article 108229, 1–17**. **Fan, W. et al. 2018. Proteomics integrated with metabolomics: analysis of the internal causes of nutrient changes in alfalfa at various growth stages. BMC Plant Biology, volume 18, article 78, 1–15**. **Figueroa-Macías, J. et al. 2021. Plant growth-defense trade-offs: molecular processes leading to physiological changes. International Journal of Molecular Sciences, volume 22, article 69, 1–18**. **Guyomarc'h, F. et al. 2021. Mixing milk, egg and plant resources to obtain safe and tasty foods with environmental and health benefits. Trends in Food Science & Technology 108, 119–132**. **Itkonen, S. et al. 2021. Partial replacement of animal proteins with plant proteins for 12 weeks accelerates bone turnover among healthy adults: a randomized clinical trial. The Journal of Nutrition 151(1), 11–19**. **Krajcovicova-Kudlackova, M. et al. 2005. Health benefits and risks of plant proteins. Bratislava Medical Journal 106(6-7), 231–234**. **Loveday, S. 2020. Plant protein ingredients with food functionality potential. Nutrition Bulletin 45(3), 321–327**. **Merra, G. et al. 2021. Influence of Mediterranean diet on human gut microbiota. Nutrients, volume 13, article 7, 1–12**.
Polyphenols (38/52)	**For humans**: According to Reed and de Frietas (2020), Redd et al. (2020), Cassidy et al. (2020), Durazzo et al. (2019), Gorzynik-Debicka et al. (2018), Qu et al. (2018), and Ignat et al. (2010), polyphenols have the following health-promoting properties: (1) antioxidant, (2) anti-inflammatory, (3) regulate gene expression, (4) neuroprotective, (5) prevents Alzheimer's disease, (6) anticancer, (7) protect the cardiovascular system, prevention of cardiovascular diseases, (8) reduce the risk of diabetes, (9) lower hypertension, (10) reduce the risk of diabetes, (11) prevent metabolic abnormalities that may include hypertension, central obesity, insulin resistance, hypertension, and imbalance of lipids in the blood, (12) reduce weight in overweight and obese individuals, (13) antitumor, via anti-initiating, anti-promoting, anti-progression, and anti-angiogenesis actions, as well as by (14) modulating the immune system and participate in the immunological defense, (15) antiallergic, (16) antimicrobial, and (17) antiviral. The biological activity of polyphenols is strongly related to their antioxidant properties. They tend to reduce the pool of reactive oxygen species (ROS) and neutralize potentially carcinogenic metabolites. Leri (2020) describes biomolecular mechanisms on how polyphenols promote health. **In plants**: According to Coman and Vodnar (2020, p. 483), over 8000 plant polyphenols are known. According to Šamec et al. (2021), Singh et al. (2021), and Marranzano et al. (2018), all higher land plants have polyphenols (1) **against abiotic stressors,** extreme temperatures, drought, flood, light, UV radiation, salt, and heavy metals. In addition, some polyphenols protect plants **against biotic stressors,** for example, (2) against herbivores (plant-eating insects and other animals, (3) against microorganisms. Polyphenolic compounds against abiotic and biotic stressors include phenolic acids, flavonoids, stilbenoids, and lignans. In addition, some polyphenols take part in (4) plant growth, and (5) plant development. **All WEP have polyphenols**. **Cassidy, L. et al. 2020. Oxidative stress in Alzheimer's disease: a review on emergent natural polyphenolic therapeutics. Complementary Therapies in Medicine, volume 49, article 102294, 1–11**. **Leri, M. 2020. Healthy effects of plant polyphenols: molecular mechanisms. International Journal of Molecular Sciences, volume 21, article 1250, 1–40**. **Marranzano, M. et al. 2018. Polyphenols: plant sources and food industry applications. Current Pharmaceutical Design 24, 4125–4130**. **Redd, P. et al. 2020. Polyphenols in Alzheimer's Disease and in the Gut–Brain Axis. Microorganisms, volume 8, article 199, 1–13**. **Šamec, D. et al. 2021. The role of polyphenols in abiotic stress response: the influence of molecular structure. Plants, volume 10, article 118, 1–24**. **Singh, S. et al. 2021. The multifunctional roles of polyphenols in plant-herbivore interactions. International Journal of Molecular Sciences, volume 22, article 1442, 1–20**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Polysaccharides (39/52)	**For humans**: According to Gan et al. (2020), Mu et al. (2020), Yin et al. (2019), Olech et al. (2019), Liu et al. (2017), and Li et al. (2015, 1557), plant polysaccharides have following health-promoting properties: (1) antioxidant, (2) immune regulation, (3) anticancer, (4) anti-inflammatory, (5) antivirus, (6) protect harmful radiation, (7) hypoglycaemic effect, and (8) prevent Alzheimer's disease. Gan et al. (2020) and Mu et al. (2020) show several molecular biological mechanisms of how these properties emerge. **In plants**: According to Zeng et al. (2017), "Polysaccharides are the principal components of plant cell walls and comprise their structural framework." **Gan, Q. et al. 2020. Modulation of apoptosis by plant polysaccharides for exerting anticancer effects. Frontiers in Pharmacology, volume 11, article 792, 1- 19**. **Liu, Q. al. 2017. Research advances in the treatment of Alzheimer's disease with polysaccharides from traditional Chinese medicine. Chinese Journal of Natural Medicines 15(9), 641–652**. **Mu, S. et al. 2020. Antioxidant activities and mechanisms of polysaccharides. Chemical Biology & Drug Design Early View Online Version of Record before inclusion in an issue**. **Zeng, Y. et al. 2017. Visualizing chemical functionality in plant cell walls. Biotechnology for Biofuels, volume 10, article 263, 1–16**.
Potassium (40/52)	**For humans**: According to Jeremic et al. (2021), Pickering et al. (2021), The National Institutes of Health Potassium (2021), McDonough and Youn (2017), and Demigné et al. (2004), potassium (K) is present in all body tissues. (1) **Potassium maintains normal cell function**. (2) Potassium maintains intracellular fluid volume. (3) Potassium has a crucial role in maintaining the electrochemical balance across cell membranes. (4) Potassium is vital to transmitting nerve signals. Nerve signals lead, for example, skeletal muscle contraction, hormone release, and smooth muscle and heart contraction. (5) Potassium strongly relates to sodium, the primary regulator of extracellular fluid volume, including plasma volume. (5) Potassium and magnesium promote cardiovascular health. (6) High potassium intake from vegetables and fruits protect against several diseases, for example, hypertension, stroke, cardiac dysfunctions, renal damage, hypercalciuria, kidney stones, and osteoporosis. (7) High potassium intake from vegetables and fruits maintains the acid-base status. (8) High potassium intake from vegetables and fruits maintains control of carbohydrate metabolism or energy balance. According to McDonough and Youn (2017), in evolution, **our physiology has developed for a high-potassium (K), low-sodium (Na) diet**. Organisms have probably evolved in a geothermal environment with high potassium(K)-to-sodium (Na) ratio, determining the cells' evolution. According to Åhlberg (2019, p. 67), WEP usually contain more potassium (K) than sodium (Na). According to Huang et al. (2020, p. 826), green plants generally need 14,000 mg/kg potassium (K). According to Huang et al. (2020, p. 826), humans need potassium 4800 mg/kg in general. WEP contain practically always more potassium (K) than humans need. Eating a Mediterranean diet provides enough potassium. **In plants**: According to White et al. (2021), Pandey and Mahiwal (2020), and Pathak et al. (2020), potassium (K) participates in (1) plant growth, (2) plant morphology, (3) plant anatomy, (4) plant metabolism, (5) many cellular activities, (6) co-factoring for many enzymes, (7) many other physiological roles (8) stomatal opening for gas exchange, (9) photosynthesis, and (10) the movement of photosynthates to developing tissues. Mahmoud et al. (2017, p. 34, 40) researched potassium in soil and caraway leaves (*Carum carvi*). In the earth, the potassium (K) level was much lower than in the leaves. Caraway (*C. carvi*) takes potassium (K) from the soil and concentrates it into the leaves. For humans, it is easy to get enough potassium (K) from the green WEP. All WEP contain potassium (K). **Demigné, C. et al. 2004. Protective effects of high dietary potassium: nutritional and metabolic aspects. The Journal of Nutrition 134(11), 2903–2906**. **Jeremic, D. et al. 2021. Therapeutic potential of targeting G protein-gated inwardly rectifying potassium (GIRK) channels in the central nervous *system. Pharmacology* & Therapeutics, volume 223, article 107808, 1–28**. **McDonough, A. & Youn, J. 2017 Potassium homeostasis: the knowns, the unknowns, and the health benefits. Physiology 32, 100–111**. **Pandey, G & Mahiwal, S. 2020. Role of potassium: an overview. In Pandey, G & Mahiwal, S. (Eds.) Role of Potassium in Plants. Cham: Springer, 1–9**. **Pathak, J. et al. 2020. Role of calcium and potassium in amelioration of environmental stress in plants. In Roychoudhury, A. & Tripathi, D. (Eds.) Protective Chemical Agents in the Amelioration of Plant Abiotic Stress: Biochemical and Molecular Perspectives. Hoboken, NJ: John Wiley & Sons, 535–562**. **Pickering, T. et al. 2021. Higher intakes of potassium and magnesium, but not lower sodium, reduce cardiovascular risk in the Framingham Offspring Study. Nutrients, volume 13, article 269, 1–12**. **The National Institutes of Health (2021). *Potassium. Fact Sheet for Health Professional*. Retrieved from** https://ods.od.nih.gov/factsheets/Potassium-HealthProfessional/ **White, P. et al. 2021. Potassium use efficiency of plants. In Murrell, T. et al. (Eds.) Improving Potassium Recommendations for Agricultural Crops. Cham: Springer, 119–146**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Pyridoxine (41/52)	**For humans**: According to The National Institutes of Health (2021), Parra et al. (2018), and Fitzpatrick (2011), pyridoxine (**Vitamin B6**) is one of the most central molecules in living organisms' cells. Pyridoxine is a critical cofactor for various biochemical reactions that regulate primary cellular metabolism, impacting overall physiology. **Humans depend on pyridoxine initially produced by plants**. **Pyridoxine promotes human health** in the following ways: (1) a cofactor for more than 140 enzyme reactions; (2) a potent antioxidant; (3) many essential roles in metabolic and developmental processes; (4) participates in cognitive development through the biosynthesis of neurotransmitters; (5) promotes immune function (e.g., it enhances lymphocyte and interleukin-2 production), and (6) participates in hemoglobin formation. Fitzpatrick (2011) presents biomolecular mechanisms on how pyridoxine acts as a cofactor in many vital processes. According to The National Institutes of Health (2020), excellent sources of Vitamin B6 include fish, beef liver, and meat. According to Fitzpatrick (2011, p. 14), pyridoxine's bioavailability varies. In general, animal products contain more bioavailable forms of Vitamin B6, compared to plant food. **In plants**: According to Fitzpatrick (2011), pyridoxine and its derivatives are derived primarily from plant cells. According to Zhang et al. (2020), pyridoxine's biosynthesis occurs in the cytosol of plants. The cytosol is an intracellular fluid. **All green WEP produce pyridoxine in their cells**. According to Fitzpatrick (2011, p. 14), leaves, flowers, fruits, and seeds have more pyridoxine than other parts of plants. According to Li et al. (2021), pyridoxine (Vitamin B6) is essential for (1) postembryonic root development; (2) enlargement of aerial organs; (3) pyridoxine participates in diverse enzymatic reactions, including transamination, aldol cleavage, decarboxylation, racemization, and elimination and replacement reactions. These enzyme reactions mainly involve amino acid synthesis and metabolism, sugar, and fatty acid metabolism; (4) pyridoxal phosphate-dependent enzymes play an essential role in the biosynthesis of biotin and folate. According to Smith et al. (2007), pyridoxine takes part (1) in amino acid transformations in enzymes and (2) secondary metabolite pathways (e.g., the biosynthesis of alkaloids). **Fitzpatrick, T. 2011. Vitamin B6 in plants: more than meets the eye. Advances in Botanical Research 59, 1–38**. **Li, Y. et al. 2021. Benefiting others and self: Production of vitamins in plants. Journal of Integrative Plant Biology 63(1), 210–227**. **Parra, M. et al. 2018. Vitamin B6 and its role in cell metabolism and physiology. Cells, volume 7, article 84, 1–28**. **Smith, A. et al. 2007. Plants need their vitamins too. Current Opinion in Plant Biology 10, 266–275**. **The National Institutes of Health 2021. *Vitamin B6. Fact Sheet for Health Professionals*. Retrieved from** https://ods.od.nih.gov/factsheets/VitaminB6-HealthProfessional/ **Zhang, J. et al. 2020. Gene cloning and multi-angle analysis of pyridoxal reductase in tobacco plants. Plant Gene, volume 22, article 100228, 1–7**.
Riboflavin (42/52)	**For humans**: According to The National Institutes of Health (2021), Jungert et al. (2020), Suwannason et al. (2020), Thakur et al. (2017), and Powers (2003), riboflavin (**Vitamin B2**) has the following health-promoting properties: (1) antioxidant, (2) anti-aging, (3) anti-inflammatory, (4) anti-nociceptive, (5) anti-migraine, (6) antianemia, (7) anticancer, (8) antihyperglycemic, (9) anti-hypertension, (10) anti-diabetes, (11) prevents oxidative stress directly or indirectly, (12) promotes iron absorption, (13) prevents mitochondrial dysfunction, (10) protects gastrointestinal tract, (14) protects against cardiovascular disease, (15) prevents brain dysfunction, (16) antivirus, (17) participates in a diversity of redox reactions central to human metabolism, (18) plays a role in thyroxine metabolism, and (19) riboflavin may be the limiting nutrient, particularly in older people. **In plants**: According to Li et al. (2021) and Fischer and Bacher (2011), all plants produce riboflavin. **All WEP have riboflavin**. According to Li et al. (2021) and Fischer and Bacher (2011), riboflavin derivatives have the following functions in the cell: (1) serve as cofactors for many redox enzymes, (2) participate in the catalysis of specific non-redox reactions, (3) cofactors of blue-light photoreceptors. Riboflavin is the precursor of the following cellular cofactors: (a) flavin adenine mononucleotide (FMN) and (b) flavin adenine dinucleotide (FAD). Most FMN/FAD-dependent enzymes catalyze redox reactions that are part of the primary metabolism, such as photosynthesis, fatty acid oxidation, the Krebs cycle, degradation of amino acids, and electron transport in mitochondria. According to Fischer and Bacher (2011), **riboflavin is an essential constituent of all living cells**. The absorption of animal-derived riboflavin is better than riboflavin from vegetables. **Fischer, M. & Bacher, A. 2011. Biosynthesis of Vitamin B2 and flavocoenzymes in plants. Advances in Botanical Research 58, 93–152**. **Jungert, A. et al. 2020. Riboflavin is an important determinant of vitamin B-6 status in healthy adults. The Journal of Nutrition 150(10), 2699–2706**. **Li, Y. et al. 2021. Benefiting others and self: Production of vitamins in plants. Journal of Integrative Plant Biology 63(1), 210–227**. **Powers, H. 2003. Riboflavin (vitamin B-2) and health. The American Journal of Clinical Nutrition 77(6), 1352–1360**. **Suwannasom, N. et al. 2020. Riboflavin: the health benefits of a forgotten natural vitamin. International Journal of Molecular Sciences, volume 21, article 950, 1–22**. **Thakur, K. et al. 2017. Riboflavin and health: A review of recent human research. Critical Reviews in Food Science and Nutrition**. **The National Institutes of Health 2021. *Riboflavin. Fact Sheet for Health Professionals*. Retrieved from** https://ods.od.nih.gov/factsheets/Riboflavin-HealthProfessional/

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Selenium (43/52)	**For humans**: According to The National Institutes of Health (2021), Michalak et al. (2021), selenium (Se) is an essential trace element for humans: (1) takes part in the structure of enzymatic proteins, (2) antioxidant, (2) anti-inflammatory, (3) prevents DNA damage, (4) protects skin from UV radiation, and (5) prevents aging of the skin. According to Cai et al. (2019), a low selenium level is beneficial to the human body. **Applying** Huang et al. (2020**, p. 826), all green WEP contain selenium**. For example, the Mediterranean diet provides both plant and animal products for optimal selenium levels. Eggs, sea fishes, and dairy products like cheese contain selenium. According to Chen et al. (2021), Naderi et al. (2021), and Terry et al. (2000), (1) there is a narrow margin between the beneficial and harmful levels of selenium (Se), and it has important implications for human health; (2) exposure to excess selenium is a risk factor for various brain disorders; and (3) for those living in selenium-deficient areas, the use of selenium-rich foods is the safest and best recommendation. **In plants**: According to Chauhan et al. (2018), White (2018), and Guignardi and Schiavon (2017), Selenium (Se) is not an essential element for plants, although it can benefit their growth and survival in some environments. According to Huang et al. (2020, p. 826), all higher plants contain selenium. (2) Selenium has many beneficial effects on several plant species. (3) Plants take up selenium (Se) mainly as selenate and selenite compounds. Plants use root high-affinity membrane transporters that usually mediate the influx of sulfate and phosphate ions. (4) Once selenium is inside cells, it can access the sulfur (S) assimilation pathway, becoming part of the selenium-amino acids. (5) Selenium at high concentrations is toxic for plants due to oxidative stress. Selenium-amino acids are non-specifically incorporated into proteins, which lose their folding and function as a result. (6) Plants have developed various strategies to cope with selenium (Se) toxicity. They usually involve the conversion of Se-amino acids into less harmful volatile compounds. **Cai, Z. et al. 2019. Selenium, aging and aging-related diseases. Aging Clinical and Experimental Research 31, 1035–1047**. **Chauhan, R. et al. 2018.Understanding selenium metabolism in plants and its role as a beneficial element. Critical Reviews in Environmental Science and Technology 49(21), 1937–1958**. **Chen, N. et al. 2021. Selenium transformation and selenium-rich foods. Food Bioscience, volume 40, article 100875**. **Guignardi, Z, & Schiavon, M. 2017. Biochemistry of plant selenium uptake and metabolism. In Pilon-Smits E. et al. (Eds.) Selenium in plants. Plant Ecophysiology, volume 11. Cham: Springer, 21–34**. **Huang S. et al. 2020. Plant nutrition for human nutrition: hints from rice research and future perspectives. Molecular Plant 13, 825–835**. **Michalak, M. et al. 2021. Bioactive compounds for skin health: a review. Nutrients, volume 13, article 20, 1–31**. **Naderi, M. et al. 2021. A comprehensive review on the neuropathophysiology of selenium. Science of The Total Environment, volume 767, article 144329 1–17**. **Schiavon, M. et al. 2017. Effects of selenium on plant metabolism and implications for crops and consumers. In Pilon-Smits E. et al. (Eds.) Selenium in plants. Plant Ecophysiology, Vol. 11. Cham: Springer, 257–275**. **Terry, N. et al. 2000. Selenium in higher plants. Annual Review of Plant Physiology and Plant Molecular Biology 51, 401–432**. **The National Institutes of Health 2021. *Selenium. Fact Sheet for Health Professionals*. Retrieved from** https://ods.od.nih.gov/factsheets/Selenium-HealthProfessional/ **White, O. 2018. Selenium metabolism in plants. Biochimica et Biophysica Acta (BBA)–General Subjects 1862(11), 2333–2342**.
Silicon and silicates (44/52)	**For humans**: According to Wu et al. (2021), Exley et al. (2019, p. 436), Oliveira et al. (2019), and Martin (2013), silicon (Si) (silicates) have the following health-promoting properties: (1) **facilitates excretion of toxic aluminum (Al) out of the human** body, (2) maintains bone health, (3) promotes the health of nails, hair, and skin, (4) promotes collagen synthesis, (5) promotes bone mineralization, (6) **reduces metal accumulation in Alzheimer's disease,** (7) **promotes immune system health**, and (8) reduces the risk for atherosclerosis. According to Huang et al. (2020, p. 826), green plants, including **WEP, need 500 mg silicon (Si) per kg. Humans need silicon 1 mg/kg**. Accordingly, it is easy to get enough silicon by eating WEP. Some WEP are silicon accumulators. It is not dangerous to get extra silicon. The stem of field horsetail (*Equisetum arvense*) contains 5%–8% silicic acid and silicates (salts of silicic acid). According to Oliveira et al. (2019), smooth sow thistle (*Sonchus oleraceus*) contains silicon (Si) and is a silicon-accumulator. **In plants**: According to Hussain et al. (2021), Ahanger et al. (2020), Mandlik et al. (2020), and Tripathi et al. (2020), the effects of silicon (Si) vary among plant species, but in general **silicon (Si)** (1) enhances water-use efficiency, (2) increases the chlorophyll pigments, (3) enhances photosynthesis, (3) remedies nutrient imbalances, (4) increases the uptake of nitrogen (N), phosphorus (P), calcium (Ca) and magnesium (Mg), (5) counteracts abiotic stresses, (6) counteracts water deficit, (7) counteracts temperature stresses, (8) counteracts shade stresses, (9) enhances plant's resistance to disease, (10) enhances the activity of enzymes, which help plants cope with metal stress, (11) improves biomass production, including stem length and leaf area, (12) the silicon content is generally higher in transpirational organs such as leaves. On the other hand, the silicon content is lower in absorptive organs such as roots, indicating that the evapotranspiration stream's upward flow influences deposition. (13) Silicon deposits in the plant leaves: (a) maintains photosynthesis, (b) increases the activity of antioxidant enzymes, (c) enhances the accumulation of antifungal compounds, (d) enhances compartmentation of toxic heavy metals, (e) enhances the accumulation of plant-protecting phenolics, (f) reduces transpiration, (g) enhances the accumulation of osmoticants, and (h) enhances the development of mechanical barriers against herbivores. (14) In a stress situation, silicon deposits on the cell wall.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Silicon and silicates (44/52) (continues)	(15) Silicon induces up-regulation of genes involved in secondary metabolism, thereby increasing the biosynthesis and accumulation of protective plant secondary compounds that provide various protective functions, including antioxidant, antimicrobial, and insecticidal activities, metal chelation, and provision of cellular and structural protection. **Ahanger, M. et al. 2020. Integration of silicon and secondary metabolites in plants: a significant association in stress tolerance. Journal of Experimental Botany 71(21), 6758–6774**. **Hussain, S. et al. 2021. Foliar application of silicon improves growth of soybean by enhancing carbon metabolism under shading conditions. Plant Physiology and Biochemistry 159, 43–52**. **Mandlik, R. et al. 2020. Significance of silicon uptake, transport, and deposition in plants. Journal of Experimental Botany 71(21), 6703–6718**. **Tripathi, D. et al. 2020. Silicon in plant biology: from past to present, and future challenges. Journal of Experimental Botany 71(21), 6699–6702**. **Wu W. et al. 2021. Silicon-containing water intake confers antioxidant effect, gastrointestinal protection, and gut microbiota modulation in the rodents. PLoS ONE, volume 16(3), article e0248508, 1–17**.
Sodium (45/52)	**For humans**: According to Strohm et al. (2018), (1) quantitatively, sodium (Na^+) and chloride (Cl^-) are the most abundant electrolytes in the extracellular space. (2) Almost all food contains sodium (Na) and chloride (Cl) ions. (3) Sodium (Na^+) and chloride (Cl^-) are osmotically active in the extracellular fluid. (4) Sodium (Na^+) and chloride (Cl^-) maintain osmotic pressure. (5) Sodium (Na^+) and chloride (Cl^-) maintain water, electrolyte, and acid-base balance, (6) affect extracellular volume, and (7) blood pressure. At the cellular level, (8) sodium (Na^+) maintains membrane potential, (9) sodium (Na^+) facilitates the active transport of molecules across cell membranes. For instance, glucose is transported together with sodium through a coupled mechanism (symport) in small intestinal enterocytes and renal tubular epithelial cells **In plants**: According to Huang et al. (2020, p. 826), **all plants contain sodium. All WEP contain sodium**. Sodium is not an essential element for plants. According to Nieves-Cordones et al. (2016), the accumulation of Na+ at high concentrations in the cytoplasm results in deleterious effects on cell metabolism, for example, on photosynthetic activity in plants. Thus, Na+ is outside the cytoplasm. In plants, it is at high concentrations in vacuoles as osmoticum. **Na+ is not an essential element in most plants, except in some halophytes**. **Huang S. et al. 2020. Plant nutrition for human nutrition: hints from rice research and future perspectives. Molecular Plant 13, 825–835**. **Nieves-Cordones, M. et al. 2016. Roles and transport of sodium and potassium in plants. In Sigel A. et al. (Eds.) The Alkali Metal Ions: Their Role for Life. Metal Ions in Life Sciences, Vol. 16. Cham: Springer, 291–324**. **Strohm, D. et al. 2018. Revised reference values for the intake of sodium and chloride. Annals of Nutrition and Metabolism 72(1), 12–17**.
Sulfur (46/52)	**For humans**: According to Francioso et al. (2020), Čolović et al. (2018), and Nimni et al. (2007), (1) Sulphur (S) takes part in the vital metabolic processes as a component of proteins and vitamins. (2) Sulfur metabolism in humans is complicated and has a central role in essential redox biochemistry. (3) Sulfur is ideal for redox biological reactions and electron transfer processes. (4) **Plant-created sulfur-containing amino acids are the primary source of sulfur in the human body**. The sulfur compounds in food include (a) amino acids including methionine, cysteine, and taurine; (b) lipoic acid; (c) two vitamins: thiamine and biotin; (d) the glucosinolates and allylic sulfur compounds. (5) In the human body, sulfur is in proteins and coenzymes such as Coenzyme A, biotin, lipoic acid, glutathione, and thiamine. (6) Sulfur-containing amino acids take part in the production of intracellular antioxidants, like glutathione. (7) Sulfur, after calcium and phosphorus, is the most abundant mineral element found in our body. Sulfur is available to us in our diets, derived almost exclusively from proteins. Only two of the 20 amino acids in proteins contain sulfur. (8) Organic sulfur compounds are effective antioxidants. (9) Organic sulfur compounds protect the human body from toxic metal ions. **In plants**: According to Huang et al. (2020, p. 826), Abadie and Tcherkez (2019), Gigolashvili and Kopriva (2014), and Tcherkez and Tea (2013): (1) all plants need sulfur. Sulfur is an essential nutrient for the synthesis of many metabolites. (2) **All plants, including WEP, produce amino acids that contain sulfur**. (3) Plants create from inorganic sulfur compounds **amino-acids-containing-sulfur**, like methionine and cysteine, antioxidants, cofactors, and secondary metabolites glucosinolates. Hawkesford de Kok (2006): "Sulphur is taken up and transported around the plant principally as sulphate, catalysed for the most part by a single gene family of highly regulated transporters. Additional regulation occurs in the pathway of reduction of sulphate to sulphide and its incorporation into cysteine, which occurs principally within the plastid." According to Tiku (2021), Cruciferae plants have glucosinolates. Glucosinolates protect plants from insects. For humans, they are health-promoting compounds. WEP of Cruciferae include yellow rocket cress (*Barbarea vulgaris*), horseradish *Armoracia rusticana*), and rocket (*Eruca vesicaria*). According to Subramanian et al. (2020) and Lengbiye et al. (2020), *Allium* species have health-promoting sulfur compounds like thiosulfinates. WEP of genus *Allium* include Chives (*Allium schoenoprasum*) and Ramsons (*A. ursinum*). Garlic mustard (*Alliaria petiolata*, Cruciferae) contains a health-promoting sulfur compound, allyl isothiocyanate. **Abadie, C.& Tcherkez, G. 2019. Plant sulphur metabolism is stimulated by photorespiration. Communications Biology, volume 2, article 379, 1–7**.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Sulfur (46/52) (Continues)	**Čolović, M. et al. 2018. Sulphur-containing amino acids: protective role against free radicals and heavy metals. Current Medicinal Chemistry 25, 1 – 12.** **Francioso, A. et al. 2020. Chemistry and biochemistry of sulfur natural compounds: key intermediates of metabolism and redox biology. Oxidative Medicine and Cellular Longevity, volume 2020, article 8294158, 1–27.** **Gigolashvili, T. & Kopriva, S. 2014. Transporters in plant sulfur metabolism. Frontiers in Plant Science, volume 5, article 442, 1–16.** **Hawkesford, M. & de Kok, L. 2006. Sulphur metabolism in plants. Plant, Cell and Environment 29, 382–395.** **Lengbiye, E. et al. 2020. Antiviral activity, phytochemistry and toxicology of some medically interesting Allium species: a mini review. International Journal of Pathogen Research 5(4), 64–77.** **Nimni, M. et al. 2007. Are we getting enough sulfur in our diet? Nutrition & Metabolism 4(24), 1–12.** **Subramanian, M. et al. 2020. Prevailing knowledge on the bioavailability and biological activities of sulphur compounds from *Alliums*: a potential drug candidate. Molecules, volume 25, article 4111, 1–15.** **Tcherkez, G. & Tea, I. 2013. 32S/34S isotope fractionation in plant sulphur metabolism. New Phytologist 200, 44– 3.** **Tiku, A. 2021. Direct and indirect defence against insects. In Singh I. & Singh A. (Eds) Plant-Pest Interactions: From Molecular Mechanisms to Chemical Ecology. Singapore: Springer, 157–192.**
Thiamin (47/52)	**For humans**: According to The National Institutes of Health (2021), Fitzpatrick and Chapman (2020), and Rapala-Kozik (2011), **for humans**, thiamin (thiamine, **Vitamin B1**) promotes health in the following ways: (1) participates in energy metabolism, (2) participates in the growth, development, and function of cells; (3) participates in human metabolism and is particularly important for proper brain functioning. The human brain needs plenty of glucose. According to Polegato et al. (2019), thiamin (thiamine, **Vitamin B1**) is essential in glucose metabolism. **In plants**: According to Li et al. (2021) and Rapala-Kozik (2011**), all plant cells produce thiamine, which is vital for plant metabolism**. **All WEP contain thiamin**. According to Li et al. (2021) and Fitzpatrick and Chapman (2020), (1) thiamine is a coenzyme in metabolic pathways, particularly those involved in energy production and central metabolism, including photosynthesis (carbon assimilation) and respiration. (2) Thiamine increases photosynthetic pigment accumulation. (3) Thiamine takes part in plant stress protection, for example, protects from pathogens. (4) Thiamine reduces membrane permeability. (5) Thiamine activates antioxidant enzymes. Thiamine-dependent enzymes are widely involved in (a) fatty acid synthesis, (b) branched-chain amino acid synthesis, (c) glycolysis, (d) the Krebs cycle, (e) nitrogen assimilation, (f) the Calvin cycle, and (g) light-independent reactions of photosynthesis that convert carbon dioxide and other compounds into glucose. **Fitzpatrick, T. & Chapman, L. 2020. The importance of thiamine (vitamin B1) in plant health: From crop yield to biofortification. JBC Reviews 295(34), 12002–12013.** **Li, Y. et al. 2021. Benefiting others and self: Production of vitamins in plants. Journal of Integrative Plant Biology 63(1), 210–227.** **Polegato, B et al. 2019. Role of thiamin in health and disease. Nutrition in Clinical Practice 34(4), 558–564.** **Rapala-Kozik, M. 2011. Vitamin B1 (thiamine): a cofactor for enzymes involved in the main metabolic pathways and an environmental stress protectant. Advances in Botanical Research 58, 38–91.** **The National Institutes of Health. (2021). *Thiamin. Fact Sheet for Health Professionals.* Retrieved from**https://ods.od.nih.gov/factsheets/Thiamin-HealthProfessional/
Tocopherols (48/52)	**For humans**: According to The National Institutes of Health (2021), Azzi (2018), and Kamal-Eldin and Appelqvist (1996), tocopherols **(Vitamin E)** have the following **health-promoting properties**: (1) antioxidants, (2) prevent cardiovascular disease, (3) prevent neurodegenerative disease, (4) prevent macular degeneration, (5) prevent cancer, (6) anti-inflammatory, (7) immune-boosting compound, (8) protect against non-alcoholic hepato-steatosis, (9) regulate cell-signaling, and (10) modulate gene transcription. **In plants**: According to Munné-Bosch and Alegre (2002), tocopherols and tocotrienols are lipid-soluble molecules with several functions in plants. **Tocopherols and tocotrienols are essential to maintain plant cell membrane integrity. Alpha-tocopherol is the primary form found in green parts of plants**, while tocotrienols are in seeds. **All WEP contain tocopherols**. These compounds are **antioxidants**; thus, they protect the plant from oxygen toxicity. According to Ma et al. (2020), **tocopherols are vital in green plants' stress response. Kamal-Eldin, A. & Appelqvist, L. 1996. The chemistry and antioxidant properties of tocopherols and tocotrienols. Lipids 31.** **Ma, J. et al. 2020. Diverse roles of tocopherols in response to abiotic and biotic stresses and strategies for genetic biofortification in plants. Molecular Breeding, volume 40(18), 1–15.** **Munné-Bosch, S. & Alegre, L. 2002. The function of tocopherols and tocotrienols in plants. Critical Reviews in Plant Sciences 21(1), 31–57** **The National Institutes of Health. (2021). *Vitamin E. Fact Sheet for Health Professionals.* Retrieved from**https://ods.od.nih.gov/factsheets/VitaminE-HealthProfessional/

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
Violaxanthin (49/52)	**For humans**: According to Šircelj et al. (2018) and Ames (2018), violaxanthin is a health-promoting antioxidant. In addition, according to Aziz et al. (2020) and Thomas and Johnson (2018), violaxanthin and other xanthophylls have the following health-promoting properties: (1) neuroprotective, (2) protect the retina, (3) vital to eyesight, and (4) heal wounds. **In plants**: According to Goss and Latowski (2021) and Sun et al. (2018, p. 62), xanthophylls are inside chloroplasts of higher green plants. They protect chlorophylls and photosynthesis from light damages. The chloroplast xanthophylls such as violaxanthin are in the thylakoid membranes; they take part in light-harvesting and photoprotection. **All green WEP have the following xanthophylls: violaxanthin, antheraxanthin, and zeaxanthin**. Humans get violaxanthin from their food. Therefore, the primary producer of violaxanthin is green plants. **Ames, B. 2018. Prolonging healthy aging: Longevity vitamins and proteins. PNAS 115(43), 10836–10844**. **Aziz, E. et al. 2020. Xanthophyll: Health benefits and therapeutic insights. Life Sciences, volume 240, article 117104, 1–12**. **Goss, R. & Latowski, D. 2021. Lipid dependence of xanthophyll cycling in higher plants and algae. Frontiers in Plant Science, volume 11, article 455, 1–22**. **Sun, T. et al. 2018. Carotenoid metabolism in plants: the role of plastids. Molecular Plant 11, 58–74**. **Thomas, S. & Johnson, E. 2018. Xanthophylls. Advances in Nutrition 9(2), 160–162**.
Xanthophylls (50/52)	**For humans**: According to Aziz et al. (2020) and Thomas and Johnson (2018), xanthophylls have the following health-promoting properties: (1) neuroprotective, (2) protect retina, (3) vital to eyesight, and (4) heal wounds. **In plants**: According to Goss and Latowski (2021), xanthophylls are inside chloroplasts of higher green plants. They protect chlorophylls and photosynthesis from light damages. In the xanthophyll cycles, violaxanthin transforms to antheraxanthin and zeaxanthin during high light illumination. According to Bulda et al. (2008), plant seeds contain carotenoids, **xanthophylls**, and chlorophylls. All green WEP have the following xanthophylls: violaxanthin, antheraxanthin, and zeaxanthin. **Aziz, E. et al. 2020. Xanthophyll: Health benefits and therapeutic insights. Life Sciences, volume 240, article 117104, 1–12**. **Bulda, O. et al. 2008. Spectrophotometric measurement of carotenes, xanthophylls, and chlorophylls in extracts from plant seeds. Russian Journal of Plant Physiology 55(4), 544– 551**. **Goss, R. & Latowski, D. 2021. Lipid dependence of xanthophyll cycling in higher plants and algae. Frontiers in Plant Science, volume 11, article 455, 1–22**. **Thomas, S. & Johnson, E. 2018. Xanthophylls. Advances in Nutrition 9(2), 160–162**.
Zeaxanthin (51/52)	**For humans**: According to Liu et al. (2019b), Amesa (2018), Nwachukwu et al. (2016), and Roberts et al. (2009), zeaxanthin has the following health-promoting properties: (1) potent antioxidant, (2) anti-lipogenesis, (4) anti-obesity, (5) contribute to ocular health, through photoprotective effects, (6) promotes skin and eye health, and (7) promotes health and longevity in general. Furthermore, Liu et al. (2019) describe a molecular biological mechanism, how zeaxanthin is anti-obesity. According to Aziz et al. (2020) and Thomas and Johnson (2018), zeaxanthin and other xanthophylls have the following health-promoting properties: (1) neuroprotective, (2) protect retina, (3) vital to eyesight, and (4) heal wounds. **In plants**: According to Goss and Latowski (2021), xanthophylls are inside chloroplasts of higher green plants. They protect chlorophylls and photosynthesis from light damages. In the xanthophyll cycles, violaxanthin transforms to antheraxanthin and zeaxanthin during high light illumination. **All green WEP have the following xanthophylls: violaxanthin, antheraxanthin, and zeaxanthin. Aziz, E. et al. 2020. Xanthophyll: Health benefits and therapeutic insights. Life Sciences, volume 240, article 117104, 1–12**. **Goss, R. & Latowski, D. 2021. Lipid dependence of xanthophyll cycling in higher plants and algae. Frontiers in Plant Science, volume 11, article 455, 1–22**. **Thomas, S. & Johnson, E. 2018. Xanthophylls. Advances in Nutrition 9(2), 160–162**.
zinc (52/52)	**For humans**: According to The National Institutes of Health (2021), Joachimiak (2021), and Zhang et al. (2021), zinc (Zn) promotes health in the following ways: (1) takes part in the catalytic activity of approximately 100–300 enzymes in the cell metabolism, (2) antioxidant, (3) anti-inflammatory, (4) takes part in immune protection, (5) antiviral, (6) takes part in DNA synthesis, (7) takes part in protein synthesis, (5) takes part in cell division, (6) takes part in wound healing, (7) takes part in the proper sense of taste and smell, (8) prevents chronic diseases like diabetes, and (8) zinc supports normal growth and development during pregnancy, childhood, and adolescence. Humans must have their daily zinc intake to maintain a steady-state metabolism because the body has no specialized zinc storage system. According to Joachimiak (2021, p. 4) and The National Institutes of Health (2021), whole-grain bread, cereals, legumes, and other plant foods contain phytates that bind zinc and inhibit its absorption into the human body. The bioavailability of zinc from grains and plant foods is lower than that of animal foods. The Mediterranean diet contains both plant and animal food. For example, nuts, almonds, seeds, eggs, seafood, fish, and meat contain bioavailable zinc.

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Health-promoting phytochemicals and other compounds and ions	Research articles supporting health claims. All scientific research claims are tentative, prone to continual testing, checking, rechecking, and improvement.
zinc (52/52) (Continues)	**In plants**: According to Hassan et al. (2020) and Andresen et al. (2018): (1) Zinc (Zn) is one of six trace metals that is essential for all plants. (2) Zinc (Zn) regulates genes. (3) Zinc (Zn) takes part in membrane systems in chloroplasts. Lack of zinc causes decreases in photosynthesis. (4) Zinc (Zn) takes part in plant resistance against drought stress by regulating various physiological and molecular mechanisms. (5) Zinc (Zn) improves seed germination. (6) Zinc (Zn) improves plant water relations. (7) Zinc (Zn) improves cell membrane stability. (8) Zinc (Zn) improves osmolyte accumulation. (9) Zinc (Zn) improves stomatal regulation. (10) Zinc (Zn) improves water use efficiency. (11) Zinc (Zn) improves photosynthesis. (12) Zinc (Zn) interacts with plant hormones. (13) Zinc (Zn) increases the expression of stress proteins, and (14) Zinc (Zn) stimulates the antioxidant enzymes for counteracting drought effects. **Andresen, E. et al. 2018. Trace metal metabolism in plants. Journal of Experimental Botany 69(5), 909–954**. **Hassan, M. et al. 2020. The critical role of zinc in plants facing the drought stress. Agriculture, volume 10, article 0396, 1–20**. **Joachimiak, M. 2021. Zinc against COVID-19? Symptom surveillance and deficiency risk groups. Plos Neglected Tropical Diseases, volume 15(1), article e0008895, 1–17**. **The National Institutes of Health. (2021). *Zinc. Fact Sheet for Health Professionals*. Retrieved from** https://ods.od.nih.gov/factsheets/Zinc-HealthProfessional/ **Zhang, Y. et al. 2021.Opportunities for plant-derived enhancers for iron, zinc, and calcium bioavailability: A review. Comprehensive Reviews in Food Science and Food Safety 20, 652–685**.

2 | CONCLUSION AND FUTURE PERSPECTIVES

I found 52 chemical constituents of green edible plants from the research literature, which (1) promote human health according to experimental research and (2) are vital for plant structure and function in the essential life processes.

We can safely assume that future researchers will find more chemical constituents like above in the coming years. There are many chemical constituents of green edible plants that no experimental researcher has not yet tested. According to Nunes et al. (2018, p. 110), researchers have identified over 5000 individual dietary phytochemicals in vegetables, fruits, nuts, and whole grains. Nunes et al. (2018, p. 110) make an educated guess: "much more are still unknown."

I try to create public knowledge on why eating various green edible plants promotes health and longevity. Specialized researchers may develop even deeper biomolecular mechanisms on how these plant chemical constituents promote health. The concentration of compounds and ions varies because of genetic and environmental variation, stages of development from seed to flowering, and fruiting plants, whether in aerial parts or underground parts. That is why I prefer Mediterranean-style boiled vegetable mixtures described in Guarrera and Savo (2016). By eating mixtures of WEP, humans increase their chance to get at least little of each health-promoting compound in plants. Common scientific knowledge is that many plants and food constituents generally promote health in small natural concentrations and are unhealthy in high concentrations.

Applying Thakur et al. (2020, p. 341), Mediterranean-style boiled wild vegetable mixtures are natural functional foods. However, this is a hypothesis to be tested in future research.

From what I have already found, I have searched those chemical constituents that prevent Alzheimer's disease. From the 52 health-promoting chemical components of green edible plants, I have found 10 compounds and ions, that according to experimental research, prevent Alzheimer's disease in some way: (1) caffeic acid, (2) carotenoids, (3) flavonoids, (4) lutein, (5) melatonin, (6) phenolic acids, (7) phenolic compounds, (8) polyphenols, (9) polysaccharides, and (10) silicon and silicates. The shared plant chemical constituents that prevent Alzheimer's disease is a theme for a future overview article.

The same could be done for any chemical constituent and any disease that experimental researchers have tested. For example, many chemical components that (1) prevent diseases like arthritis, atherosclerosis, different cancers, or diabetes, and so forth; (2) protect organs and systems like the cardiovascular system, kidneys, liver, and so forth.

The main conclusion is that it is always wise to consume available green edible plants, whether cultured or wild. Furthermore, their flowers, fruits, and seeds often contain the same 52 chemical constituents and many more health-promoting compounds and ions. However, it is always better to check that any new part of an otherwise edible plant does not contain any toxic compounds. For example, seeds of garlic mustard (*Alliaria petiolata*) contain toxic erucic acid. Leaves and flowers of garlic mustard (*A. petiolata*) suit in the Mediterranean boiled mixed vegetables. According to Kolodziejczyk-Czepas and Liudvytska (2021, pp. 589–590), rhubarb (*Rheum rhaponticum* and *R. rhabarbarum*) leaves are poisonous because of too high a quantity of oxalic acid. On the other hand, eating some rhubarb petioles promotes health because of the relatively low level of oxalic acid and many health-promoting compounds like flavonoids, such as quercetin, rutin, and phenolic acids like caffeic acid and ellagic acid.

According to research literature, quantities of health-promoting compounds vary between species and inside species. Future research may determine which species in each ecosystem are worth a particular help to save sustainable sources of health-promoting compounds and ions. Nowadays, some of the best sources of healthy food phytochemicals are undervalued, like (1) purple loosestrife (*Lythrum salicaria*) in North America, (2) Japanese knotweed (*Fallopia japonica*), and (3) rugosa rose (*Rosa rugosa*) in some parts of Europe.

CONFLICT OF INTEREST

The author confirms that he has no conflict of interest to declare for this publication.

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