An update of Åhlberg (2021a) : A profound explanation of why eating green (wild) edible plants promote health and longevity

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SHORT COMMUNICATION

An update of Åhlberg (2021a): A profound explanation of why eating green (wild) edible plants promote health and longevity

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Abstract

Last year I found 52 health-promoting ions and compounds that all green (wild) edible plants share. According to experimental research, of these 52 compounds and ions, ten compounds and ions prevent Alzheimer's disease. Later, I have found four new similar compounds in the current article that promote health and longevity: 1) acetylcholine, 2) choline, 3) phytic acid, and 4) terpenoids. According to the latest experimental research, from the 56 health-promoting compounds and ions, the following 16 substances prevent Alzheimer's disease: (1) alpha-linolenic acid, (2) ascorbic acid, (3) carotenoids, (4) caffeic acid, (5) choline, (6) dietary fibers, (7) flavonoids, (8) lutein, (9) melatonin, (10) phenolic acids, (11) phenolic compounds, (12) phytic acid, (13) polyphenols, (14) polysaccharides, (15) silicon and silicates, and (16) terpenoids. In this update, I discuss the nature of generalization in plant science and human nutrition science. Statistically, random sampling is not possible. Purposeful sampling is the best option. Accordingly, strictly statistical inferences are not possible. The best available options are theoretical generalizations from the best-case studies. However, when researchers use experimental designs to test whether plant substances promote health and longevity and make statistical assumptions, they use statistical inferences and generalizations.

KEYWORDS

Nutrition, Food and health, Healthy food, Functional foods, Food science (general), Food security

According to Åhlberg (2021a) and Pott et al. (2019), many ions and compounds that all green (wild) edible plants share belong partly to their primary (or central) metabolism, which are reactions and pathways vital for plant survival. Some ions and compounds that all green (wild) edible plants share belong to secondary (or specialized) metabolism, which fulfills essential functions for growth and development, including the interaction of the plant with the environment. According to experimental research, many secondary metabolites promote human health and longevity.

According to Ballarini et al.'s (2021) longitudinal ***research,*** the Mediterranean diet protects against Alzheimer's disease–related neurodegeneration and memory impairment. According to Corley et al. (2020), observational research findings suggest that adherence to a Mediterranean-style diet is associated with better cognitive

FIGURE 1 According to Åhlberg (2020a, 2022), aerial parts of field sowthistle (Sonchus arvensis) contain 86 health-promoting substances (compounds and ions), of which 20 prevents Alzheimer's disease, according to experimental research. Photo © Mauri Åhlberg

functioning. Mainly, green leafy vegetables and a low meat intake promote cognitive health.

Åhlberg (2021a) presented the results of experimental research on ten plant ions and compounds which prevent Alzheimer's disease. All green (wild) edible plants contain these ions and compounds. In the following, I present 16 ions and compounds in green (wild) edible plants which prevent Alzheimer's disease according to experimental research.

According to Åhlberg (2021a), polyphenols are an example of an essential group of compounds that all green (wild) edible plants share. The reason is that they belong to the structure of the plant cell wall. According to Štambuk et al. (2022), plant cell walls are mainly composed of the following structural components: polyphenols, polysaccharides, and cell wall proteins.

According to Åhlberg (2021a) and Pérez-Cano (2022), it is well established that the Mediterranean diet promotes health and longevity. Strong evidence exists for the multidirectional interaction of the dietary components with the microbiota and immunity.

Mechanisms on how plant compounds and ions promote human health are complex. I take polyphenols as an example. According to Plamada and Vodnar (2022), polyphenols are prebiotics. For humans, polyphenols belong to the most important metabolites of plants. Many polyphenols have low bioavailability. Therefore, they reach the

FIGURE 2 According to Åhlberg (2020a, 2022), aerial parts of spiny milk-thistle (Sonchus asper) contain 70 health-promoting substances, of which at least 16 prevent Alzheimer's disease, according to experimental research. Photo © Mauri Åhlberg

colon in unaltered form. Once in the colon, these compounds interact with the intestinal microbes bidirectionally by modulating them and, releasing health-promoting metabolites. The consumption of polyphenols leads to an increase in beneficial bacteria and their health-promoting metabolites. The critical roles of the gut microbiota are vital and accomplish essential functions for humans. These include (1) maintaining the structural integrity of the endothelial barrier, (2) influencing the growth of the immune system, (3) providing antimicrobial protection, (4) impacting the metabolism of carbohydrates, lipids, and proteins, and (5) participating in the synthesis of several vitamins such as vitamin K, biotin (vitamin B2), cobalamin (vitamin B12), folates (vitamin B9), nicotinic acid (vitamin B3), pantothenic acid9Vitamin B5), pyridoxine (vitamin B6), riboflavin (vitamin B2), and thiamine (vitamin B1).

Marshall et al. (2021) have built a global food systems typology. They designed it as a new tool for reducing complexity in food systems analysis. Marshall et al. (2021) include plant-based diets like the Mediterranean diet, but they neglect research on wild edible plants, especially weeds. According to Cruz-Garcia and Price (2017), Grivetti and Ogle (2000), and Turner et al. (2011), there is now plenty of evidence that farmers all over the globe incorporate selected weeds into their regular diet. For example, in Thailand, farmers use 43 weeds as vegetables. According to Eşiyok et al. (2018), weeds as vegetables are essential for Turkish rural people. People have consumed weeds for food during a food shortage like famine and war. The latest research (2016–2022) shows why these plants promote health and longevity. According to Baldi et al. (2022), health-oriented people promote wild edible plants for food in the framework of a healthy lifestyle. It is a part of a new food strategy to manage malnutrition problems and diversify the human diet, especially local food.

I have observed that people use minimally wild edible plants (including weeds) for food in Finland. In my latest book in Finnish (Åhlberg, 2022), I suggest using 75 wild edible plants with 1000s or at least 100s of years of history of use. For example, Finnish people rarely use sow thistles (Sonchus species) and red and white clovers (*Trifolium pratense* and *T. repens*) for food. These plants are safe when used, like Mediterraneans use them as part of boiled mixtures of wild edible plants. A referee asked to add figures of the plants, which I present in the text. That is why I have added seven figures to this paper. The first six images (Figures 1–6) are species that have extensive distribution. They have spread globally with human agriculture.

FIGURE 3 According to Åhlberg (2020a, 2022), aerial parts of smooth sowthistle (Sonchus oleraceus) contain 89 health-promoting substances, of which 21 prevent Alzheimer's disease, according to experimental research. Photo © Mauri Åhlberg

An example, Miura et al. (1982, 28): "the distribution of cholinesterase was found to be ubiquitous in plant leaves. Cholinesterase activity was detected in 91% of the 70 species surveyed." According to RBG Kew (2016, p. 7), scientists know over 390,000 vascular plant species. According to Antonelli et al. (2020, 25), at least 7039 plant species are edible, but humans use only 417 of them for food. The 70 surveyed species are only a tiny fraction of known species. It is not possible to research all known vascular plant species.

Applying Yin (2017) and Åhlberg and Ahoranta's (2008), research data of published research papers on wild edible plants, do not use random but purposeful samples. Purposeful samples are information-rich. In the field of plant biology, populations are enormous and continually changing. It is not possible to take a random sample of plant species or their parts strictly statistically.

In research of plants and many other fields of real-world study, there are no statistically sound ways of statistical generalizations for any larger populations. But theoretical generalizations are possible because the researched plants and their species are cases of actual plants and species, respectively. Purposeful samples of plants allow us to conclude that similar phenomena are likely to happen under similar conditions.

FIGURE 4 According to Åhlberg (2021b, 2022), aerial parts of red clover contain at least 122 health-promoting ions and compounds, of which at least 28 prevent Alzheimer's disease. Photo © Mauri Åhlberg

Researchers use theoretical generalizations when they claim that a substance (compound or ion) is "ubiquitous" in green (wild) edible plants. But when researchers study potential health-promoting properties of the same substances, they use experimental designs (Shadish et al., 2002). Researchers can make statistical generalizations based on assumptions used in statistics.

Sampling research articles on wild edible plants (WEP) to create an integrating overview is most straightforward when a researcher can analyze all available papers and book chapters of the last five to six years. I followed the procedure described in Åhlberg (2021a): When I found chemical constituents of plants that I guessed, based on my biology studies at the university, whether all edible plants share them, I used 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 have built on the latest relevant, valid, and reliable research based on my overall evaluation.

In Åhlberg (2021a), I found 52 health-promoting substances (ions and compounds) in green (wild) edible plants, of which 10 prevented Alzheimer's disease according to experimental research. For the current update (Åhlberg, 2022), I found four new similar substances. Accordingly, at least 56 health-promoting substances (ions and compounds) are in green (wild) edible plants. For this update, I checked which substances prevent Alzheimer's disease according to the latest (2016–2022) experimental research. I found that the following 16 substances Alzheimer's disease in green (wild) edible plants: (1) alpha-linolenic acid, (2) ascorbic acid, (3) carotenoids, (4) caffeic acid, (5) choline, (6) dietary fibers, (7) flavonoids, (8) lutein, (9) melatonin, (10) phenolic acids, (11) phenolic compounds, (12) phytic acid, (13) polyphenols, (14) polysaccharides, (15) silicon and silicates, and (16) terpenoids.

In the following vignettes, I present the new findings. Research literature inside vignettes is separate from the references of the main body of the text. Inside the vignettes, the references follow Åhlberg (2020, 2021a).

Research on green (wild) edible plants is proceeding vigorously. From new research articles (2016–2022), I found four new substances (compound and ions) that all green (wild) edible plants share and

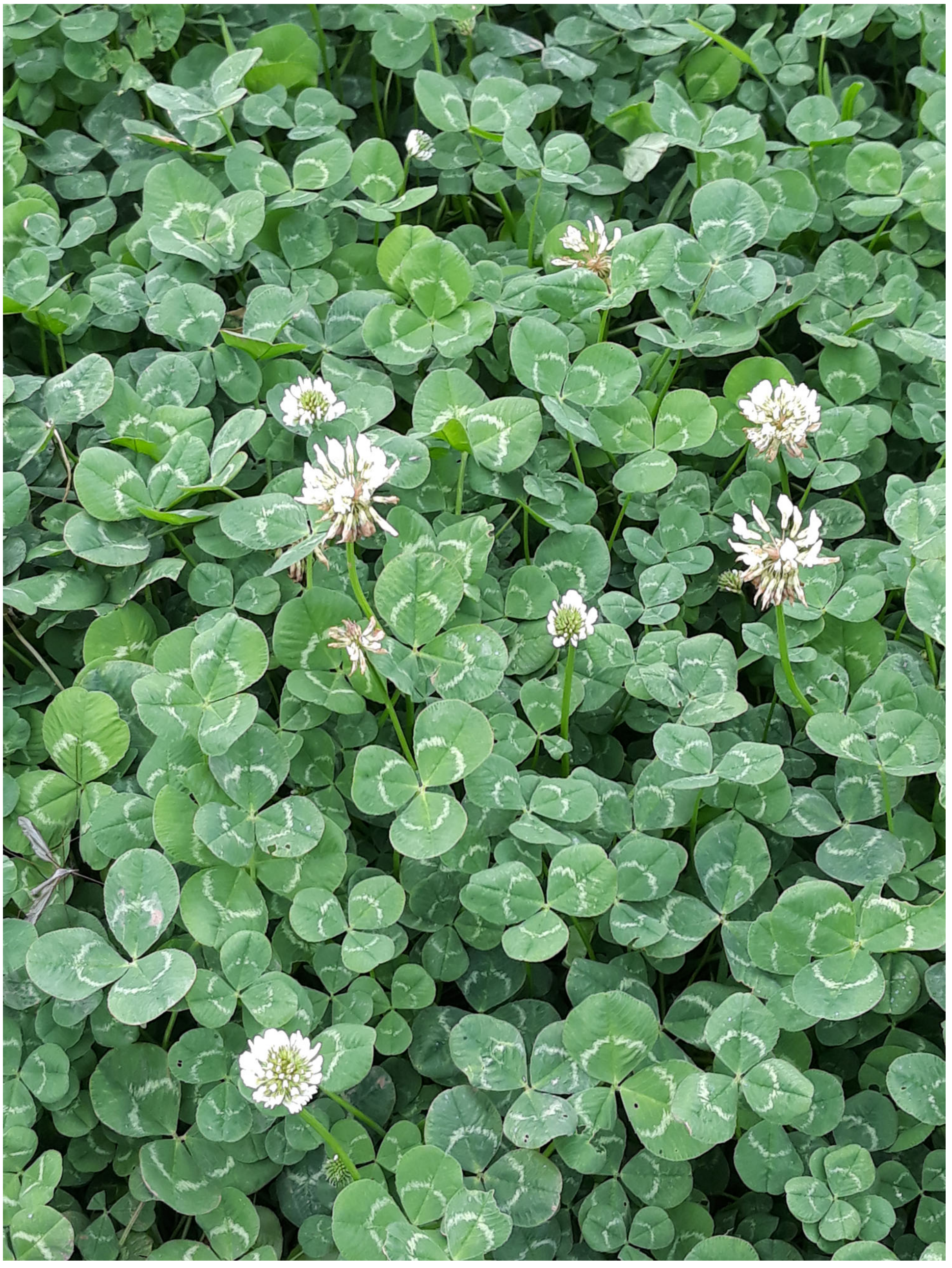


FIGURE 5 According to Åhlberg (2021b, 2022), aerial parts of white clover (*Trifolium repens*) contain 124 health-promoting substances (compounds and ions), of which 27 substances prevent Alzheimer's disease, according to experimental research. Photo © Mauri Åhlberg

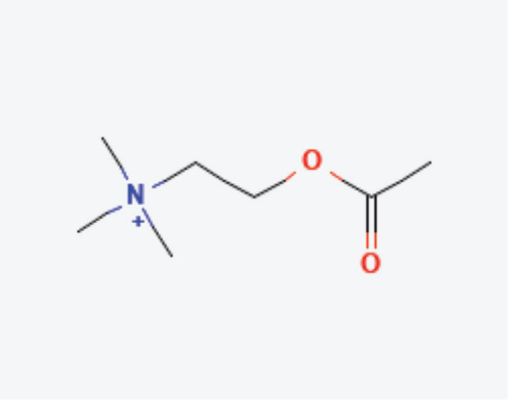
that promote human health and longevity, according to experimental research. The number of substances that prevent Alzheimer's disease increased from 10 to 16 substances. In future research, we will probably find more health-promoting substances that all green plants share. Also, the number of those substances which prevent Alzheimer's disease will likely increase. Researchers will test the earlier results to test their new and better theories.

The 56 health-promoting substances (compounds and ions) that all green (wild) edible plants share prevent many other diseases than Alzheimer's. For example, they are all antioxidant and anti-inflammatory. Most of them are also antimicrobial and antiviral.

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 Vodnar (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.

The following is the first update in 2022 of chemical constituents in all (wild) edible plants. I have searched for research articles supporting health claims. All scientific research claims are prone to continual testing, checking, rechecking, and improvement.

Acetylcholine. According to PubChem, the molecular formula of acetylcholine is $C_7H_{16}NO_2{}^+$. According to PubChem, the chemical structure of acetylcholine is the following.



For humans: According to Lamy et al. (2021), Oikawa et al. (2021), Briguglio et al. (2020), Cox et al. (2020), and Beckmann and Lips (2013), acetylcholine is essential for human health in many ways. Acetylcholine is (1) the neurotransmitter of the parasympathetic nervous system. (2) Synthesized from glucose and choline. (3) Produced by human cells and organs.

Researchers have found a shortage of cholinergic neurotransmission in conditions like Alzheimer's disease.

In plants: According to Dunant (2021), Roychoudhury (2020), and Kawashima et al. (2007), acetylcholine is synthesized in the growing parts and leaves. Acetylcholine takes part in (1) seed germination, (2) plant growth, (3) influences leaf movement, (4) membrane permeability to ions, (5) modifies enzyme activities, and (6) metabolic processes of plants.

Arias, N. et al. 2020. The relationship between choline bioavailability from diet, intestinal microbiota composition, and its modulation of human diseases. Nutrients, Volume 12, article 2340, 1–29.

Beckmann, J. & Lips, K. 2013. The non-neuronal cholinergic system in health and disease. Pharmacology, 92, 286–302.

Briguglio, M. et al. 2020. Dietary neurotransmitters: A narrative review on current knowledge. Nutrients, Volume 10, article 591, 1–15.

Cox, M. et al. 2020. Beyond neurotransmission: Acetylcholine in immunity and inflammation. Journal of Internal Medicine, 287, 120–133.

Dunant, Y. 2021. Acetylcholine, a ubiquitous signalling substance. Newcastle upon Tyne: Cambridge Scholars Publishing.

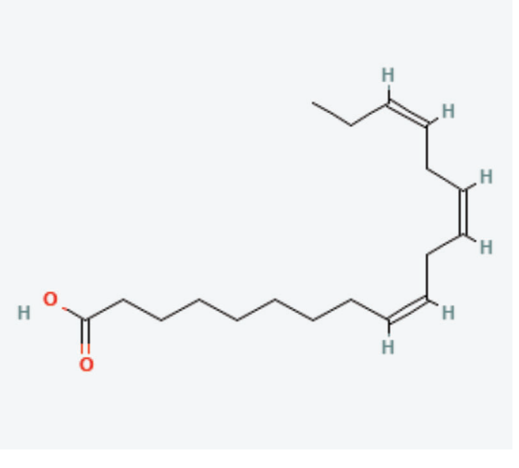
Kawashima, K. et al. 2007. Ubiquitous expression of acetylcholine and its biological functions in life forms without nervous systems. Life Sciences, 80(24–25), 2206–2209.

Lamy, E. et al. 2021. High-sensitivity quantification of acetylcholine and choline in human cerebrospinal fluid with a validated LC-MS/MS method. Talanta, Volume 224, article 121881, 1–7.

Oikawa, S. et al. 2021. Non-neuronal cardiac acetylcholine system playing indispensable roles in cardiac homeostasis confers resiliency to the heart. The Journal of Physiological Sciences, Volume 71, article 2, 1–20.

Roychoudhury, A. 2020. Neurotransmitter acetylcholine comes to the plant rescue. Journal of Molecular and Cellular Biology Forecast, Volume 3, article 1019, 1–4.

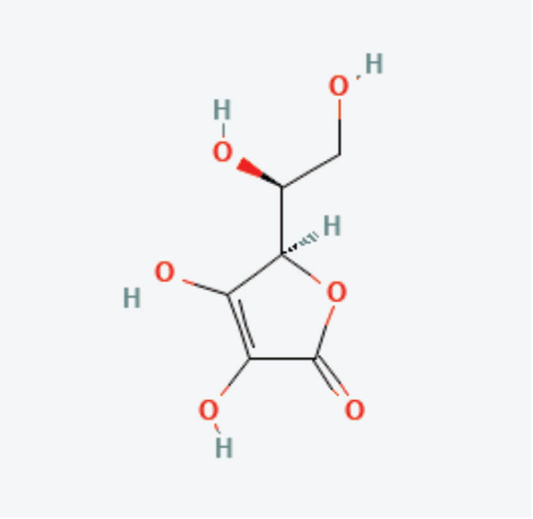
Alpha-linolenic acid. According to PubChem, the molecular formula of alpha-linolenic acid is $C_{18}H_{30}O_2$. According to PubChem, the chemical structure of alpha-linolenic acid is the following.



(Continues)

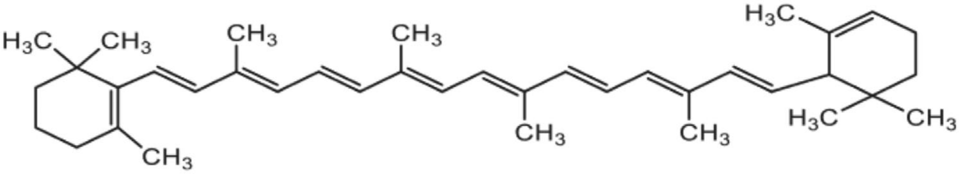
New research on alpha-linolenic acid mitigating Alzheimer's disease:
Alam, S. et al. 2021. Alpha-linolenic acid impedes cadmium-induced oxidative stress, neuroinflammation, and neurodegeneration in mouse brain. Cells, 2021, Volume 10, article 2274, 1–14.
Wood, A. et al. 2021. Dietary and supplemental long-chain omega-3 fatty acids as moderators of cognitive impairment and Alzheimer's disease. European Journal of Nutrition. Published online: 15 August 2021, 1–16.

Ascorbic acid. According to PubChem, the molecular formula of ascorbic acid is $C_6H_8O_6$. According to PubChem, the chemical structure of ascorbic acid is the following.

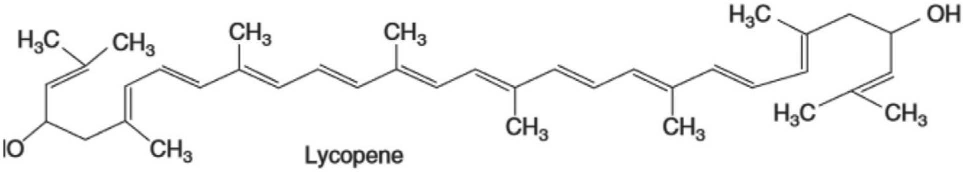


New research on ascorbic acid mitigating Alzheimer's disease:
According to Subramanian et al. (2021), a shortage of vitamin C could play a significant role in brain dysfunction and neurodegeneration. Researchers have found that plasma vitamin C levels are significantly lower in patients with neurodegenerative diseases. For instance, in Alzheimer's disease (AD), reduced vitamin C levels may accelerate amyloid-beta (Aβ) accumulation and cognitive impairment. Restoration of vitamin C levels and maintaining its homeostasis appear to safeguard against cognitive decline and the progression of Alzheimer's disease.
Subramanian, V. et al. 2021. Effect of lipopolysaccharide and TNFα on neuronal ascorbic acid uptake. Mediators of Inflammation, Volume 2021, article 4157132, 1—11.

Carotenoids. According to Riaz and co-workers (2021), there are two types of carotenoids. (1) The following is an example of the first type, beta-carotene.



(2) The following is an example of the second type, lycopene:



There is new research on carotenoids mitigating Alzheimer's disease:
Kabir, T et al. 2022. Therapeutic promise of carotenoids as antioxidants and anti-inflammatory agents in neurodegenerative disorders. Biomedicine & Pharmacotherapy, Volume 146, article 112610, 1–19.
Manochkumar, J. et al. 2021. The neuroprotective potential of carotenoids in vitro and in vivo. Phytomedicine, Volume 91, article 153676, 1–26.
Zia-Ul-Haq, M., Dewanjee. S., & Riaz, M. (Editors). 2021. Carotenoids: Structure and function in the human body. Cham: Springer.

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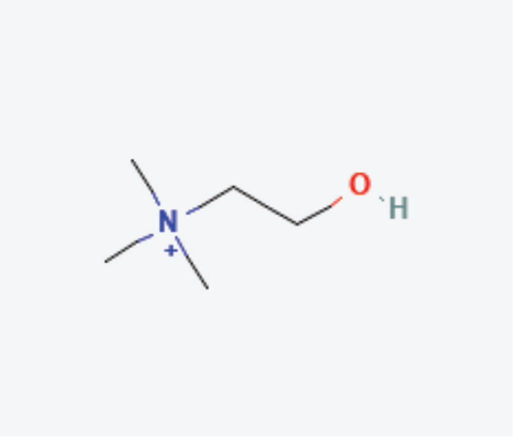
Choline. According to PubChem, the molecular formula of choline is $C_5H_{14}NO^+$. According to PubChem, the chemical structure of choline is the following.



For humans: According to Baumel et al. (2021), Goh et al. (2021), National Institutes of Health (2021), Arias et al. (2020), and Velazquez et al. (2019), choline is an essential macronutrient. Choline takes part in (1) neurotransmitter synthesis, (2) cell-membrane signaling, (3) lipid transport, (4) methyl-group metabolism, and (5) ameliorates Alzheimer's disease. Most humans do not get enough choline. All animal cells need choline to preserve their structure. Nutritional scientists try to promote awareness of choline-rich foods. The primary dietary sources of choline include eggs, fish, grains, meat, milk, from milk-derived products, and to a lesser extent, some vegetables, including wild edible plants. Choline deficiency is associated with (1) nonalcoholic fatty liver disease, (2) skeletal muscle atrophy, and (3) neurodegenerative diseases.

In plants: According to Kergomard et al. (2021) and Senthilkumar et al. (2021), choline (or its derivates) is a constituent of every living cell. All plant cells need choline to preserve their structure. All plants contain choline in some form.

Arias, N. et al. 2020. The relationship between choline bioavailability from diet, intestinal microbiota composition, and its modulation of human diseases effects of uridine/choline-enriched multinutrient dietary intervention for mild cognitive impairment: A narrative review. Neurology and Therapy, 10, 43–60.
Goh, Y. et al. 2021. Understanding choline bioavailability and utilization: First step toward personalizing choline nutrition. Journal of Agricultural and Food Chemistry, 69(37), 10774–10789.
Kergomard, J. et al. 2021. Digestibility and oxidative stability of plant lipid assemblies: An underexplored source of potentially bioactive surfactants? Critical Reviews in Food Science and Nutrition. Published online: 29 November 2021, 1–21.
National Institutes of Health. 2021. Choline. Fact Sheet for Health Professionals. Retrieved 9.12.2021, https://ods.od.nih.gov/factsheets/Choline-HealthProfessional/ Senthilkumar, M. et al. 2021. Estimation of choline content in plant tissues. In: Plant-Microbe Interactions. New York: Springer Protocols Handbooks, 127–128.
Velazquez, R. et al. 2019. Lifelong choline supplementation ameliorates Alzheimer's disease pathology and associated cognitive deficits by attenuating microglia activation. Aging Cell, Volume 18(6), article e13037, 1–11.

Dietary fibers (prebiotics). According to Waisundara (2022), researchers classify dietary fibers into the following main categories: (1) soluble dietary fibers and (2) insoluble dietary fibers. As examples of the soluble dietary fibers, Waisundara (2022) names the following: (a) inulin, (b) beta-glucan, and (c) pectin. As examples of the insoluble dietary fibers Waisundara (2022) names: (d) cellulose, (e) hemicellulose, and (f) lignin. All these six substances have different chemical structures. According to Pedrosa et al. **(2022), "Pectins are complex polysaccharides and versatile hydrocolloids, vastly available in plant cell walls and the middle lamella of higher plants." According to** Plamada and Vodnar (2022)**, also polyphenols belong to prebiotics (dietary fibers).**

New research on dietary fibers and their metabolic products of the intestinal microbiome mitigating Alzheimer's disease:

Lefèvre-Arbogast, S. et al. 2022. Dietary factors and brain health. Current Opinion in Lipidology, 33(1), 25-30.
Niaz, K. et al. 2022. Total scale analysis of organic acids and their role to mitigate Alzheimer's disease. South African Journal of Botany, 144, 437–447.
Pedrosa, L. d. F. et al. 2022. The complex biological effects of pectin: Galectin-3 targeting
as potential human health improvement? *Biomolecules*, Volume 12, article 289, 1–32.
Waisundara, V. (Ed.) 2022. Dietary fibers. London: IntechOpen.

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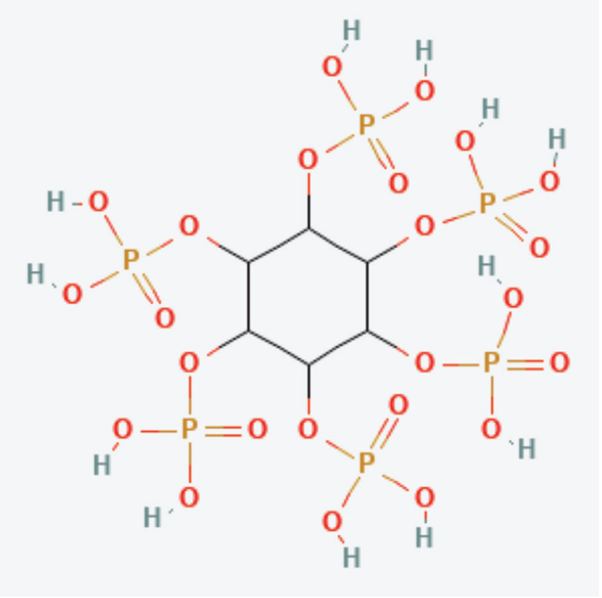
Phytic acid. According to PubChem, the molecular formula of phytic acid is $C_6H_{18}O_{24}P_6$. According to PubChem, the chemical structure of phytic acid is the following.



For humans: According to Bloot et al. (2021), Petroski and Minich (2020), and Kumar et al. (2021), phytic acid has the following health-promoting properties: (1) antioxidant, (2) antibacterial, (3) protective effects against cancer, (4) hypoglycaemic, (5) anti-diabetic, (6) cardiovascular health benefits, (7) protective effects against Parkinson's disease, (8) prevents kidney stones, (9) hypo-lipidemic, and (10) prevents Alzheimer's disease.
In plants: According to Bloot et al. (2021) and Kumar et al. (2021), (1) phytic acid is ubiquitous in eukaryotic species, and (2) all seed plants contain phytic acid in their seeds, including nuts, lentils, peas, beans, fruits, tubers, leaves, and seedlings. Plants use phytic acid in (1) seed germination and (2) to protect against biotic and abiotic stress.
Anekonda, T. et al. 2011. Phytic acid as a potential treatment for Alzheimer's pathology: Evidence from animal and in vitro models. Journal of Alzheimer's Disease, 23(1), 21–35.
Bloot, A. et al. 2021. A review of phytic acid sources, obtention, and applications. Food Reviews International. Published online: 12 April 2021, 1–21.
Kumar, A. et al. 2021. Phytic acid: Blessing in disguise, a prime compound required for both plant and human nutrition. Food Research International, Volume 142, article 110193, 1–11.
Lopez-Moreno, M. et al. 2022. Antinutrients: Lectins, goitrogens, phytates and oxalates, friends or foe? Journal of Functional Foods, Volume 89, article 104938, 1–9.
Petroski, W. & and Minich, D. 2020. Is there such a thing as "anti-nutrients"? A narrative review of perceived problematic plant compounds. Nutrients, Volume 12(10), article 29291, 1–32.

Terpenoids. According to Masyita (2022), "terpenoids (oxygen-containing hydrocarbons) are defined as modified class of terpenes with different functional groups and oxidized methylgroups moved or removed at various positions."
For humans: According to Lai Shi Min et al. (2022), El Omari et al. (2021), Gutiérrez-del-Río et al. (2021), Jagatap et al. (2021), Kabir et al. (2021), Kim (2020), and Xu et al. (202), terpenoids have the following health-promoting properties: (1) antioxidant, (2) anti-inflammatory, (3) anti-cancer, (4) anti-mycobacterial, (5) anti-neuroinflammatory, and (6) prevent Alzheimer's disease.
In plants: According to Jahangeer et al. (2021) and Karunanithi and Zerbe (2019), all plants produce terpenoids. (1) Terpenoids take part in photosynthesis. (2) The plant cell membranes contain terpenoids. (3) Plants need terpenoids for growth and development. (4) Most plant terpenoids are specialized metabolites for internal interactions, environmental defense, and adaptation. (5) Many terpenoids are toxic and protect against herbivores, insect pests, and microbial pathogens. (6) Volatile terpenoids attract pollinators and seed dispersers.
El Omari, N. et al. 2021. Natural bioactive compounds targeting epigenetic pathways in cancer: A review on alkaloids, terpenoids, quinones, and isothiocyanates. Nutrients, Volume 13, article 3714, 1–51.
Gutiérrez-del-Río, I. et al. 2021. Terpenoids and polyphenols as natural antioxidant agents in food preservation. Antioxidants, Volume 10, article 1264, 1–33.
Jagatap, V. et al. 2021. Recent updates in natural terpenoids as potential anti-mycobacterial agents. Indian Journal of Tuberculosis, Available online 15 July 2021, In Press, Corrected Proof.
Jahangeer, M. et al. 2021. Therapeutic and biomedical potentialities of terpenoids—A Review. Journal of Pure and Applied Microbiology, Volume 2021, article 6872, 1–13.
Kabir, T. et al. 2021. Exploring the anti-neuroinflammatory potential of steroid and terpenoid-derived phytochemicals to combat Alzheimer's disease. Current Pharmaceutical Design, 27(22), 2635–2647.
Karunanithi, P. & Zerbe, P. 2019. Terpene synthases as metabolic gatekeepers in the evolution of plant terpenoid chemical diversity. Frontiers in Plant Science, Volume 10, article 1166, 1–23.

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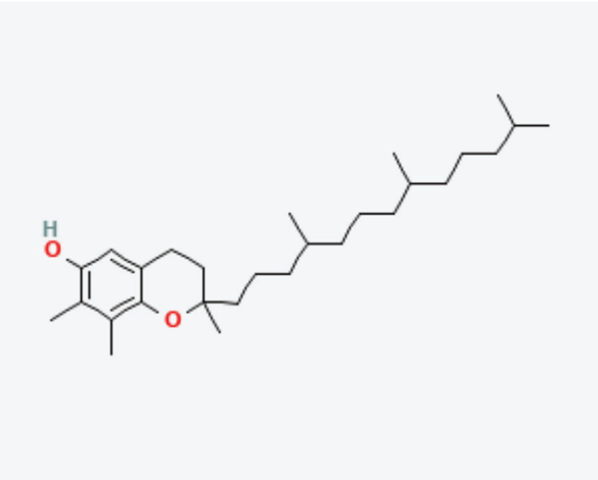
Kim, T. et al. 2020. Therapeutic potential of volatile terpenes and terpenoids from forests for inflammatory diseases. International Journal of Molecular Sciences, Volume 21, article 2187, 1–32.
Lai Shi Min, S. et al. (2022). Plant terpenoids as the promising source of cholinesterase inhibitors for anti-AD therapy. Biology, Volume 11(2), article 307, 1–16.
Masyita, A. et al. 2022. Terpenes and terpenoids as main bioactive compounds of essential oils, their roles in human health and potential application as natural food preservatives. Food Chemistry, X, Volume 13, article 100217, 1–14.
Xu, Y. et al. 2021. Natural terpenoids as neuroinflammatory inhibitors in LPS-stimulated BV-2 microglia. Mini Reviews in Medicinal Chemistry, 21(4), 520–534.

Tocopherols. According to PubChem, the molecular formula of tocopherols is $C_{28}H_{48}O_2$. According to PubChem, the chemical structure of tocopherols is the following.



New research on tocopherols mitigating Alzheimer's disease:
Ashley, S. et al. 2021. A meta-analysis of peripheral tocopherol levels in age-related cognitive decline and Alzheimer's disease. Nutritional Neuroscience, 24(10), 795–809.
Tkacz, K. et al. 2021. Phytoprostanes, phytofurans, tocopherols, tocotrienols, carotenoids and free amino acids and biological potential of sea buckthorn juices. Journal of the Science of Food and Agriculture, 102(1),185–197.
Yusof, Y. et al. 2020. Comparative effects of alpha-and gamma-tocopherol on mitochondrial functions in Alzheimer's disease in vitro model. Scientific Reports, Volume 10, article 8962, 1–14.

Correction to Åhlberg (2021)

A correction to Åhlberg (2021a, the text of figure 7): There is the wrong species name, red clover (Trifolium pratense), instead of fireweed (Epilobium angustifolium). The corrected text is Figure 7 Flowering fireweed (Epilobium angustifolium). According to Åhlberg (2021a and 2022), aerial parts of fireweed contain at least 121 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.

A referee asked to add figures of the plants, which I present in the text. That is why I have added photos to this paper.

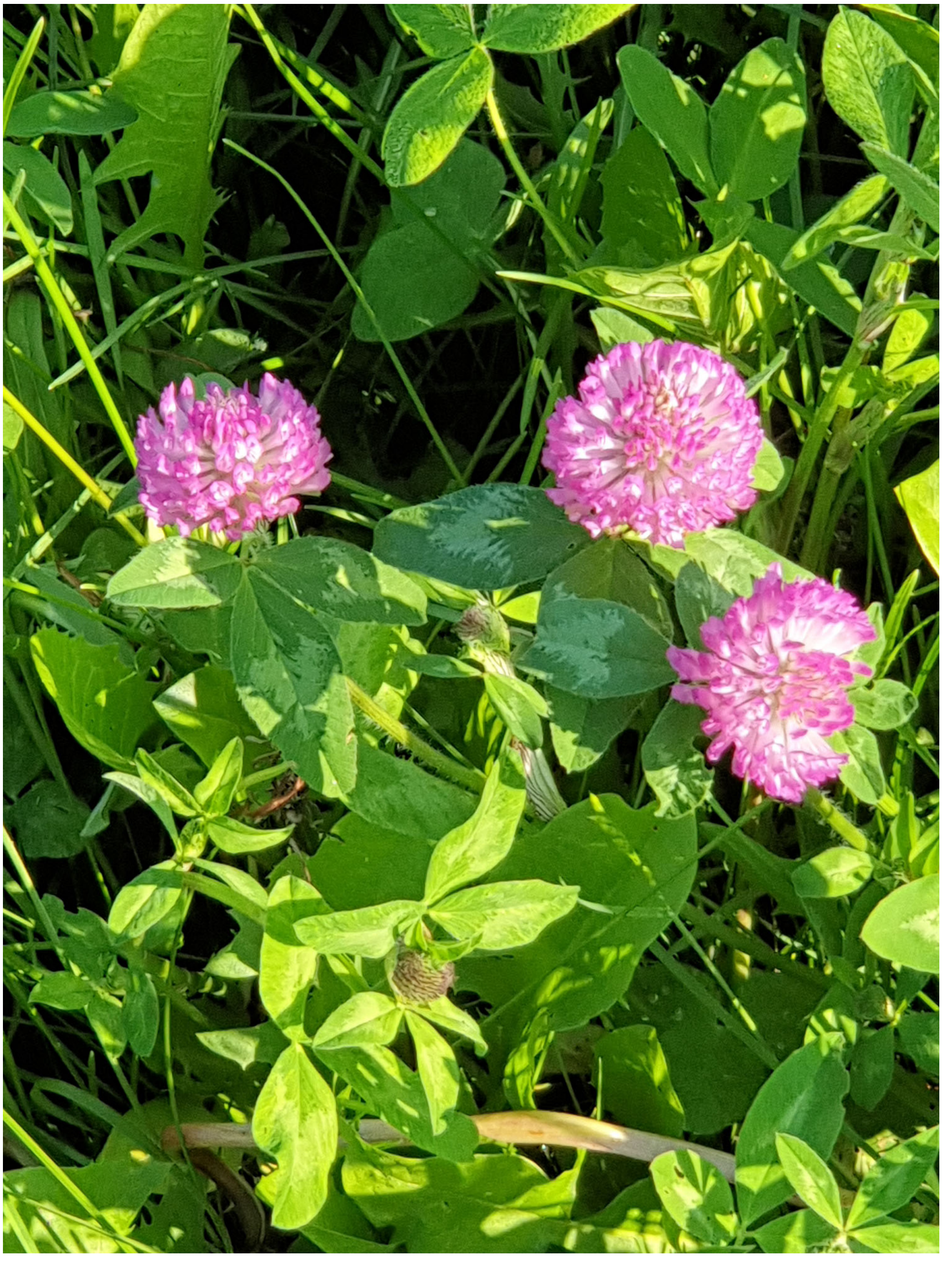


FIGURE 6 Red clover (*Trifolium pratense*) is one of the best available wild edible plants. According to Åhlberg (2021b, 2022), aerial parts of red clover contain at least 122 health-promoting ions and compounds of which at least 28 prevent Alzheimer's disease. Photo © Mauri Åhlberg

FIGURE 7 Fireweed (*Epilobium angustifolium*) is one of the best wild edible plants. According to Åhlberg (2021b, 2022), aerial parts of fireweed contain at least 121 health-promoting ions and compounds, of which at least 27 prevent Alzheimer's disease. Photo © Mauri Åhlberg

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