



Review Article

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Pain Management, Pathogenicity and Healing Using Dietary Supplements for Wellness

Leonard Sonnenschein* and Tiberious Etyang

The Sonnenschein Institute, USA

*Corresponding author: Leonard Sonnenschein, The Sonnenschein Institute, 6617 NW 24th Ave. Boca Raton, Florida 33496, USA.

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Abstract

Wellness is a complexity of an underlying support system of metabolic states: Pathogens, Pain, Mental Wellness, Physical Conditions which can be modulated towards healing and health with natural products including dietary supplements such as minerals, herbs, amino acids, vitamins and healthy food choices, water consumption and physical exercise. In this review article we explore recent literature studying these dietary relationships and health. The relationship between pain recovery and pathogenicity is interconnected, as pain can be both a symptom of pathogenic infections and a process that can impact the overall recovery from an infectious disease. Understanding this relationship is crucial for effective dietary management and treatment of infections and associated pain symptoms. Pain management and mental wellbeing also are important to recovery. A balanced diet not only provides the necessary nutrients for optimal brain health and healthy gut microbiota but also supports overall physical health, which in turn contributes to mental wellness. When our mental health is stable, we are better equipped to handle stress, relate to others, and make healthy choices. Mental health can impact physical health and vice versa. Also, a balanced and nutrient-rich diet plays a crucial role in supporting neuroplasticity and cognitive function by providing the essential building blocks and supportive environment for brain function and connectivity. In this article current research is reviewed regarding benefits of dietary supplements including foods, herbs, minerals and vitamins for pain control, pathogenicity, mental health and wellbeing. It is hoped that this will help people make decisions for their personal health plans.

Keywords: Brain health, Gut health, Heart health, Herbs, Minerals, Neuroplasticity, Neuropathy, Nootropics, Pathogenicity, and Vitamins

Abbreviations: AP1: Activating Protein 1; APCs: Antigen-Presenting Cells; AR: Allergic rhinitis; BA: Baicalin ; BCAAs: Branched-Chain Amino Acids; BDNF: Brain-Derived Neurotrophic Factor; BE: Baicalein; CNS: Central Nervous System; CVD: Cardiovascular Diseases; GABA: Gamma-Aminobutyric Acid; GBR: Germinated Brown Rice; SB: *Scutellaria baicalensis*; TCM: Traditional Chinese Medicine

Pain and Pathogenicity

Pain is described as a sensation that is felt as a result of a physically-hurting stimulus [1]. Pain can be divided into nociceptive, inflammatory, and neuropathic pain. Nociceptive pain is defined as a form of physical pain that is experienced during external injury [2]. Inflammatory pain is classified as tissue damage and infiltration of immune cells, while neuropathic pain is described as pain that is experienced through any damage to the nervous system. The transmission of pain sensation is relayed through affected neurons to the

spinal cord, which then transfers the signal to the brain for processing [2]. To date, antinociceptive and anti-inflammatory drugs are the gold standard to manage pain, while anticonvulsants and antidepressants are used to treat neuropathic pain [3].

The relationship between diet, pain recovery and pathogenicity, or the ability of a microorganism to cause disease, is an important concept in both clinical and research settings. Pathogenicity refers to the capability of a microorganism to produce a pathological ef-

fect on a host, while pain recovery pertains to the resolution of pain symptoms experienced by an individual. In the context of infections and diseases caused by pathogenic microorganisms, pain can be a common symptom. The severity and duration of pain experienced by an individual can vary depending on factors such as the initial cause of the pain, type of pathogen (often opportunistically) involved, the site of infection, the individual's immune response, and any underlying health conditions. Pain can serve as a warning signal that the body is under attack and can also be a result of inflammation or tissue damage caused by the pathogen. The process of pain recovery is complex and can be influenced by various factors, including the effectiveness of the immune response in clearing the infection, the presence of any lingering inflammation, the individual's overall health status, and the presence of any complications. Successful pain recovery often involves not only addressing the underlying cause of the pain but also managing any associated inflammation, tissue damage, and other contributing factors. In summary, the relationship between pain recovery and pathogenicity is interconnected, as pain can be both a symptom of pathogenic infections and a process that can impact the overall recovery including from an infectious disease. Understanding these relationships is crucial for effective management and treatment of infections and associated pain symptoms.

T Cell Activation and Pain Recovery

T-cell activation is a process that has been shown to begin within 1 hour after the use of Electroceid and has been observed through changes in neutrophil measurements, blood oxygen levels, and changes in characteristic symptoms as seen in recent Electroceid pre-clinical studies [4] including recognition of conversion from chronic to acute inflammation. Inflammation is part of the body's defense mechanism. It is the process by which the immune system recognizes and removes harmful and foreign stimuli and begins the healing process. Inflammation can either be acute or chronic. Acute inflammation fibrosis processes are engaged cellularly with lymphatic, neural, and circulatory responses. Most of the features of acute inflammation continue as the inflammation becomes chronic, including the expansion of blood vessels (vasodilation), increase in blood flow, capillary permeability, and migration of neutrophils into the infected tissue through the capillary wall (diapedesis). However, the composition of the white blood cells changes soon, and the macrophages and lymphocytes begin to replace short-lived neutrophils. Thus, the hallmarks of chronic inflammation are the infiltration of the primary inflammatory cells, such as macrophages, lymphocytes, and plasma cells in the tissue site, producing inflammatory cytokines, growth factors, and enzymes and hence contributing to the progression of tissue damage and secondary repair including fibrosis and granuloma formation often the a pain and thermogenic components. When one consumes the Electroceid product, there is an immediate increase in the oxygen level, followed by unhealthy cell and pathogen destruction. The destroyed products activate T cell within one hour, initiating antigen and antibody response immediately. It has been shown that acute inflammation fibrosis processes are engaged cellularly versed selection (Kisielow, et al., 1988). Peripheral with lymphatic,

neural, and circulatory responses, can lead to healing, happiness, and hope engagement for 20 hours or longer after Electroceid consumption [5].

Hypochlorous Pathway

Hypochlorous acid, generated through the hypochlorous pathway primarily by neutrophils are part of the innate immune response, and T cell activation, are the key process in adaptive immunity mediated by T lymphocytes. While these pathways typically operate independently, under certain conditions, interactions between hypochlorous acid and T cell activation may occur. Hypochlorous acid stimulation which is triggered by the Electroceid pathogen intersection potentially interacts with T cell activation by: Modulation of Antigen, changing the cytokine milieu, Influencing T Cell Signaling, Indirect micro-effects on T Cell Activity, and Potential for pathogenic Immunomodulation. Modulation of Antigen Presentation caused by Electroceid or other degradation of pathogen(s) which stimulates Hypochlorous acid can potentially impact the antigen-presenting capacity of APCs (antigen-presenting cells), such as dendritic cells and macrophages. By altering the processing or presentation of antigens, hypochlorous acid could influence the activation of T cells by APCs. This modulation could lead to changes in the quality or magnitude of T cell responses (Meng, et al. 2019) addressing the root causes of pain and healing. The hypochlorous stimulation and T cell activation may have healing implications by immune regulation, host defense, and inflammatory responses.

Relationship to Pain and Healing by Individual Natural Dietary Supplements

Holistic Inflammatory and Immune Support

With ingredients such as Turmeric and Boswellia, as found in Soreness Relief™ may strengthen immune responsiveness and support against inflammation. Soreness relief and muscle comfort can be modulated with dietary supplements to offer substantial relief for easing discomfort stemming from everyday activities and benign causes.

Turmeric: According to Kocaadam B, et al. [6], Turmeric is also known to have been used for centuries in India and China for the medical treatments of illnesses such as dermatologic diseases, infection, stress, and depression. Turmeric's effects on health are generally centered upon an orange-yellow colored, lipophilic polyphenol substance called "curcumin," which is acquired from the rhizomes of the herb. Curcumin is known recently to have antioxidant, anti-inflammatory, anticancer effects and, thanks to these effects, to have an important role in prevention and treatment of various illnesses ranging notably from cancer to autoimmune, neurological, cardiovascular diseases, and diabetic. Furthermore, it is aimed to increase the biological activity and physiological effects of the curcumin on the body by synthesizing curcumin analogues. As reported by Zhang and Kitts [7], the antidiabetic and cardioprotective effects of turmeric have attracted pronounced attention from numerous researchers with a common interest in understanding the role of turmeric and related bioactives in the protection against Cardiovascular Diseases (CVD) that currently exists as a leading

cause of mortality worldwide. Recent studies by Emirik [8] have shown the therapeutic potential of turmeric against coronavirus disease 2019 (COVID-19) and the potential to modulate cytokine storm in COVID-19 patients [9].

Boswellia: As pointed out by Siddiqui [10], Gum-resin extracts of *Boswellia serrata* have been traditionally used in folk medicine for centuries to treat various chronic inflammatory diseases. The resinous part of *Boswellia serrata* possesses monoterpenes, diterpenes, triterpenes, tetracyclic triterpenic acids and four major pentacyclic triterpenic acids i.e. β -boswellic acid, acetyl- β -boswellic acid, 11-keto- β -boswellic acid and acetyl-11-keto- β -boswellic acid, responsible for inhibition of pro-inflammatory enzymes. Out of these four boswellic acids, acetyl-11-keto- β -boswellic acid is the most potent inhibitor of 5-lipoxygenase, an enzyme responsible for inflammation.

According to Yu, et al. [11], Boswellic acid is the active ingredient in *Boswellia serrata*; it has shown significant pharmacological activity in the treatment of inflammatory diseases such as rheumatoid arthritis, chronic bronchitis, asthma and chronic inflammatory bowel diseases (ulcerative colitis and Crohn's disease) [12].

Clinical studies have shown that *Boswellia serrata* extract not only has anti-inflammatory and anti-arthritis properties, but also improves pain and physical function [13] in vitro experiments also show that *Boswellia serrata* extract can inhibit the expression of inflammatory factors such as adhesion molecules [14,15].

Ingredients for Pain Recovery and Other Health Benefits

Chinese Skullcap: *Scutellaria Baicalensis* (SB), also known as the Chinese skullcap, has a long history of being used in Chinese medicine to treat a variety of conditions ranging from microbial infections to metabolic syndrome and malignancies. Numerous studies have reported that treatment with total SB extract or two main flavonoids found in its root and leaves, Baicalin (BA) and Baicalein (BE), can prevent or alleviate the detrimental toxic effects of exposure to various chemical compounds. It has been shown that BA and BE are generally behind the protective effects of SB against toxicants [16]. Chinese skullcap, scientifically known by the name *Scutellaria Baicalensis* (SB), has been an important component of Traditional Chinese Medicine (TCM) [17]. Also known as Huang Qin, this plant from the Lamiaceae family is rich in a variety of flavonoids, polyphenols, volatile oils, etc. Of all the pharmacologically active constituents, Baicalin (BA) and Baicalein (BE) are the two that have attracted the most attention [18]. Although SB comprises other compounds such as oroxylin A, wogonin, and wogonoside, none of these have manifested an oxidant activity as great as BE and BA [19,20]. BA is the glycosylated form of BE, and both flavonoids have displayed a wide range of therapeutic and protective properties in experiments. Their effects against malignancies [21,22], cardiovascular diseases [23], neurodegenerative conditions [24,25], microbial infections [26], and obesity [27] have been previously documented. Oxidative stress and inflammation play an important role in the pathogenesis of many chronic and degenerative diseases [28] (Furman, et al. 2019). Daily exposure to chemicals in professional environments or their long-term consumption in

trace amounts in diet can increase the incidence of these conditions [29]. Moreover, different drugs and chemicals can lead to acute poisoning via ingestion and inhalational and parenteral routes that can be potentially threatening [30,31]. A remarkable number of plant or their bioactive compounds such as garlic [32], milk thistle [33], and berberine [34] have shown remarkable effects against toxic agents. Considering the pathophysiology of these diseases and intoxications and the pharmacological properties of SB flavonoids, it has been postulated that radical scavenging and anti-inflammatory properties of BE and BA can be a potentially efficient way of combating these conditions [19,20].

Mood Enhancement and Stress Reduction

Passionflower and Ginger Root contribute to mood improvement and everyday stress reduction, which may aid sleep and a more relaxed state of mind.

Passionflower: Passionflower has been traditionally used to alleviate symptoms of anxiety and insomnia, with some studies supporting its calming effects. It may help improve sleep quality by increasing Gamma-Aminobutyric Acid (GABA) levels in the brain, which has a calming effect and in some research suggests passionflower may help relieve certain types of pain, though more research is needed [35,36]. Janda, et al. [35] pointed out that stress is a natural response of the body, induced by factors of a physical (hunger, thirst, and infection) and/or psychological (perceived threat, anxiety, or concern) nature. Chronic, long-term stress may cause problems with sleep, concentration, and memory, as well as affective disorders. The passionflower (*Passiflora incarnata*) is one of the best-documented species of the Passiflora genus with therapeutic properties [37]. The literature data suggest that the passionflower itself, as well as its preparations, helps reduce stress and can therefore be helpful in the treatment of insomnia, anxiety, and depression. The aerial parts of the plant, flowers, and fruits are used for medicinal purposes. They are credited with anthelmintic, antispasmodic, and anxiolytic effects. The passionflower is also used as a remedy for burns, diarrhea, painful menstruation, hemorrhoids, in neurotic disorders, insomnia, to treat morphine dependence, and can be helpful in convulsions or neuralgia, too. *Passiflora incarnata* is a source of alkaloids, phenolic compounds, flavonoid, and cyanogenic glycosides. According to Dhawan, et al. [38] the primary phytochemicals found in the passionflower are flavonoids (apigenin, luteolin, quercetin, and kaempferol) and flavonoid glycosides (vitexin, isovitexin, orientin, and isoorientin). The species has the highest overall isovitexin content.

According to Miroddi, et al. [36] the genus *Passiflora incarnata* has long been used in traditional herbal medicine for the treatment of insomnia and anxiety in Europe, and it has been used as a sedative tea in North America. Furthermore, this plant has been used for analgesic, anti-spasmodic, anti-asthmatic, wormicidal and sedative purposes in Brazil; as a sedative and narcotic in Iraq; and for the treatment of disorders such as dysmenorrhoea, epilepsy, insomnia, neurosis and neuralgia in Turkey. In Poland, this plant has been used to treat hysteria and neurasthenia; in America, it has been used to treat diarrhoea, dysmenorrhoea, neuralgia, burns, haemor-

rhoids and insomnia. *Passiflora incarnata L.* has also been used to cure people affected by opiate dependence in India.

Ginger Root: The ginger extract is as good as loratadine in improving nasal symptoms and quality of life in AR patients [39]. According to *Yamprasert, et al* (2020), the second-generation non-sedating antihistamines are considered first-line treatment and particularly useful in the treatment of Allergic Rhinitis (AR). However, antihistamines have side effects, for example drowsiness, dry mouth, rash or fatigue, etc. [40]. For these reasons it is essential to search for a better-tolerated alternative, especially from herbs. Ginger (*Zingiber officinale* Roscoe) is widely used as a spice throughout the world. Ginger (*Zingiber officinale*) is a spice traditionally used to treat indigestion, nausea and vomiting. Ginger extracts accelerate gastric emptying and stimulate gastric antral contractions. These effects are mainly due to the presence of gingerols and shogaols and their activity on cholinergic M receptors and serotonergic 5-HT and 5-HT receptors [39]. In Thai traditional medicine, it has been used as a part of herbal remedies for treating cold, constipation, sleeplessness and relieving flatulence, etc. In other traditions such as Indian and Chinese medicine, ginger has been used for several disorders such as asthma, nausea and arthritis [41].

Benefits of Nature Based pain Alleviation non-Addictive Solutions

Non-Addictive Herb-based combinations designed to reduce stress without the risk of addiction can include mixtures of herbs like Barberry and Ginger Root for holistic health benefits.

Barberry: Barberry (*Berberis vulgaris L.*) has different medicinal applications in folk medicine of Iran. Berberine, an alkaloid constituent of this plant, is present in the roots, rhizomes, stem, and bark of *B. vulgaris* and many other plants. There have been many clinical trials conducted that suggested a wide range of therapeutic applications. Lipid-lowering and insulin-resistance improving actions are the most studied properties of berberine in numerous randomized clinical trials. There are also clinical trials regarding cardiovascular, anticancer, gastrointestinal, CNS, endocrine, and so on. Berberine has very low toxicity in usual doses and reveals clinical benefits without major side effects [42].

Barberry (*Berberis vulgaris L.*) is a medicinal plant and its main constituent is an isoquinoline alkaloid named berberine that has multiple pharmacological effects such as antioxidant, anti-microbial, antiinflammatory, anticancer, anti-diabetes, anti-dyslipidemia, and anti-obesity.

Kalmarzi, et al. [43] indicated that about 22 alkaloid compounds have been identified in the roots, the leaves, and the fruits of Barberry [44]. Studies about the chemical components of the extract of this plant show that alkaloids with an isoquinoline core such as protoberberine, berberamine, tetrandrine, chondocurine, and palmatine are among the important contents of Barberry. Studies have shown that alkaloids in this plant increase immunity through T cells [45]. Berberine in the root of Barberry has anticonvulsant, sedative, and diuretic effects. Also, the berberine in Barberry shows the elimination activity of the ONOO(-) and NOO(2)(-) radicals that can contribute to oxidative damage reduction [46]. The extract of

this plant is effective in inhibiting activating protein 1 (AP1) of human hepatoma cells [47].

Gut and Liver Support

Turmeric and Brown Rice have been shown to aid in digestive health and liver function.

Brown Rice: It is a great gluten-free alternative to wheat flour, suitable for those with celiac disease or gluten sensitivity as well as offers dietary fiber which aids in digestion and promotes feelings of fullness [48,49].

Pigmented rice is receiving much attention due to its high polyphenols, minerals, and vitamins, including many bioactive compounds (*Reddy, et al.* 2017). Bioactive compounds are present in many common plants, including pigmented rice. They include phenolic compounds, total flavonoids, total anthocyanins, and total antioxidants. As a result, pigmented rice has become a popular alternative for health benefits [49].

As published by *Cornejo, et al.* [48] in 2015, Germinated Brown Rice (GBR) is considered as a gluten-free grain characterized by an excellent nutrient profile and germination greatly enhances the content of bioactive compounds, such as GABA (c-aminobutyric acid), phenolic compounds, c-oryzanol and the antioxidant activity [50]. Scientific research supports the beneficial effects of these bioactive compounds, which includes regulation of blood pressure and heart rate, alleviation of pain and anxiety, improves sleeplessness and an autonomic disorder associated with menopausal or premenopausal periods, suppresses liver damage, inhibits cancer cell proliferation and protects against oxidative stress [51].

Brown rice is a whole grain that retains its bran and germ, making it a good source of fiber, vitamins, and minerals such as manganese, selenium, and magnesium. The fiber in brown rice helps slow down the absorption of sugar, assisting in blood sugar regulation, which can be beneficial for those managing diabetes or at risk of developing it. Brown rice's fiber content can also help lower cholesterol levels, potentially reducing the risk of heart disease. The fiber in brown rice supports healthy bowel movements and contributes to overall digestive health [52,53].

Heart Health

Ingredients like brown rice which is rich in fiber which can help reduce levels of LDL (bad) cholesterol; minerals such as magnesium; and antioxidants including selenium, manganese, and various phenolic compounds that can help reduce oxidative stress and inflammation in the body. Chronic inflammation and oxidative stress are linked to the development of heart disease that promotes heart health. Brown rice also helps lower glycemic levels in the blood helping to reduce diabetic inflammation.

Natural Stress Relief

Corydalis: *Corydalis* naturally can alleviate stress, enhance blood flow and promote relaxation.

Corydalis is a plant that has been used in traditional Chinese medicine for its potential health benefits. As reported by *Alhassen, et al.* [54], the extract of *C. yanhusuo* (YHS) has been studied for

its role in analgesia over the years. However, a systematic study by Wang, *et al.* [55] confirmed YHS analgesic effects in the tail flick, formalin paw licking, von Frey filament, and the hot box assays after spinal nerve ligation in mice. In this study, they demonstrated that YHS effectively attenuates acute, inflammatory, and neuropathic pain without causing any tolerance [55]. In addition to the various pain assays conducted, Wang *et al.* also showed that in dopamine D2KO mice, the antinociceptive effects of YHS were decreased in both the acute and neuropathic pain assays [55]. The study concluded that the effects on acute and neuropathic pain are mediated at least in part through the dopamine D2 receptor [55].

According to Deng, *et al.* [56], the genus *Corydalis* is a botanical source of various pharmaceutically active components. Its member species have been widely used in traditional medicine systems in Southeast Asia, especially in China for thousands of years. They have been administered to treat the common cold, hypertension, hepatitis, hemorrhage, edema, gastritis, cardiovascular and cerebrovascular diseases, and neurological disorders. Analgesia is the most important effect of *Corydalis* products, which are relatively non-addictive and associated with low tolerance compared with other analgesics. Certain *Corydalis* species are rich in alkaloids, which have strong biological activity, and also contain coumarins, flavonoids, steroids, organic acids and other chemical components. These constituents have pharmacological efficacy against diseases of the nervous, cardiovascular and digestive systems [56].

Some of the reported health benefits of *corydalis* include Pain relief: *Corydalis* is commonly used to help manage pain, particularly chronic pain conditions like arthritis, fibromyalgia, and neuropathic pain. It contains alkaloids, such as DL-Tetrahydropalmatine (THP), which may have analgesic properties similar to those of opioids but with potentially lower risk of dependence, Anti-Inflammatory Properties: Some studies suggest that *corydalis* may have anti-inflammatory effects, which could help reduce inflammation in the body and alleviate symptoms of inflammatory conditions, Mood Enhancement: *Corydalis* has been used traditionally to help improve mood and relieve symptoms of stress and anxiety. It may have mild sedative properties that can promote relaxation and mental well-being, Cardiovascular Support: *Corydalis* has been suggested to have cardiovascular benefits, potentially helping to lower blood pressure and improve blood circulation. These effects can have positive implications for heart health, Digestive Aid: In traditional medicine, *corydalis* is also used to support digestive health. It may help alleviate symptoms of indigestion, bloating, and abdominal discomfort, Liver Support: Some studies suggest that *corydalis* may have hepatoprotective properties, potentially supporting liver health and aiding in detoxification processes, and Sleep Aid: *Corydalis* is sometimes used to promote relaxation and improve sleep quality. Its sedative properties may help individuals with insomnia or sleep disturbances [54].

Stress and Pathogenicity

Stress can impact the pathogenicity of various microorganisms in different ways. Pathogenicity refers to the ability of a microorganism to cause disease in a host. Stress can weaken the immune

system of the host, making it more susceptible to infections by pathogens. Additionally, stress can directly affect the growth, replication, and virulence of certain pathogens [57]. Stress can influence pathogenicity by Immune Suppression: Prolonged stress can suppress the immune system, making the host more vulnerable to infections. Stress hormones such as cortisol can suppress the production of certain immune cells and weaken the body's defense mechanisms against pathogens. Some pathogens can become more virulent under stressful conditions. Stress can trigger changes in the gene expression of pathogens, leading to increased production of virulence factors that enhance their ability to cause disease. Stress can also impact the transmission of pathogens. For example, stress can lead to behaviors such as poor hygiene or increased contact with infected individuals, which can facilitate the spread of infectious agents. Stress can disrupt the delicate balance between the host and pathogen interactions. Stress-induced changes in the host's physiology can create an environment that favors the growth and survival of pathogens, leading to increased pathogenicity. It is important to note that the relationship between stress and pathogenicity is complex and can vary depending on the specific pathogen and host factors involved. Managing stress through lifestyle changes, such as maintaining a healthy diet, regular exercise, and adequate rest, can help mitigate its impact on the immune system and reduce susceptibility to infections [58].

Mental Health and Wellness

The connection between mental health and overall wellbeing is profound. Mental health refers to our emotional, psychological, and social well-being, affecting how we think, feel, and act. Diet can play an important role to provide the basis of hormones for brain function and wellness. There is also the relationship between the gut for absorption of nutrients supporting the brain for healthy metabolism. It is crucial for every stage of life, from childhood through adulthood to have the appropriate nutritional support for Mental Health [59].

Nutrients

The nutrients we consume through our diet provide the building blocks for various hormones, neurotransmitters, and other essential chemicals that are vital for cognitive function, mood regulation, and overall mental health [60]. The relationship between diet, brain function, and mental well-being is demonstrated. The Essential nutrients such as omega-3 fatty acids, vitamins (B vitamins, vitamin D), minerals (iron, zinc, magnesium), and antioxidants (vitamin E, vitamin C) are important for brain health where these nutrients support cognitive function, neurotransmitter production, and overall brain function. Certain nutrients from our diet play a role in the synthesis of neurotransmitters such as serotonin, dopamine, and norepinephrine, which are crucial for regulating mood, stress response, and emotional well-being. For example, amino acids like tryptophan (found in protein-rich foods) are essential precursors for serotonin production. The gut-brain axis is a bidirectional communication pathway between the gut and the brain. A healthy gut microbiome, which is influenced by diet, is essential for proper nutrient absorption, inflammation regulation, and neurotransmitter

production, all of which impact mental health. The role of Omega-3 fatty acids, particularly EPA and DHA found in fatty fish, flaxseeds, and walnuts, are important for brain health as they have anti-inflammatory properties, support neuronal function, and have been linked to improved mood and cognitive function. Balanced blood sugar levels are important for optimal brain function as consuming complex carbohydrates, healthy fats, and protein can help stabilize blood sugar levels, preventing energy crashes and mood swings. Antioxidant-rich foods (e.g., fruits, vegetables, nuts) help combat oxidative stress and reduce inflammation in the brain, which can protect against neurodegenerative diseases and support overall mental well-being (Xue et al, 2022). Proper hydration is essential for cognitive function and mood regulation. Dehydration can lead to fatigue, impaired concentration, and mood disturbances.

Neuroplasticity

Neuroplasticity refers to the brain's ability to reorganize itself by forming new connections between neurons and changing existing ones in response to learning, experience, and environmental factors [61]. Diet plays a significant role in supporting neuroplasticity through various mechanisms. Certain nutrients are essential for brain function and neuroplasticity. For example, omega-3 fatty acids (found in fatty fish, flaxseeds, and walnuts) are important for brain health and have been shown to enhance synaptic plasticity. B vitamins, antioxidants like vitamin E and C, and minerals like zinc and magnesium also play roles in supporting neuronal function and communication.

The Gut-Brain Axis, the gut microbiota can influence brain function and behavior. A diet rich in prebiotics (fiber-rich foods that promote the growth of beneficial gut bacteria) and probiotics (live beneficial bacteria found in fermented foods like yogurt and kefir) can support a healthy gut microbiota, which in turn can positively impact brain health and neuroplasticity [62].

Chronic inflammation in the body is often driven by a poor diet high in processed foods, refined sugars, and unhealthy fats, can impair neuroplasticity by promoting oxidative stress and disrupting neurotransmitter balance. Anti-inflammatory foods like fruits, vegetables, whole grains, and healthy fats can help reduce inflammation and support brain health.

In the Blood Sugar Regulation, diets high in refined sugars and processed foods can lead to fluctuations in blood sugar levels, which can impact brain function and neuroplasticity. Stable blood sugar levels are important for maintaining cognitive function and supporting optimal brain activity.

The Caloric Intake restriction and intermittent fasting have been linked to enhanced neuroplasticity and cognitive function. These dietary strategies can stimulate the production of Brain-Derived Neurotrophic Factor (BDNF), a protein that promotes the growth and survival of neurons.

For the Brain Health, a diet that supports overall brain health, such as the Mediterranean diet rich in fruits, vegetables, whole grains, fish, and healthy fats, has been associated with better cognitive function and reduced risk of neurodegenerative diseases.

These dietary patterns provide a broad range of nutrients and antioxidants that support brain health and neuroplasticity.

In conclusion, a balanced and nutrient-rich diet plays a crucial role in supporting neuroplasticity by providing the essential building blocks and supportive environment for brain function and connectivity. By choosing a diet rich in whole, nutrient-dense foods and supporting a healthy gut microbiota, individuals can positively influence neuroplasticity and cognitive function throughout their lives [63].

Gut-Brain Relationship

The gut-brain axis is a bidirectional communication system that links the central nervous system (brain and spinal cord) with the enteric nervous system (the gut). This communication occurs through neural, hormonal, and immunological pathways. The relationship between gut health and brain health is increasingly recognized as important for overall well-being. They include the Microbiota; the gut is home to a diverse community of microorganisms known as the gut microbiota. These microbes play a crucial role in digestion, nutrient absorption, immune function, and even mental health. The gut microbiota can influence brain function and behavior through the production of neurotransmitters, such as serotonin and dopamine [62].

The Inflammation; a compromised gut barrier (leaky gut) can lead to the leakage of bacteria and toxins into the bloodstream, triggering systemic inflammation. Chronic inflammation in the gut can impact brain health and has been implicated in various neurological conditions like depression, anxiety, and neurodegenerative diseases.

The Neurotransmitters; the gut produces many of the same neurotransmitters found in the brain, such as serotonin, dopamine, and GABA. Imbalances in these neurotransmitters in the gut can affect mood, cognition, and behavior.

The Immune System; around 70-80% of the body's immune cells are located in the gut-associated lymphoid tissue. An imbalance in gut microbiota can lead to dysregulation of the immune system, potentially contributing to immune-related disorders and neuro inflammation.

The Stress Response; the gut-brain axis plays a role in the body's response to stress. Chronic stress can disrupt the balance of gut microbiota, increase intestinal permeability, and affect brain function, leading to conditions like Irritable Bowel Syndrome (IBS) and mood disorders.

The Diet and Nutrients; what we eat can influence both gut and brain health. A diet rich in fiber, prebiotics, and probiotics can support a healthy gut microbiota, while nutrient deficiencies can impact brain function and mood.

The Therapeutic Potential; improving gut health through dietary changes, probiotics, prebiotics, and lifestyle modifications has shown promise in managing conditions like depression, anxiety, and cognitive function. This has led to the emergence of the field of psychobiotics, focusing on the use of beneficial bacteria to support mental health.

Overall, maintaining a healthy gut is essential for optimal brain function and overall well-being. Strategies that support gut health, such as a balanced diet, stress management, regular physical activity, and good sleep hygiene, can positively influence brain health and cognitive function [64].

Leaky Gut Issues

Leaky gut, a symptom existent at almost epidemic proportion worldwide, also known as increased intestinal permeability, is a condition where the lining of the intestines becomes more permeable than normal. In a healthy intestine, the lining is selectively permeable, allowing nutrients to pass through into the bloodstream while preventing larger molecules, toxins, and bacteria from crossing over. However, in leaky gut, the intestinal barrier becomes compromised and allows unwanted substances to pass through the intestinal wall and into the bloodstream. This breach in the intestinal barrier can trigger inflammation and immune responses in the body. It is believed to be associated with various health issues such as digestive problems, food sensitivities, autoimmune conditions, and even mental health disorders [65].

Factors that can contribute to leaky gut include chronic stress, poor diet (high in processed foods, refined sugars, and inflammatory fats), excessive alcohol consumption, certain medications (like nonsteroidal anti-inflammatory drugs), infections, and imbalances in gut bacteria.

Symptoms of leaky gut may include bloating, gas, cramps, food sensitivities, fatigue, joint pain, skin issues, and mood swings. Diagnosis of leaky gut can be challenging as it may require tests like specific blood tests, stool tests, and intestinal permeability tests.

Treatment for leaky gut typically focuses on addressing underlying causes such as making dietary changes (adopting an anti-inflammatory diet, removing trigger foods), managing stress, incorporating probiotics and gut-healing supplements, and lifestyle modifications to support gut health. Consulting with a healthcare provider or a gastroenterologist for proper evaluation and individualized treatment plan is recommended for those suspecting they may have leaky gut [66].

Benefits of Essential Amino Acids

Essential amino acids are the building blocks of proteins that the body cannot produce on its own and must be obtained from the diet [67]. There are nine essential amino acids: histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine that play crucial roles in various physiological processes. Essential amino acids are vital for the growth, repair, and maintenance of tissues in the body as they help build and repair muscle, bone, skin, and other tissues. The Essential amino acids, especially branched-chain amino acids (BCAAs) like leucine, isoleucine, and valine, are essential for muscle protein synthesis where they help promote muscle growth, recovery, and maintenance, making them particularly important for athletes, bodybuilders, and individuals engaging in regular exercise. Some essential amino acids can be converted into glucose through a process called gluconeogenesis, providing energy for the body, especially during periods

of fasting or intense exercise. Certain essential amino acids, such as glutamine and arginine, play significant roles in supporting immune function as they are essential for the production of antibodies and immune cells that help the body defend against pathogens and maintain overall immune health. Amino acids like tryptophan, tyrosine, and phenylalanine are precursors to neurotransmitters like serotonin, dopamine, and norepinephrine, which are essential for regulating mood, cognition, and overall brain function. Essential amino acids are crucial for the healing of wounds and injuries as they help promote tissue repair, collagen synthesis, and the formation of new blood vessels necessary for the recovery process. Some essential amino acids are involved in the synthesis of hormones such as insulin, growth hormone, and thyroid hormones, which play essential roles in metabolism, growth, and overall physiological balance. Essential amino acids are involved in various metabolic pathways, including the synthesis of enzymes, hormones, and other molecules that regulate metabolism, nutrient absorption, and overall cellular function. Ensuring an adequate intake of essential amino acids through a balanced diet helps support overall health and wellness as they are required for maintaining optimal bodily functions, promoting growth and development, and supporting various physiological processes. Including a variety of protein sources in your diet that provide all nine essential amino acids is essential for meeting your body's needs and reaping the benefits associated with these crucial nutrients [68]. More often it is necessary to supplement one's diet directly with essential amino acids to ensure the availability of essential amino acids for healthy metabolism.

Natural Nutrients (Nootropics) for Enhancing Brain Functions

Traditionally, for thousands of years, the benefits of mushrooms have been known and studied. Recently, there has been resurgence in interest regarding how mushrooms can benefit our health, memory, and performance. Specifically, for the main components of ALERT™ Lions Mane Mushroom and Turkey Tail Mushrooms research has found that the mushroom ingredients may protect against dementia, reduce symptoms of anxiety and depression, may help repair nerve damage, have strong anti-inflammatory, antioxidant, and immune-boosting abilities and to lower the risk of heart disease, cancer, ulcers, and help in the management of diabetes. Studies show that ALERT™ may even help people with ADHD due to its potential to enhance and protect brain function [69].

Lion's Mane Mushroom (*Hericium erinaceus*)

The benefits range from cognitive health where it supports brain health by stimulating the growth of brain cells and improving the functioning of the hippocampus, a region of the brain involved in memory and emotional responses while also plays a role in nervous system recovery where it has potential neuroprotective properties that may aid in the recovery of the nervous system from injuries [70,71].

According to Friedman [70] the culinary and medicinal mushroom *Hericium erinaceus* is widely consumed in Asian countries. The reported health-promoting properties of the mushroom fruit bodies, mycelia, and bioactive pure compounds include antibiot-

ic, anticarcinogenic, antidiabetic, anti-fatigue, antihypertensive, anti-hyperlipidemic, antisenescence, cardioprotective, hepatoprotective, nephroprotective, and neuroprotective properties and improvement of anxiety, cognitive function, and depression. The described anti-inflammatory, antioxidative, and immunostimulating properties in cells, animals, and humans seem to be responsible for the multiple health-promoting properties.

Kushairi, et al. [71] reported that *Hericium erinaceus* (Bull.:Fr.) Pers., or its common names, Lion's mane or Monkey's head mushroom, is a well-established culinary and medicinal mushroom for brain and nerve health. Hericenones (meroterpenoids) and erinacines (cyathane diterpenoids) are the two important classes of compounds isolated from *H. erinaceus* proven to induce the biosynthesis of Nerve Growth Factor (NGF) in nerve cells in vitro [72,73]. Previous studies have shown that *H. erinaceus* possessed potent antioxidant activities [74-77]. *In vitro* neuroprotection of *H. erinaceus* was demonstrated in several studies against amyloid beta [78,79], 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) [80] and glutamate-induced neurotoxicity [81,82].

Turkey Tail Mushroom (*Trametes versicolor*)

In addition to their nutritional value, medicinal mushrooms have emerged in recent years not only as a source of drugs but also as adjuvants to conventional chemo- or radiation-therapy to either enhance their potency or reduce their side effects [83,84]. In this regard, one of by far the best investigated medicinal mushroom in recent years is *Coriolus versicolor* (L.) Quél. (Syn. *Polyporus versicolor*) which is now known by its accepted scientific name as *Trametes versicolor* (L.) Lloyd (family Polyporaceae). Its medicinal value as part of the Chinese traditional medicine dates back for at least 2000 years and includes general health-promoting effects [85], including endurance and longevity. Both in China and Japan, preparations such as dried powdered tea of the fungus are employed in traditional medicine practices. It has been indicated to play a role in Immune Boosting since it contains polysaccharopeptide, which may boost the immune system and even fight certain cancers while also vital in gut health as it supports a healthy gut microbiota due to its high content of polysaccharides, which serve as prebiotics [84,86].

Studies show that ALERT™ can improve cognitive function, including dementia: ingredients have been shown to reduce symptoms of memory loss in mice, as well as prevent neuronal damage caused by amyloid-beta plaques, which accumulate in the brain during Alzheimer's disease. A study of people with mild Alzheimer's disease found that Alert's ingredients used for 49 weeks significantly improved cognitive test scores when compared to a placebo. ALERT's™ key ingredients can stimulate brain cell growth and protect from damage caused by Alzheimer's disease and can improve Depression and Anxiety conditions; Animal research has found that ALERT's™ key ingredients have anti-inflammatory effects that can reduce symptoms of depression and anxiety in mice and can also help regenerate brain cells and improve the functioning of the hippocampus area of the brain that processes memories and emotional responses [87].

This mushroom mix can also boost immunity; a strong immune system protects the body from disease-causing pathogens including bacteria, viruses, and other invaders. A weak immune system puts the body at a higher risk of developing disease. Animal research shows that ALERT's™ main ingredients have been shown to boost immunity by increasing the activity by stimulating beneficial changes in gut bacteria of the intestinal immune system. Mouse studies based on daily consumption of the key ingredients nearly quadrupled the lifespan of mice injected with a lethal dose of salmonella bacteria [88].

Reishi Mushrooms (*Ganoderma lucidum*)

Reishi Mushroom is known to enhance immune function through its effects on white blood cells, particularly in people who are ill, such as those with cancer while also often used to reduce stress and promote sleep and relaxation [88,89].

ALERT™ has Anti-cancer benefits; it is known that cancer occurs when DNA becomes damaged causing cells to divide and replicate out of control. When the ingredients of ALERT™ are mixed with human cancer cells in a test tube, they cause the cancer cells to die faster. In addition to killing cancer cells, one mouse study showed a 69% reduction in lung cancer spread without traditional chemotherapy side effects. Research has found that ALERT's™ main ingredients may help speed recovery from nervous system injuries by stimulating the growth and repair of nerve cells. It may also help reduce the severity of brain damage after a stroke [89]. ALERT™ can improve heart health; research shows that these ingredients can reduce the effects of obesity, high triglycerides, cholesterol and reduce blood clots and thereby reducing the risk of heart disease. Studies of rats and mice have found that lion's mane mushroom improves fat metabolism and lowers triglyceride levels. In one study, rats fed a high-fat diet showed a 27% decrease in triglycerides and a significant weight loss after one month. Since obesity and high triglycerides are both considered risk factors for heart disease ALERT™ may contribute to heart health [71]. ALERT™ can Improve gut health; Ulcers may form anywhere along the digestive tract and often are the overgrowth of the bacteria *H. pylori* and damage to the mucous layer of the stomach that's often due to long-term use of non-steroidal anti-inflammatory drugs. ALERT's™ main ingredients may protect against the development of stomach ulcers by inhibiting the growth of *H. pylori* and protecting the stomach lining from damage. ALERT™ can also reduce inflammation and prevent tissue damage in other intestinal areas and has been shown to help healing from inflammatory bowel diseases [90].

ALERT™ ingredients can help people with type 2 diabetes; In studies conducted, ALERT's™ ingredients are shown to be beneficial for diabetes by improving blood sugar management and reducing some of these side effects such as kidney disease, vision loss, and nerve damage in feet and hands. Several animal studies have shown to significantly decrease blood sugar by blocking the enzyme activity that breaks down carbohydrates in the small intestines. When this enzyme is blocked, the body is unable to digest and absorb carbs effectively, which results in lower blood sugar levels. Addi-

tionally, these ingredients may reduce diabetic nerve pain by stimulating nerve growth and regeneration. In mice with diabetes and diabetic injury, showed significantly reduced pain, lower blood sugar levels, and increased antioxidant levels from these ingredients [91].

Mushrooms which have been shown to be very safe, even at high doses. However, anyone with a known mushroom allergy should not use mushrooms or products containing mushrooms. Ensuring a nutrient-dense diet that includes a variety of whole foods such as fruits, vegetables, whole grains, lean proteins, healthy fats, and adequate hydration is crucial for supporting brain function and promoting mental well-being from childhood through adulthood. A balanced diet not only provides the necessary nutrients for optimal brain health but also supports overall physical health, which in turn contributes to mental wellness.

There exists a relationship between mental health and overall well-being. Mental health plays a significant role in regulating our emotions (emotional balance), when our mental health is stable, we are better equipped to handle stress, relate to others, and make healthy choices. Mental health can impact physical health and vice versa. For example, chronic stress or anxiety can weaken the immune system, making the body more susceptible to infections and illnesses; conversely, engaging in regular physical activity can boost mental health by reducing symptoms of anxiety and depression. Healthy relationships are essential for mental well-being, strong social connections and supportive relationships can provide a buffer against mental health challenges and contribute to overall happiness. Good mental health enhances our ability to focus, concentrate, and perform well in work and other daily activities whereas, untreated mental health issues can impair cognitive function, leading to difficulties in various aspects of life thus being key in our productivity and functioning. Mental health directly impacts our quality of life, when mental health is prioritized and maintained; individuals are more likely to experience fulfillment, satisfaction, and a sense of purpose thus better quality of life. Strong mental health promotes resilience in the face of adversity and challenges. It helps individuals bounce back from setbacks, cope with stress, and adapt to change effectively. Positive mental health fosters a healthy self-esteem and self-image. It enables individuals to have a realistic and positive view of themselves, leading to increased self-confidence and self-worth while investing in mental health prevention and treatment strategies is crucial since early intervention can prevent the development of more severe mental health conditions and improve overall well-being. In essence, mental health is a fundamental pillar of our overall well-being. Taking care of our mental health through self-care practices, healthy diet and nutrition absorption, seeking support when needed, and cultivating healthy coping mechanisms can significantly enhance our quality of life and overall wellness [92].

Brain Healthy Herbs and Plant Derivatives

Brown Rice Flour

Brown Rice Flour is a great gluten-free alternative to wheat flour, suitable for those with celiac disease or gluten sensitivity as

well as offers dietary fiber which aids in digestion and promotes feelings of fullness [48,49].

Echinacea (*Echinacea purpurea*)

Has been demonstrated to provide Immune Support as it is widely used to prevent or reduce the symptoms of colds and other infections by boosting the immune system while also with anti-inflammatory Properties which may have anti-inflammatory effects beneficial for overall health and well-being [93,94].

Ginkgo Biloba (*Ginkgo biloba L*)

Useful in circulatory Support where it promotes good blood circulation and heart health by dilating blood vessels and reducing the stickiness of blood platelets. Also, in cognitive enhancement as it is thought to improve cognitive function, particularly in people with dementia or Alzheimer's disease, by protecting against neuron damage [95,96].

Lutein

It is important for Eye Health as it acts as an antioxidant in the eye, protecting against age-related macular degeneration and cataracts. It has antioxidant properties that helps protect cells from free radical damage [97,98].

Lycopene

It is useful in Heart Health since it is associated with a reduced risk of heart disease due to its antioxidant properties and it has been shown to help with prostate health as it may lower the risk of prostate cancer and improve overall prostate health [99,100].

Vegan DHA

It is useful for the Brain Health since an omega-3 fatty acid it is important for brain function and development. It also Supports the health of the retina and may reduce the risk of age-related macular degeneration [101,102].

Vegan Omega-3

It can help reduce cardiovascular risk factors and as an Anti-inflammatory, Omega-3 fatty acids have anti-inflammatory properties [103,104].

Brain Healthy Amino Acids

Glycine Plays a role Neurotransmitter Support since Glycine is an amino acid that serves as a neurotransmitter in the brain, supporting cognitive and mental health. Some studies suggest that glycine can improve the quality of sleep, helping with falling asleep faster and achieving deeper sleep stages. Glycine also has antioxidant effects that may protect cells from damage caused by free radicals [105,91].

L-Glutamine Promotes intestinal health and can support the repair of the intestinal lining while also Serves as fuel for immune cells, potentially enhancing immune function [106,60].

N-Acetyl-Cysteine (NAC) provides an Antioxidant Support as it acts as a precursor to glutathione, a powerful antioxidant in the body as well as well as it may aid in detoxification processes and support liver health [107,108].

Brain Healthy Minerals

Boron Supports bone density and overall bone health by aiding in the metabolism of calcium and magnesium and also aids Hormonal Balance as it can influence the production and use of estrogen and testosterone in the body [109,110].

Calcium is essential for the development and maintenance of strong bones and teeth while it is also necessary for muscle contraction, including the beating of the heart [111,112].

Chromium helps maintain normal blood sugar levels by enhancing the action of insulin and also contributes to the metabolism of carbohydrates, fats, and proteins [113,114].

Copper aids in the absorption of iron, helping prevent anemia as well as functions as an antioxidant, protecting cells from damage [115,116].

Iodine is crucial for the production of thyroid hormones, which regulate metabolism, growth, and development. It is useful in Cognitive Function as it is Important for brain development, especially during pregnancy and infancy [117,118].

Iron is essential for the formation of hemoglobin in red blood cells, which carries oxygen throughout the body and also supports immune function and cognitive development [119,120].

Magnesium is key in Bone Health as it is essential for bone formation; magnesium contributes to the structural development of bone and is vital for the absorption and metabolism of calcium. It also plays a crucial role in muscle contractions, helping to prevent cramps by allowing muscles to relax. It's particularly beneficial for athletes or those with frequent muscle soreness. Magnesium is important for the proper functioning of the nervous system. It helps regulate neurotransmitter activities that send messages throughout the brain and nervous system, aiding in the reduction of stress and anxiety. It supports heart health by maintaining a normal heart rhythm, helping to regulate blood pressure, and is linked to a lower risk of cardiovascular disease. Magnesium plays a role in glucose control and insulin metabolism. A magnesium-rich diet is associated with a lower risk of type 2 diabetes. Some studies suggest that magnesium deficiency may be linked to migraines. Supplementing with magnesium can reduce the frequency and severity of migraines for some individuals. Magnesium can improve sleep quality, especially for those with insomnia, by helping to relax the body and mind. It regulates melatonin, which guides sleep-wake cycles in the body [121,122].

Manganese contributes to the formation of bone and is important for bone health and development. It also helps form an antioxidant enzyme that protects cells from damage [123,124].

Molybdenum plays a vital for the function of certain enzymes involved in detoxification and the metabolism of sulfur-containing amino acids [125,126]. Vital for the function of certain enzymes involved in detoxification and the metabolism of sulfur-containing amino acids.

Nickel is a component of some enzymes, though its specific benefits in the human body are less understood by it helps with enzyme activation [127,128].

Potassium is Essential for maintaining a healthy blood pressure and proper heart function. It supports muscle and Nerve Function as it is vital for muscle contraction and nerve transmission [129,130].

Vanadium may have a role in helping to regulate blood sugar levels [131,132].

Zinc provides Immune Support as it is crucial for the development and function of immune cells. It also helps with wound Healing as it plays a role in collagen synthesis and is important for skin health and wound healing [133,134].

Benefits of Vitamin Bs

Essential multi-vitamin, mineral and herbal combination called brain food provides much needed nutrients for normal metabolism on a daily basis. The key minerals, herbs and mushrooms provide additional nootropic benefits for the brain. Many people have reported improvements in cognitive functioning and energy levels after taking these nutritional supplements.

Vitamin B also known as Super B-Complex is actually a group of eight essential water-soluble vitamins that play a crucial role in various bodily functions including Energy Production as B vitamins help convert food into energy by facilitating the metabolism of fats, proteins, and carbohydrates. They are particularly important for the proper functioning of the mitochondria, which are the powerhouses of the cells.

Several B vitamins, such as B1 (thiamine), B6 (pyridoxine), and B12 (cobalamin), are vital for maintaining a healthy nervous system. They help in the production of neurotransmitters and myelin, which insulates nerves and enhances the conduction of nerve impulses. As reported by *Kerns and Gutierrez* [135], Vitamin B12 affects the normal growth of children, the peripheral and central nervous systems, bone marrow, skin, mucous membranes, bones, and vessels. It is possible that even when the serum cobalamin level is normal, treatment with vitamin B12 could correct defects caused by other biologically active substances. Such as recurrent stomatitis, various forms of hyperpigmentation, trophic ulcers, and burns, with vitamin B12, even if the B12 serum level is normal. Vitamin B6, B9 (folate), and B12 are crucial for the production of red blood cells. Deficiencies in these vitamins can lead to conditions like anemia. B vitamins are necessary for the synthesis and repair of DNA, which is essential for cell growth and division. B vitamins play a role in maintaining healthy skin by supporting cell production, repair, and metabolism. Biotin (B7) is especially known for its role in promoting healthy hair, skin, and nails. B vitamins, particularly B3 (niacin), B6, B9, and B12, play a role in regulating mood and reducing symptoms of depression and anxiety. They are crucial for the production of neurotransmitters like serotonin, dopamine, and norepinephrine. B vitamins, such as B6, B9, and B12, help in maintaining healthy levels of homocysteine, an amino acid that, when elevated, is associated with an increased risk of cardiovascular diseases. B vitamins are important for cognitive function and maintaining brain health. They support memory, focus, and concentration by helping in the production of brain chemicals and supporting nerve function. B vitamins are essential for a healthy metabolism. They help convert

food into energy efficiently, which can aid in weight management and overall metabolic health. It's important to note that these benefits can vary depending on the specific B vitamin, its form, and the individual's health status. A balanced diet rich in a variety of foods, including sources of B vitamins, is key to ensuring an adequate intake of these essential nutrients.

Vitamin B1 (Thiamin) is essential for converting nutrients into energy, particularly carbohydrates. It also plays a critical role in nerve transmission and the healthy functioning of the nervous system. Thiamin is also necessary for the proper function of the cardiovascular system, including muscle tone in the heart and the digestive tract [135,136]. According to *Polegato, et al.* [136], Thiamin is a water soluble vitamin that plays a role in several biological processes, mainly in glucose metabolism. There are several risk factors for developing thiamin deficiency, such as malnutrition, refeeding syndrome, gastrointestinal surgery, and alcoholism. Recently, the role of thiamin in critically ill patients has gained prominence, and the prevalence of thiamin deficiency was found to be increased in patients with severe burns, major surgery, septic shock, end-stage renal disease, and heart failure. In adults, thiamin deficiency presents as encephalopathy, dry beriberi (with neurological signs and symptoms), or wet beriberi (with cardiovascular signs and symptoms).

Vitamin B2 (Riboflavin) helps in the conversion of food into energy; plays a vital role in metabolizing fats, drugs, and steroids. It is important for maintaining healthy skin, eyes, and vision. May help reduce the risk of cataracts. It is also an antioxidant Protection that acts as an antioxidant, fighting free radicals and potentially reducing the risk of chronic diseases [137,138].

Vitamin B3 (Niacin) Can significantly lower levels of bad LDL cholesterol and increase good HDL cholesterol. It is also involved in the metabolism of carbohydrates, fats, and proteins into energy. Niacin is essential for the health of the skin and nerves; also has a role in improving digestive function [139,140].

Vitamin B5 (Pantothenic Acid) is vital for the creation of coenzyme A, necessary for various metabolic pathways, including energy metabolism. It is also crucial for synthesizing and metabolizing proteins, carbohydrates, and fats. Vitamin B5 may enhance the healing process of skin wounds and contribute to skin health [141,142].

Vitamin B6 (Pyridoxine) is essential for the metabolism of amino acids, the building blocks of proteins. It helps in the creation of hemoglobin, which carries oxygen in the blood. It also supports the immune system's ability to fight infections and plays a role in brain health and mood regulation [143,144]. Vitamin B6 (Biotin) is often recommended for strengthening hair and nails; also important for maintaining the health of the skin. It plays a key role in the metabolism of carbohydrates, fats, and proteins as well as involved in regulating the expression of genes that are critical for the function of cells [145,146].

Vitamin B9 (Folic Acid) is crucial for the formation of new cells and DNA synthesis and repair. Vital during pregnancy for fetal development. It helps lower homocysteine levels, high levels of which

are linked to heart disease. Folic Acid may play a part in controlling depression and mood swings, as it's essential for the brain's health [147,148].

Vitamin B12 (Cyanocobalamin) is essential for maintaining the health of nerve cells and supporting the production of nerve sheathing, critical for producing red blood cells, which prevent anemia. It also plays a role in converting carbohydrates into glucose, leading to energy production and reducing fatigue [149,150].

Vitamin C (Ascorbic Acid) Boosts the immune system and helps fight off infections and is an antioxidant that protects the body's cells from damage and supports skin health [151,152].

Nighttime Relax

A wind-down routine before bed can help you relax, sleep better, and feel more prepared for the next day. A good night sleep is a necessary part of a healthy routine that helps alleviate stress, anxiety and issues associated with mental health. Here are some benefits of a nighttime wind-down routine: Better sleep: You may fall asleep faster and have a deeper sleep. Less stress: You may feel more relaxed and prepared for sleep. Improved memory: Relaxation and quality sleep can help improve recall. Better mood: Relaxing activities help you feel more at ease, which can promote better sleep and wellbeing.

Brown rice is a whole grain that retains its bran and germ, making it a good source of fiber, vitamins, and minerals such as manganese, selenium, and magnesium. The fiber in brown rice helps slow down the absorption of sugar, assisting in blood sugar regulation, which can be beneficial for those managing diabetes or at risk of developing it. Brown rice's fiber content can also help lower cholesterol levels, potentially reducing the risk of heart disease. The fiber in brown rice supports healthy bowel movements and contributes to overall digestive health [52,53].

Glycine is an amino acid that serves as a neurotransmitter in the brain, supporting cognitive and mental health. Some studies suggest that glycine can improve the quality of sleep, helping with falling asleep faster and achieving deeper sleep stages. Glycine has antioxidant effects that may protect cells from damage caused by free radicals [91,105].

Magnesium glycinate is a form of magnesium bound to glycine, which is often better absorbed and may be gentler on the stomach than other forms of magnesium. Magnesium is crucial for muscle contraction and nerve transmission. It may help relieve muscle cramps and discomfort. Magnesium plays a role in mood regulation and has been studied for its potential to alleviate symptoms of anxiety and depression. It is also essential for bone formation, magnesium helps with the assimilation of calcium into the bone and plays a role in activating vitamin D in the kidneys [153,154].

Passionflower (*Passiflora incarnata*) has been traditionally used to alleviate symptoms of anxiety and insomnia, with some studies supporting its calming effects. Passionflower has the potential to alleviate some symptoms of neuropsychiatric origin. It may help improve sleep quality by increasing Gamma-Aminobutyric

ic Acid (GABA) levels in the brain, which has a calming effect and in some research suggests passionflower may help relieve certain types of pain, though more research is needed [35,36].

Valerian root (*Valeriana officinalis*) is commonly used as a natural treatment for insomnia and other sleep disorders, with studies showing its potential to improve sleep quality. It may also help reduce anxiety, thanks to its sedative properties and its ability to modulate GABA receptors in the brain. Valerian root can have a calming effect, which may help individuals manage stress better [155,156].

Wild jujube (*Ziziphus jujuba*) is traditionally used to improve sleep and reduce anxiety, possibly due to its saponin content which can have a calming effect. It may also promote digestive health by soothing gastrointestinal upset and promoting regularity. Wild jujube contains high levels of vitamin C and antioxidants, which can help support the immune system and protect against oxidative stress [157-161].

Conclusion

Foods (including essential amino acids), Minerals, Vitamins, Exercise, Water Consumption, Detoxing, and general wellbeing including happiness are all part of maintaining homeostasis. Pain and pathogenicity go hand in hand modulating many aspects of the health equation. The relationship between pain recovery and pathogenicity is interconnected, as pain can be both a symptom of pathogenic infections and a process that can impact the overall recovery from an infectious disease. Understanding this relationship is crucial for effective dietary management and treatment of infections and associated pain symptoms. Pain management and mental wellbeing also are important to recovery. A balanced diet not only provides the necessary nutrients for optimal brain health and healthy gut microbiota but also supports overall physical health, which in turn contributes to mental wellness. When our mental health is stable, we are better equipped to handle stress, relate to others, and make healthy choices. This article studies how these factors interplay towards individual's wellness. Ensuring a beneficial nutrient-dense diet that includes a variety of whole foods such as fruits, vegetables, whole grains, lean proteins, healthy fats, exercise, and adequate hydration is crucial for supporting brain function and promoting mental well-being from childhood through adulthood. A balanced diet not only provides the necessary nutrients for optimal brain health and healthy gut microbiota but also supports overall physical health, which in turn contributes to mental wellness. When our mental health is stable, we are better equipped to handle stress, relate to others, and make healthy choices. Mental health can impact physical health and vice versa. Also, a balanced and nutrient-rich diet plays a crucial role in supporting neuroplasticity and cognitive function by providing the essential building blocks and supportive environment for brain function and connectivity.

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Conflict of Interest

None.

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