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Unravelling the Pharmacological and Nutritional Potential of Kiwifruit for Human Health: A Comprehensive Review

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Kiwifruit (*Actinidia deliciosa*) belongs to the family Actinidiaceae, and the genus Actinidia is a highly nutritious fruit abundant with essential vitamins, minerals, polyphenols, flavonoids, and the unique enzyme actinidin, which aids digestion. These components contribute to kiwifruit's role as a functional food with significant therapeutic potential. Kiwifruit supports various physiological functions, including immune enhancement, cardiovascular health, and digestive regulation. Its rich fiber content promotes gut microbiota growth, improving digestion and reducing constipation. The presence of polyphenols, carotenoids (lutein, zeaxanthin), and flavonoids strengthens antioxidant defenses, reduces inflammation, and helps prevent chronic diseases such as cardiovascular disorders, neurodegenerative conditions, and metabolic syndrome. The low fiber content makes it beneficial for blood sugar regulation, aiding in diabetes management. The actinidin enzyme present in kiwifruit makes it particularly beneficial for individuals with digestive disorders by enhancing protein digestion and nutrient absorption. Additionally, its prebiotic properties foster the growth of beneficial gut bacteria, contributing to better digestive and immune health. Kiwifruit is rich in antioxidants and also supports skin health by promoting collagen synthesis, reducing oxidative stress, and maintaining hydration. Emerging research highlights its potential neuroprotective effects, suggesting a role in reducing cognitive decline and oxidative stress in the brain. Its cardioprotective properties help regulate blood pressure, and improve vascular function. With applications in functional foods, nutraceuticals, and pharmaceuticals, kiwifruit continues to gain attention for its preventive healthcare potential. Incorporating kiwifruit into the diet provides a natural approach to enhancing overall well-being, making it a valuable component in promoting longevity and reducing the risk of chronic diseases. This review seeks to provide a comprehensive knowledge of kiwifruit's nutritional profile, bioactive properties, therapeutic potential, and commercial importance, offering scientifically backed recommendations for individuals.

Keywords: Kiwifruit; nutritional; pharmacological; health; antioxidant.

1. INTRODUCTION

Kiwifruit, also known as the Chinese gooseberry, is a woody vine with berry fruit type belonging to the *Actinidia* genus in the Actinidiaceae family (Ferguson, 1990). There are approximately 76 recognized species of kiwifruit, with notable edible varieties including *A. deliciosa* (fuzzy kiwifruit), *A. chinensis* (golden kiwifruit), *A. arguta* (hardy or mini kiwifruit), *A. kolomikta* (Arctic kiwifruit), *A. melanandra* (purple or red kiwifruit), and *A. polygama* (silver vine) (Ferguson & Ferguson, 2002, Cossio et al., 2015). Kiwifruit originates from North-Central and Eastern China (Latocha et al., 2015a). In recent decades, global production has steadily increased to meet the rising demand for various commercial cultivars and hybrids. Among them, *A. deliciosa* and *A. chinensis* hold the most commercial significance (Rasheed, 2021, Latocha et al*.,* 2015b). The rising consumer demand for kiwifruit is fueled by increasing awareness of its nutritional value and diverse applications. Different species and cultivars exhibit variations in fruit shape, size, weight, skin characteristics, as well as eating qualities such as flavor, aroma, and texture, along with differences in shelf life (Ferguson & Ferguson, 2002; Li et al., 2018; Sivakumaran et al., 2018). Kiwifruit is widely acknowledged for its remarkable nutritional value and extensive health benefits (Dawei et al., 2025; Fisk et al., 2006). Native to China, this fruit has gained worldwide recognition for its exceptional vitamin C content, abundant antioxidants, and a diverse array of bioactive compounds. Over the past century, it has been introduced and successfully cultivated in various regions worldwide, including New Zealand, Italy, and the United States, emerging as an economically significant crop in the global fruit market.

Kiwifruit's nutrient profile is particularly rich, offering essential vitamins such as vitamin C, vitamin E, and folate, in addition to vital minerals like potassium, calcium, and magnesium (Dawei, 2025; Rasheed, 2021; Richardson, 2015; Wolber et al., 2013). These nutrients collectively contribute to numerous physiological functions, including immune enhancement, cardiovascular support, and digestive health improvement (Tyagi et al., 2015; Singletary, 2012). The presence of dietary fiber, polyphenols, and phytochemicals further strengthens its classification as a functional food with immense therapeutic potential (Pinelli et al., 2014; Arranz et al., 2009). Its high fiber content not only aids digestion but

Fig. 1. Kiwifruit var. Bruno

also plays a key role in modulating gut microbiota, promoting the growth of beneficial bacteria, and enhancing overall gut health (Bayer, 2022; Amer et al., 2014). Furthermore, kiwifruit has been identified as beneficial for managing metabolic disorders such as diabetes and obesity, with its low glycemic index and polyphenol content assisting in blood sugar regulation and lipid metabolism (Kerkeni et al., 2025; Mishra et al., 2017). It also contributes to skin health by promoting collagen synthesis, reducing oxidative damage, and maintaining skin hydration, making it valuable in dermatological applications (Wang et al., 2017). Research continues to uncover kiwifruit's role in neuroprotection, its potential in mitigating neurodegenerative diseases, and its ability to support mental well-being by reducing oxidative stress in the brain (Billows et al., 2022). Additionally, kiwifruit is gaining attention for its application in functional foods, dietary supplements, and pharmaceutical formulations, further expanding its role in modern preventive healthcare (Shastri et al., 2012; Skinner, 2011; Hunter et al., 2008). This review aims to provide an in-depth analysis of the pharmacological and nutritional potential of kiwifruit, emphasizing its contribution to disease prevention, overall well-being, and its expanding applications in nutraceuticals and functional foods.

2. NUTRITIONAL COMPOSITION OF KIWIFRUIT

Renowned for its impressive nutritional profile, kiwifruit is loaded with essential vitamins, minerals, dietary fiber, and bioactive compounds that contribute to overall health and well-being (Richardson et al., 2018, Bieniek and Dragańska 2013). It is particularly rich in antioxidants and phytochemicals, which help protect the body against oxidative stress and inflammation. These properties play a crucial role in immune enhancement, cardiovascular health, and digestive function (Hunter, 2011; Latocha et al., 2010, Shu et al., 2008). One of the most notable nutrients in kiwifruit is vitamin C, which exceeds the levels found in many citrus fruits (Richardson, 2015). This strong antioxidant boosts immune function, supports collagen production and iron absorption, lowers the risk of infections, and enhances skin health (Satpal et al., 20210). The fruit is also an excellent source of dietary fiber, which promotes gut health by improving digestion, regulating bowel movements, and fostering beneficial gut microbiota (Bayer, 2022; Amer et al., 2014). Regular consumption of fiber-rich foods like kiwifruit has been linked to improved metabolic health and reduced risks of gastrointestinal disorders (Amer et al., 2014, Slacin and Lioyd, 2012). Beyond its vitamin and fiber content, kiwifruit is abundant in polyphenols and flavonoids, which provide antioxidant, anti-inflammatory, and cardioprotective effects. These compounds help neutralize free radicals, reduce inflammation, and lower the risk of chronic diseases such as heart disease and diabetes (Mishra et al., 2017; Wang et al., 2017). Additionally, the presence of actinidin, a unique proteolytic enzyme in kiwifruit, enhances protein digestion and nutrient absorption, making it particularly beneficial for individuals with digestive sensitivities. Given, its remarkable nutritional profile and functional properties, kiwifruit is considered a functional food with substantial therapeutic potential, offering a natural approach to improving overall health and preventing disease (Shastri et al., 2012).

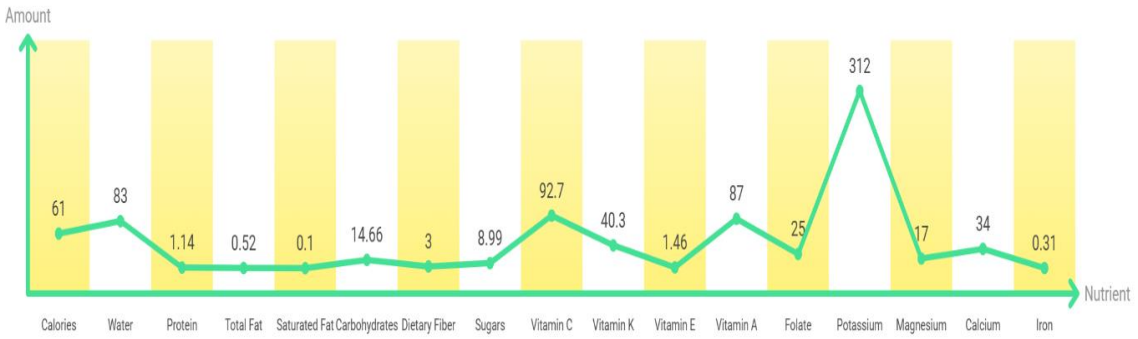

Fig. 2. Nutritional components of kiwifruit (mg per 100g) (Source: USDA National Nutrient Database)

2.1 Vitamins

Kiwifruit is an exceptional source of essential vitamins, offering a wide range of health benefits. It is particularly rich in vitamin C, with levels surpassing those found in most citrus fruits (Richardson et al., 2018; Richardson, 2015). As a potent antioxidant, vitamin C plays a crucial role in strengthening immune function by enhancing the activity of immune cells and reducing the severity of infections. Additionally, it is essential for collagen synthesis, which helps maintain skin elasticity, promote wound healing, and support joint health (Katsumata et al., 2015, Te). Another key benefit of vitamin C is its ability to enhance iron absorption, thereby preventing iron deficiency anemia, especially in individuals with low iron intake (Rasheed, 2021; Carr et al., 2012; Nishiyama et al., 2004). Beyond vitamin C, kiwifruit is also a valuable source of vitamin E, a fat-soluble antioxidant that protects cell membranes from oxidative stress (Guroo et al., 2017; Wang et al., 2017). By reducing lipid peroxidation, vitamin E supports cardiovascular health, lowers the risk of chronic diseases, and promotes healthy skin by preventing premature aging (Tyagi *at al.,* 2015). Unlike many other sources of vitamin E, kiwifruit provides this nutrient in a bioavailable form, making it highly effective in the body. Moreover, kiwifruit is abundant in folate (vitamin B9), a crucial nutrient for DNA synthesis, cell division, and red blood cell formation (Drummond, 2013). Folate is particularly important during pregnancy, as it helps prevent neural tube defects in developing fetuses. Given its dense vitamin profile, kiwifruit serves as a functional food with substantial therapeutic potential, supporting overall health and well-being (Tyagi et al., 2015). Regular consumption of this nutrient-rich fruit can contribute to immune support, skin health, heart function, and prenatal care, making it a valuable addition to a balanced diet (Carr et al., 2012; Nishiyama et al., 2004).

2.2 Minerals

Kiwifruit is abundant in essential minerals, including potassium, magnesium, calcium, and phosphorus, each playing a crucial role in maintaining physiological balance (Dawei et al., 2025; Wolber et al., 2013). Potassium is vital for regulating blood pressure, ensuring proper muscle contractions, and maintaining fluid equilibrium in the body, which collectively support cardiovascular health (Karlsen et al. 2013; Tyagi et al. 2015). Magnesium plays a key role in over 300 enzymatic reactions, contributing to energy production, protein synthesis, and nerve transmission. Calcium, essential for bone mineralization and structural integrity, works alongside phosphorus to strengthen bones and teeth. The synergistic effects of these minerals not only promote optimal muscular and neural function but also help in reducing the risk of osteoporosis, hypertension, and metabolic imbalances, making kiwifruit a valuable dietary component (Alim et al., 2019).

2.3 Dietary Fiber

Kiwifruit is a rich source of both soluble and insoluble fiber, playing a vital role in digestive health (Hussain, 2021; Richardson et al., 2018). Soluble fiber aids in slowing glucose absorption, helping to regulate blood sugar levels, while insoluble fiber adds bulk to stool, facilitating regular bowel movements and preventing constipation (Wang et al., 2022; Hussain et al., 2021; Antonelli & Donelli, 2021). Additionally, kiwifruit fiber acts as a prebiotic, fostering the growth of beneficial gut microbiota, which enhances gut health and boosts immune function. Studies have also suggested that

dietary fiber from kiwifruit may contribute to lowering cholesterol levels and improving lipid metabolism, making it particularly beneficial for individuals with metabolic disorders such as diabetes and obesity (Hussain et al., 2021; Antonelli & Donelli, 2021; Stonehouse et al., 2013).

2.4 Carotenoids

Carotenoids function as natural protective filters against harmful blue light, reducing the risk of oxidative damage to retinal cells (Guroo et al., 2017; Hunter, 2011). Consumption of carotenoid-rich foods which contain an abundance of lutein and zeaxanthin, which are essential for maintaining optimal eye health (Salehi, 2021; Latocha et al. 2015b). Research indicated that regular intake of kiwifruit which contain a considerable quantity of carotenoids can significantly lower the incidence of age-related macular degeneration and enhance overall visual function (Kandasamy & Shanmugapriya, 2015). Additionally, these antioxidants contribute to reducing inflammation and supporting cellular integrity within the ocular system (Salehi, 2021).

2.5 Polyphenols and Flavonoids

Kiwifruit is a potent source of polyphenols and flavonoids, including quercetin, catechins, epicatechins, and rutin, which contribute to its strong antioxidant, anti-inflammatory, antimicrobial, and cardioprotective properties (Rasheed et al., 2021; Pinelli et al., 2013; Arranz et al., 2009). These bioactive compounds are instrumental in neutralizing free radicals, mitigating oxidative stress, and modulating inflammatory pathways, thereby reducing the risk of chronic diseases such as cardiovascular disorders, neurodegenerative conditions, and metabolic syndrome (Latocha et al., 2015b, Kim et al., 2009). Furthermore, polyphenols in kiwifruit have been linked to improved endothelial function, enhanced vascular health, and reduced arterial stiffness, making them highly beneficial for cardiovascular well-being (Hussain et al., 2021; Tyagi et al., 2015). Emerging research also suggests their role in modulating gut microbiota, further expanding their impact on overall health (Tyagi et al. 2015; Singletary, 2012).

2.6 Actinidin Enzyme

Actinidin is a unique proteolytic enzyme found in kiwifruit, known for its potent ability to break down complex proteins into smaller peptides and amino acids, facilitating efficient protein digestion (Kaur et al., 2022; Pastorello et al., 1998). This enzymatic activity significantly enhances nutrient bioavailability, making it particularly beneficial for individuals with digestive disorders, those with compromised enzyme production, or individuals on high-protein diets (Boland, 2013). Additionally, actinidin has been shown to improve gut motility, reduce symptoms of bloating and indigestion, and support overall gastrointestinal health (Kaur et al., 2022, Richardson et al., 2018). Its role in modulating gut microbiota further underscores its significance in digestive wellness, making kiwifruit a valuable functional food for promoting optimal digestion and nutrient absorption (Kaur et al., 2022; Boland, 2013).

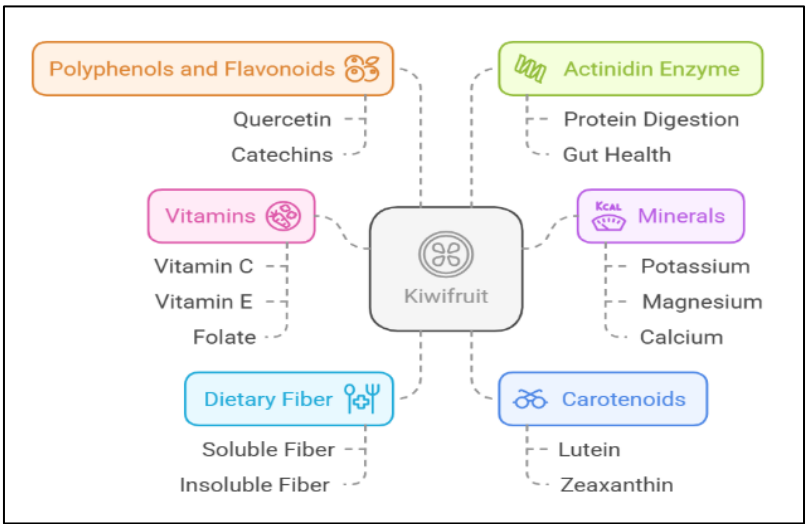

Fig. 3. Nutritional benefits and components of Kiwifruit

2.7 Prebiotic

Kiwifruit has been shown to promote the growth of beneficial gut microbiota, contributing to improved digestive health and enhanced immune function (Hussain et al., 2021; Tyagi et al., 2015). The prebiotic effects of kiwifruit help foster a healthy gut environment by increasing the abundance of beneficial bacteria such as Lactobacillus and Bifidobacterium (Yuan et al., 2021). This supports better digestion, enhances nutrient absorption, and prevents gastrointestinal disorders. Additionally, the fiber content in kiwifruit provides a substrate for fermentation in the colon, producing short-chain fatty acids that contribute to gut health and systemic metabolic benefits (Bayer, 2022; Gearry et al., 2022; Amer et al., 2014).

3. PHARMACOLOGICAL PROPERTIES OF KIWIFRUIT

Kiwifruit is widely consumed for its refreshing taste and numerous health benefits. Beyond its dietary value, kiwifruit exhibits significant pharmacological properties that contribute to human health and disease prevention (Hussain; 2021, Chawla et al. 2016).

3.1 Antioxidant

Kiwifruit is one of the richest sources of vitamin C content scavenges reactive oxygen species (ROS), protecting cells from oxidative stress (Guroo et al., 2017; El Zawawy, 2015). This is particularly important in diabetes, where oxidative damage contributes to complications such as neuropathy, retinopathy, and cardiovascular disease (Latocha et al., 2010). It also contains polyphenols, flavonoids, carotenoids, and other bioactive compounds that contribute to its antioxidant capacity (Prior, 2007). Studies suggest that kiwifruit consumption can reduce oxidative damage to lipids, proteins, and DNA, thereby lowering the risk of chronic diseases such as cancer, cardiovascular diseases, and neurodegenerative disorders (Alim et al., 2019; Gruoo et al., 2017; Motohashi et al., 2002). Polyphenols in kiwifruit help maintain mitochondrial health, improving energy metabolism and reducing metabolic dysfunction (Latocha et al., 2015b). The high antioxidant content in kiwifruit has been linked to increased activity of endogenous antioxidant enzymes such as superoxide dismutase (SOD) and glutathione peroxidase, which further protect cells from oxidative damage (Wang et al., 2018; Hunter et al., 2008).

3.2 Anti-Inflammatory Effects

Inflammation is a major factor in many chronic diseases, including arthritis, diabetes, and cardiovascular diseases. Kiwifruit possesses anti-inflammatory properties due to its high content of polyphenols, flavonoids, and vitamin C (Moysidou et al., 2024; Alim et al., 2019). Kiwifruit polyphenols inhibit the nuclear factor-kappa B (NF-κB) pathway, a critical regulator of inflammatory responses (Peng et al., 2020). This inhibition prevents the activation of pro-inflammatory genes, reducing the production of cytokines such as tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), and interleukin-1 beta (IL-1β) (Peng et al., 2020; Wang et al., 2017). By modulating this pathway, kiwifruit contributes to mitigating chronic inflammatory conditions, including arthritis, cardiovascular diseases, and neuroinflammation. The investigation showed the effects of consistently including kiwifruit in our diet, which reduces markers of systemic inflammation and improves conditions such as asthma, inflammatory bowel disease (IBD), and arthritis (Richardson et al., 2018) the studies also included the presence of quinic acid and caffeic acid in kiwifruit which contributes to its anti-inflammatory activity (Choi et al., 2024; Richardson et al., 2018).

3.3 Cardiovascular Health

Kiwifruit significantly promotes heart health by improving lipid profiles, reducing blood pressure, and enhancing endothelial function (Karlsen et al., 2013). The fiber content in kiwifruit helps lower LDL cholesterol (bad cholesterol) while increasing HDL cholesterol (good cholesterol), thereby reducing the risk of atherosclerosis and cardiovascular diseases (Antonelli and Donelli, 2021; Stonehouse et al., 2013). Furthermore, kiwifruit contains potassium, which helps regulate blood pressure by counteracting the effects of sodium and consumption of kiwifruit also improves platelet function, reducing the risk of thrombosis and stroke (Tyagi et al., 2015; Karlsen et al., 2013).

3.4 Gastrointestinal Benefits

Kiwifruit is highly regarded for its positive impact on digestive health, mainly due to its high fiber content and the presence of natural enzymes (Moysidou et al., 2024; Richardson et al. 2018). One of its key digestive enzymes, actinidin, is a proteolytic enzyme that facilitates the breakdown of proteins, improving their digestion and

absorption (Boland, 2013). This makes kiwifruit particularly beneficial for individuals who experience difficulty digesting protein-rich foods, such as those with mild digestive disorders or low stomach acid production. Beyond enzyme activity, kiwifruit is an excellent source of soluble and insoluble fiber, which synergistically promotes gut health. Soluble fiber dissolves in water to form a gel-like substance, which slows digestion, stabilizes blood sugar levels, and provides nourishment for beneficial gut bacteria (Wang et al., 2022; Hussain, 2021). Insoluble fiber, on the other hand, adds bulk to stool, enhancing bowel movement regularity and helping to prevent constipation (Wang et al., 2022; Stonehouse et al., 2013). Regular consumption of kiwifruit has been shown to improve gut motility, reducing symptoms of constipation and bloating (Latocha et al., 2015a). Kiwifruit can enhance gut microbiota by increasing populations of beneficial bacteria, which help in maintaining a balanced and healthy gut environment. These bacteria contribute to improved digestion, enhanced nutrient absorption, and strengthened immune function by producing short-chain fatty acids that support intestinal health (Bayer, 2022; Gearry et al., 2022; Amer et al., 2014). Furthermore, the prebiotic properties of kiwifruit contribute to gut microbiome diversity, fostering an environment conducive to the growth of beneficial microorganisms (Yaun et al., 2021). This not only improves overall digestive function but also has broader health implications, as a well-balanced gut microbiome has been linked to reduced inflammation, better metabolic health, and even improved mental well-being (Gearry et al., 2022). So, incorporating kiwifruit into our daily diet can be a natural and effective way to support digestive health, particularly for those prone to digestive discomfort, irregular bowel movements, or poor gut microbial balance.

3.5 Immunomodulatory Effects

Kiwifruit is valued for its immune-boosting properties, primarily attributed to its rich composition of vitamin C, polyphenols, and other bioactive compounds. Vitamin C plays a critical role in immune cell function, supporting the activity of neutrophils, macrophages, and lymphocytes (Rassam and Laing, 2005). It enhances phagocytosis, the process by which immune cells engulf and destroy pathogens, while also promoting the production of interferons and cytokines, which help coordinate the immune response. Regular consumption of kiwifruit has been linked to a reduction in the severity and duration of respiratory infections, including colds and flu. Beyond vitamin C, polyphenols and carotenoids present in kiwifruit contribute to its immunomodulatory effects by exerting antioxidant and anti-inflammatory properties (Saeed et al., 2019). These compounds help reduce oxidative stress, which can otherwise impair immune function. Additionally, kiwifruit exhibits antimicrobial properties, helping combat harmful bacteria and viruses. Studies have shown that it may enhance gut-associated lymphoid tissue (GALT) function, thereby strengthening mucosal immunity, a critical first line of defense against pathogens. Evidence suggests that kiwifruit supplementation can particularly benefit elderly individuals and those with weakened immunity, improving their immune resilience and reducing the risk of infections (Mishra and Monro, 2012).

3.6 Anticancer Potential

Kiwifruit has gained considerable attention in recent years for its potential anticancer properties due to its rich composition of antioxidants, polyphenols, flavonoids, carotenoids, and dietary fiber (Motohashi, et al., 2002). These bioactive compounds contribute to cancer prevention by neutralizing free radicals, reducing oxidative stress, modulating key signaling pathways, and enhancing immune surveillance. Free radicals and chronic inflammation are major contributors to cancer development, and the potent antioxidant activity of kiwifruit helps mitigate these risks by protecting cellular structures from DNA damage and oxidative injury (Collins, et al., 2001).

Studies have demonstrated that kiwifruit extracts exhibit cytotoxic effects against a variety of cancer cell lines, including colon, breast, lung, and liver cancers (Salama, et al., 2018). These effects are mediated through multiple mechanisms, including apoptosis (programmed cell death), inhibition of cancer cell proliferation, and suppression of angiogenesis (the formation of new blood vessels that support tumor growth). Flavonoids such as quercetin and kaempferol play a crucial role in its chemopreventive effects by inhibiting cancer cell proliferation, blocking metastasis, and interfering with carcinogenic enzyme activity (Salama, et al., 2018). Additionally, kiwifruit polyphenols have been shown to regulate cell cycle progression and enhance DNA repair mechanisms, further reducing the risk of tumor formation.

3.7 Neuroprotective Properties

Kiwifruit has been investigated for its neuroprotective effects due to its high antioxidant and anti-inflammatory potential. Oxidative stress and inflammation are key contributors to neurodegenerative diseases such as Alzheimer's and Parkinson's disease. The bioactive compounds in kiwifruit, including vitamin C, polyphenols, and flavonoids, help protect neurons from oxidative damage and reduce neuroinflammation. In some studies, it has been suggested that kiwifruit consumption may improve cognitive function and memory, making it beneficial for aging individuals at risk of cognitive decline.

3.8 Diabetes Management

Obesity, diabetes, metabolic syndrome, and dyslipidemia, are among the most significant global health challenges. These conditions are characterized by impaired glucose metabolism, insulin resistance, abnormal lipid profiles, chronic inflammation, and oxidative stress, which increase the risk of cardiovascular diseases, non-alcoholic fatty liver disease (NAFLD), and other complications. As the prevalence of metabolic disorders rises, the search for natural dietary interventions has gained traction. Kiwifruit (*Actinidia deliciosa* and *Actinidia chinensis*) has emerged as a functional food with potential therapeutic benefits for metabolic health due to its rich nutrient profile, bioactive compounds, and fiber content.

Regulation of Blood Sugar Levels: One of the most critical aspects of managing metabolic disorders, especially diabetes, is maintaining stable blood glucose levels. Kiwifruit has a low glycemic index (GI), meaning it does not cause a rapid increase in blood sugar levels after consumption (Rush and Drummond, 2019). This property makes it an excellent fruit choice for individuals with diabetes or those at risk of developing insulin resistance. The fiber content in kiwifruit, particularly soluble fiber such as pectin, plays a crucial role in slowing down glucose absorption in the intestines. This results in a more gradual release of glucose into the bloodstream, preventing sharp spikes and crashes in blood sugar levels. Studies have demonstrated that consuming kiwifruit can improve postprandial glucose response, making it a valuable addition to a diabetic-friendly diet (Chen, et al., 2011).

Enhancement of Insulin Sensitivity: Insulin resistance is a key feature of metabolic disorders, leading to elevated blood glucose levels and increased fat storage. Kiwifruit contains polyphenols such as quercetin, catechins, and flavonoids, which have been shown to enhance insulin sensitivity (Monro, et al., 2018). These bioactive compounds help improve glucose uptake by cells and facilitate insulin signaling pathways, allowing the body to use glucose more efficiently. Additionally, the high vitamin C content in kiwifruit acts as a powerful antioxidant that reduces oxidative stress- a significant factor in insulin resistance. Oxidative stress damages pancreatic beta cells, which are responsible for insulin production, leading to impaired insulin secretion and worsening diabetes. By reducing oxidative damage, kiwifruit supports pancreatic function and improves overall metabolic health.

Weight Management: Obesity is a major risk factor for metabolic disorders, and effective weight management is essential for preventing and managing these conditions. Kiwifruit aids in weight control through several mechanisms:

High Fiber Content: The fiber in kiwifruit promotes a feeling of fullness, reducing overall calorie intake. By slowing digestion and prolonging satiety, kiwifruit helps prevent overeating and supports weight management.

Regulation of Fat Metabolism: Research suggests that polyphenols in kiwifruit inhibit adipogenesis- the process of fat cell formation. These compounds help regulate lipid metabolism, reducing fat accumulation and improving body composition.

Low Caloric Value: Kiwifruit is naturally low in calories while being rich in essential nutrients, making it a great option for those aiming to lose or maintain weight without compromising nutritional intake.

3.9 Skin Health and Anti-Aging Effects

Kiwifruit is highly beneficial for skin health due to its rich content of vitamin C, vitamin E, polyphenols, and antioxidants. Vitamin C is a vital nutrient for collagen synthesis, which helps maintain skin elasticity, reduces the appearance of fine lines and wrinkles, and prevents premature aging (Teixeira, et al., 2022). By stimulating fibroblast activity, vitamin C enhances the production of structural proteins that keep the

skin firm and youthful. Additionally, its role in skin cell regeneration promotes wound healing and reduces scarring.

The antioxidants in kiwifruit play a crucial role in protecting the skin from environmental stressors, particularly UV radiation and pollution, which contribute to oxidative damage and skin aging. These antioxidants neutralize free radicals, preventing DNA damage and reducing the risk of photoaging, hyperpigmentation, and uneven skin tone (e Silva, et al., 2024). Furthermore, vitamin E, a fat-soluble antioxidant present in kiwifruit, helps maintain the skin's moisture barrier, improving hydration and preventing dryness. Kiwifruit is also rich in polyphenols, which exhibit potent anti-inflammatory and antimicrobial properties. These compounds help manage inflammatory skin conditions such as acne, eczema, and psoriasis by reducing redness, irritation, and swelling. The fruit's natural enzymes, such as actinidin, further aid in gentle exfoliation, removing dead skin cells and promoting a brighter complexion.

Moreover, the high-water content and fiber in kiwifruit contribute to overall skin hydration and detoxification. Regular consumption of kiwifruit supports a healthy gut microbiome, which is closely linked to skin health, reducing the occurrence of breakouts and promoting a clear complexion.

3.10 Respiratory Health

Kiwifruit is well known for its high vitamin C content, which plays a crucial role in supporting respiratory health. Numerous studies have suggested that regular consumption of kiwifruit can help improve lung function, reduce inflammation, and alleviate symptoms associated with respiratory conditions such as asthma.

Vitamin C and Antioxidant Effects: One of the key reasons kiwifruits benefits respiratory health is its exceptionally high vitamin C concentration. Vitamin C is a powerful antioxidant that helps neutralize free radicals, reducing oxidative stress in the respiratory tract. Oxidative stress is a major contributor to airway inflammation and lung diseases, including asthma and chronic obstructive pulmonary disease (COPD). By lowering oxidative stress, vitamin C helps maintain healthy lung function and may prevent airway constriction.

Reduction of Asthma Symptoms: Research has shown that regular consumption of vitamin C-rich fruits, such as kiwifruit, can significantly reduce symptoms of asthma. A study conducted on children and adults found that individuals who consumed kiwifruit frequently had fewer respiratory issues, including wheezing, coughing, and shortness of breath. These effects are particularly beneficial for individuals with asthma, as vitamin C enhances lung function by decreasing inflammation in the airways and improving immune response.

Natural Antihistamine Properties: Kiwifruit also possesses natural antihistamine properties, which can be beneficial for individuals who suffer from allergies and respiratory conditions triggered by allergens. Histamines are chemicals released by the immune system in response to allergens, leading to symptoms like sneezing, nasal congestion, and difficulty breathing. By inhibiting the excessive release of histamines, kiwifruit may help alleviate allergic reactions and improve respiratory comfort.

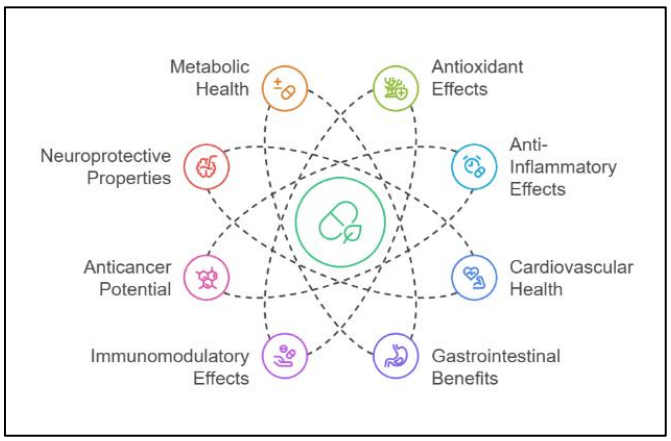

Fig. 4. Pharmacological benefits of Kiwifruits

3.11 Impact on Gut Health and Metabolic Regulation

The gut microbiome plays a crucial role in metabolic health, influencing digestion, immune function, and inflammation. Kiwifruit has prebiotic effects, promoting the growth of beneficial gut bacteria (Wilson et al., 2018).

Enhanced Digestion: The enzyme actinidin in kiwifruit aids protein digestion, improving nutrient absorption and reducing digestive discomfort.

Regulation of Gut Microbiota: Kiwifruit fiber serves as a prebiotic, nourishing beneficial gut bacteria that play a role in metabolic health. A balanced gut microbiome helps regulate glucose metabolism, reduce inflammation, and improve insulin sensitivity (Wojdylo and Nowicka, 2019).

Prevention of Intestinal Inflammation: Polyphenols in kiwifruit help strengthen the gut barrier, reducing intestinal permeability and preventing harmful substances from entering the bloodstream. This mechanism is particularly beneficial for individuals with metabolic syndrome, as gut dysbiosis is closely linked to obesity and insulin resistance.

4. POTENTIAL APPLICATIONS IN FUNCTIONAL FOODS

Kiwifruit is rich in dietary fiber, which acts as a prebiotic by promoting the growth of beneficial gut bacteria such as *Lactobacillus* and *Bifidobacterium*. It is incorporated into probiotic yogurts, fermented drinks, and gut-health supplements to enhance digestive function and support a balanced gut microbiota. Kiwifruit's high vitamin C and polyphenol content make it a popular ingredient in functional juices, smoothies, detox drinks, and herbal infusions. These beverages help in boosting immunity, detoxification, and hydration while providing a refreshing taste. Kiwifruit extracts and powders are used in nutraceutical supplements to enhance digestive health, immune function, and skin vitality (Wolber et al., 2013). These supplements come in the form of capsules, chewables, and powdered blends for smoothies or energy drinks. Dehydrated kiwifruit slices, granola bars, and energy bites enriched with kiwifruit provide fiber, antioxidants, and natural sugars, making them an ideal snack for sustained energy and gut health.

5. CONCLUSION AND FUTURE PERSPECTIVES

Kiwifruit (*Actinidia deliciosa*) offering significant pharmacological and nutritional benefits along with high vitamin C, vitamin E, polyphenols, flavonoids, carotenoids, and dietary fiber, it plays a crucial role in immune support, cardiovascular health, metabolic regulation, and digestive well-being. Its high antioxidant and anti-inflammatory properties contribute to disease prevention, making it a functional food with substantial therapeutic value. Regular consumption has been associated with improved lung function, reduced respiratory symptoms, better gut health, enhanced metabolic function, and potential neuroprotective effects. Additionally, its natural antihistamine properties make it beneficial for individuals with allergies and asthma, further reinforcing its role in preventive healthcare.

Despite substantial research highlighting its health benefits, several knowledge gaps remain in fully understanding the therapeutic potential of kiwifruit. Future investigations should focus on clinical trials to validate its efficacy in disease prevention and management, ensuring evidence-based applications in healthcare. Additionally, mechanistic studies exploring the molecular pathways through which kiwifruit bioactives exert their effects would provide deeper insights into its pharmacological relevance. Research on bioavailability, optimal dosages, and food processing techniques will also be crucial in enhancing its utility in health promotion.

The increasing global demand for functional foods and nutraceuticals presents an opportunity to incorporate kiwifruit-derived compounds into novel food formulations, dietary supplements, and pharmaceutical applications. Expanding its use in functional foods may further enhance its contribution to human health. Sustainable cultivation practices and postharvest technologies should also be optimized to maintain the fruit's nutritional integrity and extend its shelf life, ensuring its availability to a broader population.

In conclusion, kiwifruit holds great promise as a functional food with significant health benefits. However, multidisciplinary research integrating agriculture, food science, biotechnology, and medicine is essential to maximize its potential in promoting human health and preventing chronic diseases. With further advancements in clinical research and food innovation, kiwifruit can be

positioned as a key component of dietary strategies aimed at enhancing overall well-being and longevity.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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