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Fruits And Their Nutritional Compounds – An Educational Review

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SUMMARY

Introduction: Fruits are an excellent source of vitamins, minerals, fiber, and bioactive compounds including polyphenols, carotenoids, and organosulfur compounds. These substances influence many biological processes related to chronic and infectious diseases in human.

Methodology: Google Scholar, PubMed, Scopus, NIH database, Science-Direct, and other relevant electronic databases were used to write a narrative educational review. The following keywords were used to find relevant articles: Types of fruit having antioxidant, fruits for disease management, nutritional compound of fruits, minerals found in fruits, different vitamins of fruits, vitamins for disease management, and therapeutic application etc. The bioactive components of fruits, dietary requirement, pharmacological action, vitamin and mineral content, study results, suggested mechanisms of action, and fruit species were all screened and examined from the chosen studies.

Topic: This review provides a comprehensive overview for major fruits and their pharmacological activities against important diseases, including cardiovascular disease, metabolic disease, neurodegeneration, cancer, immune and respiratory diseases, gastrointestinal health, and inflammation. This article also summarizes category of fruits and how these fruits work against diseases, the key information from previous studies, and practical dietary recommendations.

Conclusion: Fruits are a rich source of bioactive nutritional substances, such as vitamins, minerals, dietary fiber, and phytochemicals, which are important for managing and preventing common human health problems. Incorporating fruits into regular dietary habits can be considered a simple, safe, and sustainable strategy for improving overall health h and considered a simple, safe, and sustainable strategy for improving overall health.

Keywords: Fruits, Nutritional Compound, Diet, Vitamin C, Disease

INTRODUCTION

It provide offer an abundance of different bioactive substances, dietary fiber, vitamins, and minerals. Studies conducted over the past few decades have demonstrated that fruit consumption helps protect against a variety of diseases, including infections and inflammatory illnesses, as well as non-communicable diseases like heart problems, type 2 diabetes, obesity, and various malignancies. Fruits contain high concentrations of phytochemicals, particularly polyphenols, carotenoids, flavonoids, and other antioxidants, are the primary source of their health benefits. These substances enhance lipid metabolism, boost immunity, lessen oxida-

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tive stress, and reduce inflammation [1-4].

Despite strong evidence supporting their health benefits, fruit consumption remains below recommended levels worldwide, particularly in low- and middle-income countries. Intake levels should be adequate and aligned with human physiological requirements (Table 1). Their impact on health is further influenced by variations in fruit type, processing techniques, accessibility, and cultural eating customs. Furthermore, our knowledge of how fruit chemicals affect human metabolism, the gut microbiota, and the course of disease is still in developing phase [5-8].

This review examines the current evidence on the relationship between fruit consumption and human illness is discussed in this review. It investigates at research outcomes, looks at the health effects of fruits, and analyzes clinical data. By providing an overview, it aims to highlight the significance of public health recommendations, and explain how fruits might help prevent and manage diseases.

METHODOLOGY

Google Scholar, PubMed, Scopus, NIH database, Science-Direct, and other relevant electronic databases were used to write a narrative educational review. The following keywords were used to find relevant articles: *types of fruit*

Fruit	Recommended frequency approx.	Important notes
Apple	1 pcs, daily all year round	Should eat with apple skin
Banana	1 pcs, 3-4 times/week (whole year round)	Better to eat before work
Orange	1 pcs, 3-5 times/week (seasonal)	Juice drinking is better
Lemon	Few squeezes every week	Use with tea and sharbat
Grapes	5-10 pcs 2-3 times/week (seasonal)	Eat whole fruits
Pomegranate	1 pcs per week and can be consumed all year round	It can be used in fruit salad and desert
Papaya	I slice of ripen papaya 2 times/week	Improves digestion and can be eaten raw and ripen
Mango	1-2 pcs, 2-3 times/week (mainly seasonal)	Can be eaten with protein
Pineapple	Few slices, at least 1 times/week	Proper timing is necessary to get better taste
Watermelon	1-2 times/week (seasonal)	Watermelon juice good for post workout
Strawberry	5-6 pcs, 2-4 times/week (seasonal)	Should wash clearly and eat fresh
Blueberry	If possible should be consumed daily few pcs	Frozen is fine to eat
Avocado	2-3 times with salad or as a whole per week	Add with salad and desert
Kiwi	1-2 pcs per week	Good for immune system
Guava	1 pcs, 2-3 times/week	High vitamin C content, on the other hand, can cause bloating and gastric discomfort if consumed in large amount
Pear	At least 1 pcs per week	Should be eaten ripe
Cherry	1-2 times/month (seasonal)	Helps sleep
Blackberry	At least half cup 3 times per week	Mostly preferred in dried form
Coconut	1-2 times/week all year round	Coconut water for hydration
Dates	3-4 pcs every day	Boost energy
Jackfruit	Mainly seasonal (1-2 times/week)	High calories
Rambutan	5-10 pcs, 2-3 times per week (seasonal and rare)	After peeling eat translucent flesh
Lychee	Seasonal, (1-2 times, few pcs/week)	Should not be eaten too much as it can cause lower blood pressure
Starfruit	1-2 pcs, 2-3 times/month (seasonal and rare)	Too sour taste
Figs	2-3 times/week	Dried fruits are calorie-dense packed
Jamun (Java pulm)	Depends on diet	Washing plum is essential
Mulberry	-	Can be eaten fresh and also dried

Table 1. Recommended frequency for eating of fruits with important notes

Note: Recommended frequency is approximate, non-clinical suggestions that could give encouragement to follow a balanced diet

Table 2. Summary of important fruits with health benefits

Note: Relevant information is consolidated, adapted and analyzed from European, Asian, and North American monitoring studies, reviews and from different health related websites

Fruits	Major nutritional compound	Health benefits	Act against disease condition and symptoms
Apple	Fiber, Vitamin C, Quercetin, Polyphenols	Improves gut health, reduces inflammation	Heart disease, type 2 diabetes, obesity, high cholesterol, constipation
Banana	Potassium, Vitamin B6, Fiber	Supports heart and muscle function, energy booster	High blood pressure, constipation, kidney stones
Orange	Vitamin C, Flavonoids, Fiber	Boosts immunity, skin health	Common cold, flu, heart disease, anemia
Lemon	Vitamin C, Citric acid	Improves digestion, detoxification	Kidney stones, infections, scurvy
Grapes	Resveratrol, Antioxidants	Protects heart and brain	Heart disease, hypertension, certain cancers
Pomegranate	Punicalagins, Antioxidants	Strong anti-inflammatory effect	Prostate cancer, breast cancer, arthritis
Papaya	Papain, Vitamin C, Beta-carotene	Aids digestion, reduces inflammation	Digestive disorders, skin damage
Mango	Vitamin A, Vitamin C, Antioxidants	Boosts immunity, energy booster, eye protection	Vitamin A deficiency, infections
Pineapple	Bromelain, Vitamin C	Reduces inflammation, helps digestion	Sinusitis, arthritis, fever
Watermelon	Lycopene, Citrulline	Hydration, heart health	High blood pressure, muscle soreness, prostate health
Strawberry	Vitamin C, Polyphenols	Anti-aging, boosts immunity	Heart disease, type 2 diabetes, cancer prevention
Blueberry	Anthocyanins, Antioxidants	Boosts memory, reduces oxidative stress	Alzheimer's disease, cancer, heart disease
Avocado	Healthy fats, Potassium, Vitamin E	Gives protein and help in nutrient absorption	High cholesterol, metabolic syndrome
Kiwi	Vitamin C, Vitamin K, Folate	Enhances immunity and digestion	Asthma symptoms, infections, constipation
Guava	Vitamin C, Fiber, Antioxidants	Strong immune booster	Infections, diabetes, digestive problems
Pear	Antioxidant, Vitamin C, Minerals	Improves digestion, controls weight	Diabetes, constipation, inflammation
Cherry	Melatonin, Anthocyanins	Improves sleep, reduces inflammation	Insomnia, gout, arthritis
Blackberry	Vitamin C, Manganese	Protects brain and immunity	Cognitive decline, heart disease
Coconut	Healthy fatty acid and electrolytes	Hydration, brain support	Dehydration, electrolytes imbalance
Dates	Fiber, Iron, Potassium	Energy boost, digestion	Anemia, constipation, fatigue
Jackfruit	Fiber, Protein, B-vitamins, Antioxidant	Immune support and energy support	Indigestion, constipation, hypertension, gut inflammation
Rambutan	Vitamin C, Manganese, Copper, Antioxidants	Boosts immunity, improves skin, aids digestion	Common cold, skin aging, iron-deficiency anemia
Lychee	Vitamin C, B6, oligonol (polyphenol)	Antioxidant, heart support, enhances immunity	Heart disease risk, infections, inflammation
Starfruit	Vitamin C, Fiber, Potassium	Digestion, immunity, hydration	Hypertension, digestive issues (should be avoided in kidney failure)
Figs	Fiber, Magnesium, Antioxidants	Constipation relief, heart and bone support	Constipation, high blood pressure, bone weakness
Jamun (Java pulm)	Anthocyanins, Iron, Vitamin C	Blood sugar control, improves hemoglobin	Diabetes, anemia, inflammation
Mulberry	Vitamin C, Iron, Anthocyanins, Resveratrol	Immune system boost and blood production	Anemia, diabetes, heart disease

having antioxidant, *fruits for disease management*, *nutritional compound of fruits*, *minerals found in fruits*, *different vitamins of fruits*, *vitamins for disease management*, and *therapeutic application* etc. The bioactive components of fruits, dietary requirement, pharmacological action, vitamin and mineral content, study results, suggested mechanisms of action, and fruit species employed were all examined from the chosen studies. Studies, reviews, and books not relevant to any of the area (e.g., types of fruit having antioxidant, fruits for disease management, nutritional compound of fruits, minerals found in fruits, different vitamins of fruits, vitamins for disease management, and therapeutic application) were excluded. All non-English materials, preprint and conference proceedings are in the exclusion list. A standardized risk-of-bias assessment was not conducted for the studies included in this review. As a result, the absence of a formal bias assessment tool may represent a methodological limitation of the included literature.

TOPIC

Therapeutic roles of fruits

Diets rich in whole fruits are frequently associated with reduced mortality and lower risk of chronic illness in human (Figure 1). Fruits provide concentrated micronutrients (Table 2), dietary fiber that preserves macronutrients, minerals (Table 3) and phytochemicals with lipid-lowering, antioxidant, anti-inflammatory, endothelial-protective, and microbiome-modulating activities. In addition to providing researchers and physicians with useful insights, this review describes the following information by disease type. Fruits are rich in phytochemicals such as flavonoids, carotenoids, vitamins, and phenolic acids, which contribute to their color, flavor, and health-promoting properties. These bioactive substances have potent anti-inflammatory and antioxidant properties that help in shielding cells from oxidative damage (Figure 2). Thus, eating fruits high in phytochemicals on a daily basis boosts immunity and lowers the risk of developing chronic illnesses.

Cardiovascular disease

Regular consumption of fruits such as apples, berries, grapes, and pomegranate on a regular basis has been associated with significant improvements in heart health. Evidence suggests that those who consume these fruits regularly had reduced rates of inflammation, high blood pressure, and harmful cholesterol. Studies supports this, demonstrating that even brief to medium-term consumption of fruit items rich in polyphenols can improve blood vessel function, blood pressure, fat metabolism, and general inflammation [9, 10]. The high polyphenol content of these fruits is a major contributing factor to these benefits. By increasing endothelial nitric oxide synthase and reducing the oxidative breakdown of nitric oxide, polyphenols increase the availability of endothelial nitric oxide (NO). Improved NO signaling results in reduced blood pressure and increased arterial flexibility since nitric oxide is essential for relaxing and maintaining vascular func-

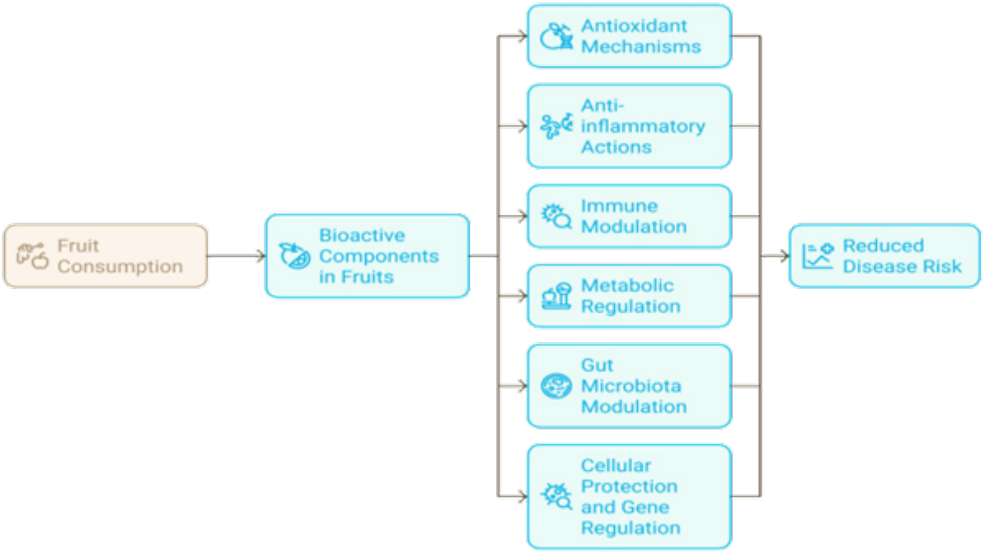

Figure 1. Flowchart illustrating the pathways through which, fruit consumption contributes to disease prevention in humans. Bioactive compounds in fruits exert antioxidant, anti-inflammatory, immunomodulatory, metabolic, and gut microbiota-mediated effects, ultimately reducing the risk of chronic and infectious diseases

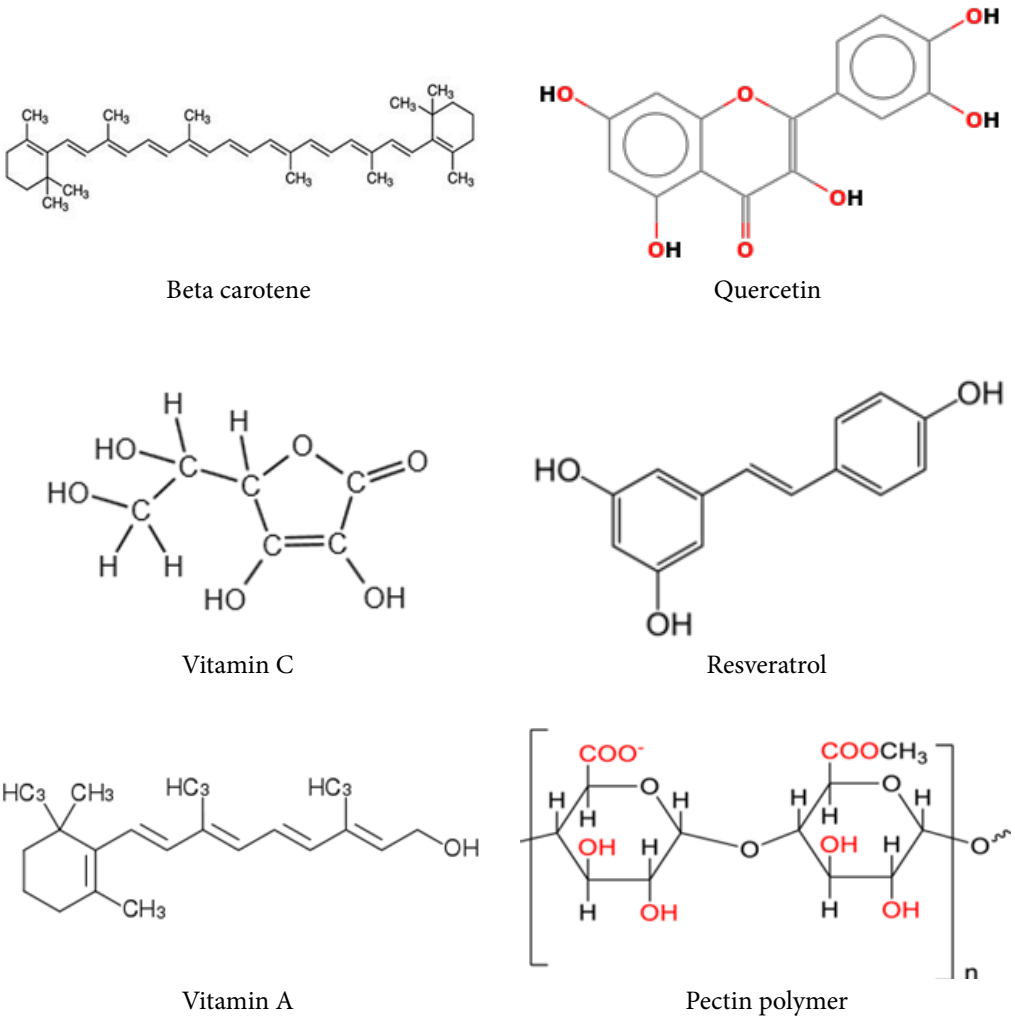

Figure 2. Commonly found six bio-chemicals in highly consumed fruit types (Source: Wikipedia; under the CC BY license)

tion. Furthermore, polyphenols suppress pro-inflammatory pathways within the vascular endothelium, leading to reduced expression of adhesion molecules involved in early atherogenesis [11, 12].

By altering the intestinal microbiota, these fruits create an impact on cardiovascular health. A significant amount of dietary polyphenols enter the colon unchanged. They are converted into bioactive substances by gut microorganisms there. This mechanism reduces the quantity of microorganisms that create atherogenic metabolites such trimethylamine, the precursor to TMAO (Trimethylamine N-oxide), and promotes the proliferation of beneficial microbial species. Fruit fiber fermentation also increases the synthesis of short-chain fatty acids. These fatty acids support the intestinal barrier, lower systemic inflammation, and control fat metabolism [13, 14].

Metabolic diseases

Metabolic diseases, such as type 2 diabetes, obesity, dyslipidemia, and hypertension, are major global health concerns caused by poor diet, lack of exercise, and chronic inflammation. Among the dietary strategies known to help these conditions, regularly eating fruits stands out as an effective and natural means. Fruits offer a unique mix of vitamins, minerals, fiber, antioxidants, and bioactive compounds. These elements improve metabolic health and lower the risk of disease [15, 16]. The high fiber content of fruits, particularly soluble fibers, is one of their most significant diet content for human. By slowing down the absorption of glucose, soluble fiber helps regulate blood sugar and lessens insulin spikes. These are essential process for controlling and avoiding type 2 diabetes. Additionally, fiber increases feelings of fullness, which reduces

Table 3. Minerals in fruits and their pharmacological benefits [52-56]

Minerals	Found rich in fruits	Pharmacological benefits
Potassium (K)	Banana, orange, avocado, mango, papaya, pomegranate, dates	Regulates blood pressure (antihypertensive), maintains fluid balance, promotes heart rhythm, reduces risk of stroke, aids muscle and nerve function
Magnesium (Mg)	Banana, avocado, dried figs, blackberries	Promotes muscular relaxation, enhances insulin sensitivity (antidiabetic), lowers the incidence of migraines, is vital for bone health, and stabilizes nerve activity
Calcium (Ca)	Orange, figs, blackberries, kiwi	Strengthens bones and teeth, supports nerve transmission, muscle contraction, helps regulate heart rhythm
Iron (Fe)	Dates, raisins, apricot, pomegranate	Vital for the production of hemoglobin, protects against anemia, enhances oxygen transmission, and boosts immunity
Zinc (Zn)	Guava, blackberry, raspberry, avocado	Boosts immunity (antiviral, antibacterial), promotes wound healing, supports taste and smell, helps enzyme function
Copper (Cu)	Avocado, guava, dates, grapes	Helps in the absorption of iron, promotes the development of red blood cells, increases antioxidant activity, and aids in energy production
Phosphorus (P)	Banana, grapes, mango	Builds bones and teeth, helps energy metabolism (ATP production), supports kidney function
Manganese (Mn)	Pineapple, banana, strawberry, kiwi	Antioxidant, supports metabolism of carbs & proteins, promotes bone formation, improves wound healing
Sodium (Na)	Very low in most fruits	Maintains fluid-electrolyte balance; extremely small amounts support nerve and muscle function
Iodine (I)	Strawberries, cranberries (trace amounts)	Essential for thyroid hormone production, regulates metabolism, prevents goiter
Fluoride (F)	Grapes, apples (trace amounts)	Helps to prevent dental cavities, strengthens tooth enamel

overall caloric intake and aids in weight management. Furthermore, fiber helps to lower LDL cholesterol levels and improve overall lipid profiles by adhering to cholesterol in the digestive tract [17].

Fruits are also rich in antioxidants, including carotenoids and polyphenols, which play a key role in reducing oxidative stress and chronic inflammation - two major contributors to metabolic disorders. Berries, grapes, apples, and pomegranates all contain phenolic substances that increase endothelial nitric oxide production. This process helps in blood vessel relaxation and decreased blood pressure. Additionally, antioxidant stops LDL oxidation, a crucial stage in the development of atherosclerosis [18].

Neurodegenerative diseases

Neurodegenerative diseases like Alzheimer's, Parkinson's, and Huntington's disease involve the gradual loss of neurons and a decline in memory, movement, and thinking skills. Although these conditions cannot be fully cured, research indicates that some nutrients, especially antioxidants and anti-inflammatory compounds in fruits, significantly support brain health. Regular eating of certain fruits can help to lower oxidative stress, slow down cognitive decline, and improve neural protection [19, 20]. Blueberries are often considered as one of the best fruits for brain health. They contain anthocyanins, which are antioxidants that lower inflammation and protect brain cells from damage. Research has found that eating blueberries can enhance memory, improve communication between brain cells, and may help to slow cognitive decline [21]. Blackberries, raspberries, and strawberries are rich in polyphenols. These substances assist the brain's natural healing processes, lessen inflammation, and enhance motor coordination. Regular consumption of these berries has been associated with improved cognitive function and a decreased risk of Alzheimer's disease in older persons [22]. Resveratrol, a potent antioxidant with a capacity for protect-

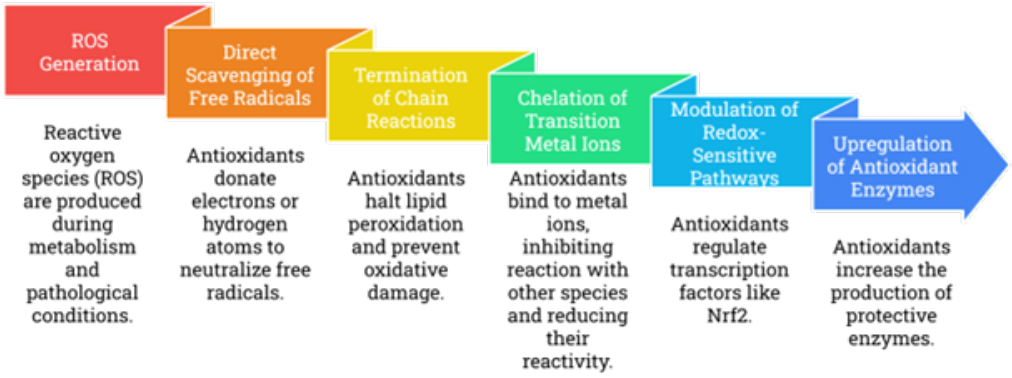

Figure 3. Antioxidant's mechanism in the human body

ing the brain, is found in grapes, particularly red and purple types of grapes. Resveratrol enhances blood flow, improve function of the brain's blood vessels, and lessens amyloid-beta accumulation. Because of this, grapes are considered as an excellent option for fostering long-term brain health [23].

Punicalagins and ellagic acid are potent antioxidants found in pomegranates. These compounds protect brain cells from oxidative stress-induced inflammation and damage. Pomegranate extract has potential to improve cognitive function and reduce memory loss, according to research [24]. Vitamin B6, which is found in bananas, aids in the synthesis of vital neurotransmitters including dopamine and serotonin. These substances are essential for maintaining a steady mood and facilitating efficient neuronal connection. Additionally, bananas contain potassium, which preserves the proper signaling activity of the brain and promotes nerve function [25]. Avocados contain a lot of good monounsaturated fats that improve blood flow to the brain [26].

Cancer prevention

Cancer remains one of the most prevalent and challenging global health conditions.. Research has repeatedly demonstrated that diet, particularly fruit consumption, play a significant role in both primary and secondary cancer prevention. Fruits are rich in antioxidants, vitamins, dietary fiber, and phytochemicals, which help reduce inflammation, protect cells from damage, and inhibit the formation of carcinogenic compounds. A natural and efficient strategy to strengthen the body's defenses against cancer is to eat a variety of fruits on a daily basis [27, 28]. Citrus fruits are rich in antioxidant limonoids, flavonoids, and vitamin C, which contribute to primary prevention by reducing inflammation, enhancing immune responses, and neutralizing free radicals. The primary function that antioxidants protect the human body is by neutralizing reactive oxygen species (ROS), which are produced both during normal cellular metabolism and in pathological situations. They prevent oxidative damage to cellular membranes, proteins, and nucleic acids by directly scavenging free radicals by giving electrons or hydrogen atoms. It also stops chain reactions of lipid peroxidation (Figure 3). By counteracting free radicals, vitamin C protects cells from potential damage. Additionally, citrus fruits help with detoxification and reduce the incidence of breast, lung, and stomach cancers [29, 30]. Punicalagins and polyphenols, potent antioxidants that help to stop cell mutations, are abundant in pomegranates. They prevent the growth of cancer cells in the breast, colon, and prostate area (Figure 4) [31]. Pomegranate juice and pomegranate seeds can both protect DNA and reduce inflammation [31]. The most important source of lycopene, a potent antioxidant linked to primary prevention of stomach, lung, and prostate cancer. Lycopene protects cells from oxidative damage and may inhibit tumor growth and progression [32, 33]. Vitamin C, vitamin E, fiber, and antioxidants are abundant in kiwi fruit. It protects DNA from damage, boosts immunity, and enhances intestinal health. Kiwi fruit may help to minimize the incidence of stomach and colon cancers by reducing oxidative stress [34]. Watermelon contains citrulline and lycopene, both are potent antioxidants that support primary prevention by reducing inflammation and oxidative damage. Lycopene, in particular, has demonstrated inhibitory effects on cancer cell proliferation, suggesting a potential role in both primary and secondary prevention. Additionally, watermelon promotes hydration and detoxification

Figure 4. Fruits that, are generally effective against neoplasm and oxidative stress

processes, indirectly contributing to overall cancer risk reduction [35]. Most findings that connect fruit intake to lower cancer risk come from observational studies, which cannot establish direct causation. These studies are often affected by other factors, such as lifestyle, genetic background, and socioeconomic status.

Gastrointestinal (GI) diseases

Gastrointestinal (GI) disorders—including ulcers, constipation, irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), acid reflux, and gastritis - affect a significant proportion of the global population. These conditions are often associated with inflammation, impaired digestion, microbial imbalance, and damage to the gastrointestinal tract. A balanced diet plays a key role in the prevention and management of many GI disorders Fruits are particularly beneficial for digestive health since they are high in fiber, water, antioxidants, and natural enzymes. Certain fruits are easy on the stomach and provide vital nutrients that improve bowel regularity, reduce inflammation, and support good gut flora [36, 37]. For intestinal problems, bananas and apple are mostly highlighted and recognized (Figure 5).

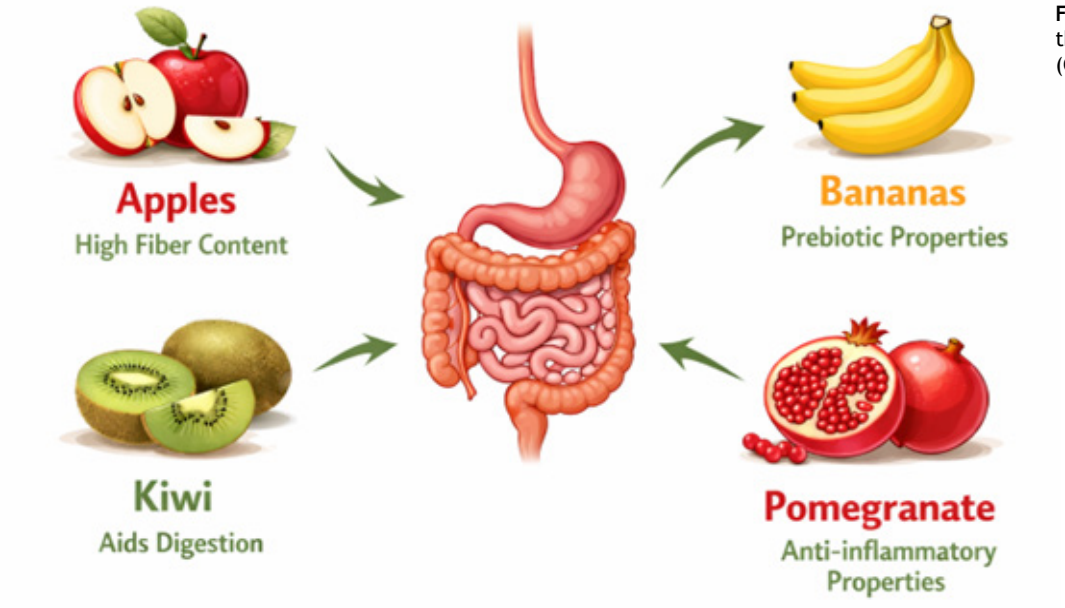

Figure 5. Few examples of fruit that helps in gastrointestinal (GI) health

They are rich in soluble fiber, particularly pectin, which helps to control bowel motions by reducing constipation and managing diarrhea. Bananas can replenish potassium lost through diarrhea or vomiting. They are beneficial for gastritis and acid reflux due to their inherent antacid like activities [38]. Papaya contains an enzyme called papain that helps with protein digestion and can ease discomfort from indigestion. It also reduces inflammation in the stomach lining, making it useful for gastritis and ulcers. Rich in fiber and water, papaya supports smooth digestion and helps to prevent constipation. It is often suggested for people with inflammatory bowel disease or chronic bloating.

Apples are a rich source of both insoluble and soluble fiber. Similar to pectin, soluble fiber promotes colon health, nourishes beneficial gut bacteria, and calms the digestive tract. Insoluble fiber helps in preventing constipation and increasing the volume of feces. A lower risk of colorectal illnesses is associated with eating apples. Cooked apples are simpler for people with sensitive stomachs to digest [39, 40]. Pineapple contains bromelin, a natural proteolytic enzyme that aids protein digestion and may reduce intestinal inflammation. It can reduce bloating and enhance digestion. However, due to its acidity, pineapple should be consumed in moderation by individuals with sensitive stomachs or acid reflux [41]. Mangoes naturally contain digestive enzymes like amylase. These enzymes facilitate digestion and breakdown of carbohydrates. Mangoes reduce constipation and promote intestinal health since they are high in fiber and antioxidants. When eaten ripe, they are also easy passable on the stomach [42]. One of the best natural sources of soluble fiber is pears. They aid in preventing constipation and controlling bowel movements. Additionally, its high water content keep the digestive tract hydrated. Pears are mild, non-acidic, and appropriate for those with acid reflux or gastritis [43].

Respiratory infections

Respiratory infections - including bronchitis, influenza, the common cold, and other viral and bacterial diseases affecting the lungs and airways - can weaken the immune system and impair respiratory function. Respiratory infections - including bronchitis, influenza, the common cold, and other viral and bacterial diseases affecting the lungs and airways - can weaken the immune system and impair respiratory function In addition to appropriate medical treatment, adequate nutrition plays a crucial role in recovery. Fruits represent an important dietary component due to their high content of water, vitamins, antioxidants, and bioactive compounds that support immune function, reduce inflammation, and promote recovery. Regular consumption of e appropriate fruits can help the body fight infections more successfully and significantly improve lung health [44]. Vitamin C is one of the essential elements for respiratory health. It strengthens the body's defenses against infections. Vitamin C is abundant in fruits including oranges, lemons, grapefruits, kiwis, strawberries, and guavas. By increasing white blood cell activity, these fruits can lessen the intensity and duration of colds. Additionally, citrus fruits act as natural decongestants, by the removal of mucus from the respiratory system. Particularly high in vitamin C, guava relieves sore throats and coughs [45, 46]. Staying hydrated is crucial for proper electrolyte balance. Fruits like watermelon, oranges, and pineapples help the body to eliminate mucous and stay hydrated because of their high water content [47]. Pineapple contains a naturally occurring enzyme called bromelain, which reduces throat irritation and increases removal of mucus from the lungs. As a result, it is especially beneficial for people with bronchitis, sinus infections, or severe congestion.

Certain fruits also provide essential micronutrients that support respiratory function. For example, pomegranates offer antioxidant and anti-inflammatory activity that may help to reduce lung inflammation [48]. Papaya is rich in digestive and immune-stimulating enzymes as well as vitamin C [49]. Mangoes are seasonal, but they contain beta-carotene, which the body converts into vitamin A, an essential ingredient for maintaining the healthy mucous membranes of the respiratory tract.

Bone diseases

One disorders, such as osteoporosis and arthritis, are characterized by reduced bone strength, increased fracture risk, and joint discomfort. Dietary strategies, including regular fruit consumption, can contribute to maintaining bone health [50]. Fruits rich in vitamin

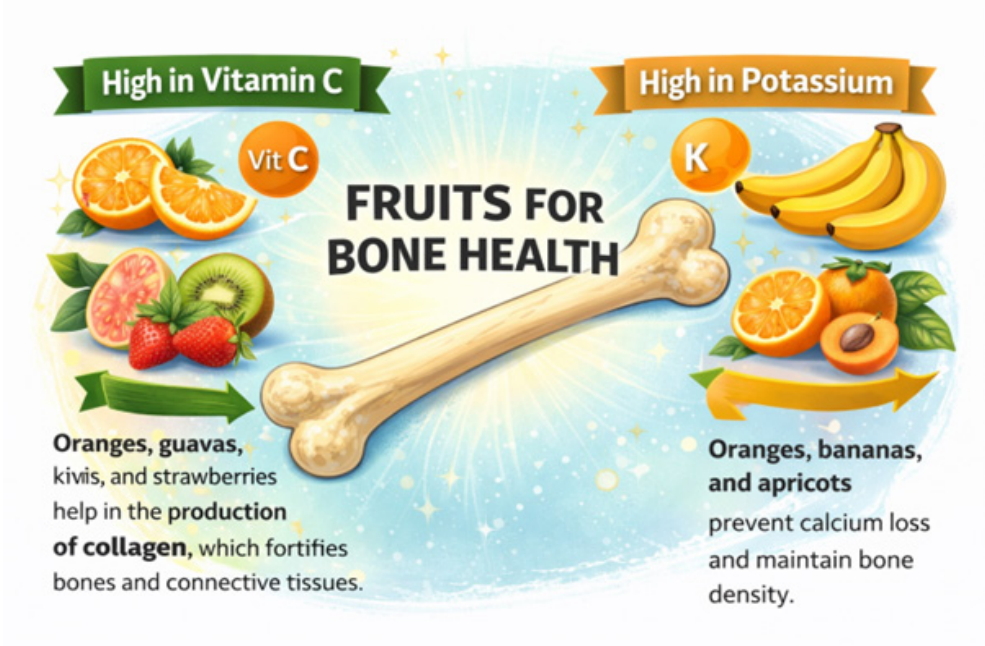

Figure 6. Fruits that nourishes and strengthen bones

C, like oranges, guavas, kiwis, and strawberries, help in the production of collagen, which fortifies bones and connective tissues. Furthermore, fruits high in potassium, such as oranges, bananas, and apricots, help to maintain bone density (Figure 6) [57]. Antioxidant-rich fruits, such as pomegranates and berries, slow down bone deterioration and relieve joint pain by lowering oxidative stress and inflammation.

Fruits like blueberries, figs, and prunes contain vitamin K, calcium, and magnesium, which are essential for bone mineralization and overall skeletal strength. Regular consumption of these fruits, a balanced diet, and medical care can all help to strengthen bones, prevent future deterioration, and enhance quality of life [51].

CLINICAL LIMITATION

Although substantial evidence supports the health benefits of fruit consumption, several research limitations remain. The bioavailability of fruit-derived bioactive compounds, such as polyphenols and flavonoids, is often low and varies considerably due to individual differences in metabolism. Numerous conclusions are based on animal or in vitro models, which could not accurately reflect physiological responses in humans. Phytochemical concentrations, including polyphenols, flavonoids, carotenoids, and organic acids, differ significantly between cultivars, ripening stages, storage conditions, and processing techniques. This natural variation makes it more difficult to standardize precise amount to eat and makes it difficult to repeat consistent clinical results. Although in vitro and animal studies demonstrate therapeutic potential, human clinical trials remain limited and less consistent. Excessive fruit consumption may also lead to adverse effects, including gastrointestinal discomfort, nutrient imbalances, and potential drug interactions. For example, furanocoumarins in grapes can interfere with drug metabolism by inhibiting cytochrome P450 enzymes, particularly CYP3A4. Furthermore, fruits contain a number of bioactive compounds, making it difficult to assign a specific clinical effect to a single phytochemical. Antagonistic or synergistic interactions within the dietary matrix can complicate clinical outcome interpretation.

FUTURE DIRECTION

One significant recommendation for the future direction is to increase scientific research on the medicinal properties of fruits. Berries, citrus, grapes, pomegranates, and other fruits have already demonstrated antibacterial, antiviral, anti-inflammatory, and antioxidant qualities (Table 4). However, further clinical study is required to determine precise mechanisms, proper diet requirements, and long-term consequences on human health. By supporting nutraceutical research and biotechnology research (Figure 7), scientists will be able to separate active ingredients like flavonoids, polyphenols, and phytochemicals and

Table 4. Future recommendations about few fruits acting against diseases

Fruit	Target diseases	Critical gap	Recommendation
Blueberries	Neurodegenerative diseases (Alzheimer, Parkinson's), cardiovascular disease	Dosage inconsistency and bioavailability issues	It needs to develop nano-formulations to improve anthocyanin absorption, carry out long-term RCTs, and assess gene-nutrient interactions
Pomegranate	Anti-inflammatory, anti-cancer (breast, prostate), metabolic syndrome	Limited clinical dosing data and inter-individual variability	It is needed to standardize extract concentrations, investigate metabolism mediated by the microbiome
Banana	Hypertension, gut dysbiosis, stress modulation	Glycemic concerns for diabetics and unclear neurotransmitter effect	Examine banana-resistant starch for diabetes, compare green and ripe bananas, and assess the effects on mental health
Mango	Antidiabetic, anticancer, eyesight protection	High sugar content and its effect; seasonal variation	It needs to research about drug interactions with mangiferin, and utilize extracts for regulated dietary dose
Orange and Lemon	Immune boosting, antiviral (flu, COVID), cardiovascular diseases	Vitamin C degradation during storage; no trials for long-term antiviral effects	It needs to assess the efficacy of fortification methods, and investigate the combined effects with zinc
Grapes	Cancer prevention, metabolic disorders, aging	Low bioavailability of resveratrol; rapid metabolism	Design controlled human trials with stabilized resveratrol formulations
Guava	Diabetes, immune disorders, gastrointestinal infections	Very less human trials	To do more study of effects on gut immunity
Papaya	Digestive disorders, liver diseases, chronic inflammation	Lack of established papain dosage	More research and clinical trial needed

use them to make fruit-based supplements, drugs, and functional foods. This could result in natural, less costly, and safer alternatives to synthetic drugs.

Another important strategy is to encourage fruit intake as part of public health policy. Daily fruit consumption can dramatically reduce the risk of numerous diseases linked to poor diet, such as obesity, diabetes, hypertension, and heart disease. Governments, health sectors, and educational institutions should collaborate to promote fruit-based nutrition through community assistance programs, school meal programs, and awareness campaigns.

CONCLUSION

Numerous epidemiologic, clinical, and mechanistic studies have consistently shown that, whole fruits can prevent a variety of disease processes. People who eat varieties of fruits had lower risks of chronic illnesses like obesity, type-2 diabetes, cardiovascular disease, some types of cancer, neurological problems, and gastrointestinal disorders, according to numerous public studies. Clinical investigations have shown that, fruits can also reduce intermediate health risk variables, including as blood pressure, lipid profiles, insulin sensitivity, oxidative stress, inflammation, and endothelial function. This indicates that fruits can affect disease trends in addition to their correlation with health outcomes.

CONFLICT OF INTEREST

All authors declare no conflict of interest.

REFERENCES

1. Maqsood S, Arshad MT, Ikram A, Gnedeka KT. Fruit-Based Diet and Gut Health: A Review. Food Sci Nutr. 2025 Apr 30;13(5):e70159. Available from: https://doi.org/10.1002/fsn3.70159

2. Jiang Q, Charoensiddhi S, Xue X, Sun B, Liu Y, El-Seedi HR, Wang K. A review on the gastrointestinal protective effects of tropical fruit polyphenols. Crit Rev Food Sci Nutr. 2023;63(24):7197-7223. Available from: https://doi.org/10.1080/10408398.2022.2145456

3. Oliveira A, Lameiras J, Mendes-Moreira P, Botelho G. Antioxidant Capacity and Cardiovascular Benefits of Fruits and Vegetables: A Proposal for Comparative Scales. Nutraceuticals. 2024; 4(4):695-709. Available from: https://doi.org/10.3390/nutraceuticals4040039

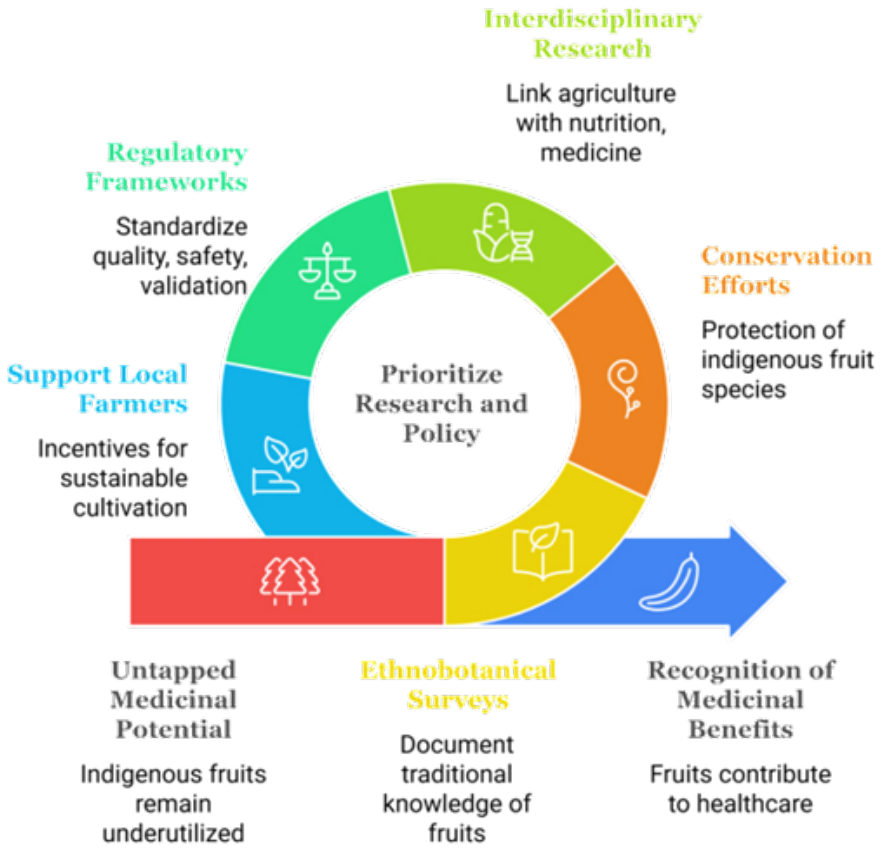

Figure 7. Policies and research area about potential medicinal fruits to be explored

4. Devirgiliis C, Guberti E, Mistura L, Raffo A. Effect of Fruit and Vegetable Consumption on Human Health: An Update of the Literature. Foods. 2024 Oct 2;13(19):3149. Available from: https://doi.org/10.3390/foods13193149

5. Pem D, Jeewon R. Fruit and Vegetable Intake: Benefits and Progress of Nutrition Education Interventions- Narrative Review Article. Iran J Public Health. 2015 Oct;44(10):1309-21. PMID: 26576343.

6. Borazon EQ, Perera S, Alokpaï N, Venance MS, Reeve E, Harris J, Tissaoui T, Thow AM. Policy landscape analysis for fruits and vegetables in four low- and middle-income countries through a food systems approach. PLOS ONE. 2025; 20(9): e0331287. Available from: https://doi.org/10.1371/journal.pone.0331287

7. Frank SM, Webster J, McKenzie B, Geldsetzer P, Manne-Goehler J, Andall-Brereton G Houehanou C, Houinato D, Gurung MS, Bicaba BW, McClure RW. Consumption of Fruits and Vegetables Among Individuals 15 Years and Older in 28 Low- and Middle-Income Countries. J Nutr. 2019 Jul 1;149(7):1252-1259. Available from: https://doi.org/10.1093/jn/nxz040

8. Wallace TC, Bailey RL, Blumberg JB, Burton-Freeman B, Chen CO, Crowe-White KM, Drewnowski A, Hooshmand S, Johnson E, Lewis R, Murray R, Shapses SA, Wang DD. Fruits, vegetables, and health: A comprehensive narrative, umbrella review of the science and recommendations for enhanced public policy to improve intake. Crit Rev Food Sci Nutr. 2020;60(13):2174-2211. Available from: https://doi.org/10.1080/10408398.2019.1632258

9. Zuraini NZA, Sekar M, Wu YS, Gan SH, Bonam SR, Mat Rani NNI, Begum MY, Lum PT, Subramaniyan V, Fuloria NK, Fuloria S. Promising Nutritional Fruits Against Cardiovascular Diseases: An Overview of Experimental Evidence and Understanding Their Mechanisms of Action. Vasc Health Risk Manag. 2021 Nov 23;17:739-769. Available from: https://doi.org/10.2147/VHRM.S328096

10. Zhao CN, Meng X, Li Y, Li S, Liu Q, Tang GY, Li HB. Fruits for Prevention and Treatment of Cardiovascular Diseases. Nutrients. 2017 Jun 13;9(6):598. Available from: https://doi.org/10.3390/nu9060598

11. Kashi DS, Shabir A, Da Boit M, Bailey SJ, Higgins MF. The Efficacy of Administering Fruit-Derived Polyphenols to Improve Health Biomarkers, Exercise Performance and Related Physiological Responses. Nutrients. 2019 Oct 7;11(10):2389. Available from: https://doi.org/10.3390/nu11102389

12. Olędzki R. Polyphenolic Compounds in the Prevention and Treatment of Hypertension: A Review. International Journal of Molecular Sciences. 2025; 26(21):10665. Available from: https://doi.org/10.3390/ijms262110665

13. Bianchi F, Cappella A, Gagliano N, Sfondrini L, Stacchiotti A. Polyphenols-Gut-Heart: An Impactful Relationship to Improve Cardiovascular Diseas-

es. Antioxidants (Basel). 2022 Aug 30;11(9):1700. Available from: https://doi.org/10.3390/antiox11091700

14. Cardona F, Andrés-Lacueva C, Tulipani S, Tinahones FJ, Queipo-Ortuño MI. Benefits of polyphenols on gut microbiota and implications in human health. J Nutr Biochem. 2013 Aug;24(8):1415-22. Available from: https://doi.org/10.1016/j.jnutbio.2013.05.001

15. Clemente-Suárez VJ, Beltrán-Velasco AI, Redondo-Flórez L, Martín-Rodríguez A, Tornero-Aguilera JF. Global Impacts of Western Diet and Its Effects on Metabolism and Health: A Narrative Review. Nutrients. 2023 Jun 14;15(12):2749. Available from: https://doi.org/10.3390/nu15122749

16. Ahmed SK, Mohammed RA. Obesity: Prevalence, causes, consequences, management, preventive strategies and future research directions. Metabol Open. 2025 Jun 14;27:100375. Available from: https://doi.org/10.1016/j.metop.2025.100375

17. Nitzke D, Czermainski J, Rosa C, Coghetto C, Fernandes SA, Carteri RB. Increasing dietary fiber intake for type 2 diabetes mellitus management: A systematic review. World J Diabetes. 2024 May 15;15(5):1001-1010. Available from: https://doi.org/10.4239/wjd.v15.i5.1001

18. Di Pietro N, Baldassarre MPA, Cichelli A, Pandolfi A, Formoso G, Pipino C. Role of Polyphenols and Carotenoids in Endothelial Dysfunction: An Overview from Classic to Innovative Biomarkers. Oxid Med Cell Longev. 2020 Oct 19;2020:6381380. Available from: https://doi.org/10.1155/2020/6381380

19. Nagpal D, Nema S, Nagpal S, Pandey MM, Kaushik D, Kathuria H. Management and Prevention of Neurodegenerative Disorders: Can Antioxidant-Rich Dietary Interventions Help? Antioxidants (Basel). 2025 Sep 2;14(9):1078. Available from: https://doi.org/10.3390/antiox14091078

20. Feng J, Zheng Y, Guo M, Ares I, Martínez M, Lopez-Torres B, Martínez-Larrañaga MR, Wang X, Anadón A, Martínez MA. Oxidative stress, the blood-brain barrier and neurodegenerative diseases: The critical beneficial role of dietary antioxidants. Acta Pharm Sin B. 2023 Oct;13(10):3988-4024. Available from: https://doi.org/10.1016/j.apsb.2023.07.010

21. Kalt W, Cassidy A, Howard LR, Krikorian R, Stull AJ, Tremblay F, Zamora-Ros R. Recent Research on the Health Benefits of Blueberries and Their Anthocyanins. Adv Nutr. 2020 Mar 1;11(2):224-236. Available from: https://doi.org/10.1093/advances/nmz065

22. Subash S, Essa MM, Al-Adawi S, Memon MA, Manivasagam T, Akbar M. Neuroprotective effects of berry fruits on neurodegenerative diseases. Neural Regen Res. 2014 Aug 15;9(16):1557-66. Available from: https://doi.org/10.4103/1673-5374.139483

23. Cicero AFG, Ruscica M, Banach M. Resveratrol and cognitive decline: a clinician perspective. Arch Med Sci. 2019 Jul;15(4):936-943. Available from: https://doi.org/10.5114/aoms.2019.85463

24. Aleksandrova S, Alexova R, Dragomanova S, Kalfin R, Nicoletti F, Fagone P, Petralia MC, Mangano K, Tancheva L. Preventive and Therapeutic Effects of Punica granatum L. Polyphenols in Neurological Conditions. Int J Mol Sci. 2023 Jan 17;24(3):1856. Available from: https://doi.org/10.3390/ijms24031856

25. Field DT, Cracknell RO, Eastwood JR, Scarfe P, Williams CM, Zheng Y, Tavassoli T. High-dose Vitamin B6 supplementation reduces anxiety and strengthens visual surround suppression. Hum Psychopharmacol. 2022 Nov;37(6):e2852. Available from: https://doi.org/10.1002/hup.2852

26. Dreher ML, Davenport AJ. Hass avocado composition and potential health effects. Crit Rev Food Sci Nutr. 2013;53(7):738-50. Available from: https://doi.org/10.1080/10408398.2011.556759

27. Ubago-Guisado E, Rodríguez-Barranco M, Ching-López A, Petrova D, Molina-Montes E, Amiano P, Barricarte-Gurrea A, Chirlaque MD, Agudo A, Sánchez MJ. Evidence Update on the Relationship between Diet and the Most Common Cancers from the European Prospective Investigation into Cancer and Nutrition (EPIC) Study: A Systematic Review. Nutrients. 2021 Oct 13;13(10):3582. Available from: https://doi.org/10.3390/nu13103582

28. Gonzalez CA, Riboli E. Diet and cancer prevention: where we are, where we are going. Nutr Cancer. 2006;56(2):225-31. Available from: https://doi.org/10.1207/s15327914nc5602_14

29. Saini RK, Ranjit A, Sharma K, Prasad P, Shang X, Gowda KGM, Keum YS. Bioactive Compounds of Citrus Fruits: A Review of Composition and Health Benefits of Carotenoids, Flavonoids, Limonoids, and Terpenes. Antioxidants (Basel). 2022 Jan 26;11(2):239. Available from: https://doi.org/10.3390/antiox11020239

30. Miles EA, Calder PC. Effects of Citrus Fruit Juices and Their Bioactive Components on Inflammation and Immunity: A Narrative Review. Front Immunol. 2021 Jun 24;12:712608. Available from: https://doi.org/10.3389/fimmu.2021.712608

31. Turrini E, Ferruzzi L, Fimognari C. Potential Effects of Pomegranate Polyphenols in Cancer Prevention and Therapy. Oxid Med Cell Longev. 2015;2015:938475. Available from: https://doi.org/10.1155/2015/938475

32. Bin-Jumah MN, Nadeem MS, Gilani SJ, Mubeen B, Ullah I, Alzarea SI, Ghoneim MM, Alshehri S, Al-Abbasi FA, Kazmi I. Lycopene: A Natural Arsenal in the War against Oxidative Stress and Cardiovascular Diseases. Antioxidants (Basel). 2022 Jan 26;11(2):232. Available from: https://doi.org/10.3390/antiox11020232

33. Imran M, Ghorat F, Ul-Haq I, Ur-Rehman H, Aslam F, Heydari M, Shariati MA, Okuskhanova E, Yessimbekov Z, Thiruvengadam M, Hashempur MH, Rebezov M. Lycopene as a Natural Antioxidant Used to Prevent Human Health Disorders. Antioxi-

dants (Basel). 2020 Aug 4;9(8):706. Available from: https://doi.org/10.3390/antiox9080706

34. Richardson DP, Ansell J, Drummond LN. The nutritional and health attributes of kiwifruit: a review. Eur J Nutr. 2018 Dec;57(8):2659-2676. Available from: https://doi.org/10.1007/s00394-018-1627-z

35. Naz A, Butt MS, Sultan MT, Qayyum MM, Niaz RS. Watermelon lycopene and allied health claims. EXCLI J. 2014 Jun 3;13:650-60. PMID: 26417290.

36. Kmail A. Mitigating digestive disorders: Action mechanisms of Mediterranean herbal active compounds. Open Life Sci. 2024 Apr 18;19(1):20220857. Available from: https://doi.org/10.1515/biol-2022-0857

37. Sensoy I. A review on the food digestion in the digestive tract and the used in vitro models. Curr Res Food Sci. 2021 Apr 14;4:308-319. Available from: https://doi.org/10.1016/j.crfs.2021.04.004

38. Rabbani GH, Teka T, Zaman B, Majid N, Khatun M, Fuchs GJ. Clinical studies in persistent diarrhea: dietary management with green banana or pectin in Bangladeshi children. Gastroenterology. 2001 Sep;121(3):554-60. Available from: https://doi.org/10.1053/gast.2001.27178

39. Koutsos A, Tuohy KM, Lovegrove JA. Apples and cardiovascular health--is the gut microbiota a core consideration? Nutrients. 2015 May 26;7(6):3959-98. Available from: https://doi.org/10.3390/nu7063959

40. Koutsos A, Lima M, Conterno L, Gasperotti M, Bianchi M, Fava F, Vrhovsek U, Lovegrove JA, Tuohy KM. Effects of Commercial Apple Varieties on Human Gut Microbiota Composition and Metabolic Output Using an In Vitro Colonic Model. Nutrients. 2017 May 24;9(6):533. Available from: https://doi.org/10.3390/nu9060533

41. Chakraborty AJ, Mitra S, Tallei TE, Tareq AM, Nainu F, Cicia D, Dhama K, Emran TB, Simal-Gandara J, Capasso R. Bromelain a Potential Bioactive Compound: A Comprehensive Overview from a Pharmacological Perspective. Life (Basel). 2021 Apr 6;11(4):317. Available from: https://doi.org/10.3390/life11040317

42. Moorthi S. Biochemistry, Nutritional Composition, and Health Benefits of Mango (Mangifera indica): A Comprehensive Review. Int. J. Curr. Microbiol. App. Sci. 2025;14(06): 243-260. Available from: https://doi.org/10.20546/ijcmas.2025.1406.022

43. Reiland H, Slavin J. Systematic Review of Pears and Health. Nutr Today. 2015 Nov;50(6):301-305. Available from: https://doi.org/10.1097/NT.0000000000000112

44. Tobin EH, Thomas M, Bomar PA. Upper Respiratory Tract Infections With Focus on The Common Cold. [Updated 2025 May 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK532961/

45. Alberts A, Moldoveanu E-T, Niculescu A-G, Grumezescu AM. Vitamin C: A Comprehensive Review of Its Role in Health, Disease Prevention, and Therapeutic Potential. Molecules. 2025; 30(3):748. Available from: https://doi.org/10.3390/molecules30030748

46. Murphy VE, Jensen ME, Harvey S, Beyene T, Gregson J, Islam F, Huang W, Aistrope K, Collison A. Vitamin A, C and/or E Intake During Pregnancy and Offspring Respiratory Health: A Systematic Review and Meta-Analysis. J Hum Nutr Diet. 2025 Aug;38(4):e70086. Available from: https://doi.org/10.1111/jhn.70086

47. Guppy MP, Mickan SM, Del Mar CB, Thorning S, Rack A. Advising patients to increase fluid intake for treating acute respiratory infections. Cochrane Database Syst Rev. 2011 Feb 16;2011(2):CD004419. Available from: https://doi.org/10.1002/14651858.CD004419.pub3

48. Shateri Z, Hosseini SA, Abolnezhadian F, Maraghi E, Haddadzadeh Shoushtari M, Zilaee M. Pomegranate extract supplementation improves lung function parameters and IL-35 expression in participants with mild and moderate persistent allergic asthma: A randomized, double-blind, placebo-controlled trial. Front Nutr. 2022 Oct 18;9:1026343. Available from: https://doi.org/10.3389/fnut.2022.1026343

49. Santana LF, Inada AC, Espirito Santo BLSD, Filiú WFO, Pott A, Alves FM, Guimarães RCA, Freitas KC, Hiane PA. Nutraceutical Potential of Carica papaya in Metabolic Syndrome. Nutrients. 2019 Jul 16;11(7):1608. Available from: https://doi.org/10.3390/nu11071608

50. Föger-Samwald U, Dovjak P, Azizi-Semrad U, Kerschan-Schindl K, Pietschmann P. Osteoporosis: Pathophysiology and therapeutic options. EXCLI J. 2020 Jul 20;19:1017-1037. Available from: https://doi.org/10.17179/excli2020-2591

51. Price CT, Langford JR, Liporace FA. Essential Nutrients for Bone Health and a Review of their Availability in the Average North American Diet. Open Orthop J. 2012;6:143-9. Available from: https://doi.org/10.2174/1874325001206010143

52. Slavin JL, Lloyd B. Health benefits of fruits and vegetables. Adv Nutr. 2012 Jul 1;3(4):506-16. Available from: https://doi.org/10.3945/an.112.002154

53. Jahan S, Gosh T, Begum M, Saha BK. Nutritional Profile of Some Tropical Fruits in Bangladesh: Specially Anti-Oxidant Vitamins and Minerals. Bangladesh Journal of Medical Science. 2011; 10(2): 95-103. Available from: https://doi.org/10.3329/bjms.v10i2.7804

54. Mazzoni L, Capocasa F, Ariza Fernández MT. Potential Health Benefits of Fruits and Vegetables III. Applied Sciences. 2025; 15(15):8133. Available from: https://doi.org/10.3390/app15158133

55. Kandasamy P, Shanmugapriya C. Medicinal

and Nutritional Characteristics of Fruits in Human Health. Journal of Medicinal Plants Studies. 2015; 4(4): 124-131.

56. Onuegbu ME, Ifemeje JC, Anyanwu RO, Ajakpofo FO, Okafor OC, Onuorah JO. Comparative Analysis of Vitamins and Minerals in Important Fruits and Vegetables as Affected by Petroleum Hydrocarbons. Eur. J. Nutr. Food. Saf. 2025 Sep;17(9):50–56. Available from: https://doi.org/10.9734/ejnfs/2025/v17i91831

57. Chin KY, Ima-Nirwana S. Vitamin C and Bone Health: Evidence from Cell, Animal and Human Studies. Curr Drug Targets. 2018;19(5):439-450. Available from: https://doi.org/10.2174/1389450116666150907100838

Voće i hranljivi sastojci voća - edukativni pregled

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KRATAK SADRŽAJ

Uvod: Voće predstavlja odličan izvor vitamina, minerala, dijetetskih vlakana i bioaktivnih jedinjenja, uključujući polifenole, karotenoide i organosumporna jedinjenja. Ove supstance imaju važnu ulogu u različitim biološkim procesima povezanim sa hroničnim i infektivnim bolestima kod ljudi.
Metodologija: Narativni edukativni pregled sproveden je korišćenjem baza podataka kao što su Google Scholar, PubMed, Scopus, NIH, ScienceDirect i druge relevantne elektronske baze. Za pronalaženje odgovarajućih radova korišćene su sledeće ključne reči: vrste voća sa antioksidativnim svojstvima, voće u lečenju bolesti, nutritivni sastav voća, minerali u voću, vitamini u voću, vitamini u terapiji bolesti i terapijska primena. Odabrane studije su analizirane u pogledu bioaktivnih komponenti, nutritivnih potreba, farmakološkog delovanja, sadržaja vitamina i minerala, rezultata istraživanja, predloženih mehanizama delovanja i vrsta voća.
Tema: Ovaj pregled pruža sveobuhvatan prikaz glavnih vrsta voća i njihovih farmakoloških efekata na značajne bolesti, uključujući kardiovaskularne bolesti, metaboličke poremećaje, neurodegenerativne bolesti, rak, bolesti imunog i respiratornog sistema, zdravlje gastrointestinalnog trakta i upalne procese. Takođe se sumiraju kategorije voća, mehanizmi njihovog delovanja, ključni nalazi prethodnih studija i praktične preporuke u ishrani.
Zaključak: Voće je bogat izvor bioaktivnih nutritivnih supstanci, kao što su vitamini, minerali, dijetetska vlakna i fitokemikalije, koje su važne za prevenciju i kontrolu čestih zdravstvenih problema. Uključivanje voća u svakodnevnu ishranu predstavlja jednostavnu, bezbednu i održivu strategiju za unapređenje opšteg zdravlja.

Ključne reči: voće, nutritivne komponente, ishrana, vitamin C, bolesti

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