

Fruits as a Cornerstone of Human Health: A Mini Review of Nutritional Contributions, Global Consumption, and Strategies for Increased Intake

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Abstract: Fruits are an important source of vitamins, antioxidants, and other essential nutrients for human health. In many countries, especially in Asia and Africa, average per capita fruit intake is still below recommended levels despite the World Health Organization's recommendations. Different demographics have diverse intakes due to a variety of factors that greatly influence consumption patterns, including personal preferences, socioeconomic status, and environmental constraints. The review highlights the potential of fruits as a cornerstone of human health and nutrition by eliminating obstacles to fruit intake and promoting awareness of their health benefits. Furthermore, focus on the importance of community empowerment and public health programs to increase fruit consumption, especially among vulnerable populations such as children and adolescents. More funds must be allocated to research and focused strategies to ensure that all populations may access and benefit from the nutritious contributions of fruits.

Index Terms: Fruit consumption, Human health, Nutritional benefits, Strategies

1 INTRODUCTION

Fruits are the ripened ovaries of plants, intended for reproduction, containing seeds that facilitate the next generation's growth [1]. According to [2], they can be categorized according to their edible parts, colors, and botanical families. Additionally, they are foods that are high in nutrients and low in energy. Also, they are high in fiber, vitamins, minerals, and phytochemicals [3].

Several factors, including social, socioeconomic, and environmental ones, have contributed to a decrease in fruit consumption [4]. A number of chronic diseases, including type 2 diabetes, cardiovascular disease, and certain cancers, as well as an increased risk of micronutrient deficiencies, are linked to inadequate consumption of fruits [5].

Encouraging the consumption of fruits is crucial for improving human health, especially for children's growth and development [6]. According to [7], public health initiatives should concentrate on raising knowledge and enabling communities to grow their own fruits, particularly through small-scale gardening. Additionally, to lower production costs and improve accessibility to fruits in low-income regions, investments in research and technology are required [5].

This review aims to explore the nutritional benefits of fruits for human health, as well as the global patterns

in fruit consumption and the issues related to insufficient fruit intake. Furthermore, to emphasize strategies for boosting fruit intake and reducing nutrient deficits.

2 NUTRITIONAL CONTRIBUTION OF FRUITS

In addition to being flavorful and colorful components of the diet, fruits also provide energy, vitamins, minerals, dietary fiber, and antioxidants [4]. Moreover, they provide minerals including iron, calcium, and magnesium [8] as well as natural antioxidants such as saponins, flavonoids, alkaloids in avocados, vitamin A, flavonoids, beta-carotene, and polyphenols in mangoes. Guava (228,3 mg), papaya (61 mg), orange (53 mg), pineapple (47,8 mg), and mango (36,5 mg) are fruits with a high vitamin C content per 100 grams of fruit [9].

Since most rural poor people cannot access livestock sources, much of the vitamin A (provitamin A), other micronutrients, and minerals in developing countries come from plant sources. It is estimated that over 80% of vitamin A in developing countries is provided by fruits and vegetables [10].

The percentage of carbohydrates in fresh fruits varies widely, generally falling between 10 and 25%. The primary sugars in fruits are sucrose, glucose, and fructose, and the relative importance of each sugar varies depending on the fruit. Sugar content varies from about 0.9% in limes to 16% in fresh figs, with the vacuole being the main location of sugars. Ripe bananas and pineapples have a sugar concentration of over 8%, while cherries, grapes, and pomegranates have only a trace amount. Small granules of starch are found in the cells of immature fruits. When fruits get mature and riper, starch converted into sugar. Less than 1% of protein is found in fruits (compared to 9–20% protein in nuts such as walnut, pistachio, and almond). Except for avocados, olives, and nuts, lipids account for only 0.1-0.2% of most fresh fruits. Fresh fruits are generally acidic. Certain fruits, such limes and lemons, have as much as 2-3% acid by their total fresh weight. The total phenolic content of fruits varies between 0.1 and 2g per 100 g fresh weight and is higher in immature fruits than in mature fruits. Fruit phenolics comprise simple phenols, cinnamic acid derivatives, leucoanthocyanidins, epicatechin, catechin, and chlorogenic acid [4].

2.1 Potential Benefits of Underutilized Fruit Crops

Fruit crops that have value but are not commonly grown, rarely available in the market, or not cultivated for commercial purposes are known as underutilized fruit crops [11].

Since these underutilized fruit crops don't need additional resources like fertilizer or irrigation, integrating them into an agricultural farming system may be economically advantageous. When properly recognized and utilized, these underutilized fruit crops can be low cost, nutrient-dense foods [12].

Since underutilized fruit crops don't require external resources like fertilizer or irrigation, they can be employed for sustainable land use. Undomesticated landraces can occasionally endure conditions that highbred cultivars cannot because they have adapted to a range of ecosystems. Due to the low requirements for external inputs, there have also been suggestions that the production of underutilized crops and organic certification can go hand in hand, providing producers with options in niche market [13].

Enhanced use of underutilized fruits can combat hidden hunger and improve nutrition. For an example, compared to commonly available commercial species and varieties, many underutilized fruits and

vegetables contain higher levels of provitamin A and vitamin C [11].

3 IMPORTANCE OF FRUITS IN HUMAN HEALTH

400–500 g of fruits and vegetables per day is the minimal amount recommended by the WHO (except from potatoes and other starchy tubers). 150 grams of fruit daily per capita is the recommendation of World Health Organization (WHO) [9].

Because fruits are high in water, fiber, and antioxidants that promote a healthy digestive system, regular fruit intake is associated with a lower risk of cancer, heart disease, type 2 diabetes, obesity, and stroke. For example, papaya has papain enzymes that aid in the digestion of proteins [6]. Promoting vegetable and whole fruit consumption to young adults, especially those with higher BMIs, might be helpful to maintain their weight as they transition into adulthood [3].

Antioxidants, including vitamins A, C, and E, play a crucial role in neutralizing free radicals (oxidants), which are known to be the cause of diabetes, heart disease, cancer, cataracts, hypertension, and stroke. Vitamin A is a nutrient which is important for body's certain metabolic processes. Fruits are one of the best sources of potassium and foliate, which are known to avoid heart disease, stroke, cancer, birth defects, and hypertension. Furthermore, fruits contain a lot of fiber, which is beneficial for digestion and bowel motions. World Health Organization lists low consumption of fruits and vegetables as one of the twenty risk factors for mortality worldwide, ranking slightly behind the more well-known killers like high cholesterol and tobacco use. In developing countries, vitamin A deficiency is the major health issue that puts children at higher risk of mortality, morbidity and disability [10].

In comparison to other races except for the Mexican population, the prevalence of vitamin C deficiency (plasma levels $< 2 \mu\text{g/ml}$) reaches its peak among Indians and people of South Asian origin. The significant prevalence of vitamin C deficiency in these populations may be attributed to South Asians' lower intake of fresh fruits and vegetables and their tendency to overcook food. Higher incidences of cancer and cardiovascular disease among South Asians may be explained by people in Pakistani, Indian, Malay, and Chinese populations having lower vitamin C levels than most Western nations [14].

Low consumption of fruits and vegetables is one of the major risk factors for mortality and disability in the globe; it is estimated to cause approximately 1.7 million deaths annually and 16 million living with a disability life worldwide. Poor dietary practices, which include consuming low fruits and vegetables, was the major risk factor in the United States, contributing to 26% of all deaths and 14% of all disabilities. However, raising an individual's daily consumption of fruits and vegetables to 600 grams (approximately five servings per day) could reduce the global burden of disease by 1.8% and the burden of ischemic heart disease and stroke by 31% and 19%, respectively. [15].

In addition to preventing viral infections, providing patients with a healthy, balanced diet is crucial for speed up their recovery. To prevent some diseases, a person must maintain their immune system strong, particularly by preventing the growth of pathogenic microorganisms and counteracting the impacts of products. It's essential to have a good nutrition before, during, and after an infection. A family's meal plan should contain all the nutrients needed, including fat, protein, carbohydrates, vitamins and minerals. In terms of boosting immunity, or the body's immune system, fruit and vegetable consumption is necessary for the body to have a nutritious diet as recommended by balanced nutrition guidelines because they are a

source of vitamins, minerals, and fiber [9].

Fruits are beneficial for psychological health. Numerous studies have been conducted on the effects of carbohydrates on psychological functioning and in particularly mood. Ingestion of simple carbohydrates which are found in refined sugary products, have the potential to temporarily elevate mood. It has been proposed that because complex carbohydrates release glucose more slowly, their effects remain longer. Complex carbohydrates are especially found in low glycemic index foods, such as some types of fruits (bananas, peas, and beans). Fruits and vegetables (spinach, brussels sprouts, and oranges) are rich in B vitamins, especially folate, and vitamin B6, which is crucial for methylation processes in the brain and the synthesis of important neurotransmitters (peas, bananas, and beans). Vitamins C and E, as well as phytochemicals like polyphenols, also lower poor mental health, which includes depression [8].

4 FRUIT CONSUMPTION IN THE WORLD

Fig. 1. Data from the World Bank (2023) and the Food and Agriculture Organization of the United Nations (2023) show that many countries, especially in Asia and Africa, have average per capita fruit intakes that are below the minimum recommended guidelines.

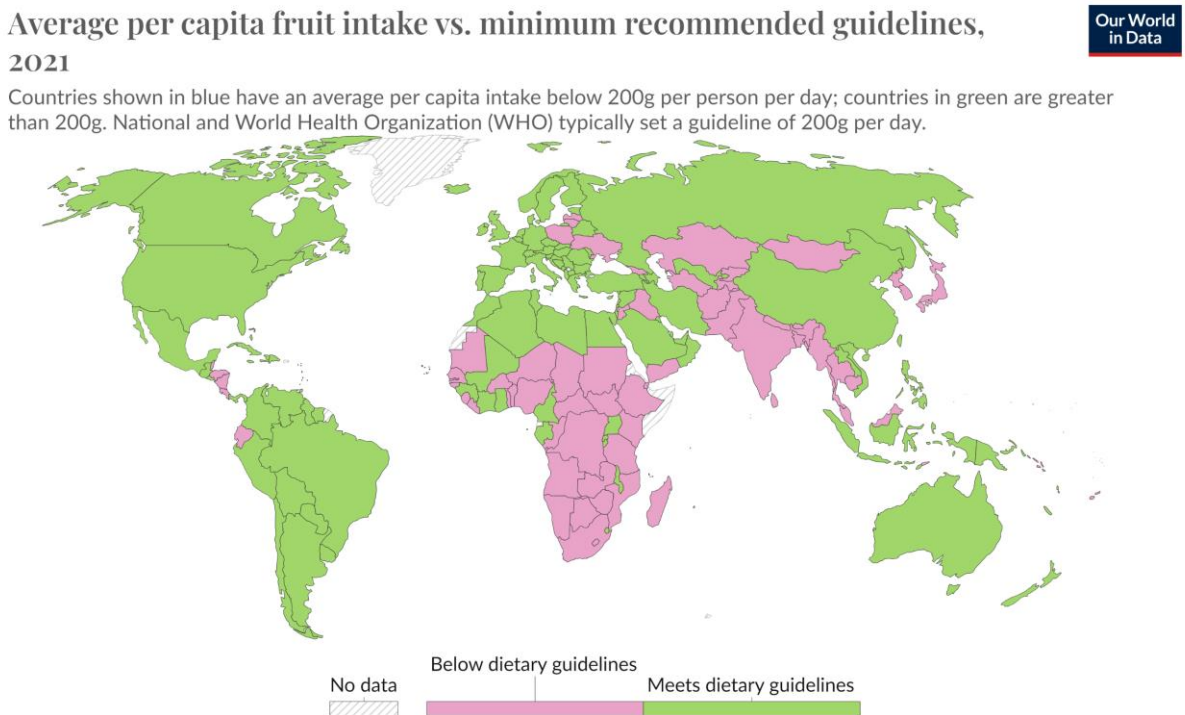


Fig. 1. Average per capita fruit intake in the world vs. minimum recommended guidelines 2021

Additionally, the data, Fig. 2. from the Food and Agriculture Organization of the United Nations (2023) shows the average annual fruit intake per person, measured in kilograms, and shows trends in worldwide fruit consumption by type from 1961 to 2021. It displays a breakdown of many fruit categories, including grapes, apples, bananas, oranges, and others, allowing a review of how certain fruit varieties have affected general consumption over time.

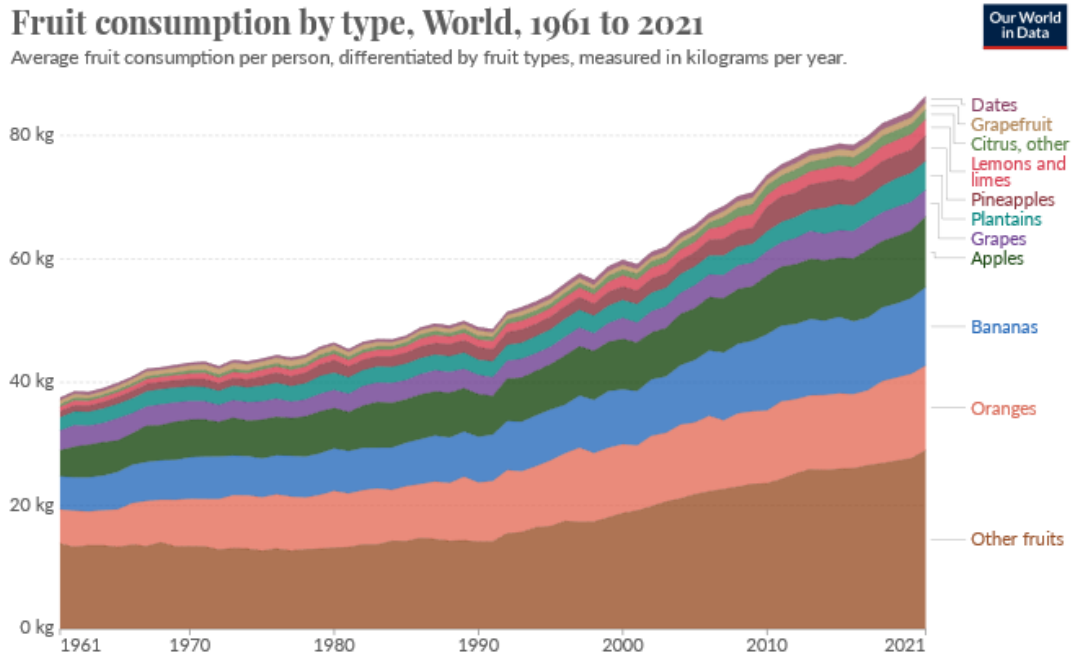


Fig. 2. Fruit consumption by type in the world, 1961 to 2021

Fig. 2. shows that, between 1961 and 2021, the average global fruit intake per person increased consistently from around 30 kg to over 80 kg. Oranges and bananas had regularly contributed significantly, with orange consumption stabilized while banana consumption has been steadily increasing. This growth has also been significantly attributed to apples, grapes, and "other fruits". The "other fruits" category, which includes fewer well-known fruits, has expanded dramatically, suggesting a wider range of fruit preferences. Fruit consumption has increased significantly since the 1990s, indicating a growing global demand for a range of fruits. Fruits including pineapples, plantains, lemons, and limes have all seen increases in consumption. However, there have been periods where some fruits, like oranges, have stabilized or slightly declined.

The data, Fig. 3. presented above, from the Food and Agriculture Organization of the United Nations (2023), presents a global map illustrating the average per capita fruit consumption, expressed in kg per year, for each country for the year 2021. Based on how much fruit is consumed per person, the countries are colored, with lighter green denoting lower levels of consumption and darker green indicating higher levels. The largest fruit consumption is found in Europe (such as Spain, Italy, Greece) and Latin America (such as Argentina, Brazil), where annual fruit intake per person exceeds 75 kg, and in some cases exceeds 100 kg. Fruit consumption is moderate in nations like China, the US, and some regions of South Asia (50–75 kg per person annually). There is a lower fruit consumption (less than 50 kg) in several Middle Eastern, Southeast Asian, and African countries. Some areas consume very little fruit, especially in Central Africa and Northern Europe, or there is insufficient information. Fruit consumption is lower in Africa and South Asia due to economic and agricultural constraints, while it is higher in Europe and Latin America due to cultural influences and easier access. This demonstrates a global imbalance whereby rich countries consume more fruits, and low-income areas consume fewer fruits than recommendations.

Fruit consumption per capita, 2021

Average fruit consumption per person, measured in kilograms per year.

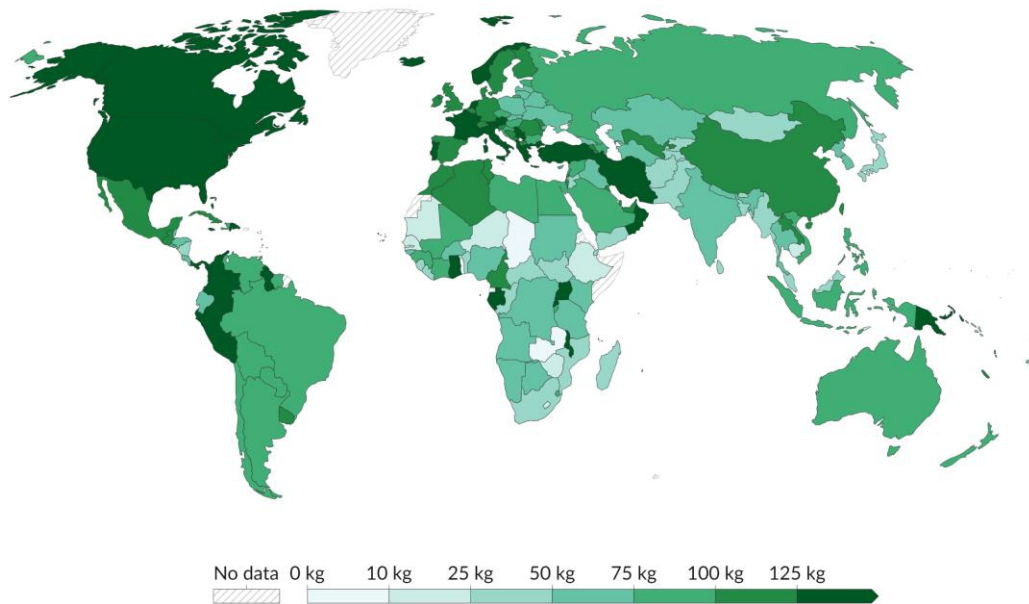


Fig. 3. Fruit consumption per capita, 2021

In many countries, there is insufficient fruit consumption, especially among young individuals who often consume fruit at lower rates. When a person gets into a new stage of life, like motherhood, their consumption usually rises. Numerous factors, such as gender, socioeconomic position (SES), individual preferences, availability, accessibility, and parental intake, have been found to influence fruit and vegetable intake. For instance, in 1995, people from lower socioeconomic status locations in Australia consumed the least amount of fruit, with women consuming more than men. The most popular foods were pome fruits and fruit juice, which were mostly consumed as snacks in between meals [16]. Geographical location frequently affects access to fresh produce. In places where access is restricted, canned and frozen foods may assist fulfil daily needs. Adolescent consumption patterns are influenced by sociodemographic variables such as parental behaviors, age, gender, and socioeconomic status. According to problem behavior

theory, there is a correlation between inadequate consumption of fruits and negative behaviors such as substance abuse, psychological distress, and inactivity [6]. According to WHO (2005), consumption of fruits tends to increase with affluence and urbanization in sub-Saharan Africa; nonetheless, adolescents living in rural areas of developing countries often consume more fruits than their urban counterparts.

In most Asian, Western, and South African countries, large population groups, including children and adolescents consume significantly less fruits than advised. Chinese school children from low socioeconomic status (SES) families consume fruit daily, respectively to the high SES families. Only 18% of people living in low- and middle-income countries fulfil the WHO's recommendation of 400 g of fruits and vegetables per day. At the individual level, those with a secondary education or higher were more likely to meet the recommendations than those without any formal education. The proportion of people meeting WHO recommendations increased with increasing country GDP levels and with decreasing country food price index [5].

Significant disparities occur in fruit and vegetable consumption between the highest and lowest consumers, as well as between regions, social classes, and gender. It has been discovered that those with greater money, social status, and levels of education consume more fruits and vegetables than people with lesser incomes, social classes, and levels of education. Elderly people consuming more fruits and vegetables than younger generations, with women consuming more than males. Individual food attributes, including flavor, texture, quality, aroma, and appearance, are significant factors in determining a person's decision to eat or not. "Taste" was among the top three factors listed, while "quality" was the one that was most frequently noted. A higher frequency of reported food dislikes has been linked to sensitivity to 6-n-propylthiouracil solutions such as lemon juice and grapefruit juice [16].

4.1 Reasons for Inadequate Nutrient Intake of Fruits

Although the fact that buying fruit is driven by health concerns, many individuals do not consume the required daily amounts of fruit. Social and socioeconomic variables are among them. In a society where people have less time to prepare and eat meals, consumers have stated that fruits don't eat as reliably or predictably as artificial snacks. Obstacles to purchasing and consuming fruit can also include unpredictability in ripening, flavour, texture, and appearance [4].

For instance, fertilizing with nitrogen may boost fruit size and output. On the other hand, low quantities of soluble sugar, low levels of vitamin C, and increased fruit losses during storage can all be caused by elevated nitrogen status. From the perspective of the consumer, all of these are detrimental elements [4].

It was discovered that availability, attitude, habit, and social influences had a small but significant impact on the intention to eat fruits in Malaysian adults. The intention of adults to consume fruits was more effectively influenced by environmental influences than by personal ones [17].

Regardless of ethnicity, iTaukei and Indian urban Fijians valued and enjoyed eating fruits, and they were aware of the health benefits; nonetheless, availability and pricing were seen as significant obstacles [7].

When food waste at the home or individual level is considered, the estimated supply gap in the formal agriculture sector to fulfil the present demand for fruit and vegetables is 22% (34%), with variations between low- and upper-middle-income countries ranging from 58% to 13%. By 2025 and 2050, the global

supply: need ratios for fruit and vegetables rise somewhat to 0.81 and 0.88, respectively [15].

Due to the limited time people must buy fruit and the distance to the closest fruit seller, the majority of them only sometimes eat fruit. Other factors that are seen to be barriers to eating fruit include high cost, dislike of fruit and frequent forgetting to eat it [9].

Many countries offer producer-end subsidies for dairy and grain crops, which encourage farmers to develop these products while discouraging the production of fruits. The majority of industrialized and developing nations lack government incentives to cultivate and sell fruits. Both the supply side (growth incentives) and the demand side (customer price increases) may be impacted by this [5].

The main barrier to independent production in Ethiopia seems to be a lack of knowledge on the significance of fruits for women's and children's health. According to FAO estimates, Ethiopians consume fewer than 100 g of fruits and vegetables per day [10].

4.2 Strategies to Improve Fruit Consumption and Nutrient Intake

Families need to be educated about the value of eating fruits and vegetables for human health and nutrition, especially for the growth and development of young children. To allow to produce fruits and vegetables in backyard gardens, communities must be actively empowered in terms of raising awareness and acquiring technical expertise. Many regions of the world have seen successful in urban agriculture programs, demonstrating that even urban homes may produce enough vegetables for domestic consumption [10].

It has been suggested that 120 mg of vitamin C per day be the recommended dietary amount (RDA). People who smoke, have cancer, or are more likely to develop coronary artery disease may need to consume more ascorbate through their diet or as supplements. Whenever possible, fruits and vegetables should be the primary source of vitamin C intake. Similarly, for individuals who cannot or do not want to eat fruits, vegetables, or meals or beverages enriched with vitamin C, a 200 mg vitamin C supplement should be taken [14].

Fruit consumption was highly correlated with age, gender, educational attainment, community, exercise level, marital status, and alcohol use. The World Health Organization's minimum recommended fruit intake of 400 g/d was not met by China's older generation. Increased public health initiatives and strategies are required to encourage older Chinese generation to consume more fruits [18].

The results point to the need for public health initiatives aimed at promoting fruit consumption in Fiji to concentrate on strengthening the domestic fruit supply's stability and enhancing the viability of small-scale urban gardening. Additional public health initiatives are also required to make fruits and vegetables more appealing than processed diets [7].

Certain fruit types or an increase in fruit consumption are variably correlated with specific individual socioeconomic characteristics, but not with contextual socioeconomic factors. Changes in fruit consumption were found to be correlated with factors such as education level, number of children, marital and occupational status, and physical activity level. These findings suggest that nutritional prevention strategies should concentrate on individual-level behaviors, independent of environmental factors, such as nutrition knowledge, attitudes towards healthy eating, food motivation, resources, stressors, and

psychological resources. Higher socioeconomic status was associated with a greater tendency to consume more fruits and vegetables [19].

Increased funding for studies targeted at cutting fruit and vegetable production costs could have a significant positive impact on population health by lowering the cost of these foods and improving their accessibility for those in need. The difficulty of utilizing available technologies to boost fruit and vegetable production at a reduced cost is similar to that of the availability of fruits and vegetables in low-income nations [5].

5 CONCLUSION

This review brings out the vital role that fruits play in human health, emphasizing both the nutritional value of fruits and the urgent need to raise fruit consumption rates globally. There are still significant disparities in fruit consumption despite rising trends, especially in low-income regions where access and affordability are major obstacles.

It is necessary to implement diverse strategies that emphasize community involvement, education, and expanding fruit availability to address these issues. We can encourage better dietary habits by empowering communities to grow their own fruits and by enhancing awareness about the health benefits of doing so. Governments, health organizations, and communities must be collaborative to create an environment that encourages fruit intake and, in turn, improves health outcomes worldwide.

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