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Mini Review

Nutritional Values and Current Research on Passion Fruit (*Passiflora Edulis*)

Mohammad G Arabzai[1,4], Nazir K Mohammadi[2,3], Omotola A Olunuga[1], Hamid Ullah[5], Yuan Qin[1]*, and Lulu Wang[1]*

[1]College of Agriculture, Fujian Provincial Key Laboratory of Haixia Applied Plant Systems Biology, College of Life Sciences, Fujian Agriculture and Forestry University, Fuzhou 350002, Fujian Province, China

[2]State Key Laboratory of Herbage Improvement and Grassland Agro-Ecosystems, College of Pastoral Agriculture Science and Technology, Lanzhou University, Lanzhou 730020, China

[3]Agronomy Department, Faculty of Agriculture, Paktia University, Gardiz City Paktia 2201, Afghanistan.

[4]Assistant Professor at Department of Agronomy, Agriculture Faculty, Paktia University, Gardiz City, Paktia

[5]Center of legume plant genetics and system biology, collage of agriculture, fujian agriculture and forestry University fujian china

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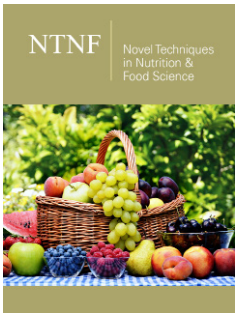

***Corresponding author:** Yuan Qin and Lulu Wang College of Life Sciences, Fujian Provincial Key Laboratory of Haixia Applied Plant, Systems Biology, Fujian Agriculture and Forestry University, Fuzhou 350002, Fujian Province, China
Email:
yuanqin@fafu.edu.cn/luluwanghn@163.com

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Abstract

Passion fruit (*Passiflora edulis*) is a tropical fruit that is widely consumed for its desirable taste, nondurable shelf life, nutritional value and health qualities. It is an excellent source of vitamins C, A and B-complex, along with minerals, dietary fiber and antioxidants. Which play therapeutic roles in the health of the user reducing inflammation including anxiety and anti-cancer. It has been investigated in the recent past for its bioactive compounds, with potential uses in increasing health, while at the genomic level it is being researched to increase its production and resistance to diseases and stress. The purpose of this review has been to unveil simple but essential facts about the fruit as well as ongoing and future developments in health and horticulture.

Keywords: Passion fruit; Vitamins; Health; Disease; Stress

Introduction

Passion fruit is native to South America and obtained wide recognition due to its intensified taste and nutritional value. Moreover, passion fruit farming is gradually increasing in countries like those in Africa, Asia and Australia because of the increased passions of the fruits in the international market. For instance, at the production level, Brazil is dominant; at the emerging level, Kenya and India are upcoming [1]. In the past, passion fruit has also been used in traditional medicine to treat sleeplessness and anxiety that is why it has so many applications [2]. It is an important source of bioactive compounds, which act as a cure for some conditions such as inflammation, cancer and insomnia [3]. However, recent studies are aimed at developing its improved horticultural qualities, including yield, disease resistance and climate adaptability [4,5]. This review focuses on the nutrient profile and the existing advancements in the scientific literature in terms of passion fruit's health effects and agricultural advancements.

Nutritional value and bioactive compounds

Passion fruit is an easily digestible food which is very rich in vitamins, minerals, dietary fiber and contains antioxidants. Vitamin C with the amount of 30mg per 100g, can meet 50% of the daily intake and is essential for the immune system, skin, connective tissues and iron uptake [6]. Vitamin A, derived from beta-carotene, helps prevent eye problems, maintains the skin and immune system and reduces free radical effects [7]. Niacin, riboflavin and folate in B-complex group help in energy production and red blood cell formation and also for prenatal health [8]. The fruit also contains potassium, magnesium and iron that controls hypertension, supports muscles and prevents anemia respectively [9]. Dietary fiber, on this case, stands at 10g per

100g which aids in digestion by maintaining bowel movement and also moderating blood glucose. It also helps to suppress appetite and therefore can be used in management of obesity [10-12]. Flavonoids such as quercetin, catechins and anthocyanins act as antioxidants, anti-inflammatory and anti-cancer agents and shields the cell from Reactive Oxygen Species (ROS) and other diseases like heart diseases and cancer [5]. Passion fruit contains carotene especially beta-carotene and lutein which aids in vision especially the part that has an antioxidant that protect the retina. Caffeic acid, chlorogenic acid and ferulic acid also possessed as antioxidant and anti-inflammatory properties that inhibit cancer, cardiovascular diseases and diabetic conditions [4,5]. Even though passion fruit is a rich source of vitamins, minerals and other nutrients, it contains only 97 kcal per 100g, which means it will not harm your slimming goals if included in your diet (Figure 1) [13].

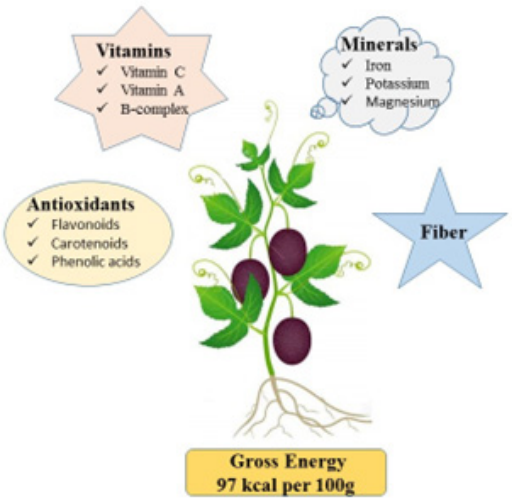

Figure 1: Nutritional value and bioactive compounds of passion fruit.

Current research and advancements

Recent researches have provided insights into various therapies arising from passion fruit ingredients. Harman and harmaline are two such examples of alkaloids, which affect anxiolytic and sedative values associated with neurotransmitters processing anxiety and ability to sleep [14]. They also establish that polyphenols in the fruit exhibit anti-inflammatory activity since they suppress inflammatory pathways and antitumor activity since they retard cancer cell division [15]. The fruit's antioxidants also help to reduce the risk of heart diseases, improve vascular health and lower blood pressure [16]. For instance, in agriculture, genes associated with stress tolerance, diseases resistance and fruit ripening have also been found through genomic work hence creating an improved cultivar [17]. Molecular techniques like marker assisted selection for diseases like Fusarium wilt acts as a tool for sustainability in the production [18]. Liang also determined that *Passiflora edulis* holds 90 antioxidant genes which include; PeSODs, PeAPXs and PeCATs among others. These genes exhibited tissue-specific regulation that has been linked to developmental regulation and response to oxidative stress conditions. Interestingly, several genes were identified potential candidates for locus that may confer temperature stress resistance. Moreover, microRNAs and transcription factors' involvement were reported to help regulate the antioxidant genes Still [19]. In another study, Hou revealed six HVA22 genes in *Passiflora edulis*; these are involved in ABA, drought tolerance and reproductive development. Most of the genes of the PeHVA22 family were found to be developmentally regulated and tissue specific indicating their importance in stress response and growth control [20]. In addition, Zhang found 32 PeCaM/PeCML genes in *Passiflora edulis* which of them are categorized with conserved structural domains and play roles in floral or/and fruit development. Of these, PeCML26 seemed to play a more specific role concerning growth regulation and hormonal signaling and stress responses, which gave a good clue to investigating the functional diversification of this gene family in passion fruit [21]. In addition, current molecular techniques, such as CRISPR-Cas9 gene editing, transgenesis and RNA interference, are being used to improve nutritional value of passion fruit by increasing beneficial constituents; flavonoids and carotenoids [22]. These advancements represent significant progress in breeding programs aimed at achieving higher resilience and better-quality produce.

Challenges and future directions

Despite its promising health benefits, passion fruit faces several challenges in terms of cultivation and commercial production. The fruit's sensitivity to environmental conditions, such as temperature fluctuations and drought, makes it difficult to cultivate on a large scale [5]. Climate change poses a significant threat to passion fruit production, as it may lead to decreased yields and lower fruit quality [23]. Additionally, the fruit's short shelf life and the lack of standardized processing methods present challenges for its commercialization [4]. To overcome these challenges, the following agricultural technology innovations can be applied in the breeding and production of crops; Siemens Hybrid Breeding, Double Haploid (DH) technique and precision agriculture [24]. they can also help in the creation of stress tolerance and high yielding gene varieties using bio tools such as CRISPR-Cas9 [25]. Furthermore, emerging research areas, such as the potential applications of passion fruit in personalized nutrition and precision medicine, are gaining attention. These approaches could pave the way for tailored dietary interventions and therapeutic applications based on individual health profiles. Future research should focus on improving cultivation practices, particularly in the context of climate change, to ensure a stable supply of passion fruit for global markets. Additionally, more clinical trials are needed to better understand the long-term health benefits of consuming passion fruit and to identify its optimal therapeutic applications. Further exploration of the bioactive compounds in passion fruit and their mechanisms of action is essential for the development of passion fruit-based functional foods and nutraceuticals.

Conclusion

Passion fruit contains an undeniable amount of nutrients essential for the body, derived from vitamins, minerals, fiber and

antioxidants. The bioactive compounds present in passion fruit exhibit significant medicinal properties, such as anti-cancerous, anti-inflammatory and anxiolytic activities. With applied molecular biology and improved breeding practices, its cultivation efficiency, resistance to diseases and nutritional value are being enhanced. Passion fruit plays a dual role in promoting global health and economic development. Additionally, it holds immense importance in food science and nutrition research, contributing to the advancement of nutraceuticals and functional foods while supporting sustainable agricultural practices globally.

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