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Chickpea: A poor man's meat

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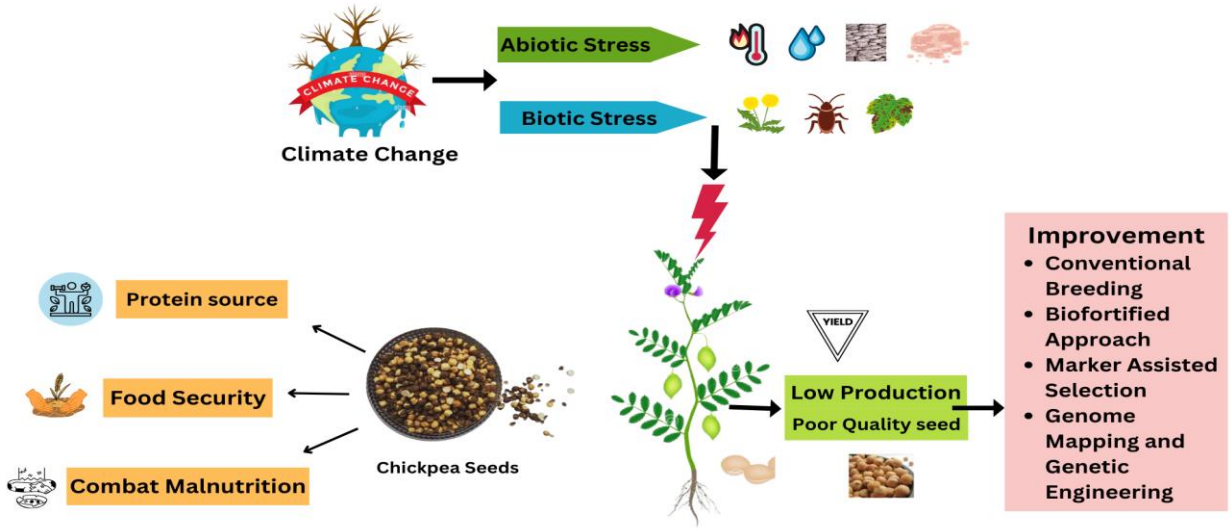
Chickpea (Cicer arietinum) an annual crop, member of the Leguminosae family, and referred to as "poor man's meat." In developing countries, it is a staple diet for millions of people and vegetarians totally rely on chickpea instead of other food items. A significant source of vitamins, minerals, fibers, and carbohydrates, it also contains 18–22% protein and plays a significant role in addressing malnutrition in many impoverished nations, especially among kids, and ensuring food safety. Chickpeas are beneficial to the environment and help preserve the health of the soil via biological nitrogen fixing and is also an affordable and sustainable protein source. Together with biotic and abiotic variables like disease, drought, salinity, heat stress, and insect attacks on chickpea production and seed quality, the changing climate has become a significant threat to agricultural crops worldwide. To resolve this problem, several breeding strategies should be employed to improve chickpea quality and yield, including traditional breeding, biofortification, and marker-assisted selection. Innovative tools, genomics and gene editing are effective to produce nutrient-rich crops. Now researchers are focused on improving the nutritional profile of chickpea by reducing anti-nutritional contents and enhancing micronutrients, selenium, iron, zinc. These practices resolve all issues like malnutrition, food insecurity, low productivity, and guarantee that chickpea stays as key protein source for future generations.

Keywords: chickpea, reduce malnutrition, food security, protein source, breeding approaches, high nutrition, high quality



INTRODUCTION

Chickpeas (Cicer arietinum L.) are widely cultivated in dry and semi-arid areas, an annual herbaceous plant belonging to the Leguminosae family. 68.5% of the world's production comes from India, with Pakistan, Australia, Russia, Ethiopia, and Türkiye far behind. The two most popular types are Desi and Kabuli, with Kabuli having larger seeds and Desi having smaller ones [1]. A vital component in the diets of people worldwide, this legume is extremely important as a protein-enriched legume that is also rich in minerals and vitamins [2]. Millions of people in impoverished nations rely heavily on grain legumes, sometimes referred to as the "poor man's meat," for their sustenance. Chickpeas play a crucial role in the diets of

vegetarians who might not have access to foods that contain animal meat. [3].

Nutritional composition of chickpea

Chickpeas are abundant in protein and carbohydrates, and consumers have been using them for decades due to their significant nutrient-rich qualities [4]. Their immature seeds are consumed as snacks, roasted, boiled, or salted, and are the main source of calcium, iron, phosphorus, protein, fiber, and amino acids. They consist of 18–22% proteins and 52–70% carbs, which together make up around eighty percent of the dry seed's mass. They also contain a minimal level of lipids (>5% DM) and 4–10% fat. It is a significant crop among pulses, free of cholesterol and rich in minerals, vitamins, and other nutrients [5].

Compared to lentil and field peas, chickpeas have a greater mean protein level of around 18% [6]. Customers are paying greater interest in plant-derived vegan proteins than in animal-based ones because of their many benefits, which include affordability, benefits for the environment, natural abundance, sustainability, and protection against cardiovascular disease [7].

Chickpea's role in reducing malnutrition.

In poorer nations, malnutrition is a common nutritional problem. This is mostly caused by inadequate intake and use of nutrients that are necessary for several physiological functions. About five hundred million children under five suffer from malnutrition; most of these youngsters are from South Asia and Africa. According to the United Nations International Children's Fund (UNICEF), one out of every thirteen children are affected by wasting. In India, Bangladesh, and Pakistan, almost fifty percent of the world's malnourished population resides. To combat this issue, it is now vital to encourage the production of affordable, nutrient-dense plant-based diets in response to the rising population and the high expense of foods derived from animals. Insufficient quality of food and limited access to additional nutrients are the main causes of malnutrition among Pakistani children. It has been pointed out that Pakistan's national and global nutrition surveys are revealing serious nutritional imbalances among its people. This problem is primarily caused by the lack of least sufficient quality protein or a balanced diet. One measure that could help reduce protein-energy malnutrition is the inclusion of legumes in a diet regarded as main. Chickpeas contain significant amounts of nutritious protein that is easily absorbed [8]. Chickpeas are helping to ensure food safety worldwide by filling the protein gap in the daily rations of many people [9].

Chickpea: a sustainable protein source

Chickpeas are beneficial to the environment and help preserve the health of the soil via biological nitrogen fixing. It saves fertilizer expenses, prevents nutritional deficiency, and enhances human health [10]. After grains, beans are the most significant food and are widely regarded as a meat substitute due to affordability and sustainability [8].

Challenges in chickpea production and quality

In recent years, the changing climate has become a major worldwide concern, and its effects on agriculture are becoming more severe. Over the past 50 years, there has been a significant increase in the frequency of extreme rainfall, floods, droughts, etc. [11].

Abiotic factors that affect chickpea output include soil salinity, elevated temperatures, flooding, and nutrient deficits (such as nitrogen and phosphorus) as well as heavy metals (such as arsenic) that alter plant water relations and cause stress reactions. Biotic risks further diminish productivity. These include parasitic nematodes, illnesses (such fusarium wilt, Ascochyta blight), and pests (like pod borer, cutworm) [12].

Breeding approaches for high quality chickpea

Conventional breeding and Biofortified Approach

Chickpeas are a major source of minerals, such as selenium (Se), zinc (Zn), and iron (Fe). By 2030, the Sustainable Development Goals set by the UN aim to eradicate malnutrition and food insecurity worldwide.

Boosting the number of micronutrients in traditional crops by traditional breeding and biofortification utilizing the latest biotechnology has proven crucial in the fight against world hunger and malnutrition. As a target crop for Fe, Zn, and Se enhancement, chickpeas are the subject of numerous international research projects aimed at creating cultivars that would combat micronutrient deficiency, sometimes known as "hidden hunger [6]."

Marker Assisted Breeding

Genetic development in legumes has been gradual, but genetic markers are already improving traditional breeding efficiency. Rapid advances in marker development for chickpeas and other pulses have resulted in marker-trait linkages for important agronomic characteristics. Breeders can increase production in complex crops like chickpeas by making accurate selections based on identifying markers associated with characteristics like yield, nutritional content, and disease resistance. A quicker and more focused method of enhancing crop performance is marker-assisted selection [13].

Genome mapping and Genetic Engineering

Chickpeas are attracting attention in breeding focused on their enhanced nutritional traits because of their nutritional as well as medicinal value. There has been development in sequencing in the recent past that has made it possible to map the chickpea genome and that facilitates the use of genetic engineering in the improvement of the crops. These breeding methods are aided by quantitative trait locus (QTL) mapping, GWAS, and genomic selection as identification of beneficial traits within specific genomic regions.

Research has revealed important QTLs and SNPs associated with the protein, iron, and zinc content of chickpeas, emphasizing the role of the gene CaNAS2 in raising iron levels.
To produce rich in nutrients, minimal anti-nutrient types of chickpeas, researchers are looking for qualitative trait loci and SNPs that will increase the level of carotenoid and decrease anti-nutritional components [14].

CONCLUSION

In summary, chickpeas are an essential sustainable protein source that combats world hunger and has several positive environmental effects. Further study and innovative ideas in breeding approaches, like marker-assisted selection and genetic engineering, are required to improve their nutritional value and resistance to climate change. To successfully tackle food poverty, future initiatives must concentrate on boosting chickpea production, enhancing nutritional content, and maintaining accessibility for people who are at risk.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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