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Review Article

Technological, Processing and Nutritional Aspects of Chickpea (*Cicer arietinum*)

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Abstract

Chickpea adds significant amount of nitrogen to soil and organic matter to improve the soil fertility and health aspects. Chickpea is grown in semi-arid areas, consider as drought tolerant and many cultivars with various levels of tolerance to drought have been produced. Worldwide chickpea in 2018 was 17.19 million tones which account for 18.63% of total pulse production. In chickpea, the chief phytochemicals comprise of flavonoids, phenolic acids, lignin, stilbenes and carotenoids. In chickpea, phytochemical are phenolic compounds, specifically 5-deoxyiso flavonoids and have important role in providing defensive action against pathogens and also help in nitrogen fixation by acting as chemical signal. As compared to other pulse protein like pea and soybean protein chickpea protein has highest thermal expansion value, stability and forming capacity chickpea also higher emulsion stability index. Chickpea consider as a suitable vehicle for developing the replacement beverage because it is a rich source of nutrition. Individual suffering from lactose intolerance plant based beverage are beneficial for those people.The viability of probiotic bacterial culture increased by chickpea flour. Result to decrease in pH of yoghurt during stowage, strengthen the protein network thus increased viscosity.

Keywords: Chickpea, applications, bioactive compounds, technological processes.

INTRODUCTION

Throughout the world pulses are widely cultivated crops since ancient time. They are rich source of micronutrients, dietary fiber, and protein and have numerous health benefits. For maintainable future pulses are described as nutritional seeds and the year 2016 was professed as the International year of pulses. For their protein requirement vegetarian people dependent on pulses. In developing countries, pluses in combination with cereals are extensively consumed as an essential diet [1, 2].Vegetarian peoples who cannot afford animal protein chickpea is inexpensive and significant source of protein [3].Additionally, chickpea is a good source of unsaturated fatty acid, minerals, and β-carotene. Important role in sustaining the soil fertility by fixing the nitrogen at the rate of up to 140 Kg/ha/year Chickpea relatively required low amount of nitrogen as it derives 70 percent of nitrogen of its N through symbiotic N2 fixation and benefits other cereal crops as well. For dry land crop production chickpea was found to be superior due to an adaptive root distribution. Chickpea and pea under drought stress dry matter yield reduced by 36.4, 23.9 and 14.5%, respectively [4, 5].

Production of Chickpea

In the world, India is the largest country in chickpea production with a share of about 66.19% and contributes 86.03% to Asia's total chickpea production. In the world after pulse crop, chickpea is the second most widely cultivated crop [6]. In the world total cultivated area under pulse crop in the year 2018 was 95.76 million hectares out of which 17.81 million hectares are covered under chickpea cultivation. Worldwide chickpea in 2018 was 17.19 million tones which account for 18.63% of total pulse production. Total global pulse production in India 27.53% and in Asia 59.67% [7, 8, 9].

Bioactive compounds in Chickpea

The presence of bioactive components in chickpea has a several health benefits. In chickpea the chief phytochemicals comprise of flavonoids, phenolic acids, lignin, stableness and carotenoids. Chickpea variety as compared to Kabuli antioxidant compounds

in greater amount. Against the damage caused by reactive oxygen species in living species that are formed as a result of successive single electron reduction of molecular oxygen these antioxidant compounds are accountable for providing the protection system[10].

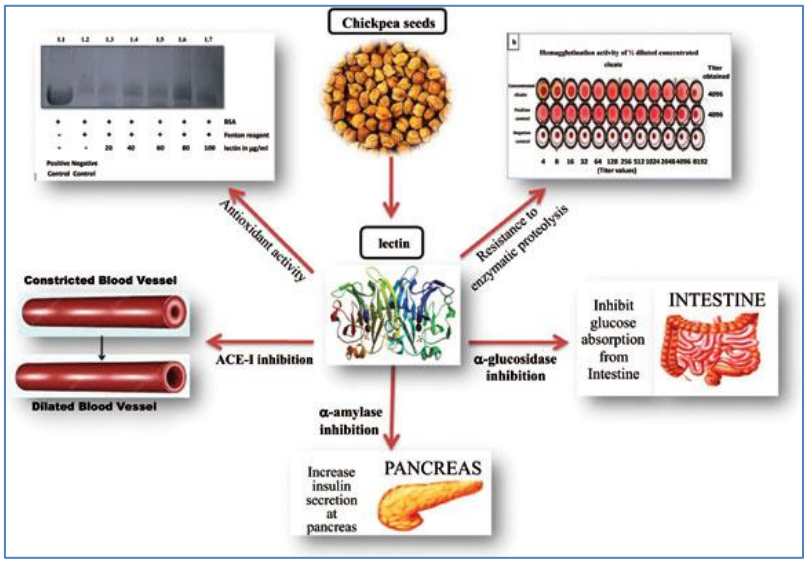

Fig-1: Shows the biochemical composition and bioactivities by chickpea

In chickpea, majority of phenolic and flavonoids are present in seed coat in concentrated form and levels of these as flavonoid, total phenolic, and antioxidant activity respectively lower [11]. As compared to other phenolic acids and flavonoids chlorogenic and quercetin are found higher concentration. Carotenoids mainly xanthophyll cryptoxanthin and beta carotene all these compound extract from chickpea seeds. Carotenoids are of great significance as they increase the bio-availability of iron in human body by acting as promoters of iron absorption. Canthaxanthin is found to have anti-cancerous and anti-tumor properties [12, 13].

Technological Aspects of Chickpea for Traditional and Novel Food Uses

In development of chickpea based bread these characteristic of chickpea protein plays a role. Its imparts high specific volume to the bread apart improving the nutritional characteristic. Adding of chickpea flour in free from gluten batter resulted in an increase in storage of modulus and decrease in cohesiveness was observed during chickpea bread storage [14, 15].

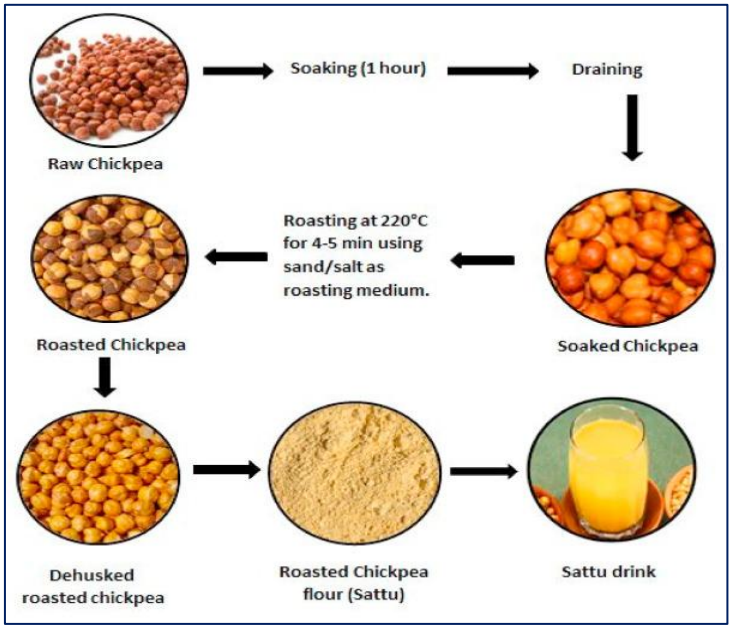

Fig-2: Shows the technological aspects of chickpea for traditional and novel food uses

For making bread, adding chickpea flour to the wheat in dough mixture, affects rheological properties of the dough. Chickpea wheat flour dough indicated that with water absorption capacity of the dough was found to increase with increase in the level of chickpea flour whereas there was decrease in dough development and stability. The amount of gluten decreased with the increase in the ratio of chickpea flour resulting in weaker dough. Observed from extenso-graph incorporation of chickpea flour resulted in increased dough extensibility. Partial substitution of wheat flour by chickpea flour (30%) in bread making resulted in enhanced rheological belongings [16, 17].

For preparation of various traditional food products like thin pancake, deep fat fried spherical droplets, and steamed savory cake dehisced chickpea flour is used in the form of batter in the water. For making thick chickpea batter appropriate amount of water is added and continuously stirring. To impart taste different flavors are added to prepare fragilities obtained from use of batter. Rheological properties of the chickpea four suspension and additives effect on its properties studied by reported and researchers elsewhere. Decrease with an increase in shear rate superficial viscosity of 40 percent flour of chickpea suspension [18, 19, 20].

In case of chickpea protein isolation this shear thinning behavior has also been studied. This phenomenon takes place due to the shear forces resulting in breakdown of agglomerated particles. Chickpea suspension categorized as non-Newtonian fluid. In the preparation of traditional fried food products addition of salt in the batter, provides better flow properties. This is due to the plasticization effect of the salt [21, 22].

The salt soluble fraction of chickpea protein, which is globulin, gets solubilized to greater extent with increase in salt concentration thus decreasing the viscosity by adding it to the continuous phase. To get flour of chickpea suspension droplets are deep fried in oil. Simultaneous transfer of heat and mass is a frying process. During this process oil is a medium for transfer of heart to food surface convection and towards the center by conduction, migration of fat into food, moisture migrate out through cavities [23, 24, 25, 26].

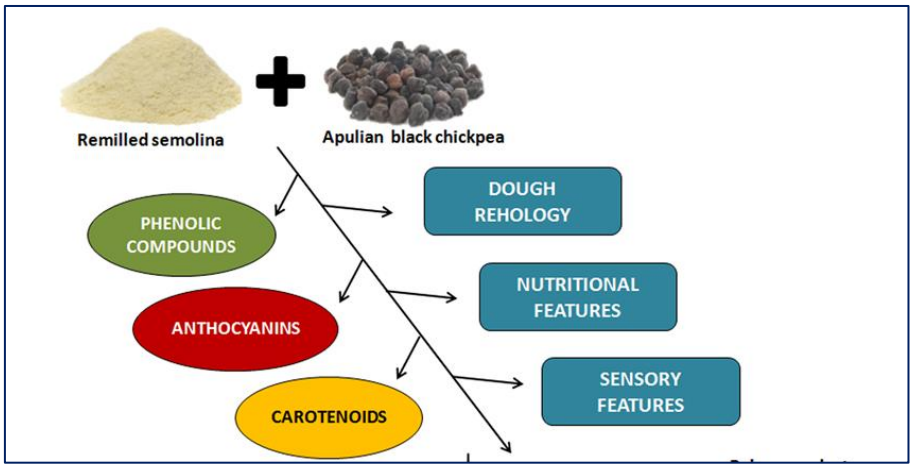

Fig-3: Shows the nutritional importance of chickpea with combination of remilled semolina

During frying quality of final product affected by the batter concentration and in batter quality of product in term of firmness, oil less uptake, uniformity and oily mouth feel, it had been 40-42% concentration observed. Transferring the fried boondi into hot sugar syrup boondi for this purpose additional processed into spiced or sweet boondi needed reserved for some time for sugar impregnation. Then into small balls, commonly called as Ladoo from the sweetened boondi. As a prasad served on religious events. In India besan ladoo, and boondi lado are commonly offered as festive treats. On the other hand, spiced boondi is also commonly used to serve large meal after the addition into the crud and is known as boondi raita. Another name of roasted chickpea is sattu, in the summer consumed as a drink and it cause cooling effect on body of human [27, 28].

By mixing with milk it also consumed in slurry form and useful for those people which suffering from gastrointestinal ulcer. Due to low cost high nutritional value and several health benefits it is popular in people. It has different formulation that consists of pulses and cereals. Flours of germinated pulse and cereal incorporated to increase the nutritional properties of sattu. To sattu drink lime juice, spices, salt and sugar flavors are added [29, 30].

Thermal and physical properties of roasted chickpea flour found to be affected by the particle size of flour and moisture content. Flow ability of roasted chickpea flour was reduced, bulk density and true density increase at higher moisture content. With increase in moisture content thermal conductivity increase. With decrease in particle size specific heat

increase significantly. With increase in moisture content particle size reduced, thermal diffusivity of roasted chickpea flour was found to increase [31, 32, 33].

To improve nutritional value chickpea flour is used in different food items like pasta, dairy products like yoghurt, bread and biscuit. Ready to eat snack food it is also used mainly the extruded products. Durum wheat is used in preparation of widely consumed food products. Significant decrease in glycemic index and increase in protein, mineral content and fat with addition of 25% chickpea flour in pasta [34-38].

In another observation pasta reduced the cooking time water absorption and increased adhesiveness with addition of chickpea flour. With increase chickpea flour level, the glycemic index decrease. De-hulled chickpea flour enhances the cooking quality and the utilization of whole chickpea flour in pasta decrease the cooking quality. Differential scanning calorimetric results of composite pasta and semolina pasta made of chickpea flour and semolina showed that degree of starch gelatinization was lower in chickpea as compared to semolina incorporated pasta. This is mainly due to the protecting influence exerted by the matrix formed by non-starch polysaccharides, protein, and fat present in in flour of chickpea [39-42].

The translational stage of weaning children leads to Protein Energy Malnutrition (PEM) if mother's milk is shifted to nutritionally imbalanced food. Effective weaning foods are required to prevent the childhood malnutrition that is nutritious and inexpensive at the same time. The whole chickpea grain utilization for the production of infant formula has already been investigated. Chickpea germination followed by drying, dulling, and boiling can be suitable technique for preparing infant follow on formula with vitamin and mineral fortification [43-49].

Skimmed milk powder and sugar mixed with extruded flour of chickpea and maize can also be utilized as weaning food. It is found to have increased in-vitro digestibility of protein and starch. Roller dried or popped malted barley and chickpea have also been used in the improvement of weaning foods [50].Due to shift towards veganism increase in demand of plant base milk. For cow's milk legumes are consider as a potential substitute. Plant based soy milk beverage available in the marketplace is the most common [51-52].

CONCLSION

As compared to other substitute plant based milk using coconut and chickpea is a good nutritional profile, especially high calcium and protein level. In term of nutritional quality and sensory profile 30% coconut extract and 70% chickpea extract gave batter results. For substituting cow milk and soy milk fresh and fermented chickpea beverage also has potential. In the development of stirred bio yoghurt chickpea flour utilized as prebiotic and thickening agent. Combination of chickpea flour in stirred bio yoghurt resulted that viscosity increased and antioxidant activity improved.

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