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Review Article

Agriculture and Plant Sciences Based Aspects of Chickpea and Its Importance as a Potential Crop in Plant Sciences

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Abstract

The pulses such as chickpeas or garbanzo beans, lentils and the dry peas, are progressively being documented for their major role in health promotion. Chickpea is reflected as a unique due to the presence of higher level of protein (40%) in it. The drought stress is the major cause of reduction of growth of plants by disturbing the molecular, physiological and the biochemical processes like ion uptake, respiration, signaling pathways, photosynthesis, and induction of hormones, nitrogen assimilation, carbohydrates and the amino acids metabolisms. Nonstop decrease in the productivity of chickpea is indorsed to inadequate genetic variations and the different stresses. Chickpeas comprise a soluble fiber called raffinose, a kind of oligo-saccharide which is fermented in colon through the useful bacteria called the *Bifidobacterium*. There are some earliest investigations which demonstrate that the individuals eating chickpeas can lesser their danger for diabetes. Chickpeas also play a vital role in the diet of those people who are effected by osteoporosis for its prevention. The protein ratio to starch can be adjusted to target definite textural characteristics of textured pea-protein to closely mimic the various products of meat such as chicken, beef and fish. . Not only do chickpeas produce a valued crop but at the same time they also are responsible for a natural organic technique of breaking disease cycle in barley and wheat crops.

Keywords: Proteins, composition, agricultural aspects, wheat crops, biomedical importance.

INTRODUCTION

The pulses such as chickpeas or garbanzo beans, lentils and the dry peas, are progressively being documented for their major role in health promotion [1-3]. Scientists have stated that the pulses consumption on regular bases reduces the risks of diseases like heart disease, cancer and diabetes. Pulses are useful, easy to make ingredient which can be utilized in appetizers, breads, desserts and salads [4-7]. Chickpea has capability to make certain biologically active materials generally reflected as anti nutritional elements which disturb the humans and animals diet. In chickpeas tannic acid is present which hinders trypsin, lipase, amylase and chymotrypsin activities. The chickpea is the most primitive cultivated legume, remains as old as 7,500 years were discovered in Middle-East. Domestic chickpeas have been discovered in the Neolithic-pottery in some regions of Turkey. Amid pulses, the chickpea is favored to diet pulses in the some areas because of chickpeas uses. Chickpea is reflected as a unique due to the presence of higher level of protein (40%) in it [8, 9].

Table-1: Shows the nature of compounds, characteristics and mechanism of action

Compounds	Aspects	Characteristics and action against disease	Mechanism of action	References
Water	Biological	Maintains the reactions in biological systems	Biochemical	[8]
Proteins	Agriculture	These involved to maintains pH , growth	Biological	[11]
Fibers	Agriculture	These are helpful for digestion	Biochemical	[14]
Fats	Agriculture	Maintains the myelin sheath layer	Biochemical	[17]
Acids	Agriculture	As antioxidant	Molecular	[19]
Sugars	Agriculture	Antifungal	Biochemical	[7]
Carbohydrates	Agriculture	Anticancer, antifungal, anticancer	Cellular	[19]
DPPH activity	Biological	Capturing the free radicals	Molecular	[10]
Insoluble compounds	Biomedical	Water transport, fluid maintains	Biochemical	[18]
Lipids	Agriculture	Role in cell signaling and energy reservoirs	Biochemical	[19]

Agricultural and Plant based protein Aspects

Chickpeas are major plant based protein source, making them favorite for those do not like animal products. Conversely, a fine genetic base of grown chickpea (Cicer arietinum L.) has minimized the growth in understanding higher yield seeds in the breeding agendas. Moreover, many biotic and abiotic stresses are main holdups for increasing productivity of chickpea [10, 11]. Nonstop decrease in the productivity of chickpea is indorsed to inadequate genetic variations and the different stresses. Chickpea and many other pulses are extremely vulnerable to the terminal-drought-stress. Transgenic chickpea lines sheltering transcriptional factors, DREB (Dehydration Responsive Element-Binding) protein-1A from the Arabidopsis thaliana compelled by the stress-inducible-promoter (rd29a) were established, with intending to enhance drought lenience in the chickpea [12-14].

Chickpeas comprise a soluble fibre called raffinose, a kind of oligo-saccharide which is fermented in colon through the useful bacteria called the Bifidobacterium. As the bacteria breakdown this fibre, a small chain fatty-acid called butyrate is formed [15, 16].

The chickpeas glycemic index is 28 that is on inferior end. And that one reason it doesn't spike your blood sugar levels. There are some earliest investigations which demonstrate that the individuals eating chickpeas can lesser their danger for diabetes [17, 18].

Agricultural importance and Composition

In the chickpeas many of the nutrients are present like calcium and iron, all these nutrients helps in healthy bone structure and also strengthen the bones. Chickpeas also play avital role in the diet of those people who are affected by osteoporosis for its prevention [19]. Like other legume crops the chickpea also have symbiotic relation with the N_2 fixing bacteria and this crop help to improve the growth and yield of succeeding crops [20].

The drought stress is the major cause of reduction of growth of plants by disturbing the molecular, physiological and the biochemical processes like ion uptake, respiration, signaling pathways, photosynthesis, and induction of hormones, nitrogen assimilation, carbohydrates and the amino acids metabolisms [21, 22].

Many of the growth parameters like leaf area are influenced by the various growth promotors in legume crops. The plant growth regulators had an influence on the plant which exhibited the similar values of leaf area dry matter, nitrate assimilation rate, crop growth rate, leaf area index, and TDM over the controlled plant. CGR, AGDM (average dry matter), NAR and LAI had significant linear relationship with the grain yield [23]. The retention of bud was greater significantly when plant growth regulators were applied twice. Furthermore, on time application of tri-acontanol or with KNO_3 improves setting of pods, biomass, 100 grains weight, seed yield and harvest index at ha. The collective apply of 50kg P_2O_5+20kg/ha with FYM and PGR mainly tri-acontanol increases the productivity of seed, seeds protein and the protein yield [24]. The chickpea has important role in diet of vegetarian for the thousands of years.

Fig-1: Shows the differences in color on the basis of pigmentation

Pea-protein is mixed with the accumulative levels of flour of chickpea to form a textured plant protein item by the use of extrusion-technology [25, 26]. The protein ratio to starch can be adjusted to target definite textural characteristics of textured pea-protein to closely mimic the various products of meat such as chicken, beef and fish [27-29].

In the earlier times chickpeas were used as a perfect diet [30]. The Roman Empire's important agricultural proficient, Columella, observed that the crops cultivated after chickpea harvest gives more yield – this understanding is accredited with increasing production of crop all over the Roman Empire and out there. Researchers would discover late that the chickpeas help to raise N_2 level in the soil, hence profiting whatever is cultivated after chickpeas [31-33].

CONCLUSION

Production of chickpeas faces numerous challenges due to several abiotic stresses like drought, and the lower and higher temperatures. Chickpeas are agricultural miracle. Not only do chickpeas produce a valued crop but at the same time they also are responsible for a natural organic technique of breaking disease cycle in barley and wheat crops. This means a smaller amount insecticide and less fungicide, subsequent in a clean, green environment.

REFERENCES

1. Paredes- López, O., Ordorica- Falomir, C., & Olivares- Vázquez, M. R. (1991). Chickpea protein isolates: physicochemical, functional and nutritional characterization. Journal of Food Science, 56(3), 726-729.
2. Kaur, M., & Singh, N. (2007). Characterization of protein isolates from different Indian chickpea (Cicer arietinum L.) cultivars. Food Chemistry, 102(1), 366-374.
3. Aurelia, I., Iuliana, A., Aura, D., Gabriela, G., Cristina, B., & Andrei, N. (2009). Chemical and functional characterization of chickpea protein derivates. The Annals of the University of Dunarea de Jos of Galati. Fascicle VI. Food Technology, 33, 16.
4. Clemente, A., Vioque, J., Sánchez-Vioque, R., Pedroche, J., Bautista, J., & Millán, F. (1999). Protein quality of chickpea (Cicer arietinum L.) protein hydrolysates. Food Chemistry, 67(3), 269-274.
5. Zhang, T., Jiang, B., & Wang, Z. (2007). Gelation properties of chickpea protein isolates. Food Hydrocolloids, 21(2), 280-286.
6. Torres-Fuentes, C., Alaiz, M., & Vioque, J. (2011). Affinity purification and characterisation of chelating peptides from chickpea protein hydrolysates. Food Chemistry, 129(2), 485-490.
7. Zhang, T., Jiang, B., Mu, W., & Wang, Z. (2009). Emulsifying properties of chickpea protein isolates: Influence of pH and NaCl. Food Hydrocolloids, 23(1), 146-152.
8. Pedroche, J., Yust, M. M., Girón- Calle, J., Alaiz, M., Millán, F., & Vioque, J. (2002). Utilisation of chickpea protein isolates for production of peptides with angiotensin I- converting enzyme (ACE)-inhibitory activity. Journal of the Science of Food and Agriculture, 82(9), 960-965.
9. Papalamprou, E. M., Doxastakis, G. I., Biliaderis, C. G., & Kiosseoglou, V. (2009). Influence of preparation methods on physicochemical and gelation properties of chickpea protein isolates. Food Hydrocolloids, 23(2), 337-343.
10. Kharkwal, M. C. (1998). Induced mutanons for improvement of protein in chickpea (Cicer arietinum L.). The Indian Journal of Genetics and Plant Breeding, 58(1), 61-68.
11. Yust, M. D. M., Millán- Linares, M. D. C., Alcaide- Hidalgo, J. M., Millán, F., & Pedroche, J. (2012). Hypocholesterolaemic and antioxidant activities of chickpea (Cicer arietinum L.) protein hydrolysates. Journal of the Science of Food and Agriculture, 92(9), 1994-2001.
12. Boye, J. I., Aksay, S., Roufik, S., Ribéreau, S., Mondor, M., Farnworth, E., & Rajamohamed, S. H. (2010). Comparison of the functional properties of pea, chickpea and lentil protein concentrates processed using ultrafiltration and isoelectric precipitation techniques. Food Research International, 43(2), 537-546.
13. Hameed, A., Shah, T. M., Atta, B. M., Iqbal, N., Haq, M. A., & Ali, H. (2009). Comparative seed storage protein profiling of Kabuli chickpea genotypes. Pak. J. Bot, 41(2), 703-710.
14. Chang, Y. W., Alli, I., Molina, A. T., Konishi, Y., & Boye, J. I. (2012). Isolation and characterization of chickpea (Cicer arietinum L.) seed protein fractions. Food and Bioprocess Technology, 5(2), 618-625.
15. Wang, J., Korber, D. R., Low, N. H., & Nickerson, M. T. (2014). Entrapment, survival and release of Bifidobacterium adolescentis within chickpea protein-based microcapsules. Food research international, 55, 20-27.
16. Osman, A. O., Mahgoub, S. A., & Sitohy, M. Z. (2014). Hindering milk quality storage deterioration by mild thermization combined with methylated chickpea protein. International Food Research Journal, 21(2).
17. Fernandez, M. L., & Berry, J. W. (1988). Nutritional evaluation of chickpea and germinated chickpea flours. Plant Foods for Human Nutrition, 38(2), 127-134.
18. Mousazadeh, Morad, Mohammad Mousavi, Gholamreza Askari, Hossein Kiani, Isabelle Adt, and Adem Gharsallaoui. "Thermodynamic and physiochemical insights into chickpea protein-Persian gum interactions and environmental

effects." International journal of biological macromolecules 119 (2018): 1052-1058.
19. Moser, P., Ferreira, S., & Nicoletti, V. R. (2019). Buriti oil microencapsulation in chickpea protein-pectin matrix as affected by spray drying parameters. Food and Bioproducts Processing, 117, 183-193.
20. Tavano, O. L., Neves, V. A., & da Silva Júnior, S. I. (2016). In vitro versus in vivo protein digestibility techniques for calculating PDCAAS (protein digestibility-corrected amino acid score) applied to chickpea fractions. Food Research International, 89, 756-763.
21. Deep Singh, G., Wani, A. A., Kaur, D., & Sogi, D. S. (2008). Characterisation and functional properties of proteins of some Indian chickpea (Cicer arietinum) cultivars. Journal of the Science of Food and Agriculture, 88(5), 778-786.
22. Felix, M., Cermeño, M., & FitzGerald, R. J. (2020). Influence of Hydrolysis on the Bioactive Properties and Stability of Chickpea-Protein-Based O/W Emulsions. Journal of Agricultural and Food Chemistry, 68(37), 10118-10127.
23. Wali, A., Mijiti, Y., Yanhua, G., Yili, A., Aisa, H. A., & Kawuli, A. (2021). Isolation and identification of a novel antioxidant peptide from chickpea (Cicer arietinum L.) sprout protein hydrolysates. International Journal of Peptide Research and Therapeutics, 27, 219-227.
24. Serventi, L., Vittadini, E., & Vodovotz, Y. (2018). Effect of chickpea protein concentrate on the loaf quality of composite soy-wheat bread. LWT, 89, 400-402.
25. Indurker, S., Misra, H. S., & Eapen, S. (2007). Genetic transformation of chickpea (Cicer arietinum L.) with insecticidal crystal protein gene using particle gun bombardment. Plant cell reports, 26(6), 755-763.
26. Moser, P., Nicoletti, V. R., Drusch, S., & Brückner-Gühmann, M. (2020). Functional properties of chickpea protein-pectin interfacial complex in Buriti oil emulsions and spray dried microcapsules. Food Hydrocolloids, 107, 105929.
27. Verma, M. M., Ledward, D. A., & Lawrie, R. A. (1984). Utilization of chickpea flour in sausages. Meat Science, 11(2), 109-121.
28. Indurker, S., Misra, H. S., & Eapen, S. (2010). Agrobacterium-mediated transformation in chickpea (Cicer arietinum L.) with an insecticidal protein gene: optimisation of different factors. Physiology and Molecular Biology of Plants, 16(3), 273-284.
29. Mhadhbi, H., Jebara, M., Limam, F., & Aouani, M. E. (2004). Rhizobial strain involvement in plant growth, nodule protein composition and antioxidant enzyme activities of chickpea-rhizobia symbioses: modulation by salt stress. Plant Physiology and Biochemistry, 42(9), 717-722.
30. Tavano, O. L., & Neves, V. A. (2008). Isolation, solubility and in vitro hydrolysis of chickpea vicilin-like protein. LWT-Food Science and Technology, 41(7), 1244-1251.
31. Muszyński, S., Tomaszewska, E., Dobrowolski, P., Kwiecień, M., Wiącek, D., Świetlicka, I., ... & Tomczyk-Warunek, A. (2018). Analysis of bone osteometry, mineralization, mechanical and histomorphometrical properties of tibiotarsus in broiler chickens demonstrates a influence of dietary chickpea seeds (Cicer arietinum L.) inclusion as a primary protein source. PLoS One, 13(12), e0208921.
32. Mazid, M. (2014). Seed priming application of gibberellic acid on growth, biochemical, yield attributes and protein status of chickpea (Cicer arietinum L. cv. DCP 92-3). International Journal of Genetic Engineering and Biotechnology, 5(1), 17-22.
33. Devi, S., Varkey, A., Dharmar, M., Holt, R. R., Allen, L. H., Sheshshayee, M. S., & Kurpad, A. V. (2020). Amino acid digestibility of extruded chickpea and yellow pea protein is high and comparable in moderately stunted South Indian children with use of a dual stable isotope tracer method. The Journal of nutrition, 150(5), 1178-1185.