

**CURRENT KNOWLEDGE AND FUTURE PERSPECTIVES ON CHICKPEA
PROTEIN-DERIVED METAL-CHELATING PEPTIDES**

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Chickpea (*Cicer arietinum* L.) is a valuable plant protein source containing peptides that can interact with metal ions and can serve as a functional ingredient for mineral supplementation. This review summarizes the literature on metal-chelating peptides and peptide-metal complexes obtained from chickpea protein hydrolysates, focusing on their enzymatic production, purification, structural properties, metal-binding, and biological activity.

Initial studies focused on copper-chelating peptides. Chickpea protein hydrolysates prepared using Alcalase® and Flavourzyme® were subjected to copper affinity chromatography, resulting in peptide fractions with high Cu²⁺ ion chelation and antioxidant activity. It was found that the purified fractions were rich in histidine, and that peptide size and amino acid sequence also affected the activity. Subsequent hydrolysis with pepsin and pancreatin followed by affinity and gel-filtration chromatography demonstrated particularly high Cu²⁺-chelating activity in small peptides containing approximately 20-30% histidine. Similar approaches were subsequently applied to iron, with purified chickpea peptide fractions exhibiting enhanced Fe-chelating activity, particularly in fractions containing more than 20% histidine.

More recent studies have expanded chickpea peptide-metal systems to vanadium and zinc. Vanadium complexes generated using papain, trypsin, and Alcalase® contained nine identified peptides with molecular masses of approximately 437-1864 Da and demonstrated inhibitory activity against A549 lung cancer cells. Zinc-binding studies using tryptic chickpea protein hydrolysates identified eleven peptides by chromatographic and mass-spectrometric approaches, including the histidine-containing sequence HKERVQLHIPTAVGK, demonstrating the transition from activity-based peptide fractions toward structurally characterized peptide-metal complexes. Calcium-binding peptides from this plant are relatively underexplored. Papain-generated chickpea peptide-calcium chelates have demonstrated chelation capacity, stability, and antioxidant activity; however, the identities of the individual peptides and their detailed calcium-coordination mechanisms remain insufficiently characterized.

Overall, chickpea proteins represent a promising source of multifunctional metal-chelating peptides. Metal-binding properties appear to depend on protease specificity, hydrolysis conditions, molecular size, histidine content, amino-acid composition, and peptide sequence, while the coordinated metal may influence biological activity. Further integration of peptide purification, high-resolution LC-MS/MS, structural characterization, gastrointestinal stability, and bioavailability studies is needed to establish relationships between structure and metal-binding activity and facilitate the development of chickpea-derived peptide-mineral complexes for functional foods and nutraceutical applications.