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THE ROLE OF PROTEIN DENATURATION IN FOOD CHEMISTRY AND BIOLOGICAL SYSTEMS

Harris, N. C.
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Abstract: Protein denaturation is a fundamental biochemical process involving structural changes in protein molecules without breaking primary peptide bonds. It plays an important role in food processing, enzyme inactivation, digestion, and pathological conditions. This study analyzes the mechanisms and consequences of protein denaturation in food chemistry and biological systems. The findings indicate that temperature, pH, salts, organic solvents, and mechanical stress can alter protein structure and function.
Keywords: protein denaturation, food chemistry, enzymes, biological systems, thermal processing

Introduction

Proteins maintain their biological function through specific three-dimensional structures. Denaturation disrupts secondary, tertiary, or quaternary structures and changes solubility, enzymatic activity, and nutritional properties. In food chemistry, denaturation can improve digestibility and texture but may also reduce biological activity. In living systems, abnormal protein denaturation is associated with cellular stress and disease.

Materials and Methods

Scientific literature on protein chemistry, food processing, and cell biology was reviewed. Mechanisms of thermal, chemical, and mechanical denaturation were analyzed. Examples from milk, meat, eggs, enzymes, and cellular proteins were included.

Results

Thermal processing caused unfolding and aggregation of proteins. Acidic and alkaline conditions altered charge distribution and solubility. Enzymes lost catalytic activity after structural disruption. In food products, denaturation changed texture, water-binding capacity, and digestibility. In biological systems, protective chaperone proteins helped prevent harmful aggregation.

Discussion

Protein denaturation has both beneficial and harmful effects depending on context. In food technology, controlled denaturation improves product quality and safety. In cells, uncontrolled denaturation may impair function and activate stress responses. Understanding denaturation mechanisms is important for biotechnology, nutrition, and medicine.

Conclusion

Protein denaturation is a key process in food chemistry and biological systems. It influences enzyme activity, nutritional quality, texture, and cellular function. Controlled management of denaturation processes has practical importance in food technology and biomedical research.

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