Title: Extensive inhibition of starch digestion by exogenous proteins and inhibition mechanisms: A comprehensive review

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Abstract: The rapid digestion of starch is closely related to the high risk of diet-related illnesses. In recent years, the combination of starch with other nutrients has been a widespread approach to suppress starch digestion. Particularly, exogenous proteins attract extensive attention due to their diverse options and compelling ability to inhibit starch digestion. Whilst exogenous proteins have widely been reported to inhibit starch digestion, systematic discussion regarding the inhibition mechanisms is scarce. After summarizing and categorizing the factors affecting the inhibition of starch digestion by exogenous proteins, this review delves into the inhibition mechanisms from the food processing stage to the enzymatic digestion stage, as well as highlights the intermolecular interactions. Exogenous proteins effectively suppress the rapid digestion of starch, offering the potential to reduce postprandial blood glucose levels. The inhibitory effect is contingent upon the structure of exogenous proteins. Pretreatment of exogenous proteins and processing of food systems enhance the inhibitory effect by modulating the structure and properties of the proteins. During food processing, exogenous proteins adhere to the surface of starch granules and form continuous networks in the starch matrix, inhibiting starch gelatinization, improving starch ordered structure, and changing food system micromorphology. Into enzymatic digestion, exogenous proteins block the enzyme attack on starch through maintained protein barriers and elevated food compactness and/or reduce enzyme activities by binding to enzyme active sites or enzyme-substrate complexes. Notably, protein-starch and protein-enzyme interactions play fundamental roles in the inhibition of starch digestion by exogenous proteins.

Keywords: Starch digestion, Exogenous proteins, Inhibition mechanisms, Postprandial blood glucose, Food processing, Enzymatic digestion

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