Poster Presentation

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Brazzein and structurally similar proteins: structural/functional comparisons

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Brazzein, a 6.5-kDa protein consisting of 54 amino acids and four disulfide bonds, is the smallest sweet-tasting protein yet isolated from the wild African plant Pentadiplandra brazzeana. Brazzein has various desirable properties for use as a low-calorie sweetener in the diets of individuals suffering from diabetes, obesity, and metabolic syndrome. For example, brazzein has a high water solubility and a high thermostability. In addition, brazzein is 2000-times sweeter than sucrose on a weight basis. Both the solution and crystal structures of brazzein have been reported. In the crystal structure [1], brazzein has a defensin-like fold containing two α-helices and a three-stranded antiparallel β-sheet. Defensins are small cysteine-rich cationic proteins found in both animals and plants, which function by binding to the microbial cell membrane, and, once embedded, forming pore-like membrane defects that allow efflux of essential ions and nutrients. In fact, Yount and Yeaman reported that brazzein has antimicrobial activity against Gram positive (Bacillus subtilis and Staphylococcus aureus) and negative (Escherichia coli) bacteria and a fungus (Candida albicans) at pH 7.5 rather than pH 5.5 [2]. A search for proteins with a similar backbone fold to brazzein using the DALI server shows that structurally similar proteins to brazzein include plant defensins, scorpion neurotoxins (K+ channel blockers), arthropod defensins, mollusc defensins, mold defensins, and a plant trypsin inhibitor. These proteins commonly have a γ-core sequence. Here we compare their sequences, structures and functions, which has led to a conclusion that the C-terminal half of brazzein is important for its antimicrobial activity, brazzein will not have a neurotoxin activity, and it will not act as a trypsin inhibitor.

[1] *Nagata, K. et al. Acta Crystallogr. D69, 642-647 (2013).,* ***[2]*** *Yount, N. Y. and Yeaman, M. R. Proc. Natl. Acad. Sci. USA 101, 7363-7368 (2004).*

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