Cranberry proanthocyanidin-chitosan hybrid nanoparticles as a potential inhibitor of extra-intestinal pathogenic Escherichia coli invasion of gut epithelial cells

Emilia Alfaro-Viquez, Daniel Esquivel-Alvarado, Sergio Madrigal-Carballo, Christian G. Krueger, Jess D. Reed

PII: S0141-8130(17)34737-2
DOI: https://doi.org/10.1016/j.ijbiomac.2018.01.033
Reference: BIOMAC 8865

To appear in:

Received date: 28 November 2017
Revised date: 3 January 2018
Accepted date: 5 January 2018

Please cite this article as: Emilia Alfaro-Viquez, Daniel Esquivel-Alvarado, Sergio Madrigal-Carballo, Christian G. Krueger, Jess D. Reed , Cranberry proanthocyanidin-chitosan hybrid nanoparticles as a potential inhibitor of extra-intestinal pathogenic Escherichia coli invasion of gut epithelial cells. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Biomac(2017), https://doi.org/10.1016/j.ijbiomac.2018.01.033

Cranberry Proanthocyanidin-Chitosan Hybrid Nanoparticles as a Potential Inhibitor of Extra-Intestinal Pathogenic *Escherichia coli* Invasion of Gut Epithelial Cells

Emilia Alfaro-Viquez[1,2], Daniel Esquivel-Alvarado[2], Sergio Madrigal-Carballo[2(*)], Christian G. Krueger[2], Jess D. Reed[1,2]

[1] Material Sciences & Engineering, University of Wisconsin-Madison, 1415 Engineering Dr, Madison WI 53706, United States. [2] Reed Research Group, Department of Animal Sciences, University of Wisconsin-Madison, 1675 Observatory Dr, Madison WI 53706, United States.

(*) Corrresponding author: Sergio Madrigal-Carballo, sergio.carballo@wisc.edu

Abstract

Chitosan interacts with proanthocyanidins through hydrogen-bonding, which allows encapsulation and development of stable nanoparticles via ionotropic gelation. Cranberry proanthocyanidins (PAC) are associated with the prevention of urinary tract infections and PAC inhibit invasion of gut epithelial cells by extra-intestinal pathogenic *Escherichia coli* (ExPEC). We determined the effect of cranberry proanthocyanidin-chitosan hybrid nanoparticles (PAC-CHTNp) on the ExPEC invasion of gut epithelial cells *in vitro*. PAC-CHTNp were characterized according to size, morphology, and bioactivity. Results showed a decrease in the size of the nanoparticles as the concentration of PAC was increased, indicating that PAC increases cross-linking by hydrogen-bonding on the surface of the chitosan nanoparticles. Nanoparticles were produced with diameters ranging from 367.3 nm to 293.2 nm. Additionally, PAC-CHTNp significantly inhibited the ability of ExPEC to invade the enterocytes by ~80% at 66 µg GAE/mL and by ~92% at 100 µg GAE/mL. Results also indicate that chitosan nanoparticles alone were not significantly different from controls in preventing ExPEC invasion of enterocytes (data not shown) and also there were not significant differences between PAC alone and PAC-CHTNp, suggesting that the new PAC-CHTNp could lead to an increase in the stability of encapsulated PAC, maintain the molecular adhesion of PAC to ExPEC.