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Abstract

Effect of Silicon-Enriched Meat Consumption on Proximal Colonic Antioxidant Status of Late-Stage T2DM Rats †

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† Presented at the 2nd International Electronic Conference on Nutrients, 15–31 March 2022; Available online: https://iecn2022.sciforum.net/.

Abstract: Colonic mucosa exhibits numerous functional alterations associated to type 2 Diabetes Mellitus (T2DM). Oxidative stress, a factor involved in T2DM pathogenesis and its complications, may contribute to some of the colonic alterations. Silicon (Si) is a trace element with antioxidant, anti-inflammatory and anti-diabetic effects. In this study, we examined if the intake of soluble G^5 organic Si (2 mg/kg b.w./day) as a functional ingredient might enhance the antioxidant status of proximal colonic mucosal barrier in late-stage T2DM rats. A control restructured meat matrix (RM) included in a high saturated-fat hypercholesterolemic diet (HSFHCD-RM) and combined with low-dose streptozotocin plus nicotinamide was used to induce T2DM. Sixteen diabetic rats were divided in two groups and received different experimental diets for 8 weeks: LD group fed a HSFHCD-RM, and LD-Si group fed a Si-enriched RM (HSFHCD-Si-RM). We evaluated Si effects on the immunolocalizations and activities of antioxidant enzymes in proximal colonic mucosa. Compared to LD-group mucosa, LD-Si group showed stronger immunoreactivities in Cu, Zn-superoxide dismutase (SO1) (4.63 ± 0.02 vs. 1.5 ± 0.03; 626%, $p = 0.00001$), Mn-superoxide dismutase (SOD2) (3.63 ± 0.03 vs. 0.5 ± 0.05; 208.6%, $p = 0.0001$), catalase (CAT) (2.38 ± 0.03 vs. 0.75 ± 0.05, 131.51%, $p = 0.0001$), glutathione peroxidase (GPx) (3.25 ± 0.03 vs. 0.5 ± 0.05; 550.0%, $p = 0.0001$) and glutathione reductase (GR) (3.50 ± 0.05 vs. 2.56 ± 0.03; 36.75%, $p = 0.001$). Moreover, Si consumption led to higher total SOD (3.06 ± 0.42 vs. 2.53 ± 0.39; 20.94%, $p = 0.001$), CAT (34.10 ± 1.75 vs. 30.51 ± 1.81; 11.65%, $p = 0.01$) and GR (63.11 ± 13.22 vs. 51.46 ± 9.97; 22.60%, $p = 0.001$) activities; and lower GPx activity (191.82 ± 18.89 vs. 226.61 ± 20.07, 22.63%, $p = 0.001$). In summary, these results demonstrate the enhanced antioxidant status of the proximal colonic mucosa after Si intake in a late-stage T2DM model. Si effectively protected colonic mucosa against oxidative stress induced by T2DM. The incorporation of Si as a functional ingredient could be beneficial as a new nutritional tool to reverse colonic mucosa dysfunction associated to metabolic disorders, such as T2DM.

Keywords: silicon; functional meat; type 2 diabetes mellitus; antioxidant status; proximal colonic mucosa

Citation: Hernández-Martín, M.; Redondo, R.; Garcimartín, A.; Macho-González, A.; González-Muñoz, M.J.; Bastida, S.; Benedí, J.; Sánchez-Muniz, F.J.; Lopez-Oliva, M.E.; Bocanegra, A. Effect of Silicon-Enriched Meat Consumption on Proximal Colonic Antioxidant Status of Late-Stage T2DM Rats. **2022**, *69*, x. https://doi.org/10.3390/xxxxx

Academic Editor(s): Torsten Bohn

Published: date: 15 March 2022