Effects of Dietary Gingerol-Enriched Ginger Supplementation on Distribution of Colon Function Markers in Rats With Diabetic Neuropathic Pain

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Objectives: Inflammation and leaky gut may contribute to the pathogenesis of diabetic neuropathic pain (DNP). Ginger has been used in the treatment of a variety of pain disorders for its anti-inflammatory, antioxidant, and analgesic effects. We previously reported that gingerol-enriched ginger (GEG) supplementation suppressed the DNP-induced mRNA expression levels of claudin-3 (tight junction protein), PINK1 (autophagy marker), DRP1 (mitochondrial fission protein), and GFAP (astrocyte marker) in colons. Thus, this study was to further investigate the effects of GEG supplementation on the distribution of function markers in the colon of DNP rats.

Methods: Male Sprague-Dawley rats were assigned to three groups: low-fat diet (Control), high-fat diet (HFD)+ streptozotocin (DNP), and HFD + streptozotocin + 0.75% GEG w/w in diet (DNP + GEG). Colons were collected and preserved at -80 degrees. The localization and quantity of claudin-3, PINK1, DRP1, and GFAP in colons were determined by cryosectioning, immunohistochemistry and fluorescence confocal microscopy. The protein levels were quantified by the average fluorescence intensity in cross-sections of intestinal crypts within predetermined regions of interest (ROIs), normalized by the background ROI. The comparisons between groups were made using an unpaired t-test.

Results: Compared to the Control group, the DNP group had higher expression levels of claudin-3 (Control, $n = 6$; DNP, $n = 5$; $P < 0.005$), PINK1 (Control, $n = 7$; DNP, $n = 7$; $P < 0.05$), and DRP1 (Control, $n = 6$; DNP, $n = 7$; $P < 0.01$) in colons of animals. GEG supplementation into diets significantly suppressed DNP-induced expression levels of claudin-3 (DNP, $n = 7$, DNP + GEG, $N = 6$; $P < 0.05$), PINK1 (DNP, $n = 7$, DNP + GEG, $n = 5$; $P < 0.05$), and DRP1 (DNP, $n = 7$, DNP + GEG, $n = 6$; $P < 0.05$) in colons of animals. There were no significant differences in PINK1 expression between the Control group and the DNP + GEG group ($p > 0.05$). Similar to PINK1 finding, we did not observe the difference in DRP1 expression between the Control and the DNP + GEG group.

Conclusions: These findings show that gingerol-enriched ginger reduces the physiological colonic disruption associated with diabetic neuropathy.

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