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NANOVESICLES IN BROCCOLI SPROUTS AS A NATURAL POTENTIAL MEDICINE FOR THE TARGETED TREATMENT OF INFLAMMATORY BOWEL DISEASE

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Inflammatory bowel disease (IBD) is an incurable small intestine and colon disorder. While exerting anti-inflammatory effects, bioactives in broccoli sprouts cannot treat IBD well probably due to their instability in the gastrointestinal (GI) tract and/or inadequate transit into colon cells. The study aimed to investigate if broccoli sprout-derived exosome (BSDExo) nanovesicles can protect bioactives from the upper GI extreme environments and confer selectively targeted delivery of bioactives to inflamed colon cells in IBD. Microparticles with 1198.3±86.2 nm and nanovesicles with 40.1±17.2 nm were isolated from broccoli sprout juice using differential centrifugations and measured by a DelsaTM Nano C nanosizing system. They showed different morphologies under a scanning electron microscope (SEM). Total protein and RNA were characterized in both broccoli sprout-derived microparticles and nanoparticles. Exosomes expressed the highest level of transmembrane protein CD63 evaluated by an Exo-Check array. These nanosized and identified proteins are known to be associated with exosomes. BSDExo protected bioactive sulforaphane for 2 hours in stomach-mimicking acid and 24 hours in intestine-mimicking conditions. BSDExo with a total protein level of 25 ng/mL could promote the proliferation of human normal colon epithelial CCD841 CoN cells with a cell viability of 154±5% ($p<0.05$). Both colon CCD841 CoN and Caco-2 cellular uptake of fluorescence-labeled BSDExo significantly increased with more severe inflammation stimulations. Interleukin 8 (IL-8) secretion from inflammation-stimulated normal colon cells was significantly reduced by the BSDExo treatment ($p<0.05$). BSDExo also significantly recovered the decreased transepithelial electrical resistance (TEER) values caused by inflammations in Caco-2 cells ($p<0.05$). Overall, the isolated BSDExo improved the stability, inflammation-targeting, and therapeutic efficacy of bioactives in colon epithelial cells via a naturally formed nanostructure. Demonstrating that BSDExo interacts with the targeting gut inflammatory cells and regulates anti-inflammatory responses would be a significant step forward in treating IBD.