Impact of structural difference in Fructans from *Polygonatum cyrtonema* on anti-inflammatory activity

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Introduction: Polysaccharides are recognized as the major active ingredients in *Polygonatum cyrtonema* Hua and possess diverse benefits.

Objectives: In this study, we aimed to investigate the structure-activity relationship of *Polygonatum cyrtonema* polysaccharides (PCP) and oligosaccharides (PCOP).

Methods: The structures of PCP and PCOP were characterized through molecular weight detection, molecular morphology, methylation analysis, and NMR analysis. Subsequently, we employed a DSS-induced colitis model and *Caenorhabditis elegans* (*C. elegans*) model to assess the anti-inflammatory efficacy of PCP and PCOP.

Results and Discussion: PCP and PCOP showed similar glycosidic linkages, consisting of a →1)-β-Fru*f*(2→ residue backbone. However, they differed significantly in molecular weight, with PCP at 1.78 × 10^4 Da and PCOP at 1.65 × 10^3 Da. Our findings showed that PCP and PCOP could protect the intestinal barrier and regulate short-chain fatty acid levels. Notably, PCOP effectively alleviated colitis symptoms and regulated the inflammatory factors better than PCP. Additionally, PCOP also increased the relative abundance of *Faecalibaculum* apart from the *norank_f__Muribaculaceae* in colitis mice compared to PCP. Overall, these results suggest that the molecular weight of PCP and PCOP significantly affect their

anti-inflammatory effects, providing a foundation for the development and application of *Polygonatum cyrtonema* glycans as therapeutics or functional foods.