

Poster of Distinction

P50 - Unique In-Vitro Model Investigating the Effects of Pea Protein Enteral Formulas on Prebiotic Indices and Microbiota Composition in Pediatric and Adult Donors

Vanessa Millovich, DCN, MS, RDN, CNSC¹; Susan Ray, MS, RD, CNSC, CDCES²; Robert McMahon, PhD³; Christina Valentine, MD, RDN, FAAP, FASPEN⁴

¹Kate Farms, Hemet, CA; ²Kate Farms, Temecula, CA; ³Seven Hills Strategies, Columbus, OH; ⁴Kate Farms, Cincinnati, OH

Financial Support: Kate Farms provided all financial support.

Background: Whole food plant-based diets have demonstrated metabolic benefits across many populations. The resulting increased intake of dietary fiber and phytonutrients is integral to the success of this dietary pattern due to the positive effect on the digestive system. Patients dependent on tube feeding may not receive dietary fiber or sources of phytonutrients, and the impact of this is unknown. Evidence suggests that the pathways that promote digestive health include more than traditional prebiotic sources from carbohydrate fermentation. Data on protein fermentation metabolites and potential adverse effects on colon epithelial cell integrity are emerging. These lesser-known metabolites, branched-chain fatty acids (BCFAs), are produced through proteolytic fermentation. Emerging research suggests that the overproduction of BCFAs via protein fermentation may be associated with toxic by-products like p-cresol. These resulting by-products may play a role in digestive disease pathogenesis. Enteral formulas are often used to support the nutritional needs of those with digestive conditions. Plant-based formulations made with yellow pea protein have been reported to improve GI tolerance symptoms. However, the underlying mechanisms responsible have yet to be investigated. The purpose of this study was to assess the impact of a mixed food matrix enteral formula containing pea protein, fiber, and phytonutrients on various markers of gut health in healthy children and adults, using an in-vitro model.

Methods: Stool samples of ten healthy pediatric and 10 adult donors were collected and stored at -80°C. The yellow pea protein formulas (Kate Farms™ Pediatric Standard 1.2 Vanilla-P1, Pediatric Peptide 1.0 Vanilla-P2, and Standard 1.4 Plain-P3) were first predigested using standardized intestinal processing to simulate movement along the digestive tract. The in-vitro model was ProDigest's Colon-on-a-Plate (CoaP[®]) simulation platform which has demonstrated in vivo-in vitro correlation. Measurements of microbial metabolic activity included pH, production of gas, SCFAs, BCFA, ammonia, and microbiota shifts. Paired two-sided t-tests were performed to evaluate differences between treatment and control. Differential abundance analysis was performed using LEfSe and treeclimbR. Statistical significance, as compared to negative control, is indicated by a p-value of < 0.05.

Results: In the pediatric group, the microbial analysis showed significant enrichment of Bifidobacteria as well as butyrate-producing genera Agathobacter and Agathobaculum with the use of the pediatric formulas when compared to the control. P1 resulted in a statistically significant reduction of BCFA production ($p < 0.05$). P1 and P2 resulted in statistically significant increases in acetate and propionate. In the adult group, with treatment using P3, microbial analysis showed significant enrichment of Bifidobacteria compared to the control group. P3 also resulted in a reduction of BCFAs, although not statistically significant. Gas production and drop in pH were statistically significant ($p < 0.05$) for all groups P1, P2, and P3 compared to control, which indicates microbial activity.

Conclusion: All enteral formulas demonstrated a consistent prebiotic effect on the gut microbial community composition in healthy pediatric and adult donors. These findings provide insight into the mechanisms related to digestive health and highlight the importance of designing prospective interventional research to better understand the role of fiber and phytonutrients within enteral products.

Milovich V, Ray S, McMahon R, Valentine C. P50 – Unique in-vitro model investigating the effects of pea protein enteral formulas on prebiotic indices and microbiota composition in pediatric and adult donors. *Nutr Clin Pract.* 2025;49(S1):S164. Abstract presented at: ASPEN Nutrition Science & Practice Conference; March 22–25, 2025; Columbus, OH. doi:10.1002/jpen.2735