The Effects of Dietary Fiber on Rattus norvegicus

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This study investigated how different types of dietary fiber affect gut microbial fermentation and energy utilization in Rattus norvegicus, testing the hypothesis that soluble fiber would increase short-chain fatty acid (SCFA) production by increasing microbial fermentability. Rats were housed under controlled environmental conditions and assigned to one of three diet groups: control chow, soluble fiber (inulin), or insoluble fiber (cellulose). After an acclimation period, fecal samples were collected, dried, and prepared for analysis. The original plan to measure caloric extraction using bomb calorimetry was modified due to equipment malfunction, and infrared (IR) spectroscopy was used instead. IR absorption peaks at 1186 cm-1 and 1756 cm-1, associated with SCFAs, were measured. Linear regression and statistical tests were performed to evaluate relationships between IR intensity and estimated SCFA concentration. IR analysis showed consistent and significant differences between diet groups, with a positive linear relationship between SCFA concentration and IR intensity (R^2 ˜ 0.37, $p < 0.05$). Trial-to-trial variability was very low (SD = 0.003), indicating high precision. Soluble fiber promoted greater SCFA production and more targeted fermentation, while insoluble fiber maintained higher microbial diversity. Rats fed soluble fiber also showed metabolic patterns consistent with more efficient energy extraction. The hypothesis was supported, and soluble fiber increased SCFA production compared to insoluble fiber and control diets. Precision was high due to low standard deviation, though moderate R^2 values suggest minor biological complexity or overlapping absorption peaks. These findings provide real-world applications in understanding dietary fiber's role in gut health.

Awards Won:
Fourth Award of $600