Formulation-Dependent Preservation of Lactase Activity Under Simulated Gastrointestinal Conditions

Xian, Jolee (School: Bryn Mawr School)

Lactase dietary supplements are widely used to address lactose intolerance, a condition where the small intestine produces insufficient lactase enzyme to break down lactose, the natural sugar in dairy products. This results in symptoms like diarrhea, bloating, and gas, and affects approximately 67% of the global population. However, the extent to which different supplement formulations retain enzymatic activity after digestion remains unclear. This study investigated how supplement form influences the activity of lactase enzymes following exposure to simulated gastrointestinal conditions. Coated tablets, fast-acting tablets, chewable/gummy formulations, and powder with equal initial levels of lactase enzyme (9,000 Food Chemical Codex Units) were subjected to simulated gastric acidity, followed by neutralization to approximate transition to the small intestine. Lactase activity was then quantified via a colorimetric glucose assay at 505 nm, as glucose levels have a positive correlation to lactase activity after introduction of lactose substrate, as lactase breaks down lactose into glucose and galactose. The tablet formulations produced the highest glucose yield while the gummy/chewable formulation produced intermediate values, and the powder formulation produced the lowest values. These findings indicate that formulation can strongly influence lactase function as supplements travel through the gastrointestinal tract. This approach provides a framework for comparing digestive performance across enzyme-based supplements and for informing more performance-relevant labeling, as well as further optimization of formulations for maximum enzyme effectiveness.

Awards Won:

Fourth Award of $600

NC State College of Engineering: Scholarship to attend NC State Engineering Summer Camp