Introduction:

- Digestion is the process of breaking down food into smaller components which can be easily absorbed in the intestinal tract.
- Research in human digestion is limited due to the complex multistage process of digestion and technical difficulties in obtaining real time data.
- The possibility of numerically analyzing the fluid dynamics of food in the human gastrointestinal tract can enhance the understanding of the human digestive process and this could be useful for the food and health sectors in predicting the bio-availability of nutrients.

Computational methods:

- A 2D axisymmetrical fluid flow model was developed for a small section of the small intestine (5 cm long and 1.1 cm diameter). Properties of water were used to predict the fluid flow.
- The basic geometry and motility parameters required to develop this model were obtained from a study performed by Ohkubo et al., (2013)². This study assessed the small intestinal motility in healthy human volunteers using an MRI technique.

Results:

- In the Figure 5, the colors represent velocity levels, blue being the lowest and red being the highest.
- The fluid flow was observed in the direction of the peristaltic wave as indicated by small black arrows. Localized flow reversal was observed during the initiation of the peristaltic wave.
- The numerically predicted flow field was qualitatively confirmed with the results reported by Hari et al. (2012)².

Future work:

- Step 1: The flow model should be further developed to simulate the fluid flow in the entire length of the small intestine with multiple peristaltic waves and with fluid properties (density and viscosity) closer to real-time food values.
- Step 2: To incorporate reaction and diffusion physics to the fluid flow numerical model and predict glucose absorption rate as a function of the viscosity of the starch-based food system.

References: