Development and Initial Testing of an *In Vitro* Human Gastric Digestion Model with Peristalsis Function

P.P.S. Sachinthaka[1], G.M. Somaratne[1*], F.H.C.A. Silva[2], M.S. How[3], A.A.P.S. Amarasinghe[2], A. Hettiarachchi[1], and K.A.K.L. Chandrasiri[1]

[1]Department of Food Science and Technology, Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka.
[2]Department of Agricultural Engineering, Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka.
[3]Department of Process and Food Engineering, Faculty of Engineering, University of Putra, Malaysia.

[*] *gsomaratne@agri.pdn.ac.lk*

Foods are digested by a combination of physical and biochemical processes in the human stomach. Biochemical digestion is catalysed by digestive enzymes secreted in the stomach whereas physical digestion is induced mainly by peristaltic wall motion in the stomach. The objective of this research was to develop an *in vitro* human stomach model for the simulation of both biochemical and physical food gastric digestion. The developed human stomach model mainly consisted of a conical shape gastric chamber made of butyl rubber which is simulating the stomach chamber, and 4 custom made nylon half rollers attached to 2 rubber belts that were driven by 2 direct current 12 V geared motors and 6 custom made nylon pulleys to create a continuous contraction on the gastric chamber. The continuous peristaltic wall contractions of the stomach were emulated in the human stomach model by using contraction waves that had the frequency of ~3 cycles per min that were similar to those observed in the human stomach. Gastric sieving was done by a 1.5 mm pore size polyester mesh bag. Gastric emptying was done using a 24 V solenoid valve which was operated manually using a toggle switch. A 12 V peristaltic pump which was programmed as the gastric secretion flow rate of 2.5 mL per min using Arduino IDE software was used to deliver the gastric juice into the gastric chamber. A 100 W bulb, LM 35 temperature sensor, and Arduino Nano board was used to develop the temperature control system which was able to give temperature data in every second and maintain the temperature inside the insulating box at 37 °C. The accurate control of temperature, gastric secretion, gastric emptying, and the adjustable mechanical driving force in the developed model successfully provide an essential tool for Sri Lankan Laboratories to analyse food gastric digestion.

Keywords: Human Stomach Model, Gastric Emptying, Gastric Sieving, *iIn Vitro*, Peristaltic Contraction