In vitro oro-gastro-intestinal digestion of pearl millet fortified 3D printed idli

ANANDHARAMAKRISHNAN C. (1,2), VIJAYAKUMAR R. (2), PRIYADARSHINI S. (2), MOSES J. (2)
1 CSIR-CFTRI, Mysuru, India
2 NIFTEM-Thanjavur, Thanjavur, India

Objective:
This study focused on determining the glycaemic index of pearl millet flour fortified idli batter (80:20 %w/w) printed at optimum printing conditions (800 mm/min speed; 1.22 mm nozzle diameter; 360 rpm motor speed; 2 bar pressure; 40,100% infill) using integrated dynamic oral processing, stomach and small intestinal system ARK.
Methods:
The mastication conditions observed in the in vivo experiments are simulated in the in vitro dynamic oral mastication system. The in vitro bolus is then digested in stomach model and the gastric emptying kinetics were evaluated. The gastric digesta was then digested in dynamic small intestine system to estimate the glucose absorbance, from which the glycaemic index of the samples was estimated.
Results:
The oral mastication kinetics are affected by the compositional changes of idli. 3D printed idli had a higher total consumption time (1.30±0.30 chews/s) as compared to idli samples (1.10±0.25 chews/s). Fortified idli printed at 40% infill (98.62 ± 9.23 min) has shown higher gastric half emptying time as compared to idli (74.78 ± 8.25 min). The batter printed at 40% infill (73.33±3.56) has shown lesser glycaemic index than the control idli samples (96.80±5.5). This reduction in Glycaemic index can be attributed due to the complex internal microstructure of the batter printed with 40% infill.
Conclusions:
Utilizing 3D printing for food-to-food fortification has the potential to alter the shape of foods and their nutrient bioavailability. By studying the digestibility kinetics of foods in a dynamic oro-gastro-intestinal system and taking into account the dynamics of food breakdown at all phases, the prediction accuracy of nutrient bioavailability and glycaemic index estimation using in vitro simulators can be improved.