GASTROINTESTINAL MODELS (TIM) WITH HIGH PREDICTIVE POWER

The TIM models save time and reduce the need for animal testing. These unique gastrointestinal models are flexible, accurate and produce highly reproductive results. Nutritional and functional properties or foods and ingredients can be assessed under simulated physiological digestion conditions. The systems are well validated and offer broad versatility in experimental strategies and goals.

The TIM models are assembled as multi-compartmental, dynamic computer-controlled models. TIM-1 simulates the digestive processes of stomach and small intestines. TIM-2 represents the colon and includes a rich microbial gut-derived flora. The models have been extensively validated based on data from human and animal nutritional research. In the TIM systems, behaviour of single compounds as well as complete meals can be studied. Results are characterized by an unparalleled predictive power TIM studies are published in over 40 peer-reviewed papers (Cf R. Havenaar in Entrez Pubmed). The TIM systems proved to be excellent tools for studying a.o.:

- availability for absorption of macro- and (formulated) micro-nutrients;
- interactions between nutritional and functional food compounds,
- effects of food processing on the nutritional and functional quality
- stability of probiotics and efficacy of prebiotics in the upper and lower GI tract

SIMULATION UPPER DIGEST TRACT

TIM-1 consists of compartments simulating the stomach and small intestine: duodenum, jejunum and ileum. Simulated parameter are amongst others:

- body temperature
- flow of saliva, gastric- and pancreatic juice including digestive enzymes, and bile
- peristalsis for mixing and gastrointestinal transit times
- regulation of gastric and intestinal pH
- continuous removal of digested lipophilic and hydrophilic compounds using hollow fibre membranes

GI parameters can be adapted to mimic specific conditions related to age (infant, adult, elderly), type of meal (liquid, semi-solid, and solid meals), and health or disease status (e.g. dyspepsia, cystic fibrosis).
TIM-1 enables research on nutritional and functional aspects on single or combined compounds as well as in complete meal matrices during passage through the upper GI tract under strictly controlled human conditions. TIM studies can be combined with microbial and biochemical analysis as well as cell based bio-assays.

SIMULATION OF THE COLON: TIM-2

The TIM-2 system simulates the conditions in the large intestine (colon). This includes pH, anaerobiosis and gradual intake of pre-digested meal compounds coming from the small intestine. The compartments contain a high density metabolic-active microflora of human origin (healthy persons or patients). Selected beneficial or pathogenic bacteria can be added to this microflora.

In TIM-2, the fermentation properties of dietary compounds such as fibres, pro- and prebiotics, and anti-oxidants can be investigated by analysis of metabolites (SCFA’s, amino acids) and/or composition and metabolic activity of the colon microbiota. Single or repeated addition of the compounds to the model is possible. Samples can be taken in time for chemical and microbial analysis (e.g. with the intestinal chip) and functional cell-based assays. The results will give reliable information about bioaccessibility, biofunctionality, produced metabolites, and changes in microbiota composition.
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