The regulation of digestive hormones and gastric acid under different conditions

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As we all know, by eating food, different kinds of nutrients are absorbed in our digestive system, which are then metabolised and provide nutrients and energy for our body. Digestion starts at the moment when food enters the mouth. During food passing through the gastrointestinal (GI) tract, food in large pieces will be gradually digested into small pieces (in the mouth), chyme (in the stomach), large molecules and finally small molecules (in the small intestine). The final small molecules can be absorbed into our blood circulation. At last, water is absorbed in the large intestine and waste is discharged through the anus.

Digestion of the food is a complicated process which relies on the functions of many gut hormones and other biochemical compounds released in the gut, for instance several enzymes, acids (i.e., gastric acid) and salts; the digestion is also largely controlled by the nervous system. Normally, when we eat food, the GI tract can sense the physical and chemical changes caused by food, and responds to it by releasing hormones to facilitate the digestion. However, scientists also found that even without the real food, by thought, sight, smelling, and swallowing of food, our body can respond to the upcoming food intake though a part of the nervous system called vagus nerve. This means that even when the GI tract senses nothing, the nervous system could pre-react to upcoming food and produce digestion related compounds, which could enhance the speed and efficiency of later digestion. A normal vagus nervous function is very important for a healthy life, however it is still not easy to precisely diagnose the injury of the vagus nerve. In our study, we focused on the injured vagus nerve, which is closely related with type I diabetes and is currently a therapy for obese (vagotomy surgery). We quantitatively studied how could vagotomy affect the release of gastric acid and two other hormones: pancreatic polypeptide (PP) and ghrelin, which are of great importance in regulating the digestions. From the result, we found that PP is very powerful for establishing the diagnostic system because its release is significantly lost in vagotomy patients. Although gastric acid is also shown to be directly regulated by nervous system, the sample collection process is rather tough for patients and requires a lot work for doctors and nurses.

Diabetes is a well known digestion-related disease which is currently treated by a hormone called GLP-1, which could help lowering the blood glucose level. However, side effects of this treatment is not clearly studied. Nausea is the known common clinical side effect of GLP-1 treatment, and in our study we want to know how does it affect other physiological status, such as its influence on other digestive hormones. From our study, we found that infusion of GLP-1 could significantly reduce the level of another hormone (peptide tyrosine tyrosine, PYY) in the blood circulation, as well as affect its own concentration in the blood. PYY is very important for nutrients absorption after food intake, so it is very important to further study the detailed mechanisms of the reduction effect of GLP-1 on blood PYY, because every hormone is essential and it could be a problem if the treatment with one affects another one.