This article, the third in this series on the gastrointestinal (GI) tract, describes the form and function of the stomach.

**Form**

The stomach (Fig 1) is a J-shaped area of the gastrointestinal (GI) tract that sits in the upper left side of the abdomen. It joins with the oesophagus above it and the small intestine beyond it. It is the most dilated area of the tract and has several regions – the fundus (the expanded part of the stomach), the cardia, the body, and the funnel-shaped antrum. The shorter, inner curve of the stomach is called the lesser curvature and the longer, outer one, the greater curvature. Food enters the stomach through the cardiac or gastroesophageal sphincter and leaves it via the pyloric sphincter.

The stomach is approximately 25cm long and can expand to hold up to 4L of food and drink, although its empty volume is only 50ml (Marieb, 2005). The total interior surface area of the stomach is about 800cm². It has an extra muscle layer in addition to those lining the rest of the GI tract – an oblique layer that allows the stomach to distend in order to store food (Smith, 2005).

The stomach collapses in on itself when it is empty and forms folds or rugae.

**Functions of the stomach**

The stomach performs a number of important functions including:

1. Food reservoir. We are able to eat large meals spaced many hours apart because of the stomach’s ability to expand and hold food. The contents are released slowly due to the action of the strong pyloric sphincter;
2. Absorption. Foodstuffs are only partially broken down by the time they reach the stomach and the molecules are too big to cross the gastric wall. Most of the digestive activity takes place in the pyloric region but only a small amount of absorption occurs in the stomach – some water is absorbed, about 20 per cent of the alcohol we drink and some drugs, especially aspirin and other non-steroidal anti-inflammatory drugs, which are mildly acidic. These drugs can cause gastric irritation and bleeding;
3. Mucus secretion. This is particularly important in the stomach as it prevents the stomach digesting itself. The enzyme pepsin, which digests protein, is produced in the stomach and would erode the stomach walls if it came into contact with them. The stomach mucus is like a gel. It is made of a protein (mucin) and glycoproteins, and is spread in a layer about 1mm thick that adheres to the rugae of the stomach. Mucus in the stomach also contains some bicarbonate, which helps to neutralise the stomach acids. Mucus also helps to lubricate food in the stomach;
4. Gastric juice secretion. Gastric juice is a mixture of the secretions from two types of cell within the stomach. The billion or so parietal cells in the adult stomach secrete intrinsic factor (see below) and
hydrochloric acid (HCl), while the chief cells secrete an enzyme, pepsinogen (Fig 2). Together they produce 2–3L of gastric juice a day, which is highly acidic (pH 1.2–3.0). The acid has a number of functions:
- It stops the proliferation of bacteria in the stomach;
- It inactivates salivary amylase, mixed with the food in the mouth;
- It curdles milk to prepare it for digestion;
- It tenderises proteins (by denaturing them);
- It converts the pepsinogen produced by chief cells into pepsin, which starts to digest protein;

5. Churning food. Food that enters the stomach is mixed with and diluted by the gastric secretions into a thick soup-like substance called chyme. The chyme is churned by waves of peristalsis. Each wave lasts about half a minute and ‘flows’ from the top of the stomach to the bottom;

6. Production of intrinsic factor. The parietal cells in the stomach also produce intrinsic factor, which is essential for the absorption of vitamin B₁₂ from the ileum in the small intestine. Vitamin B₁₂ is necessary for the healthy functioning of nerve fibres in the body, for the formation of myelin sheaths on the nerves in the spinal cord and for the formation of red blood cells.

**Nausea and vomiting**

Nausea is the unpleasant sensation that often precedes vomiting. Sufferers may look pale and sweaty and may experience waterbrash (a sudden and profuse secretion of saliva into the mouth) and antiperistalsis (reverse waves of peristalsis in the stomach from pylorus to cardia and sometimes also in the first part of the small intestine).

Vomiting can be defined as the forceful expulsion of the gastric and intestinal contents through the mouth (Marieb, 2005). It occurs as the result of a reflux and can be stimulated by a number of different factors:
- Irritation of any part of the GI tract – this is a protective mechanism against the ingestion of substances dangerous to the body;
- Impulses from the semicircular canals of the ear, namely motion sickness;
- Brain tumours or anything else that causes a rise in intracranial pressure;
- Impulses from the higher cerebral centres in response to heightened emotions such as anxiety, fear and unpleasant smells and sights;
- Some drugs such as opiates, digoxin and the emetic substance ipecacuanha.

**Movement and emptying**

Foodstuffs leave the stomach at different rates. Emptying starts and food begins to enter the small intestine about 30 minutes after a meal and is usually completed within 4–5 hours.

The strength of the peristaltic movement of the stomach is altered by a number of factors. Generally, stronger movements are linked with more rapid emptying.

Gastric emptying is slowed down when the sympathetic nervous system is stimulated, for example if we experience fear or anxiety, during heavy exercise or following blood loss.

During a meal the stomach distends due to the presence of food and activity increases in the parasympathetic nervous system. These factors, combined with the presence of the hormone gastrin, which is produced in the G cells of the mucosal layer of the stomach, act together to increase motility in the stomach and to speed up gastric emptying.

The lower parts of the stomach, the antrum and pylorus, act together with the first part of the small intestine, the duodenal cap, and squirt the chyme through the pyloric valve into the small intestine – the antrum contracts first, followed by the pylorus and finally the duodenal cap (Smith, 2005). The pylorus holds about 30ml of chyme but each contraction of the stomach squirts 3ml or less through the pyloric sphincter into the small intestine (Marieb, 2005).

The presence of fat or acid in the duodenum of the small intestine slows down gastric emptying and allows time for the acidity to be neutralised and for fats to be absorbed in the small intestine. This effect may be brought about by hormones produced by the small intestine in response to chyme.

Once the duodenum is filled with chyme and its wall is stretched, the enterogastric reflex occurs and slows down gastric emptying by inhibiting the parasympathetic nerves and tightening the pyloric sphincter (Marieb, 2005).