

SMALL INTESTINE

1. What is the main function of the small intestine?

This is the principle site for the absorption of carbohydrate, lipid, proteins, water, electrolytes, vitamins and essential minerals.

2. What is the transit time for chyme to pass through the small bowel?

2–4 h.

3. What are the three main types of small bowel motion seen after a meal?

- *Peristalsis*: in common with the rest of the gut
- *Segmentation*: more frequent than the above, occurring about 8 times per minute in the ileum, lasting for several seconds. Involves localised contraction of 1–2 cm of bowel that leads to the propulsion of chyme in both directions. Important for mixing chyme with the digestive juices
- *Pendular movements*: longitudinal muscle contractions lead to movement of the bowel wall over luminal contents. Also important for mixing

4. How does the motility differ when the small bowel is empty of contents?

During fasting, a *migrating motor complex* spreads from the duodenum to the ileocaecal junction. This contractile wave helps to clear the small bowel of any remaining contents.

5. What is the composition of small bowel secretions?

This is made up of mucous, water and NaCl, predominantly.

6. What is the output of this daily?

1,500 mL per day.

7. How does this compare to the rest of the gut?

The daily volume of gut secretions in (mL per day) may be summarised:

- *Saliva*: 1,500
- *Gastric*: 2,000
- *Bile*: 500
- *Pancreatic*: 1,500
- *Small intestine*: 1,500

8. How much water does the small bowel absorb per day?

Assuming that oral intake is 2,000 mL daily, the small bowel absorbs about 8,500 mL of water daily. The colon, about 400 mL daily. This leaves around 100 mL excreted in the faeces per day.

9. What are the effects of terminal ilectomy?

- *Loss of bile salt re-uptake*: this alters the colonic flora and changes the consistency of stools. There is also increased bile salt manufacture by the liver in response to reduced uptake, increasing the incidence of gallstones
- *Decreased Vitamin B₁₂ uptake*: producing macrocytic anaemia
- *Reduced water absorption*: this is one of the important functions of the terminal ileum. This can lead to loose and frequent stools
- *Reduced uptake of γ -globulin*: the terminal ileum is full of lymphatic tissue, and there is some re-uptake of immunoglobulin. Loss of this tissue may affect local gut immune surveillance

SODIUM BALANCE

1. What is the major distribution of sodium in the body?

Sodium is the major extracellular cation of the body:

- 50% is found in the ECF
- 45% found in the bone
- 5% in the intracellular compartment
- Note that 70% of this ion is found in a readily-exchangeable form

2. What is the major physiological role for this ion?

This is the ion that generates the greatest osmotic force. For this reason, it is vital for the internal water balance between the intracellular and extracellular spaces. The osmolality that it generates also influences the control of the ECF volume that is under renal control.

This osmotic role occurs because this ion is so abundant in the body.

3. What is the daily sodium requirement?

1 mmolkg⁻¹ per day.

4. Give some causes for hyponatraemia.

- *Water excess*
 - *Increased intake:* polydipsia, iatrogenic, e.g. TURP syndrome, excess administration of dextrose
 - *Water retention:* syndrome of inappropriate ADH (SIADH)
 - *Retention of water (with a bit of salt):* nephrotic syndrome, cardiac failure, hepatic failure
- *Water loss (with greater sodium loss)*
 - *Renal losses:* diuretics, Addison's disease
 - *Gut losses:* diarrhoea, vomiting

- *Pseudohyponatraemia*: measuring the sodium inaccurately in the presence of hyperlipidaemia

5. What does the *inappropriate* in SIADH refer to?

In SIADH, there is an excessive and pathological retention of water in the absence of renal, adrenal or thyroid disease. The 'inappropriate' refers to the fact that the urine osmolality is inappropriately high in relation to the plasma osmolality.

6. Which conditions may trigger the SIADH?

- *Lung pathology*: pneumonia, lung abscess and TB
- *Malignancy*: small cell carcinoma of the lung, brain tumours, prostatic carcinoma
- *Other intra-cranial pathology*: head injury, meningitis
- *Alcohol withdrawal*

7. What are the causes of hypernatraemia?

- *Water loss*
 - Diabetes insipidus
 - Insufficient intake or administration
 - Osmotic diuresis, e.g. hyperglycaemia
- *Excess sodium over water*
 - Conn's or Cushing's syndrome
 - Excess hypertonic saline

8. What is diabetes insipidus?

This is a syndrome of polyuria with hypernatraemia and dehydration with compensatory polydipsia caused by an insensitivity to (nephrogenic form) or deficiency of (cranial form) ADH. Characteristically, fluid deprivation fails to concentrate the urine.