

The length and mucosal surface area of the small and large gut in young rats

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A knowledge of the dimensions of the gut mucosa is useful in studies on intestinal absorption. Although values for length and surface area of the whole or parts of the absorptive gut in adult rats have been reported by Verzar & McDougall (1936), Wood (1944), Fisher & Parsons (1950) and Boyne, Fell & Robb (1966), there appear to be no satisfactory figures reported for young growing rats, which are often used in absorption and nutrition experiments. We therefore offer here a summary of some measurements on the small and large gut of a group of young rats and a comparison of their mucosal areas per unit gut length in different regions with those of adult rats previously reported in the literature (Table 1).

The body weights and gut lengths were measured in 25 randomly selected male Sprague–Dawley rats aged 5 weeks. After killing the rats by a blow on the head the guts were dissected free without tension and pinned out flat. Measurements were made of the duodenum (from the pylorus to the distal attachment of the pancreas), the combined jejunum and ileum, the caecum, and the colon (to the pelvic brim). The mucosal area determinations were made in 4 rats by the method of Fisher & Parsons (1950) which involves making measurements on tracings of magnified longitudinal and transverse sections cut from Bouin fixed, paraffin embedded segments of gut. In the calculations a correction was made for shrinkage due to fixation and embedding. The gut segments we used were taken from six sites, named and located as follows: *Duodenum*, 3.5 cm from the pylorus; *Jejunum*, 10 cm from the pylorus; *Midgut*, midway between the pylorus and the ileocaecal junction; *Ileum*, 3 cm above the ileocaecal junction; *Upper colon* and *lower colon*, 4 cm and 8 cm respectively below the ileocaecal junction.

The mucosal area per unit gut length ratio in these young rats shows a distally falling gradient of about 2:1 over the length of the small gut. The effects on surface area of varying degrees of folding of the mucosa and the presence of villi are seen more clearly in the values for relative area per unit length of the different parts of the small gut compared with the colon as unity, i.e. considering the colon as a tube of the same diameter as the small gut with flat mucosa. Comparing the values for mucosal area per unit length in young rats with the values for the corresponding regions in the small gut in adult rats as reported by Fisher & Parsons (1950) it appears that the ratios are all significantly lower in the young rat small gut and that an appreciable error could occur if the adult values were applied to young

Table 1. *Length and mucosal area of various parts of the gut in young rats and comparison with some reported values for mucosal area in adult rats*

The location of the named parts is given in the text. The values for body weight and gut length are means \pm S.E.M. for 25 rats. Mucosal area per unit gut length values are corrected $\times 1.24$ (shrinkage correction according to Fisher & Parsons, 1950) and are means \pm S.E.M. for four rats. In the right-hand column, which shows previously reported values for adult rats, the small gut figures are taken from the corresponding regions according to Fisher & Parsons (1950) and the colon value is from Wood (1944).

Male Sprague-Dawley rats, body weight 61 \pm 1 g

Part	Length (cm)	Mucosal area			
		Area/unit length (cm ² /cm)	Relative area/unit length. Colon = 1	Actual area (cm ²)	Adult rats. Area/unit length (cm ² /cm)
Duodenum	7.1 \pm 0.1	5.8 \pm 0.4	2.5	41	8.2 \pm 0.8
Jejunum	60 \pm 2.0	4.5 \pm 0.2	2.0	60 \times 4.1 = 246	—
Midgut		4.1 \pm 0.3	1.8		6.3 \pm 0.2
Ileum		2.9 \pm 0.3	1.3		4.4 \pm 0.8
Caecum	2.5 \pm 0.1	—	—	—	—
Upper colon	10.2 \pm 0.2	2.4 \pm 0.03	2.3	23	2.2
Lower colon		2.2 \pm 0.03			

rats. On the other hand the mucosal area per unit length ratio for the colon in young rats agrees with the value previously reported for the adult rat colon by Wood (1944).

SUMMARY

Lengths and mucosal areas of the small and large guts of 5 week old rats were determined. The mucosal areas per unit length of the parts of the small gut showed a distally falling gradient of 2:1 and were much lower than previously published values for adult rats although values for the colon were the same for both age groups.

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