

COMPARISON OF PHENOL RED AND  $^{14}\text{C}$ -POLYETHYLENE GLYCOL AS NON-ABSORBABLE MARKERS FOR THE STUDY OF JEJUNAL UPTAKE IN THE RAT

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The two non-absorbable markers most commonly used to study intestinal water movement are phenol red (phenolsulphonphthalein) and polyethylene glycol (PEG). Because of an apparent poor correlation between results in uptake studies using these two markers, an experiment was undertaken to compare their efficacy in jejunal perfusion experiments in the rat. Barmada et al. (1983) have reported that PEG appears to be an unreliable marker for the determination of luminal volume in rat jejunum.

Male Sprague-Dawley rats were anaesthetized with pentobarbitone and a 10-cm length of proximal jejunum cannulated and perfused (0.125 ml/min) with a solution containing glucose (4 mmol/l), together with sufficient sodium chloride to make the solution iso-osmolar (304 mOsm/l). Phenol red (20 mg/l) and  $^{14}\text{C}$ -PEG (1 mmol/l) were included as non-absorbable markers. The solution was perfused for 20 min to establish a steady state and the effluent solution was collected over a further 20 minutes. Net water movement to or from the gut lumen was determined by three methods; by measuring the ratio of the concentrations of either phenol red or  $^{14}\text{C}$ -PEG in the solutions entering and leaving the cannulated segment, and by direct weighing of the solution delivered to and recovered from the segment. The rates of water movement and the rates of glucose uptake, corrected for water movement using the three methods, are shown in the table below.

MARKER	UPTAKE (Mean $\pm$ SEM, n = 6)	
	Water (ml/min/kg dry tissue)	Glucose (mmol/min/kg dry tissue)
Phenol red	81.7 $\pm$ 6.8 <sup>a</sup>	1.86 $\pm$ 0.18
$^{14}\text{C}$ -PEG	- 66.4 $\pm$ 54.5 <sup>b</sup>	1.58 $\pm$ 0.23
Direct measurement	107.8 $\pm$ 7.2 <sup>c</sup>	1.91 $\pm$ 0.17

Significant differences: Students t-test, c > b P<0.01, a > b, c > a, P<0.05

Water uptake determined by the direct method was slightly more than that calculated from measurement of phenol red. Calculations based on measurement of the  $^{14}\text{C}$ -PEG showed greater variability and indicated an efflux of water, thus giving poor agreement with the other methods. Measured glucose uptake was affected according to which marker was used to correct for water movement but differences were not significant.

In a second experiment total recovery of phenol red from the perfused segment was measured. The segment was perfused first with the glucose solution, but without phenol red for 10 minutes; this was followed by the same glucose solution with phenol red for 30 minutes, and finally by the glucose solution without phenol red for 15 minutes to wash the remaining indicator out of the segment. The procedure gave satisfactory recovery of the phenol red (99.1  $\pm$  1.2%; mean  $\pm$  SEM, n = 4). These results indicate that phenol red is a more reliable than PEG as a marker for the quantitative study of jejunal absorption in the rat.

BARMADA, S.R., ELDER, J.B., and TOMLIN, A. (1983). *J. Physiol.* 342: 19P.

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