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Measurement of mouth to caecum transit time

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The measurement of mouth to caecum transit time is important in the study of gut function. The appearance of breath hydrogen after the ingestion of the unabsorbed carbohydrate lactulose has been widely employed for this purpose. However, lactulose has been criticized because it changes transit time in a dose dependant manner[3]. There is osmotic retention of fluid in the lumen of the small intestine and a transit rate faster than that of a normal meal; the process may therefore be considered unphysiological. This effect may be partly due to the lack of macronutrients accompanying the lactulose[2].

In this paper we report the measurement of mouth to caecum transit times in normal subjects given a test meal containing uncooked white flour as a source of unabsorbed carbohydrate, and we compare the results with those obtained by administering a similar meal containing lactulose.

Five male and four female apparently healthy subjects were fasted overnight and provided in the morning with an iso-osmotic (265 mosm/l) liquid meal consumed within 10 minutes. The meal (meal A, 2090 kJ) containing 15 per cent of energy as protein (egg white), 35 per cent as fat (olive oil) and 50 per cent as carbohydratye (10 per cent as sucrose and 40 per cent as starch) and was flavoured with vanilla essence. Transit was also measured after consuming a similar meal (meal B, 1547 kJ) in which the sucrose and starch were replaced with 20 g lactulose (Duphalac, Philip Duphar, Amsterdam).

End-expiratory breath samples were collected by using a modified Haldane-Priestly tube immediately before and at 30 minute intervals after ingestion of the test meal. Hydrogen was measured using an exhaled hydrogen monitor (GMI, Renfrew UK) with a sensitivity of ± 1 ppm. The time taken for the test meal to reach the caecum was defined as a sustained rise in breath hydrogen concentration of at least 5 ppm over the baseline level. The 50 g of uncooked white wheat flour used in meal A produced a consistent and sustained rise of greater than 5 ppm hydrogen. The mean and standard error of the initial rise was 10 ± 2 ppm which was similar to that for the lactulose, 12 ± 3 ppm, in meal B, indicating that both transit markers were equally sensitive. The mean transit times (±s.e.) for the meal containing wheat flour were longer (466 ± 48 min) than for the meal containing lactulose (137 ± 27 min) and this difference was statistically significant ($P < 0.001$)., The range of values for individual subjects was 270–660 min and 60–300 min for flour and lactulose respectively. Representative breath hydrogen curves are shown in Fig. 1. The subject had a sustained rise in breath hydrogen 60 minutes after lactulose ingestion whereas wheat flour produced a marked prolonged transit time (450 min).

The intra-subject variability of mouth to caecum transit was determined in five subjects who consumed meal A on four or five occasions at least 7 days apart (Fig. 2). The average coefficient of variation was 16 per cent with a range of 0–50 per cent and these figures are similar to those obtained using 10 g of lactulose[1].

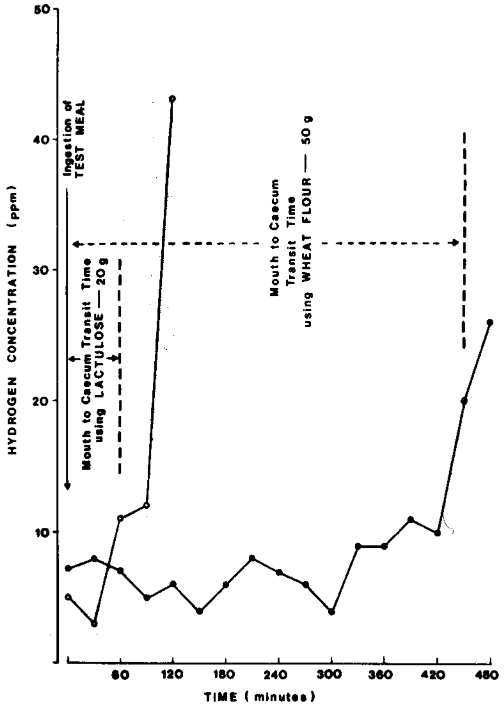

Fig. 1. Breath H_2 excretion by a healthy subject, showing mouth to caecum transit time after ingestion of the test meal containing lactulose or wheat flour.

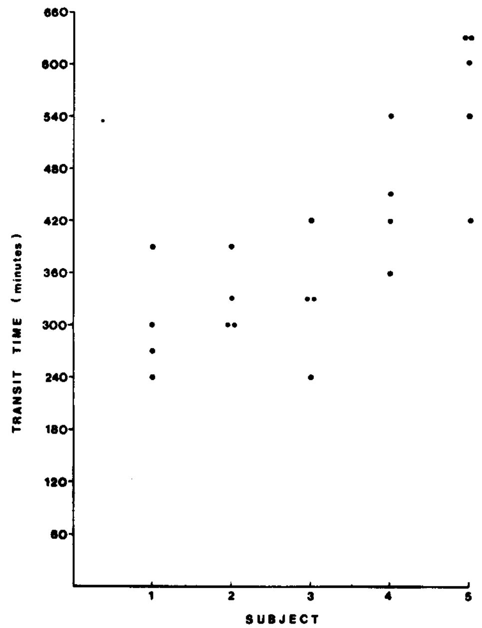

Fig. 2. Transit time measurements repeated four to five times in five healthy subjects after ingestion of 50 g uncooked wheat flour.

We conclude that uncooked white wheat flour can be used as a marker for the measurement of mouth to caecum transit by measuring breath hydrogen levels which show a sustained rise greater than 5 ppm. The results are at least as reproducible as those obtained when lactulose is used but the transit times are considerably longer and may be considered to be more physiological.

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