

Measurement of Gastric pH during Digestion of a Solid Meal in Dogs

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The behavior of gastric pH during digestion of a solid meal in beagle dogs was determined by use of an ion-selective field effect transistor pH sensor. The pH in the stomach was 3.9 ± 0.4 (mean \pm S.D., $n=6$) at 0.5 h after meals. It was maintained at a mildly acidic (about pH 3) level for long periods.

Keywords beagle dog; ion-selective field effect transistor pH sensor; gastric pH; meal

Beagle dogs are commonly used as a model species for the evaluation of drug bioavailability because of ease of their handling. However, the bioavailability in beagle dogs differs considerably from that in humans because of species differences in the gastrointestinal physiology.¹⁾ In predicting drug bioavailability in humans, it is important to clarify the characteristics of gastrointestinal physiology in beagle dogs. In our previous paper, the gastric pH in fasting beagle dogs was determined by use of an ion selective field effect transistor pH sensor.²⁾ The aim of the present study is to investigate the influence of an ordinary solid meal on gastric pH in beagle dogs.

Experimental

Animals Six healthy male beagle dogs weighing 9.5 to 11 kg were used. After overnight fasting, 300 g of a standard solid meal of commercial food (Oriental Yeast Co., Ltd., Japan) was given to each dog. During the experimental period, all dogs were allowed free access to water, but no food was given.

Measurement of the Gastric pH A KR-500 pH/pCO₂ monitor (Kuraray Co., Ltd., Japan) connected with an ion-selective field effect transistor pH sensor (pH sensor) was used in the experiment. The pH sensor was placed in Teflon tubing (6 mm in o.d., 4 mm in i.d., 70 cm long) in order to protect it from possible damage during the experimental period. The gastric pH was measured *via* the pH sensor inserted perorally into the stomach of conscious beagle dogs. The detailed procedure was described in a previous paper.²⁾ Measurement was carried out at 0.5 h before and at 0.5, 1, 2, 3, 4 and 6 h after meals. The pH sensor was inserted into the stomach at each time of measurement.

Results and Discussion

Figure 1 and Table I show the gastric pH *versus* time profile before and after solid meals in beagle dogs. A wide inter-individual variation from 0.7 to 6.8 was observed in the fasting state. However, variation of the gastric pH was not found at 0.5 h after meals: at this time the pH in the stomach was 3.9 ± 0.4 (mean \pm S.D., $n=6$). In a high acidity dog, the pH rises following ingestion of a meal, while the pH drops in the case of a low acidity dog. The changes in gastric pH seem to be due to the buffering effect of food and the secretion of gastric acid, respectively. In addition, the pH in the stomach was maintained at a mildly acidic (about pH 3) level for long periods (more than 5 h). Recently, Mojaverian *et al.*³⁾ reported that the gastric pH in human is from 3.0 to 5.0 at 0.5 h after a meal. It is suggested that the gastric pH during digestion is similar in the two species.

Figure 2 shows the result of the day-to-day measurement of gastric pH before and after solid meals in beagle dogs. The experiments in the fed condition gave excellent reproducibility; this suggests that the bulk phase pH in the canine stomach is homogeneous in the fed condition. Moreover, the measurement was repeated several times at

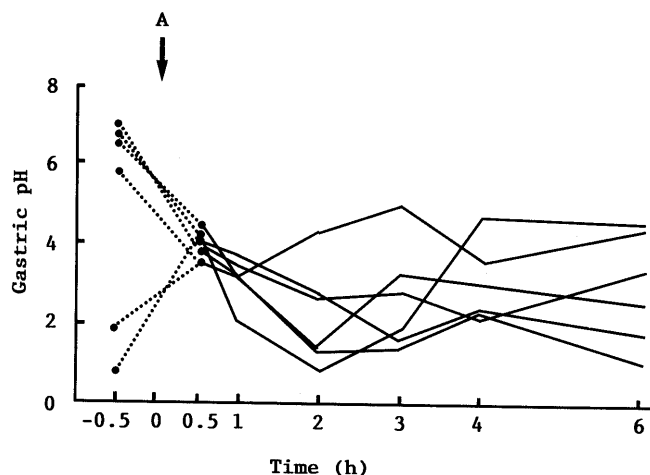


Fig. 1. Gastric pH *versus* Time Profile before and after Meals in Beagle Dogs ($n=6$)

A, meal.

TABLE I. Individual Gastric pH before and after Meals in Beagle Dogs

Dog	Before meal (h)		After meal (h)				
	0.5	0.5	1	2	3	4	6
1	5.8	3.5	3.2	1.2	0.8	2.3	1.1
2	0.7	4.1	3.7	2.7	1.5	2.4	1.8
3	6.6	4.5	3.2	4.3	5.0	3.6	4.4
4	7.0	3.9	3.4	2.6	2.8	2.3	3.4
5	1.8	3.6	3.1	1.3	3.3	3.1	2.7
6	6.8	3.6	2.0	0.8	4.4	4.8	4.6
Mean	4.8	3.9	3.1	2.2	3.0	3.1	3.0
S.D.	2.8	0.4	0.6	1.3	1.6	1.0	1.4

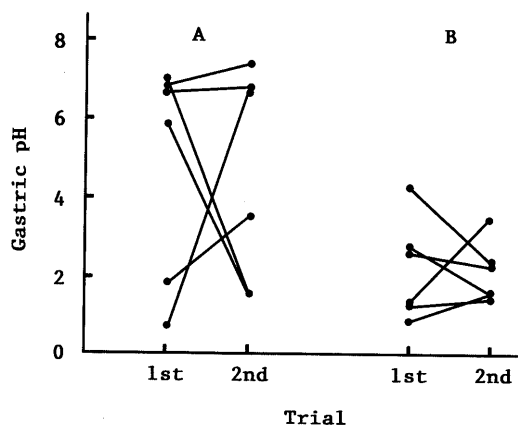


Fig. 2. Inter-day Variation of Gastric pH before and after Meals in Beagle Dogs ($n=6$)

A, before a meal; B, at 2 h after a meal.

regular time intervals. No intra-individual variation was found in any beagle dog.

In the bioavailability study of drugs after a meal, it is necessary to take into account the change of the gastric pH as well as gastric emptying rate.⁴⁾ The above finding is useful for the evaluation of bioavailability of pharmaceutical preparations, especially sustained release dosage forms.

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