formed in any department, and provides a direct measure of lipophilic [^{99m}Tc]HM-PAO. This method produces comparable results to the three-system chromatographic procedure and is less variable.

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Gender-Related Differences in Gastric Emptying

TO THE EDITOR: We have read with interest the article by Datz et al. (*1*) on gender-related differences in gastric emptying (GE). Their data, in fact, coincides with studies we published several years ago (*2,3*), despite variations in the method; as is usual among groups who investigate GE. The magnitude of the difference between males and females found by Datz, expressed in terms of T1/2 is almost identical to that we described (*3*); T1/2 is 1.4 to 1.5 times more prolonged in females than in males. These results are also similar to those reported recently by Hutson et al. (*4*).

In our work (*3*) we studied 18 women, the ages ranged from 18 to 27 yr, with a mean of 23 yr, who did not take contraceptives for the previous 6 mo, and all the studies were performed in the afternoon. We found a relationship between GE and the phase of the menstrual cycle, with a significant tendency to a faster GE in the ovular phase. There was no difference between the follicular and luteal phases. This finding has not been confirmed by Horowitz et al. (*5*), studying ten women with a wider age range (from 26 to 45 yr, with a mean of 36 yr), who had bilateral ovarian tubal ligation performed from 6 to 120 mo previously. All the studies were performed in the morning. In this study no differences was noted between the follicular and luteal phases, but the ovular period was not studied. However, there is a previous observation by McDonald (*6*) who described a faster GE of a liquid meal during ovulation.

Unfortunately, in their study of 15 women aged from 23 to 44 yr, with a mean of 32 yr, Datz et al. do not inform us of the phase of the subjects' menstrual cycle. The day of the menstrual cycle on which GE studies were done is necessary to ascertain the importance of a progesterone effect on GE.

Since circadian variations in GE have been observed (*7*), the time of the day in which the studies were performed is also relevant. Other facts that can influence GE and should be mentioned are: dietary habits of the population studied (*8*), fast duration (*9*), degree of physical activity (*10*), and smoking habit (*11*).

Early studies to investigate possible differences in GE between sexes probably failed due to technical insufficiencies, for example, fractionate liquid aspiration at 10 and 20 min only (*12*). There are, however, several clinical facts in gastrointestinal pathology which suggest a hormonal influence on gastrointestinal motility, e.g., the apparition of gastroesophageal reflux and biliary ectasis during pregnancy. Furthermore, sexual receptors in the stomach and gastrointestinal tract of the baboon and cobaya have been recently identified (*13,14*).

We agree with Datz et al. in the sense that differences in GE between sexes are due to an effect of sex hormones on gastrointestinal motility. We believe that further studies are required to ascertain the influence of the phase of the menstrual cycle, and probably of the hormonal situation related to age, on gastric motility.

The exact adjustment to a monoexponential pattern in GE of liquids is still controversial. GE of liquids is often considered only to approximate an exponential model (*15*). In our study (*3*), such an exact adjustment to a monoexponential pattern was only possible in nine of 50 cases; in the remaining there was a better fit to a biphasic model, with a faster first phase followed by a stationary phase. This finding has also been described by other authors (*16*), and seems in agreement with the effect of gravity after ingestion (described by Hunt), with the passive escape of liquids to the duodenum before mixing with solids (*17*), and with the noninitiation of the gastric reflex of receptive relaxation when ingestion is <1 kg (*18*).

GE studies using radiolabeled test meals have contributed to the knowledge of the diversity of factors that influence gastric motility. We believe that with caution when deriving conclusions, radionuclide GE studies can still offer significant contributions to gastroenterology.

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REPLY: We thank Drs. Carrio and Notivol, and associates, for their interest in our work. As we had noted in our original article, Notivol et al. found similar differences in gastric emptying rates between males and females, although they used a different technique (*1*).

We did not publish the phase of the menstrual cycle of our subjects because of human and animal data that indicate the phase of the cycle has little effect on gastrointestinal motility. Using a dual isotope radionuclide technique in humans, Horowitz et al. found no difference in the gastric emptying rate between the follicular and the luteal phases of the menstrual cycle (*2*). This lack of change in gastric emptying rates during the menstrual cycle also has been confirmed in animal studies. In rats, no change in gastrointestinal transit was found in cycling, compared to pregnant animals (*3*). These investigators felt the data indicated female sex hormones are responsible for slowing gastrointestinal transit but the absolute levels of the hormones were not important. Notivol and Carrio, et al. like Horowitz et al. found no difference between the follicular and luteal phases; however, Notivol stated they found a tendency for faster gastric emptying in the ovulatory phase (*1*). These investigators studied only 18 patients in various phases of their menstrual cycles, with only three patients in mid-cycle. In fact, in reviewing Figure 5 of Notivol's article, there is significant scatter in the gastric emptying T½'s that would make it difficult to come to any significant conclusions regarding the specific effect of ovulation. In addition, the authors did not confirm that ovulation or hormonal changes occurred mid-cycle. They merely assumed the 14th day equalled ovulation in their subjects. McDonald's study, which they quoted, was performed with an intubation technique and liquid meals only (*4*); therefore, we feel further study is necessary before concluding there is more rapid gastric emptying during the ovulatory phase. Finally, our study showed delayed gastric emptying in females; therefore, even if there were more rapid gastric emptying during ovulation, this in no way affects the results showing *delayed* gastric emptying in women compared to men.

The authors also ask if certain factors, such as time of day, were kept constant in our study group. They were. In fact, the article that Carrio and Notivol et al. reference on the effect of circadian rhythm on gastric emptying is from our group (*5*). Carrio and Notivol et al. mentioned further studies should be performed on "... the hormonal situation related to age ...". Indeed, we have studied this situation. In a study comparing 15 postmenopausal women to pre-menopausal women, we found premenopausal women, (normal sex hormone levels), had significantly slower gastric emptying than did post-menopausal women, (low or absent sex hormone level) (*6*). In fact, when the post-menopausal group was compared with a group of men, no statistically-significant difference in the rate of gastric emptying was found.

We disagree with Carrio and Notivol et al. concerning the shape of the liquid emptying curve. In numerous studies, we, as others, have found liquids empty in an exponential manner (*7–16*). Notivol et al. state they were able to fit only nine of 50 patients to a mono-exponential pattern; in the remainder, they found a better fit to a bi-phasic model. We think this is related to their technique. The authors performed their baseline data acquisition at 15 min after eating, and then obtained only three points at 30-min intervals. Curve fitting to this small number of data points would tend to straighten any curve. This is especially true since liquid T½'s are short (only 30.3 min for men and 53.8 min for women) (*17*). It is interesting to note Notivol and Carrio et al. did find exponential liquid emptying after 45 min (*1*).

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