Morning and night gastric emptying half-time differed more than 220% in two young healthy adults

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Abstract

Objective: It is important to know normal gastric emptying half-time (GEHT) of a specific meal taken at specific hours and at specific physical and biological conditions, in order to better evaluate abnormal GEHT. It seems that it is more specific to study as we have done in the present paper, GEHT in the same individual using a certain meal administered at two different hours, i.e. in the morning and at night. Thus, we have avoided many errors and difficulties methodologies. **Subjects and methods**: We studied 2 healthy individuals, one male 26 years old and one female, 19 years old, who received the same French toast meal at 08:00 and 23:00. **Results**: The GEHT for the morning and the night test for the male individual (P. F.) were 55min and 125min, respectively. For the female individual (K. F.) the GEHT were ~80min and ~200min, respectively. For both individuals GEHT differed more than 220% between the morning and night tests. **Conclusion**: We noticed a more than 220% delay of the GEHT in a normal young man and a normal young woman when they received a French toast meal at 23:00h as compared to the same meal at 08:00h. The female had 158% more delay in GEHT at night as compared to the GEHT of the male individual.

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Introduction

Food intake is coordinated to cellular metabolism by clock gene expression with a master clock in the suprachiasmatic nucleus synchronized by light exposure. Gastric vagal afferents play a role in regulating food intake. Circadian rhythm may act to control food intake differentially at different times of the day [1].

According to many factors, the rate of gastric emptying for solid and liquid meals variates in meal composition, energy content and subject characteristics [2]. Similarly, ileal starch digestibility is altered by food and starch properties [2].

It has been reported long ago that even mild mental stress delays solid phase gastric emptying in healthy subjects [3]. During night sleep, gastric emptying (GE), saliva production and frequency of swallowing were also found decreased [4].

Following the above, normal values of GE half-time (GEHT) vary by age, gender, the kind of food, stress factors, indigestion, the time of the day and other factors [4, 5]. In a study of 123 normal men and women from Institutes in U.S, Europe and Canada the upper normal limit for gastric retention at 2h was >60min [6].

It is thus important to know normal GEHT of a specific meal taken at specific hours and at specific physical and biological conditions in order to better evaluate abnormal GEHT.

It seems that it is more specific to study as we have done in the present paper, GEHT in the same individual of a certain meal administered at two different hours, i.e. in the morning and at night. Thus, we avoided many errors and issues as have been mentioned above [5].

We were unable to find in the literature a study of GEHT in the same young healthy individuals, a male and a female, studied at 08:00 and at 23:00 with the same test meal.

Subjects and methods

P. F. was a healthy, single, 26 years old Caucasian male student of the University with no previous chronic or important acute illness, of 80kg weight and 1.82cm height and body mass index 24.69kg/m^2 [7]. He was non smoker and lived a normal student's life. He was not under stress and had no financial or personal problems. Both he and the

other case studied, a female individual, gave their informed consent for the study. Both individuals received the radioactive meal at 08.00 in the morning and after a month's time again at 23.00 at night. The meal consisted of two egg's-whites in which 25MBq of technetium-^{99}m sulfur colloid (^{99}mTc-SC) were inserted using a 2mL syringe and a 19G needle. The eggs were then fried for 3-5min and given as a French toast with four thin slices of white bread. The bread weighted 117g, had 327kcal of energy, 9.36gr proteins, 60.8gr hydrocarbonates, 4.7gr lipids and 1.17gr phytins. Soon after, the subjects drank 200mL of orange juice. Meal taking time was about 7min. The subjects lied supine under an one-headed γ-camera (Sofa, France) using a large view collimator and 128×128 matrix and were studied at the anterior and the left anterior oblique (LAO) at 45° positions. Two dynamic views, 3 static views of 60sec each, followed by 3 static views of 5min each and 1 view every 10min were taken till GEHT was reached. Gastric emptying half-time of the above views was calculated after subtracting the background around the stomach. The geometric mean of the two measurements was calculated as follows: √ net counts of anterior view×net counts of LAO view. The LAO view was preferred so as not to disturb the examined individuals during the night examination. For patients' preparation, for meal preparation and other parts of the whole procedure, the paper of Donohoe KJ et al (2009) was followed [5]. The study was performed in the morning after an overnight fast [6].

The same GEHT test was repeated at 23.00. The examined individuals were lying in a quiet room with very little light, like being ready to sleep. Once or twice he or she may had napped for a few minutes between measurements. The next morning at 08.00 more static images were taken at the anterior and LAO positions. Regions of interest (ROI) of all images corrected for decay of the radionuclide and plotted on a graph paper indicated the GEHT. Care was taken so that the camera head and the subjects' position were the same during the whole procedure.

The female individual (K.F.) was a 19 years old university student of 65kg weight, 1.75cm height, with BMI 21.2kg/m2 and was examined during the first 10 days of her menstrual period [5]. The whole procedure of taking the radioactive meal and performing the examination was the same as that of the male individual.

Results

Results were as follows: The GEHT for the morning and the night test for the male individual (P.F.) were 55min and 125min, respectively (Figures 1, 2). For the female individual (K. F.) the GEHT were ~80min and ~200min, respectively (Figure 3). For both individuals GEHT differed more than 220% between the morning and night tests.

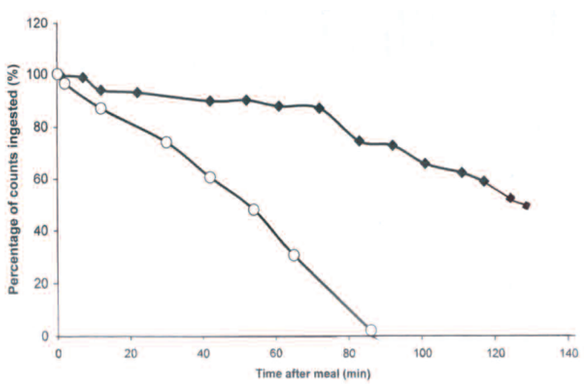


Figure 1. Subject P.F. male. The morning curve (-o-) had a GEHT of ~55min and the night curve (-■-) of ~125min.

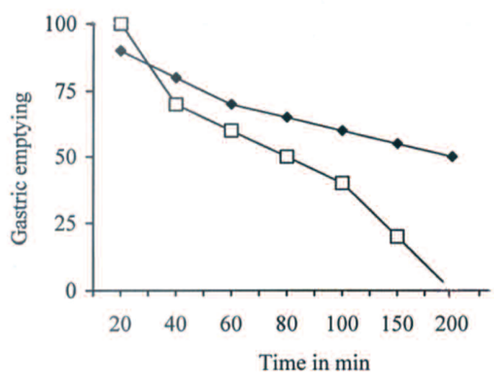
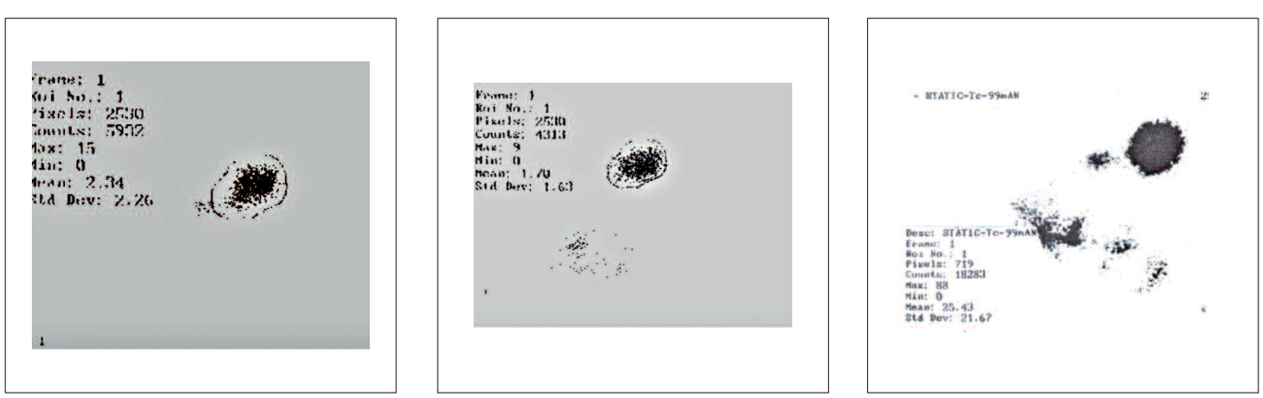


Figure 3. Subject K.F. female. The morning curve (-❑-) had a GEHT of ~80min and the night curve (-■-) a GEHT of ~200min.



A ~80% of GEHT after 20min B ~58% of GEHT after 61min C ~67% of GEHT after 113min

Figure 2. One of the gastric emptying images of P.F. from the morning test" (A and B) and the "night test" (C).

Discussion

Today, although medical societies of gastroenterology have met and tried for a consensus, there is no agreement as to the content of the radioactive meal to be given to the individuals tested, the normal values of GE and the overall indications of this study [8]. Differences in GEHT of solids between men (59.8±4.9min) and women (92.4±7.5min) have long ago been documented [9]. Others reported GEHT for solids after studying 31 normal men and 20 normal premenopausal women as 52.2±2.9 and 86.2±5.1, respectively [10]. Others reported that normal values of GE for 123 men and women were 60% at 2h [6].

It has been reported that there is high reproducibility of GE tests in the same individual [11, 12] and this finding supports the comparison of GEHT as in our study in the same individual at different days. Others have studied 16 healthy males and found that the same solid meal when taken in the morning at 08.00 showed a much faster GEHT, by 53.6% than the evening meal at 20.00 [13].

Previous studies have also reported that GEHT was delayed at night [4, 14]. It is interesting that in our study, the delay in GEHT was in both cases more than 220%. The GEHT curves seemed monoxponential over most of the time. One may consider that this great difference in GEHT between the morning and the night meal can cause in elderly people not only indigestion but also serious cardiac overload.

It has been reported that GE in females is by an average 15% slower than in males [15]. Although the GEHT test is more accurate when studying the geometric mean of measurements, it seems that results of the same person at the anterior or only the LAO position are also valid. Others noticed no statistical difference in the GEHT of liquids when using the anterior, the posterior, the LAO or the geometrical mean in 49 healthy subjects in both sexes [16].

In conclusion, we noticed a more than 220% delay of the GEHT in a normal young man and a normal young woman when they received a French toast meal at 23.00h as compared to the same meal at 08.00h. The female had 158% more delayed GEHT at night as compared to the GEHT of the male individual.

The authors declare that they have no conflicts of interest.

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