methionine content. In contrast, choline prevented perosis and promoted growth on both diets.

The results indicate that choline is required as such for the prevention of perosis and for growth and that betaine and methionine when added to the simplified diet enabled the chick to synthesize choline. This may be caused by an unidentified factor present in the simplified diet which is necessary for choline synthesis. Another possible explanation is that a factor which inhibits choline synthesis is present in the purified diet.

When the casein in the purified diet was replaced with an isolated fraction of the proteins of soybeans with resultant reduction in methionine content, betaine and methionine failed to prevent perosis but promoted some growth. The growth response obtained with betaine and methionine in this instance is believed to be due to a deficiency of methyl groups only. Choline was again effective for both purposes.

14651 P

Initial Emptying Time of Stomach in Primigravidae as Related to Evacuation of Biliary Tract.*

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Previous studies[1] have shown that in the second and third trimesters of pregnancy the gall bladder of 13 gravidæ discharged an average of only 49% of contents (within 40 minutes after a standard meal of egg-yolk) as compared with an average discharge of 73% obtained from 12 nulligravidæ; that the best 8 of the 13 discharged an average of only 57% and the remaining 5 an average of only 38%; but when the latter were tested 6 to 8 weeks postpartum, the amount of bile discharged in the 40-minute period (71%) approximated the nulligravid figure.

The present study has attempted to ascertain whether this retardation in rate of emptying of the gall bladder in pregnancy could have been due to a delay in the initial rate of emptying of the stomach. To this end 17 nulligravidæ (nursing students) were examined fluoroscopically after receiving a standard meal of egg-yolk to which 3 heaping teaspoons of barium sulphate had been added. They were then used as controls for 18 primigravidæ of the second and third trimesters, similarly treated. Fluoroscopic observations were supplemented by films. In addition to recording the time of the first spurt into the bulb, and the length of time required for the head of the meal to reach the pars inferior duodeni and the jejunum, an attempt was made to estimate the amount discharged from the stomach during the first 15 minutes. After the above tests were concluded, it was ascertained by experiment that 10 cc of egg-yolk (2/5 of a swallow) was enough to induce evacuation of 72% of the contents of the gall bladder in 35 minutes, when injected directly into the duodenum.

Table I summarizes the most striking results. In each of the 2 groups of subjects there were 13 individuals in whom the pylorus opened within the first few minutes.

* Aided by a grant from the Graduate Research Funds of the University of Minnesota.

1 Gerdes, Maude M., and Boyden, Edward A., *Surg., Gyn., and Obst.*, 1938, **66**, 145.

TABLE I.
Initial Rate of Emptying of Stomach.

Subjects	Time, in minutes, at which meal enters		Estimated amount discharged
	Bulb	Pars inf.	
17 nulligravidæ	Avg of 13 = 2.06 min. (0.25-3.5)	Avg of 11 = 4.04 (1.7-6.8)	9 of 13 = at least 10 cc (1-17 min.)
	" " 4 = 14.8 " (7.2-20)	" " 2 = 35+	4 of 13 = " " 5-7 " (4-13)*
		" " 4 = 19.8 (17.2-22.8)	
18 primigravidæ	" " 13 = 2.72 " (0.3-8.7)	" " 7 = 3.43 (0.6-6.8)	8 of 13 = " " 10 cc (1.2-14 min.)
		" " 3 = 24.95 (16.7-29.5)	5 of 13 = " " 3-5 cc (1-10) †
		" " 3 = 33+	
	" " 5 = 32 " +	" " 5 = 33+	

* 2 cases, no record after 6 min. † 1 case, no record after 7 min.

(This corresponds to the period in which the gall bladder first contracts.) The other 4 or 5, in each group, showed a more or less delayed reaction. It took longer, however, for the head of the meal to reach the inferior angle of the duodenum in more of the first 13 primigravidæ than in the corresponding controls. This suggests that in pregnancy there is a slowing down of peristalsis. But since there was sufficient food in the duodenum to empty the gall bladder in a comparable number of cases in each group, it would not appear that the rate of emptying of the stomach is a primary factor (if one at all) in causing delayed evacuation of the gall bladder in pregnancy.

Recently two groups of workers[2,3] conducting experiments with guinea pigs, have presented interesting evidence that female sex hormones diminish the contractile force of the gall bladder. This finding is in accord with the observation noted in the first paragraph of this article—namely, that even the best 8 of the gall bladders studied in pregnancy evacuated much more slowly than the controls. However, it may be questioned whether the negative findings of these authors, with respect to the sphincter of Oddi, can be applied to human gravidæ: first, because the sphincter of the guinea pig (unlike that of man) is a peristaltically active evacuating mechanism (the functional rate of which, incidentally, was not tested in the above mentioned experiments) and secondly because the evidence seems to indicate that in the human blood stream hormones that affect the musculature of the gall bladder likewise affect the sphincter.[4]

[2] Smith, J. J., Pomarane, M. M., and Ivy, A. C., *Am. J. Physiol.*, 1941, **132**, 129.

[3] Myers, G. S., and Hill, W. T., *Am. J. Physiol.*, 1942, **135**, 347.

[4] Boyden, Edward A., Bergh, George S., and Layne, John A., *Surgery*, 1943, **13**, 723.