CX. THE INFLUENCE OF MEALS ON THE RISE OF THE HYDROGEN ION CONCENTRATION OF THE BLOOD DURING HYPERPNOEA.

BY ELIZABETH HERDMAN LEPPER AND MARJORIE MARTLAND.

*From the Departments of Experimental Pathology and Biochemistry,
Lister Institute, London.*

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IN the foregoing paper on the rapid rise in the p_H of the blood which occurs in forced breathing [Lepper and Martland, 1927] we confined ourselves to the discussion of experiments made not more than 2 hours after a meal. If the forced breathing was carried out 3 or 4 hours after food the course of events was always rather different, the p_H of the blood rising much more slowly and the maximum increase being never so great.

A number of experiments were made, some just before and others shortly after a meal, other conditions being as far as possible identical. The subject of the experiments (E. H. L.) had acquired considerable experience in forced breathing, and great care was taken to keep the rate and character of the respirations uniform in every case.

Fig. 1 gives the results of two typical forced breathing experiments carried out (A) just before, and (B) soon after lunch.

Fig. 1. The effect of forced breathing on the p_H of the blood before and after meals.

• — • — • — • p_H of blood.
○ — ○ — ○ — ○ Percentage of CO₂ in alveolar air.
A. Before meals. B. After meals.

All our comparable observations are set forth in Table I. The determinations were not always made at intervals of exactly 5, 10 or 15 minutes, but to simplify the tabular record of the results, graphs of each experiment were drawn from which values for these intervals were derived by interpolation. These are combined in Fig. 2 which shows composite curves of the observations on the p_H of the blood and the alveolar CO_2 made before and after meals. Table I shows that for equal ventilation the level of p_H reached is always lower before meals than after by not less than 0.09.

Fig. 2. Composite curves of the p_H of the blood and of the alveolar CO_2 during forced breathing experiments, carried out before and after meals

- — • — • — • — • p_H of blood before meals.
- — — — ○ — — — ○ p_H of blood after meals.
- — — — ○ — — — ○ alveolar CO_2 after meals.
- — — — □ — — — □ alveolar CO_2 before meals.

The alveolar CO_2 showed a less marked fall than in the experiments carried out soon after a meal. Notwithstanding the same respiratory efforts it was not possible to reach the same low level of CO_2 in the alveolar air before as after meals. Nevertheless, this factor is not wholly responsible for the different behaviour of the p_H of the blood. Before meals the blood appears to be more

efficiently buffered. Perhaps, while gastric juice is being secreted into the stomach, hydrochloric acid escapes less readily from the corpuscles to adjust changes in the hydrogen ion concentration of the blood. This would explain why the alveolar CO_2 can be reduced to a lower level while gastric digestion is proceeding.

Table I.

Time after meal hours mins.		Duration of forced breathing									
		p_{H} of capillary blood					Alveolar CO_2 %				
		0 min.	5 mins.	10 mins	15 mins.	18 mins.	0 min.	9 mins.	15 mins.	20 mins.	
3	15	7.605	7.69	7.72	7.712	7.722	5.85	3.35	3.30	—	
4	30	7.625	7.705	7.73	—	—	—	—	—	—	
4	45	7.629	7.65	7.655	7.70	7.718	6.04	3.20	3.09	3.0	
5	0	7.625	7.66	7.70	7.715	7.718	6.25	3.31	—	—	
Means		7.621	7.676	7.70	7.71	7.72	6.05	3.28	3.19	—	
0	20	7.635	7.735	7.775	7.79	—	5.87	3.10	2.75	2.54	
0	40	7.61	7.81	—	—	—	—	3.60	—	—	
0	45	7.637	7.735	7.81	—	—	—	—	—	—	
1	15	7.617	7.79	7.835	—	—	—	—	—	—	
1	30	7.635	7.75	7.795	7.827	7.848	5.87	2.85	2.60	2.40	
1	30	7.607	7.715	7.80	7.83	7.835	6.05	—	—	2.48	
Means		7.624	7.763	7.80	7.816	7.84	5.93	3.18	2.65	2.46	

SUMMARY.

In forced breathing experiments carried out 3 or more hours after meals, the p_{H} of the blood rises more slowly, and the maximum change is less, than in similar experiments performed within 2 hours after food. Under the former conditions, the alveolar CO_2 cannot be reduced to the same extent by the same rate and depth of respiration.

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REFERENCE.

Lepper and Martland (1927). *Biochem. J.* **21**, 823.