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A Study of Continued Alkalinity of Morning Urine.

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A series of determinations of the reaction of successive specimens of morning urine has been carried out on 296 subjects, most of whom were studied because an absence of hydrochloric acid in the gastric juice was suspected. There were twenty-two of these, in whom all of the 5 or 6 specimens obtained, gave pH values 7.0 or higher. It has seemed worth while to try to determine the cause of such a finding, particularly as duplicate studies on the same patient usually gave results which were similar.

The case histories were reviewed, and nothing significant found in the diagnosis or in the age and sex to distinguish these patients from the rest of the series. The group was remarkably free from signs of nephritis. Only one patient had cystitis. Diagnoses of neuroses of one type or another, and of various forms of gastro-intestinal disorders were frequent, but probably not more frequent than can be explained on the basis of the type of subjects who were submitted to the test. The only finding distinguishing this group was the small number of patients who showed an absence of hydrochloric acid in the gastric juice. There were only 2 of these included, while approximately a third of the whole series gave such a finding.

The average figures showed two things. First, the reaction of the night specimen was decidedly less alkaline than was that of those collected during the morning. As a matter of fact, in 13 of the 20 cases where the necessary data were available this specimen was less alkaline than that collected immediately after awakening, and in 7 of these 13 the pH was actually lower than 7.0. This suggests that the morning alkalinity in a fair proportion of these cases was not due to disease (cystitis) or to the diet taken before the test because in these conditions there is also an alkalinity of the night specimen. Respiratory adjustment to waking conditions seems to be the most satisfactory explanation of the development of alkalinity immediately after awakening before any meal is fed.

The second thing noticeable about the average figures is that, while the difference among the reactions of the morning specimens was small, the results assumed the form of a curve with 2 periods of alkalinity. The second one—after the meal—may be ascribed to

the secretion of hydrochloric acid in the stomach, while the first one, which has its highest pH value in the first hour, is probably due to respiratory adjustment.[1] In one case of achlorhydria, it was possible to alter the form of the curve markedly by keeping the patient in bed, while a similar experiment upon a normal subject caused no such change in the form of the results obtained. The difference between the results could be adequately explained by the presence of changes in the body fluids in the normal patient which were absent in the case of achlorhydria. The factor of adjustment to waking conditions is common to both, and is lessened by the stay in bed when respiratory variations are reduced to a minimum. In the normal patient, however, the secretion of acid may cause changes which make further demands on the regulatory mechanism of the organism.

The proof that such an explanation is adequate for the experiment upon the normal subject cannot be regarded as complete, for the result was the same when a meal was taken and when it was omitted. This has been observed in some, but not all, normal cases[2] and is difficult to explain on a basis of gastric secretion. The afternoon curve upon the normal subject was regular; and showed that she then responded in the usual manner to the secretion of acid by the stomach.

Conclusion: A fairly large number of persons show a marked urinary alkalinity which persists through the morning period. This alkalinity may be independent of diseases of the kidneys and urinary tract, and of the type of diet preceding the test. It may not be present during the afternoon period. It probably represents an unusual adjustment to waking conditions, exaggerated in most instances by the secretion of hydrochloric acid by the stomach. The reason why such an adjustment is different in these cases from that more commonly observed did not appear in a study of the type of patient upon whom the results were obtained. It seems to the authors that the following general statement covers the fact: there are 2 methods of compensating for a tendency towards alkalosis—through the urine and through the lungs. In these subjects the compensation is accomplished through the kidneys to a greater extent than is the case in most persons.

[1] Hubbard, R. S., *J. Biol. Chem.*, 1929, lxxxiv, 191.

[2] Hubbard, R. S., and Steele, T. M., *J. Biol. Chem.*, 1929, lxxxiv, 199.