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Hydrogen-ion concentration in the gastro-intestinal tract of the albino rat.

By E. M. ABRAHAMSON and E. G. MILLER, Jr.

[*From the Laboratory of Biological Chemistry of Columbia University at the College of Physicians and Surgeons, New York City.*]

In order more accurately to interpret various findings in nutritional studies with albino rats, it was desired to ascertain the normal alimentary conditions of the rat, with special reference to the hydrogen-ion concentration.

Adult male rats were fed various diets, for periods of from one to nine days, except when otherwise noted below. The food was given *ad lib.*, and the rats were killed several hours after the last day's supply of food had been placed in the cage. The contents of the stomach were promptly removed and filtered through glass wool. The small intestines were divided into two portions of equal length, and the contents gently expressed and filtered. (The scant volume of the intestinal contents made it impracticable to make definite comparisons of the various anatomical divisions of the intestines.) The pH of each fluid was then determined colorimetrically, using the Clark and Lubs indicators, and using standard phosphate solutions which had been checked electrometrically. When necessary, a comparator was used in matching colors.

The diets used were: our standard mixed diet (which includes meat, milk, cheese, corn, rye, oats, bread, cabbage); lean beef alone; beef fat alone; boiled potato alone; Pappenheimer and Sherman's rachitic diet "84" (flour 95 per cent, calcium lactate 2.9 per cent, sodium chloride 2 per cent, ferric citrate 0.1 per cent); and the Pappenheimer-Sherman diet plus five per cent cod liver oil.

In the rats on the mixed diet, and on lean beef, fat, and potato diets, we found varying degrees of acidity throughout the tract, as summarized in the tables below.

In the experiments on the Pappenheimer-Sherman rachitic diet, eight rats were used. After seven weeks on this diet, four of the rats were killed and their gastric and intestinal contents

studied. The other four were continued on the same diet for two more weeks, and then fed the same mixture to which 5 per cent cod liver oil had been added. After two to three weeks of this diet they were killed and studied. As will be seen from the table below, the rachitic rats showed a marked increase in the pH of the intestinal contents (rising as high as 7.4); while the curative effect of cod liver oil was associated with a return to the normal acidity. The rise in pH, with the resulting formation of the insoluble calcium phosphate in the intestine, is probably an important factor in the deficiency of calcium absorption and deposition on the "rachitic diet".

No. of rats	Diet	pH gastric contents	pH upper half int.	pH lower half int.
6	Mixed	3.4, 2.7, 3.4 2.6, 3.2, 2.9	6.0, 5.9, 5.2 5.2, 5.3, 5.2	6.0, 5.9, 5.4 5.2, 5.3, 5.3
6	Lean beef	3.7, 3.8, 3.6 3.4, 3.7, 3.5	5.3, 5.7, 6.0 5.9, 6.1, 6.0	5.4, 5.5, 5.8 5.8, 6.1, 6.0
12	Fat (beef)	2.6, 3.2, 3.2 2.8, 3.6, 3.0 3.3, 3.7, 4.0 3.0, 3.2, 3.5	6.0, 5.2, 5.6 5.9, 5.6, 5.7 6.3, 5.9, 6.4 5.8, 6.0, 6.0	6.1, 5.4, 5.9 6.3, 5.9, 5.7 6.3, 6.0, 6.5 5.9, 5.9, 6.0
6	Potato	3.4, 4.1, 3.4 3.3, 3.0, 3.1	6.0, 6.1, 6.0 6.0, 6.0, 6.0	6.2, 6.1, 5.8 6.0, 6.0, 6.0
2	Fast 24 hrs., then cheese <i>ad lib.</i>	3.8, 3.8	5.9, 6.0	6.1, 6.2
2	Fast 24 hrs., then rye and carrots	3.6, 3.7	6.0, 5.9	6.0, 6.0
2	Fast 24 hrs., then rye and cheese	3.8, 3.8	5.9, 6.0	6.0, 6.0
4	"Rachitic" diet, Pappenh.-Sherman	3.8, 3.8, 3.8 4.0	6.4, 7.0, 7.1 7.0	6.7, 7.0, 7.4 7.0
4	"Rachitic" diet plus cod liver oil	3.2, 3.3, 3.0 3.4	5.4, 5.4, 5.6 5.7	5.6, 5.4, 5.8 5.8

The solid nature of the contents of the large intestine did not permit direct application of the above methods; moreover, the reaction of the colon and feces have been studied by other workers. In 13 of our rats on various diets, the contents of this portion of the intestines was pressed against filter paper, and the moist spot so formed was found to be uniformly violet (alkaline) to bromthymol blue.