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Sulphates of Sodium and Magnesium on Gastro-intestinal Activity.

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Our experiments were designed to ascertain the effects of the sulphates of sodium and magnesium on the gastro-intestinal tract of unanesthetized dogs, each having a gastric and intestinal fistula. Rozen and Perussé¹ using unanesthetized dogs with a gastric fistula reported on gastric activity several hours after the use of magnesium chloride but other similar work has not been noted.

Two female dogs, S and B, were used as subjects. The fistulae were made after the manner of Thiry² (intestinal) and Carlson³ (gastric) in a 2 stage operation. The animals were in good physical condition. Food was withheld for 18 hours prior to an experiment, but water was allowed *ad libitum*. Both subjects were trained to lie quietly during the experiments. Our experiments will be described under 2 series since the technic in each differed.

Series I—This series deals with the effects of the sulphates of sodium and magnesium on gastro-intestinal activity when the salines were placed in the stomach, graphic records (smoked paper) being obtained from both stomach and intestinal segment by means of balloons and soap water manometers. The salines were usually given after a normal record of about 1 hour had been procured.

The controls for this series were of 2 kinds: (a) with the stomach empty and (b) with the stomach containing 0.85% sodium chloride.

Results: Isotonic sodium or magnesium sulphate (25 to 50 cc. amounts) in contact with the gastric mucosa was without noteworthy effect on gastro-intestinal activity. Hypertonic (5 times) solutions of magnesium sulphate, however, depressed both gastric and intestinal movements slightly but were without effect on intestinal activity. Hypertonic sodium sulphate (5 times) appeared to increase intestinal activity about 30%.

Series II—Series II deals with the effects of the above salines on the gastro-intestinal activity of dogs S and B when the salines were

¹ Rozen, J. S., and Perussé, G. L., *Am. J. Physiol.*, 1929, **91**, 298.

² Thiry, *Sitzgsbr d. Wiener Acad. Math. Nat. Hist.*, 1864, **50**, 77.

³ Carlson, A. J., "The Control of Hunger in Health and Disease," University of Chicago Press, 1916, 42.

placed in the loop of the intestinal fistula. As before, simultaneous records of the gastric and intestinal movements were taken, the gastric movements being recorded by the balloon method and the intestinal activity by a new closed system method in which the intestinal fistula was directly connected to the manometer. The essential parts in this system were: fistula—reservoir—manometer. A small stopper carrying a glass tube was placed in the opening of the fistula (dog B) or a rubber tube over a glass tube (dog S). Between the manometer and the fistula was a reservoir into which the solution from the intestinal fistula could flow when contractions occurred and from which the solution could drain into the segment of intestine when relaxation occurred. The manometer was the same type used in the first series. This method of recording intestinal activity we believe is essential, since there is no escape of fluid as in the balloon method, thus making long observations possible.

The results obtained were from experiments of 4 hours duration in which the sulphate solutions were either interspersed between physiologic saline or following it, each saline being left in the intestinal fistula for a period of about 1 hour. The hypertonic solutions were never more concentrated than twice hypertonic. Distilled water was also used in a few experiments.

Results: Stomach—no noteworthy effects.

Intestines—Hypertonic sodium chloride and distilled water: Distilled water in general caused only a slight increase in movements, except in 2 experiments in "B" the amplitude was doubled when used following isotonic sodium chloride. Hypertonic sodium chloride increased the amplitude over the normal but slightly in some instances, whereas in others the amplitude was increased 8 times that of the control, the average being about 3 times. There was also a temporary increase for a few minutes in the fluid content of the intestines.

Isotonic sodium sulphate and isotonic magnesium sulphate: The isotonic sodium sulphate stimulated the activity to twice that of the control sodium chloride regardless of whether it preceded or followed the magnesium sulphate. The magnesium sulphate stimulated the activity to 4 times that of the control. When isotonic sodium chloride followed isotonic magnesium sulphate the usual basic effects of isotonic sodium chloride were absent. Both isotonic magnesium and sodium sulphate increased the fluid content of the

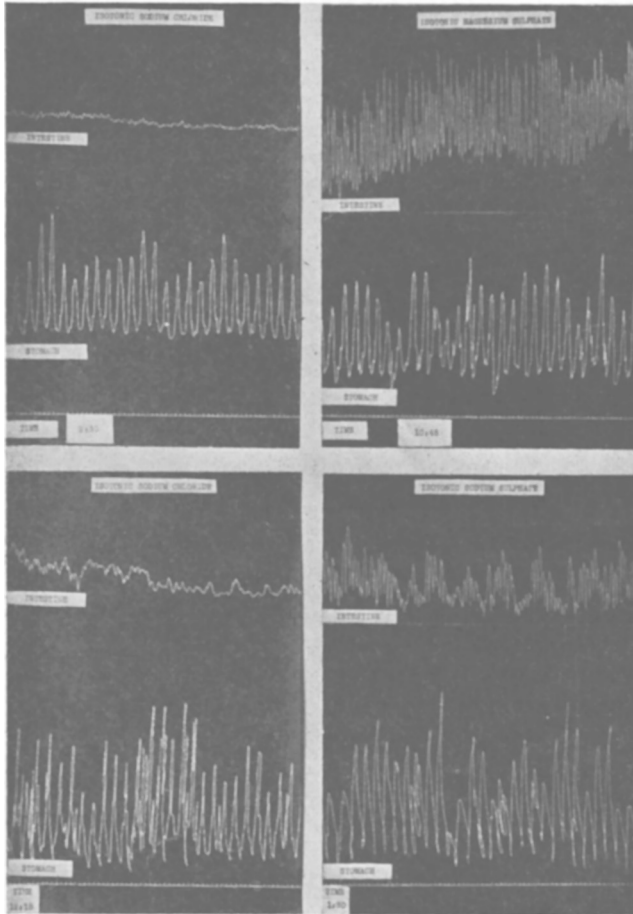


FIG. 1.

Effects of various isotonic salines on gastric intestinal loop activity on un-anesthetized dog (Brindle: 12½ kg. Female. 12/22/33.)

Time in 6 seconds: Tracings as follows: Upper left, isotonic sodium chloride; upper right, isotonic magnesium sulphate; lower left, isotonic sodium chloride; lower right, isotonic sodium sulphate.

The upper tracings were taken one-half hour, lower tracings about 45 minutes, after the salines were placed in the intestinal loop.

intestines, the effects lasting throughout the experiment. The magnesium effect was the more marked.

Hypertonic sodium sulphate and hypertonic magnesium sulphate: The magnesium sulphate (twice hypertonic) caused a stimulation of intestinal activity 9 to 10 times that of the control (isotonic sodium chloride). The sodium sulphate (twice hypertonic) increased the activity about 8 times when it preceded the magnesium, and about 12 times when it followed the magnesium.

When isotonic sodium chloride followed hypertonic magnesium sulphate the usual contractions present during sodium chloride were absent in some experiments and present in others. The fluid content of the intestine was markedly increased with each of the hypertonic solutions but slightly more so after the magnesium. The magnesium also appeared to lower the tone of the intestine.

Specific effects of both magnesium and sulphate ions have thus been demonstrated as well as the usual osmotic effects.

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Determination of Lactic Acid in Presence of Certain Interfering Substances.

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Probably the best technique now available for the determination of lactic acid is that of Friedemann, Cotonio, and Shaffer¹ as modified by Friedemann and Kendall² and, more recently, by Friedemann and Graeser.³ There are certain substances which interfere with the lactic acid determination; these have been listed in the original and some of the subsequent articles. Some of these substances, notably the sugars, may be removed from solution by the copper sulfate-calcium hydroxide procedure.² Appreciable amounts of others, however, remain in solution even after this treatment. Important examples of these substances are malic and citric acids, both of which give large yields of bisulfite-binding substances under the conditions used for the oxidation of lactic acid to acetaldehyde. In fact, by some slight modifications of the conditions it is possible to obtain very nearly a quantitative yield of acetaldehyde from malic acid (90 to 93%).⁴ The product formed by the oxidation of citric acid is apparently acetone⁵ and by the lactic acid method a yield of about 60% of the theoretical may be obtained.⁴ However, both malic and citric acids may be quite completely removed from solu-

¹ Friedemann, T. E., Cotonio, M., and Shaffer, P. A., *J. Biol. Chem.*, 1927, **73**, 335.

² Friedemann, T. E., and Kendall, A. I., *J. Biol. Chem.*, 1929, **82**, 23.

³ Friedemann, T. E., and Graeser, J. B., *J. Biol. Chem.*, 1933, **100**, 291.

⁴ McChesney, E. W., unpublished observations.

⁵ Kuyper, A. C., *J. Am. Chem. Soc.*, 1933, **55**, 1722.