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A Fluoroscopic Study of the Motility of Gastro-Intestinal Tract of Rats Fed a Vitamin Deficient Diet.

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(Introduced by W. H. Harris.)

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A review of the literature reveals that a vitamin deficient diet fed to animals will alter the motility of their gastro-intestinal tract, and is also capable of producing in their intestines marked pathological changes. Most of these observations appertaining to the motility, however, were made by methods other than with the Roentgen rays and in the few instances wherein it was employed, the skiagraphic method was used with unsatisfactory results.

In order that experimental observations upon animals may have a practical application to man, it is necessary to utilize animals whose diet is very much of the same nature as that of the human species, and their gastro-intestinal tract must bear a close resemblance to that of primates. In the rat we have an animal that will ideally serve this purpose, better in fact than herbivorous or graminivorous mammals.

A comparative study by means of frequent fluoroscopic observations was made on the motility of the gastro-intestinal tract of rats fed diets deficient in vitamin B, vitamin D and also a diet deficient in vitamins A and D with a balanced mineral content. These studies were undertaken principally to ascertain the effect of deficient vitamin A and D diet with adequate mineral balance, upon the motility of the gastro-intestinal tract of rats.

Seventy rats were used. Twelve were fed a deficient vitamin B diet, 14 a deficient vitamin D diet with an unbalanced mineral content, 17 a diet deficient in vitamins A and D but with an adequate mineral balance and 27 normal rats served as controls. After the rats were fasted for 48 hours and water withheld during the last 24 hours of fasting they were fed, in separate cages, a meal consisting of 5 gm. of barium sulphate and 5 cc. of buttermilk. They were allowed to eat for 20 minutes, when they were immediately fluoroscoped in loose cotton bags as previously described,[1] in order to ascertain whether their stomachs were full. Fluoroscopic observations were made every 15 minutes thereafter until the cecum ap-

[1] Menville, L. J., Blackberg, S. N., and Ané, J. N., PROC. SOC. EXP. BIOL. AND MED., 1929, xxvi, 758.

pearance of the food column was observed and continued until the small intestine emptied. The colon observations were made at longer intervals of time on account of the slow emptying of this organ.

The fluoroscopic observations made on the rats, demonstrated that those fed a diet deficient in vitamin B showed a marked hypomotility of their gastro-intestinal tract. The D deficient rats also showed a hypomotility, but not so marked as was found in the B rats. The A and D rats showed a motility comparable to the normal rats.

TABLE I.

Rats	Wt. Gm.	Ate Gm.	Cecum Appear. Time	Stom. Emp. Time	Sm. I. Emp. Time	Col. Emp. Time	No. of Rats
A-D	91.7	7.8	3:41	6:22	10:19	70 hr.	17
B	89.8	7.23	4:17	11:14	15:27	121.8 hr.	12
D	103.1	8.3	2:22	9:50	12:05	95 hr.	14
Norm.	184.0	6.3	3:19	7:04	10:36	65 hr.	27

Our table demonstrates by comparison the various emptying times of the gastro-intestinal tracts of rats fed diets deficient in certain vitamins. It can also be seen that the rats fed a deficient vitamin A and D diet show a striking similarity in their motility to that of the normal rats.

While we have made no attempt to prove in these experiments that a diet deficient in vitamin D alone produces a hypomotility of the gastro-intestinal tract, we believe, however, that it plays an important part, as the mineral content of the diet fed the A and D rats contained an adequate mineral balance, with a resulting motility comparable to the normal. This would indicate that the hypermotility produced by the deficient A vitamin as observed by many investigators was balanced by a factor antagonistic to it, and probably that a hypomotility was produced by a deficient D vitamin.