

Enzymic Efficiency in Avitaminosis

VII. Peptic Digestion in Vitamin B Deficiency*

By

BARNETT SURE, Ph.D.

and

ROBERT TROY HARRELSON, M.S.†

FAYETTEVILLE, ARKANSAS

THE literature on the efficiency of peptic digestion either in experimental polyneuritis or vitamin B deficiency in man is scanty and unconvincing. In 1926, Farnum (1) found feeding a beri-beri producing diet to a dog gradually decreases the total volume as well

severe cases of this deficiency, in which anorexia is accompanied by nervous and muscular symptoms, there is gastric atony. Successful vitamin therapy is followed by a rapid improvement in tone of the stomach musculature. The only direct statement we are able to find in the literature concerning the influence of experimental polyneuritis or peptic activity is that of Farmer and Redenbaugh (3) who found marked reduction in peptic efficiency in polyneuritis columbarum in five pigeons. At that time (1925) the necessity for controlling the plane of nutrition was not fully appreciated. Recently Alvarez and co-workers (4) maintained two persons for six weeks and one for four weeks on a diet markedly deficient in vitamin B₁. The concentrations of hydrochloric acid and pepsin in the gastric juice were measured almost every day. In two subjects there were no definite changes in the gastric juice, and in the third the only changes consisted in two falls in acidity, each associated with a respiratory infection. These workers concluded: "The work here reported indicates that a diet deficient in vitamin B₁, by itself, is not likely to produce much reduction in gastric acidity. It is possible, however, that such a diet might reinforce the lowering effect on gastric acidity of fever induced by injections of foreign protein."

TABLE I
Influence of a deficiency of the vitamin B complex on peptic efficiency

Experiment No.	Animal Marking and Sex	Per cent of loss of Weight in Pathologic Animals	Peptic Digestion Expressed in Units Period of Digestion		
			30 Minutes	60 Minutes	90 Minutes
3304	P-M R-L.M	22	1.75	0.96	0.67
			1.41	0.82	0.57
3491	P-DL.M R-DR.M	23	1.55	0.86	0.59
			0.75	0.49	0.36
3302	P-M R-L.M	23	1.47	0.86	0.62
			1.41	0.83	0.59
3416	P-R.F R-D.F	23	1.62	0.85	0.53
			1.47	0.79	0.53
3398	P-R.F R-D.F	24	1.65	0.91	0.59
			1.59	0.84	0.57
3399	P-DL.F R-DR.F	24	1.61	0.90	0.62
			1.61	0.91	0.63
3423	P-R.M R-D.M	25	1.79	0.94	0.66
			1.59	0.84	0.52
3392	P-DL.M R-DR.M	25	1.50	0.86	0.61
			1.59	0.87	0.59
3395	P-R.M R-D.M	25	1.78	0.97	0.67
			1.55	0.88	0.67
3353	P-DL.F R-DR.F	26	1.34	0.80	0.57
			1.37	0.78	0.56
3355	P-R.M R-D.M	26	0.94	0.60	0.43
			0.91	0.53	0.42
3305	P-F R-L.F	27	1.34	0.79	0.56
			1.45	0.85	0.61
3397	P-F R-R.F	28	1.39	0.84	0.57
			1.52	0.80	0.55
3304	P-DL.F R-DR.F	29	1.73	0.93	0.66
			1.05	0.64	0.48
3303	P-R.F R-D.F	50	1.53	0.83	0.66
			1.43	0.82	0.53

P = Pathologic; R = Restricted to the same plane of nutrition.

as the free and total acidity of gastric secretion. In the same year Cowgill and co-workers (2) reported that in mild cases of vitamin B deficiency in the dog, associated with anorexia, there is no marked change in the character of the hunger contractions. In the

*From the Laboratory of Agricultural Chemistry, University of Arkansas, Fayetteville.

†Deceased.
Research Paper No. 452, Journal Series, University of Arkansas.
Submitted December 24, 1936.

EXPERIMENTAL

Peptic digestion was studied in two series of experiments. A deficiency of the vitamin B complex was produced in 15 sets of animals and uncomplicated vitamin B₁ deficiency accompanied by varying degrees of polyneuritis in 24 sets of rats, according to the paired feeding technique previously described (5). The essential point of this feeding procedure is that the control animal of the same litter and sex was restricted to the same plane of nutrition daily as the avitaminotic rat. The composition of the rations is outlined in Table III. The control animals of the vitamin B complex set received Ration 1751 in which 10 per cent of the dextrin was replaced by an equivalent amount of Northwestern dehydrated yeast. The control animals of the vitamin B₁ set received the same ration as the polyneuritic rats but in addition 10 y of Merck's crystalline vitamin B₁ daily.

The peptic digestion was studied according to the vicometric technique of Northrop (6). Twenty-five per cent glyceryl extracts were made of the stomachs in concentration of 1 to 20, ground with sand, shaken for 5 minutes, and allowed to stand at room temperature for 24 to 26 hours. The supernatant liquid was then decanted off and an equal volume of 25% glycerol added, shaken for 5 minutes, and recentrifuged. Kahlbaum's casein was used, prepared according to Hammersten. The digestion was carried out in a thermostat at 37° C., employing the Oswald type of vicosimeters. The digestion was run at 10, 20, 30, 40, 50, 60, 70, 80, and 90 minute intervals. A

total of 674 titrations were made in this investigation. To save space, we are reporting, however, only 30, 60, and 90 minute digestions. The results are expressed in pepsin units described by Northrop (6). All of the data are summarized in Tables I and II.

mate controls. In the rest of the experiments the difference in rate of digestion between the avitaminotic rats and their controls are too small to be of any significance. Summarizing all the results, the pathologic animals showed an increase in peptic diges-

TABLE II
Influence of vitamin B₁ deficiency on peptic efficiency

Experiment No.	Animal Marking and Sex	Per cent of Loss of Body Weight	Degree of Paralysis	Peptic Digestion Expressed in Units Period of Digestion			On Rations
				30 Minutes	60 Minutes	90 Minutes	
3413	P-R.M R-D.M	14	Marked	1.53 1.24	0.84 0.73	0.59 0.53	1751; 2345; 3148-A; 3148-X
3347	P-DL.M R-DR.M	18	Marked	1.67 1.68	0.94 0.93	0.65 0.64	3148-A
3478	P-R.M R-D.M	20	Marked*	1.28 1.27	0.76 0.75	0.54 0.51	1751; 2345; 3148-A
3401	P-M R-L.M	20	Moderate	1.59 2.30	0.96 1.27	0.68 0.81	3148-A
3480	P-R.M R-D.M	21	Marked	1.65 1.63	0.90 0.90	0.61 0.61	1751; 2345; 3148-A; 3148-X
3372	P-DL.F R-DR.F	21	Marked	1.66 1.56	0.90 0.89	0.64 0.62	3148-A
3331	P-D.M R-R.M	22	Moderate	1.98 1.61	0.99 0.81	0.67 0.62	1751; 2345
3390	P-DL.F R-DR.F	25	—	1.78 1.50	0.95 0.85	0.64 0.58	1751; 2345
3379	P-DL.M R-DR.M	25	Marked	1.27 0.97	0.72 0.59	0.51 0.42	3148-A
3371	P-R.F R-D.F	26	Slight	1.31 1.04	0.83 0.64	0.53 0.47	3148-A
3350	P-DR.M R-D.M	26	Slight	1.22 1.32	0.74 0.78	0.59 0.50	1751; 2345
3376	P-D.F R-L.F	26	Marked	1.22 1.60	0.73 0.91	0.52 0.63	3148-A
3366	P-DL.F R-DR.F	26	Slight	1.35 1.02	0.80 0.62	0.58 0.49	3148-A
3410	P-DL.F R-DR.F	26	Slight	1.49 1.70	0.86 0.97	0.62 0.69	1751; 2345
3229	P-D.M R-DL.M	27	Slight	1.50 1.33	0.98 0.98	— —	1751; 2345
3342	P-R.F R-D.F	27	Slight	0.85 0.90	0.54 0.58	0.32 0.38	3148-A
3290	P-DL.F R-DR.F	26	Slight	0.91 0.92	0.58 0.67	0.43 0.43	1751; 2345
3291	P-DL.M R-DR.M	28	Slight	1.62 1.50	1.06 0.96	— —	3148-A
3374	P-DL.M R-DR.M	32	Slight	1.12 1.09	0.67 0.64	0.48 0.46	3148-A
3334	P-DL.M R-DR.M	32	Slight	1.53 0.86	0.84 0.57	0.58 0.35	3148-A
3329	P-D.M R-DL	33	Slight	1.11 1.15	0.66 0.72	— —	1751; 2345
3362	P-DL.M R-DR.M	38	Marked	1.42 1.23	0.89 0.93	0.59 0.52	3148-A
3344	P-M R-L.M	40	Slight	1.25 1.51	0.76 0.88	0.56 0.62	3148-A
3268	P-DL.R.M R-LDR.M	41	Marked†	1.40 1.54	0.82 0.89	0.59 0.62	3148-A

P = Pathological; R = Restricted to the same plane of Nutrition.

* Slight Convulsions.

† Marked Convulsions; cart wheels.

Peptic Digestion in a Deficiency of the Vitamin B Complex. In only two groups, 3491 and 3304, marked differences in rates of digestion have been observed. In each of these cases the pathologic animals have shown a more rapid rate of digestion than the litter

tion in the 30, 60 and 90 minutes to the extent of 14.3, 11.9, and 10.9 per cent respectively. There was no influence on the rate of the loss of body weight on rate of peptic digestion.

Peptic Digestion in Vitamin B₁ Deficiency Asso-

TABLE III
Composition of rations

	Number of Rations			
	1751	2345	3148-A	3148-X
Casein (Commercial)	—	—	16	16
Casein ¹	20	10	—	—
Salts No. 185	4	4	4	4
Agar-agar	2	—	—	—
Butterfat (filtered)	10	10	—	—
Dextrin	64	61	—	—
Autoclaved beef ²	—	15	—	6
Autoclaved Fleishman's Yeast ³	—	—	12	9
Cod liver oil	—	—	2	2
Cornstarch	—	—	57	54
Unfiltered butterfat	—	—	9	9
	100	100	100	100

1. Washed for 10 days with acidulated water and extracted thoroughly with 25 per cent alcohol.
2. Autoclaved for 6 hours at 20 pounds pressure at the natural pH of the beef (round steak).
3. Dehydrated Fleishman's yeast autoclaved for 5 hours at 15 pounds pressure at the natural pH of the yeast.

ciated with *Polynneuritis*. There was considerable variation in rate of digestion of the 23 groups studied.

Fourteen pathologic animals showed varying degrees of increase in the rate of peptic digestion compared with their litter mate controls restricted to the same plane of nutrition, while nine avitaminotic rats showed varying degrees of decrease in peptic activity compared with their controls.

Summarizing all the results for the 30, 60, and 90 minute periods of digestion, the pathologic rats showed an increase over their controls of 6.9, 3.5, and 3.7 per cent respectively. Varying degrees of paralysis and increase in per cent of the loss of weight had no noteworthy influence on the rate of peptic digestion.

CONCLUSION AND SUMMARY

The data presented in this paper conclusively demonstrates that neither in a deficiency of the vitamin B complex nor in vitamin B₁ deficiency associated with varying degrees of paralysis is there any significant change in the rate of peptic digestion when comparisons are made with litter mate controls of the same sex and restricted to the same plane of nutrition.

REFERENCES

1. Farnum, M. B.: *Arch. Int. Med.*, Vol. 37, p. 212, Feb., 1926.
2. Cowgill, Geo. R., Deul, H. J., Plummer, N. and Messer, F. C.: *Am. J. Physiol.*, Vol. 77, p. 389, July, 1926.
3. Farmer, C. J. and Redenbaugh, H. E.: *Am. J. Physiol.*, Vol. 75, p. 45, Dec., 1925.
4. Alvarez, W. C., Pilcher, F., Foley, M. A. and Mayer, A.: *Am. J. Dig. Dis. and Nutrit.*, Vol. 3, p. 102, April, 1936.
5. Sure, B., Kik, M. C. and Smith, M. E.: *J. Nutrit.*, Vol. 5, p. 155, 1932.
6. Northrop, J. H.: *J. Gen. Physiol.*, Vol. 16, p. 7, 1933.

Unusual Course of Pelvic Abscess and Fistulous Tract*

By

HUGH BEATON, M.D.
FORT WORTH, TEXAS

THIS case is reported because of the long continued ailment and the very great distance between the source of infection and the external pointing of the abscess.

CASE HISTORY

The patient, male, nineteen years, was referred to me by Dr. Charles Clayton, orthopedic surgeon, with the following history:

In March, 1932, he developed an abscess on the outer middle third of the left leg, accompanied with the usual symptoms: pain, redness, swelling and elevation of temperature. He went to the City-County Hospital where the abscess was opened and drained. He was discharged in two weeks. *Two months later*, the patient had a recurrence accompanied by a discharge near the old scar. He returned to the hospital. A diagnosis of osteomyelitis of the descending ramus of the left ischium was made. He was operated on and a cast applied. He remained this time in the hospital for ten weeks, being discharged the last week of *August, 1932*.

Three weeks after leaving the hospital, the patient noticed that he had some drainage from the original opening. That condition continued until July, 1933.

He was again hospitalized and drainage instituted, by wide exposure of the femur on its lateral aspect. He was discharged at the end of ten weeks. When he left,

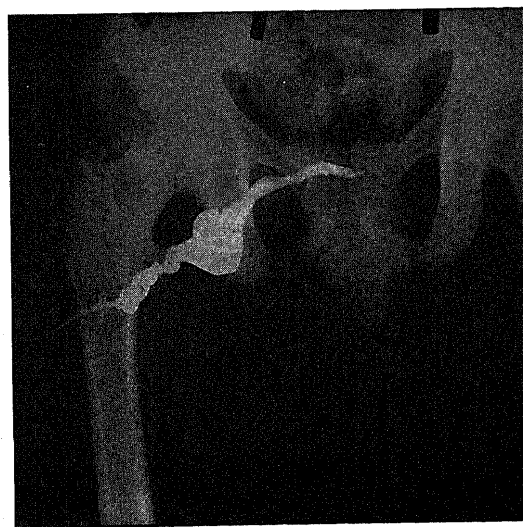


Fig. 1. Roentgen film after injection of fistulous tract with opaque substance. The size, course and internal termination of the tract are well demonstrated.

*Read at the Annual Meeting of the American Proctologic Society, Kansas City, Mo., May 11, 1936. Submitted May 19, 1936.