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Clinical Experiences with the Measurement of the Urinary Excretion of Vitamin B_1.

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Vitamin B_1 is currently used in the treatment of a large number of complaints and diseases. In relatively few of these situations has an actual deficiency of vitamin B_1 been demonstrated in the patients. In the majority of instances the presence of a deficiency is assumed because of resemblance between the symptoms under suspicion and the symptoms which occur in known vitamin B_1 deficiencies, such as beri-beri and certain forms of polyneuritis. At times the diagnosis may be corroborated by the patient's previous dietary history and by an improvement in his symptoms coincident with vitamin B_1 therapy. However, evaluation of dietary histories and therapeutic responses is difficult, and if direct measurements of some phase of vitamin B_1 metabolism can be correlated with the patient's need for vitamin B_1,

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the problem of vitamin B_1 therapy might be considerably simplified. The data presented in this paper furnish further evidence[1, 2, 3] that such a correlation may be possible.

Method. We have measured the urinary excretion of vitamin B_1 using a modification of the procedure of Hennessey and Cerecedo[4] arranged to be convenient for clinical use.[5] The method gave results which were comparable to those obtained by Melnick and Field[6] on the same samples of urine.†

Results. The amount of vitamin B_1 appearing in 24-hour urine samples is generally agreed to be some function of the amount of vitamin B_1 ingested in that 24-hour period.[1, 2, 7] Normal individuals on ordinary normal diets appear to excrete somewhere between 10 and 40% of the amount of B_1 in their diet. The addition of small amounts of vitamin B_1 to these normal diets or the injection of vitamin into these normal individuals results in the excretion of about 10-40% of this added B_1, Table I. This increased B_1 excretion

TABLE I.
Excretion of Vitamin B_1 by Normal Individuals (Interns) on Their Usual Diets and Their Response to a Tolerance Test Dose.

Subject	24-hour excretion of B_1 on usual normal diet γ	24-hour excretion of B_1 on usual normal diet + 0.5 mg of B_1 subcutaneously γ
P	108	163
C	150	252,238
D	120	
I	220	
A	77*	198
S	283	
N	149	230
R	168	335
W	109	280
Wl	260	—
D	390	avg increment 133
Pr	153	(after 1 mg po. 258)
	Avg 182	

*Ulcer subject.

1 Westenbrink, H. G. K., and Goudsmit, J., *Arch. Neérl. de physiol.*, 1938, **23**, 79.

2 Robinson, W. D., Melnick, D., and Field, H., Jr., *J. Clin. Invest.*, 1940, **19**, 399.

3 Hou, H. C., and Yang, E. F., *Chinese J. Physiol.*, 1939, **14**, 269.

4 Hennessey, D. J., and Cerecedo, L. R., *J. Am. Chem. Soc.*, 1939, **61**, 179.

5 Ferrebee, J. W., and Carden, G. A., *J. Lab. and Clin. Med.*, 1940, **25**, 1320.

6 Melnick, D., and Field, H., Jr., *J. Biol. Chem.*, 1939, **127**, 515.

† The writers wish to thank Dr. H. Field, Jr., for his kindness in sending them these urine samples.

7 Westenbrink, H. G. K., and Goudsmit, J., *Arch. Neérl. de physiol.*, 1937, **22**, 319.

can be considered their response to a tolerance test dose of vitamin B_1. Since no effort was made in our series to control the dietary selection or intake in these normal subjects, considerable variation may have occurred in the amount of B_1 ingested by the same individual on different days, and as a result it is not possible to determine from our data the exact percentage of the added vitamin which these individuals excreted. The essential point at present is that the normal individuals on normal diets had an excretion of vitamin B_1 of more than 100 γ per 24 hours and that this excretion could be routinely augmented by the administration of a small tolerance dose.[1, 2, 7] On the other hand, the 24-hour urinary excretion of vitamin B_1 in a group of hospital patients suspected of suffering from vitamin B_1 deficiency was low, Table II. These patients had been on apparently deficient diets for varying periods of time preceding hospital admission and in some there were clinical symptoms suggestive of vitamin B_1 deficiency. When small test doses of vitamin B_1‡ were administered to the members of this group, approximately normal increments in the urinary excretion of vitamin B_1 were obtained in only a portion of the cases, 1-4, Table III. In the others, 5-9, the patients in whom the evidence for B_1 deficiency was strongest, the responses became normal only after the patient had been in the hospital for several days, received B_1 in several tolerance tests, and eaten an adequate diet.

Discussion. We have determined the urinary excretion of vitamin B_1 directly by a chemical method and have tried to correlate its urinary excretion with the state of vitamin B_1 nutrition. In so doing we appreciate the numerous variables of tissue saturation and renal function which must be considered in interpreting measurements of

TABLE II.
The 24-hour Urinary Excretion of Vitamin B_1 by Hospital Patients Suspected of Vitamin B_1 Deficiency.

Subject	24-hour excretion of vitamin B_1 γ
Br	40
McK	15
Sh	70
Wd	25
Di	50
Ad	20
Dy	15
Lm	15
Lv	5
Dt	15
Pl	20

‡ Supplied by Roche-Organon Co., Nutley, N. J.

TABLE III.
Effect of Small Doses of Vitamin B_1 upon the Urinary Excretion of Vitamin B_1 in Patients Suspected of Vitamin B_1 Deficiency.

	Subject	Diagnosis	Daily vitamin B_1 treatment	Amt of vitamin B_1 in 24-hour urine sample γ
1	Br		0	40
			.5 mg p.o.	130
			"	110
			.5 mg i.m.	100
			"	150
			"	150
			"	80
			"	80
			"	130
			0	15
			1 mg p.o.	200
2	McK	Chronic cholecystitis, healed or inactive ulcerative colitis	0	15
			.5 mg i.m.	110
			"	200
			"	140
			"	215
			0	110
			1 mg p.o.	210
3	Di	Addison's disease	0	50
			1 mg s.c.	380
			"	310
			1 mg p.o.	190
			"	190
4	Ad		0	15
			1 mg s.c.	120
			"	130
			"	230
5	Dt	Ulcerative colitis	0	15
			.5 mg i.m.	50
			"	50
			1 mg i.m.	140
			"	190
6	Am	Cardiac insufficiency of unknown etiology	1 mg s.c.	15
			"	40
			"	190
			"	160
			"	120
7	Pl	Pernicious anemia	.5 mg s.c.	20
			"	10
			"	15
			1 mg s.c.	50
			"	140
			"	140
			"	140
8	Lm	Advanced carcinoma with metastases	0	15
			1 mg i.m.	70
			"	90
			"	80
			"	45
			"	130
			20 mg i.m.	2000+
9	Dy	Alcoholic polyneuritis	0	15
			"	15
			.5 mg p.o.	20

Subject	Diagnosis	Daily vitamin B_1 treatment	Amt of vitamin B_1 in 24-hour urine sample γ
		.5 mg i.m.	50
		"	25
		"	50
		"	30
		"	50
		1 mg i.m.	50
		"	120
		0	15
		1 mg i.m.	60
		2 mg p.o.	160
		"	340
		0	75
		"	70
		"	15

urinary excretion of vitamin. At present it seems evident that patients who have been on low vitamin B_1 diets excrete less than the usual normal amounts of vitamin B_1 in their urine, and that the more deficient ones have a less than normal increment in B_1 excretion following the administration of small doses of vitamin. A much larger series of patients and a better understanding of the factors relating tissue saturation and urinary excretion will be required before accurate interpretation of the results of B_1 tolerance tests can be attempted. However, it is interesting that in one year we were unable to find any patient whose urinary excretion of vitamin B_1 could not be raised to normal by the administration of very small amounts of vitamin, amounts comparable to those obtainable in ordinary normal diets.

Conclusion. It appears possible to correlate the urinary excretion of vitamin B_1 with the state of vitamin B_1 nutrition in man using a thiochrome method for determining the amount of vitamin B_1 in urine.

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Gravimetric Intestinal Oncometry in the Dog.

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The usual difficulties of quantitative plethysmography are multiplied when the method is applied to the intestine by the occurrence of intestinal contractions which may compress gases trapped within the lumen of the gut, even though the ends of the loop are open, and