

# THE URIC ACID CONTENT OF THE BLOOD COMPARED WITH THE RENAL DIETARY TEST

THE BLAND DIET COMPARED WITH THE ORDINARY TEST DIET \*

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During the past three years we have carried out about 180 renal dietary tests and blood analyses. Most of the cases were diagnosed nephritis or arteriosclerosis, though a number of other diseases have been included in the tables. The routine employed was as follows: The blood for analysis was collected before breakfast. The patients were in bed during the dietary test. They received a uniform quantity of water and food. In most instances the Mosenthal<sup>1</sup> modification of the Hedinger and Schlayer<sup>2</sup> diet was administered. The urine was collected in two hour periods from 8 a. m. to 8 p. m., and in one period from 8 p. m. to 8 a. m.

Recently Mosenthal<sup>3</sup> and Schlayer and Beckmann<sup>4</sup> compared the effect of a low protein or bland diet with that of the usual test diet. The former author found that both had approximately the same effect on the urine. Schlayer and Beckmann observed that in severe cases of nephritis the bland diet gave results which were similar to those obtained with the usual diet; in less severe cases the variability of the volume and specific gravity was more marked in the case of the bland diet, while in mild cases the difference between the two diets was even more striking. Their bland diet was administered in five meals. It consisted of a cup of milk and a roll at breakfast, a cup of milk and a roll in the forenoon; a plate of unsalted cereal soup and 500 to 600 grams of porridge at noon; a cup of milk and a roll in the afternoon and 500 to 600 grams of porridge and a cup of milk for supper. In our series of bland dietary tests the patients received 840 c.c. of milk, 45 grams of bread, 12 grams of oatmeal and 50 grams of rice divided into five meals. The nitrogen content of the diet was about 6 grams, the sodium chlorid content about 1.6 grams and the calorie value 890.

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1. Mosenthal, H. O.: Arch. Int. Med., **16**:733, 1915.

2. Hedinger, M., and Schlayer: Deutsch. Arch. f. klin. Med. **114**:120, 1914.

3. Mosenthal, H. O.: Arch. Int. Med. **22**:770, 1918.

4. Schlayer and Beckmann: München. med. Wchnschr. **65**:92, 1918.

TABLE 1.—CASES SHOWING A MODERATE ABNORMALITY IN THE RENAL DIETARY TEST OR BLOOD ANALYSIS

Clin- ical Num- ber	Age	Diagnosis	Blood Pressure	Heart	Edema	Albu- min	Casts	Maximum Sp. Gr.	Varia- tion Sp. Gr.	Night Urine		Blood	
										Volume, Cc.	Sp. Gr.	Urea N, Mg. per Cent.	Uric Acid, Mg. per Cent.
5735	27	Chronic interstitial nephritis...	180-110	+	—	+	+	1.015	9	567	1.015	23.4	4.7
		Same case.....	.....	..	..	..	..	1.020	4	515	1.019		
Obst.	17	Chronic interstitial nephritis...	192-120	+	—	—	—	1.009	4	750	1.009	19.6	3.1
3135	51	Chronic interstitial nephritis...	220-160	+	+	+	+	1.025	11	420	1.018	24.0	4.6
		Same case.....	.....	..	..	..	..	1.023	6	666	1.017		
3099	19	Chronic interstitial nephritis...	125-83	+	+	+	+	1.020	0	900	1.020	17.4	
		Same case.....	.....	..	..	..	..	1.020	5	750	1.018	16.0	2.1
4978	20	Chronic interstitial nephritis...	170	—	—	—	—	1.014	3	745	1.014	18.9	2.0
4398	28	Chronic interstitial nephritis...	140-90	+	—	—	—	1.030	9	124	1.030	31.0	4.1
4269	39	Chronic interstitial nephritis...	195-135	+	+	+	+	1.017	7	675	1.013	24.0	3.2
3484	24	Chronic interstitial nephritis...	120-86	+	+	+	+	1.022	19	400	1.020	25.0	6.6
3294	64	Chronic interstitial nephritis...	270-170	—	—	—	—	1.020	13	280	1.020	15.6	5.0
5885	27	Chronic interstitial nephritis...	200-128	+	+	+	+	1.010	4	230	1.008	15.0	1.8
		Same case.....	.....	..	..	..	..	1.008	3	85	1.008		
5958	23	Chronic interstitial nephritis...	210-110	+	+	+	+	1.010	2	706	1.009	16.0	6.0
		Same case.....	.....	..	..	..	..	1.010	2	1,160	1.009		
3222	19	Acute nephritis.....	116-60	—	—	—	—	1.014	6	890	1.011	23.7	3.6
		Same case.....	.....	..	..	..	..	1.012	7	780	1.011		
5087	20	Nephritis.....	192-102	+	+	+	+	1.016	9	710	1.016	26.6	3.3
5640	19	Nephritis.....	145-85	—	—	—	—	1.013	4	567	1.010	12.0	
		Same case.....	.....	..	..	..	..	1.015	5	390	1.015		
4159	37	Syphilitic nephritis.....	120-75	—	+	—	—	1.016	5	880	1.011	26.6	3.5
5384	50	Cardiorenal sclerosis.....	182-112	+	—	—	—	1.028	3	415	1.023	26.0	
		Same case.....	.....	..	..	..	..	1.019	2	510	1.019		
5704	49	Cardiorenal sclerosis.....	225-120	+	—	+	+	1.015	2	180	1.013	13.0	3.2
		Same case.....	.....	..	..	..	..	1.016	6	85	1.012		
4447	45	Cardiorenal sclerosis.....	100-110	—	—	—	—	1.018	10	2,340	1.008	22.0	7.3
3078	69	Arteriosclerosis.....	140-90	+	+	+	+	1.020	3	400	1.017	12.9	5.6
4725	64	Arteriosclerosis.....	135-110	+	+	+	+	1.015	6	566	1.015	29.0	3.5
3653	51	Arteriosclerosis.....	184-140	+	+	+	+	1.017	15	430	1.017	15.0	7.0
4436	82	Arteriosclerosis.....	100-82	+	—	—	—	1.020	8	335	1.020	26.0	3.6
4029	50	Arteriosclerosis.....	150-98	+	+	+	+	1.027	22	215	1.027	24.0	5.2
4511	60	Arteriosclerosis.....	172	+	+	+	+	1.018	9	505	1.018	27.0	3.5
5055	28	Hysteria.....	122-65	—	—	—	—	1.013	9	600	1.013	14.7	3.4

TABLE 2.—CASES SHOWING A SLIGHT ABNORMALITY IN THE RENAL DIETARY TEST OR BLOOD ANALYSIS

Clinical Number	Age	Diagnosis	Blood Pressure	Heart	Edema	Albumin	Casts	Maximum Sp. Gr.	Variation Sp. Gr.	Night Urine		Blood	
										Volume, C.c.	Sp. Gr.	Urea N, Mg. per Cent.	Uric Acid, Mg. per Cent.
3199	55	Chronic interstitial nephritis...	200-100	+	—	+	—	1.022	2	240	1.020	17.9	3.3
		Same case.....	.....	+	—	+	+	1.024	4	260	1.023		
3301	21	Chronic interstitial nephritis...	148-48	+	—	+	+	1.033	18	250	1.033	18.6	6.4
		Same case.....	.....	—	—	—	—	1.023	16	276	1.022	13.5	5.1
		Same case.....	.....	—	—	—	—	1.027	24	228	1.027		
5356	18	Chronic interstitial nephritis...	100-110	+	—	—	—	1.021	11	575	1.013	23.4	2.4
4224	44	Chronic interstitial nephritis...	140-80	—	—	—	—	1.020	12	725	1.014	28.0	2.8
Pod.	10	Chronic interstitial nephritis...	108-86	+	+	+	+	1.025	9	109	1.022		
4682	33	Chronic interstitial nephritis...	140-80	+	—	+	+	1.025	16	197	1.025	22.4	1.0
2066	23	Chronic interstitial nephritis...	130-64	—	—	—	—	1.022	15	365	1.022	18.0	4.0
3569	22	Chronic interstitial nephritis...	150-90	—	+	+	+	1.020	15	370	1.014	10.0	3.2
		Same case.....	.....	—	—	—	—	1.020	8	530	1.020	6.7	3.3
3856	29	Chronic interstitial nephritis...	140-90	—	—	—	—	1.019	17	400	1.018	18.6	4.2
3451	56	Chronic interstitial nephritis...	194-126	—	—	+	+	1.020	13	1,090	1.007	14.4	1.5
3369	32	Chronic interstitial nephritis...	152-90	—	—	+	+	1.030	7	380	1.026	19.0	4.0
3260	50	Chronic interstitial nephritis...	220-110	+	—	+	+	1.021	9	790	1.012	16.3	2.7
		Same case.....	.....	—	—	—	—	1.020	4	555	1.017		
4932	38	Chronic interstitial nephritis...	240-140	+	—	+	+	1.020	4	365	1.018	21.0	3.4
4951	40	Chronic interstitial nephritis...	172-103	+	—	+	+	1.013	10	885	1.013	16.5	1.6
5684	33	Chronic interstitial nephritis...	144-88	+	—	+	—	1.023	13	280	1.021	16.1	3.7
		Same case.....	.....	—	—	—	—	1.027	4	275	1.026		
5684	44	Chronic interstitial nephritis...	135-87	—	—	+	+	1.021	8	205	1.019	13.2	2.7
		Same case.....	.....	—	—	+	+	1.016	8	405	1.016		
5971	66	Chronic interstitial nephritis...	198-120	+	+	+	+	1.016	8	440	1.010	14.6	4.5
		Same case.....	.....	—	—	—	—	1.017	8	369	1.017		
4190	18	Chr. parenchymatous nephritis...	145-100	—	—	+	+	1.022	14	303	1.022	23.1	2.4
5050	24	Chr. parenchymatous nephritis...	130-78	+	+	+	+	1.025	14	435	1.012	15.0	2.7



TABLE 3.—CASES SHOWING NO ABNORMALITY IN THE RENAL DIETARY TEST OR BLOOD ANALYSIS

Clin- ical Num- ber	Age	Diagnosis	Blood Pressure	Heart	Edema	Albu- min	Casts	Maximum Sp. Gr.	Varia- tion Sp. Gr.	Night Urine		Blood	
										Volume, C.c.	Sp. Gr.	Urea N. Mg. per Cent.	Uric Acid, Mg. per Cent.
3908	27	Chronic interstitial nephritis...	160-95	—	—	—	+	1.022	14	270	1.018	18.0	1.7
3951	45	Chronic interstitial nephritis...	210-110	+	—	+	—	1.025	13	335	1.025	13.0	1.0
3959	27	Chronic interstitial nephritis...	122-78	—	—	+	—	1.028	16	350	1.028	15.0	2.3
3971	38	Chronic interstitial nephritis...	180-120	—	—	+	—	1.022	9	325	1.020	17.0	1.8
3987	27	Chronic interstitial nephritis...	130-85	—	—	+	—	1.019	17	325	1.019	16.0	1.8
5583	48	Chronic interstitial nephritis...	120-70	+	—	+	+	1.019	13	407	1.019	16.0	1.4
6066	32	Chronic interstitial nephritis...	140-90	+	—	+	+	1.027	10	370	1.027	14.2	1.8
		Same case.....	.....	..	..	..	+	1.033	10	300	1.033		
6016	45	Chronic interstitial nephritis...	104-78	—	—	—	+	1.033	10	300	1.033	22.0	1.9
6077	43	Same case.....	.....	..	..	..	+	1.033	10	150	1.033	11.6	1.9
6106	26	Chronic interstitial nephritis...	198-110	+	+	+	+	1.024	12	245	1.024	17.4	1.9
		Chronic interstitial nephritis...	150-100	+	—	+	+	1.035	24	300	1.021		
		Same case.....	.....	..	..	..	+	1.031	19	140	1.031		
6145	47	Chronic interstitial nephritis...	170-110	+	—	+	—	1.021	15	215	1.021	15.4	1.6
6491	51	Chronic interstitial nephritis...	140-78	—	—	+	—	1.025	20	190	1.021	16.4	2.1
		Same case.....	.....	..	..	..	+	1.024	15	205	1.024		
3339	25	Acute nephritis.....	140-60	+	+	+	+	1.019	12	325	1.018	14.0	1.2
5736	18	Albuminuria.....	120-75	—	—	+	+	1.025	16	320	1.016	18.0	
5050	24	Nephrosis.....	120-88	—	+	+	+	1.029	9	220	1.020	7.7	2.6
		Same case.....	.....	..	..	..	+	1.029	9	265	1.021		
4209	49	Arteriosclerosis.....	210-110	—	—	—	—	1.027	20	345	1.018	21.0	1.0
3635	57	Arteriosclerosis.....	175-95	—	—	—	—	1.030	20	220	1.020	8.0	2.5



## DISCUSSION

Depending in a general way on the degree of abnormality, the cases have been tabulated in three groups. The cases showing marked abnormality have been omitted. In addition to the laboratory findings, the clinical number, age, diagnosis, systolic and diastolic blood pressures, presence of cardiac enlargement, edema, albumin and casts have been considered. The following norms have been adopted for the dietary tests and blood analyses: Maximum specific gravity, eighteen or higher; variation in specific gravity nine or more; volume of the night urine 400 c.c. or less; specific gravity of the night urine eighteen or more; urea nitrogen concentration of the blood 0.020 grams per cent. or less, and the uric acid concentration of the blood 0.0025 grams per cent. or less.

Tables 1 and 2 summarize the data of 100 cases showing moderate and slight abnormality, respectively. All showed renal involvement from the clinical point of view. *Sixty-six per cent. had an abnormality in the dietary test, while 74 per cent. showed an increased concentration of uric acid in the blood.* Myers and collaborators<sup>5</sup> have pointed out that in nephritis the uric acid content of the blood is increased long before urea. Mosenthal and Lewis<sup>6</sup> compared the delicacy of the various tests for renal function, but omitted consideration of the blood uric acid. They concluded that the dietary test was the most delicate.

It follows from the above that the uric acid concentration of the blood is a delicate, if not the most delicate, index of renal function at our disposal. The individual abnormalities in our series were as follows: Twenty-six as regards maximal specific gravity, forty-nine as regards variability of specific gravity, forty as regards volume or concentration of the night urine and thirty-five as regards urea nitrogen content of the blood. An abnormal dietary test with normal blood findings was found in 8 per cent. of the cases. An abnormally high urea with a normal uric acid concentration was encountered in only six instances. The figures in Tables 1 and 2, but particularly those in Table 3 indicate that 400 c.c. is the upper normal limit for the volume of the night urine, provided the patients are kept in bed during the test period. At any rate we have never found more in an individual in whom there was no reason to suspect renal involvement.

If each test is considered as a whole, the figures of Table 4 indicate that the results are similar with either the bland or the relatively

5. Myers, V. C., and Fine, M. S.: J. Biol. Chem. **20**:391, 1915. Myers, V. C.; Fine, M. S., and Lough, W. G.: Arch. Int. Med. **17**:570, 1916. Chace, A. F., and Myers, V. C.: J. A. M. A. **67**:929, 1916.

6. Mosenthal, H. O., and Lewis, D. S.: J. A. M. A. **67**:933, 1916.

high protein and salt diets. Owing to the small quantity of solids which it contains, the bland diet tends to lower the specific gravity of the night urine. As one would expect in cases with fixation of specific gravity the volume of the night urine is greater on the regular than on the bland diet. On the whole, it appears that both tests may be used interchangeably. The advantages of the bland diet are that it is easily prepared, and that it may be used where a high protein diet is undesirable or where digestive disturbances are present.

TABLE 4.—COMPARISON OF THE DATA OF BOTH DIETARY TESTS, BLAND AND REGULAR

Maximum Sp. Gr.		Variation Sp. Gr.		Total Volume, C.c.		Night Urine			
						Volume, C.c.		Sp. Gr.	
Bland	Regu- lar	Bland	Regu- lar	Bland	Regu- lar	Bland	Regu- lar	Bland	Regu- lar
1.010	1.010	2	2	1,764	2,783	760	1,160	1.009	1.009
1.021	1.026	10	17	1,070	1,066	290	310	1.021	1.025
1.022	1.020	16	16	1,128	1,754	395	304	1.015	1.020
1.020	1.020	16	14	1,305	1,185	260	350	1.020	1.020
1.026	1.019	3	4	833	1,194	415	510	1.023	1.019
1.015	10.13	5	4	1,163	1,340	360	567	1.015	1.010
1.017	1.021	6	3	1,593	1,127	615	590	1.017	1.021
1.029	1.035	12	13	744	492	348	222	1.020	1.030
1.015	1.016	2	8	593	944	100	85	1.013	1.012
1.023	1.036	22	31	1,013	600	237	165	1.009	1.029
1.015	1.024	6	12	1,694	1,436	457	515	1.015	1.023
1.015	1.020	9	4	1,807	1,177	567	515	1.015	1.019
1.021	1.029	17	15	1,287	561	245	232	1.021	1.022
1.010	1.008	4	3	762	671	230	85	1.008	1.008
1.022	1.019	16	10	1,016	1,062	380	310	1.016	1.017
1.023	1.027	13	3	808	676	280	275	1.021	1.026
1.025	1.030	16	10	1,213	641	320	232	1.016	1.030
1.009	1.010	0	1	1,506	1,705	845	935	1.009	1.009
1.025	1.024	17	7	1,899	1,343	370	490	1.025	1.024
1.024	1.026	18	11	965	590	330	155	1.012	1.026
1.033	1.033	9	9	678	833	300	150	1.033	1.033
1.021	1.016	8	7	823	1,600	205	405	1.019	1.016
1.029	1.022	9	12	370	757	220	510	1.020	1.010
1.016	1.017	8	3	1,300	670	440	360	1.010	1.017
1.028	1.035	20	31	1,157	1,570	202	220	1.028	1.035
1.014	1.018	7	12	1,595	1,652	250	335	1.014	1.018
1.028	1.027	24	17	979	963	305	312	1.016	1.026
1.024	1.032	18	10	1,405	520	130	140	1.024	1.032
1.027	1.033	10	12	447	507	170	200	1.027	1.033
1.021	1.026	13	20	1,638	2,315	190	250	1.021	1.026
1.031	1.029	16	23	674	1,377	155	210	1.031	1.029
1.025	1.026	18	22	1,315	1,750	160	195	1.025	1.026
1.020	1.025	14	20	1,460	2,680	160	290	1.020	1.025
1.028	1.026	11	16	760	1,120	280	280	1.028	1.026
1.035	1.031	24	19	953	836	300	140	1.021	1.031
1.023	1.023	15	17	1,467	2,180	312	280	1.023	1.023
1.020	1.025	13	19	1,700	1,575	400	350	1.020	1.019
1.036	1.029	14	19	224	725	98	120	1.036	1.029
1.022	1.034	17	24	1,690	1,262	700	950	1.014	1.010
1.024	1.028	10	19	590	657	135	180	1.024	1.028

#### CONCLUSIONS

In conclusion, we wish to emphasize the desirability of keeping the patients in bed during the test period. Even then the results may be unreliable in the presence of edema, cardiac decompensation or when the urine is scanty or highly concentrated as in midsummer. Needless to say all forms of treatment must be interdicted during the test period.