Effect of Vitamin B* Administration on Urine of Mothers with Negative Arakawa's Reaction.

141st Report of the Peroxidase Reaction.

(88th Human Milk Study.)

By

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In preceding papers¹⁾²⁾ (Cf. 136th Report and 137th Report of the Peroxidase Reaction) I reported of the relation between Arakawa's reaction[†] and chlorine content of lactating mothers, and of the abnormal retention of chlorine in the body of Arakawa-negative mothers. Murayama³⁾ found out for the first time that the amount of urine of Arakawa-negative mothers is essentially smaller than that of Arakawa-positive mothers. This assertion has been confirmed by Morikawa[‡] and myself. In the present paper I want to report of the influence of vitamin B upon the chlorine content, the amount and the specific gravity of the urine of mothers with negative Arakawa's reaction.

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* B means B₁ throughout this article.

† Arakawa-positive may be used in two different senses. One of these is: Arakawa-positive in a biochemical sense. A sample of human milk is said to have become Arakawa-positive, when it becomes blue on the addition of Arakawa's reagent. There it means that the sample is not negative to Arakawa's reaction. Arakawa-positive in a clinical sense: A sample of human milk is clinically Arakawa-positive only when it shows such a reaction as or in one minute of the addition of Arakawa's reagent. Another sample of human milk may be Arakawa-positive in the first described sense, but yet clinically negative.

1) H. Umemura, Tohoku J. Exp. Med., 1940, 39, 103.

2) H. Umemura, Tohoku J. Exp. Med., 1940, 39, 116.

3) H. Murayama, To be published in this Journal.

‡ T. Morikawa, Not published.

Materials and Method.

Materials: Urine voided during 24 hours in the case of lactating mothers, who had, according to what they asserted, no menses, no pregnancy, or no renal diseases during the present experiment.

Vitamin B was injected every 24 hours, and then the urine collector was removed for another urine collector. The amount and specific gravity was noted and then the chlorine content was determined; protein reaction was tried.

Method of Investigation: I applied the blood chlorine method of Rusznyak⁴⁾ to human urine.¹⁾ Protein was tested with 20% sulfosalicylic acid. Arakawa's reaction was tested within 3 hours of milk obtaining (Cf. 52nd Report of the Peroxidase Reaction⁵⁾; milk was always obtained before nursing.

Report of Cases.

Case 1 (Cf. Table 1 and Table 15).

In this case 0.25 mgrms. of vitamin B were injected subcutaneously as often as 19 times, making the total amount of 4.75 mgrms. Arakawa's reaction showed a tendency to become more and more positive after the vitamin administration. The chlorine content of urine was on an average 1.03 g/dl* before the vitamin administration, but, after this, 0.98 g/dl on an average, showing thus a reduction of about 5%. The total urine contained on an average 12.6 grms. of chlorin before the vitamin administration, but, after it, 15.4 grms. on an average, showing thus an increase of 22%. In two instances the total chlorin was 11.8 and 12.4 grms. respectively (in contrast to 12.6 grms. before the administration) after the vitamin administration, but such an instance with a reduction of the total chlorin occurred only twice.

The amount of the urine was 1227 c.c. on an average before the vitamin administration. After this, it always showed an increase and was 1574 c.c. on an average, showing an increase of 28%. Only once it was 1130 c.c., smaller than that before the vitamin administration, but this was an exceptional instance. The specific gravity was 1.024 on an average before the vitamin injection, but it was 1.020 after it on an average, showing thus a reduction of 0.4%.

4) St. Rusznyak, Biochem. Z., 1921, 114, 23.

5) Y. Uga, Tohoku J. Exp. Med., 1934, 24, 208.

* g/dl means grms. per decilitre.

TABLE 1.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 1. K. Yamamoto, male, aged 2 months.

Diagnosis: Healthy. Age of mother, 26 years.

No. of experiment	Date	Arakawa's reaction										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B, mgrms. (subcutaneously)	Time of injection	
		Right.					Left					grms. per 100 c.c.	grms. per day						
		0'	1'	2'	3'	4'	5'	0'	1'	2'	3'								4'
1	18. IV	—	—	—	±	±	±	—	—	—	—	—	—	0.89	12.4	1390	1025	(—)	10 p.m.
2	19. "	—	—	—	±	±	±	±	±	±	±	±	1.12	13.3	1190	1025	"		
3	20. "	—	—	—	±	±	±	±	±	±	±	±	1.09	12.0	1100	1021	"		
4	22. "	—	—	—	±	±	±	±	±	±	±	±	1.12	16.8	1500	1016	"		
5	23. "	—	—	—	±	±	±	±	±	±	±	±	0.96	17.6	1830	1015	"		
6	24. "	—	—	—	±	±	±	±	±	±	±	±	0.82	15.2	1850	1017	"		
7	25. "	—	—	—	±	±	±	±	±	±	±	±	0.89	16.2	1820	1018	"		
8	26. "	—	—	—	±	±	±	±	±	±	±	±	0.96	17.6	1830	1018	"		
9	27. "	—	—	—	±	±	±	±	±	±	±	±	1.00	18.2	1820	1021	"		
10	28. "	—	±	±	±	±	±	±	±	±	±	±	1.00	15.1	1510	1018	"		
11	29. "	—	±	±	±	±	±	±	±	±	±	±	0.83	14.1	1700	1020	"		
12	30. "	—	±	±	±	±	±	±	±	±	±	±	1.07	13.7	1280	1024	"		
13	1. V	—	±	±	±	±	±	±	±	±	±	±	1.07	14.9	1390	1024	"		
14	2. "	—	±	±	±	±	±	±	±	±	±	±	1.07	16.9	1580	1020	"		
15	3. "	±	±	±	±	±	±	±	±	±	±	±	0.96	16.1	1680	1021	"		
16	4. "	—	±	±	±	±	±	±	±	±	±	±	1.00	14.2	1420	1025	"		
17	5. "	—	±	±	±	±	±	±	±	±	±	±	1.00	18.1	1810	1017	"		
18	6. "	—	—	—	±	±	±	±	±	±	±	±	1.12	12.6	1130	1024	"		
19	7. "	—	—	—	±	±	±	±	±	±	±	±	0.89	12.4	1390	1020	"		
20	8. "	—	—	—	—	±	±	±	±	±	±	±	0.92	11.8	1280	1018	"		
21	9. "	—	±	±	±	±	±	±	±	±	±	±	0.92	16.6	1800	1020	"		
22	10. "	—	±	±	±	±	±	±	±	±	±	±	1.07	13.8	1290	1026	"		

Case 2 (Cf. Table 2 and Table 15).

In this case 0.25 mgrms. of vitamin B were injected subcutaneously as often as 9 times, making the total amount of 2.25 mgrms. Arakawa's reaction showed a tendency to become more and more positive after the vitamin administration. The chlorine content of urine was on an average 0.65 g/dl before the vitamin administration, but, after this, 0.73 g/dl on an average, showing thus an increase of about 12%. The total urine contained on an average 5.7 grms. of chlorin before the vitamin administration, but, after it, 7.6 grms. on an average, showing thus an increase of 33%. After the vitamin administration, in three instances it was 5.0, 5.1 and 5.0 grms. respectively, smaller than that before the vitamin administration.

The amount of the urine was on an average 875 c.c. before the vitamin administration. After this, it always showed an increase (ex-

cept for two instances in which it was 850 and 750 c.c. respectively) and the amount was 1028 c.c. on an average, showing thus an increase of 17 %. The specific gravity was on an average 1.015 before the vitamin administration, but it was 1.019 on an average after it, showing an increase of 0.4 %.

TABLE 2.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 2. O. Ishihata, male, aged 2 months. Diagnosis: Healthy. Age of mother, 24 years.

No. of experiment	Date	Arakawa's rection										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B ₁ mgrms. (subcutaneously)	Time of injection
		Right					Left					grms. per 100 c.c.	grms. per day					
		0'	1'	2'	3'	4' 5'	0'	1'	2'	3'	4' 5'							
1	4. V	±	±	+	+	+	±	±	+	+	+	0.56	5.3	950	1012	(-)	(-)	
2	5. "	±	±	+	+	+	±	±	+	+	±	0.75	6.0	800	1018	"	"	
3	6. "	±	+	+	+	±	±	±	+	+	±	0.87	10.9	1250	1018	"	"	
4	7. "	±	+	+	+	±	±	±	+	+	±	0.82	12.3	1500	1016	"	"	
5	8. "	-	±	+	+	±	±	-	+	+	±	0.50	5.0	1000	1018	"	"	
6	9. "	-	-	±	±	±	±	-	±	+	±	0.75	6.7	900	1017	"	"	
7	10. "	-	±	±	+	+	±	-	±	+	±	0.92	7.8	850	1022	"	"	
8	11. "															"	(-)	(-)
9	12. "															"	(-)	(-)
10	13. "	-	-	-	-	-	±	-	-	-	±	0.54	5.1	950	1024	(±)	0.25	10 p.m.
11	14. "	-	-	-	-	±	±	-	±	±	+	0.67	5.0	750	1018	(-)	"	"
12	15. "	-	-	±	±	+	+	-	±	±	±	0.71	7.4	1050	1017	(-)	"	"
13	16. "	-	±	+	+	±	±	-	±	±	±	0.81	8.1	1000	1021	(-)	"	"

Case 3 (Cf. Table 3 and Table 15).

In this case vitamin B was injected subcutaneously in the amount of 1 mgrm. at one time, and in the amount of 0.25 mgrms. at the 2 other times, making the total amount of 1.5 mgrms. Arakawa's reaction showed a tendency to become more and more positive after the vitamin administration. The chlorine content of urine was on an average 0.68 g/dl before the vitamin administration, but, after this, 0.88 g/dl on an average, showing thus an increase of 29 %. The total urine contained on an average 5.6 grms. of chlorine before the vitamin administration, but, after it, 15.3 grms. on an average, showing thus an increase of 173 %. After the vitamin administration, the chlorine content of total urine showed in all the instances an increase.

The amount of the urine was 867 c.c. on an average before the vitamin administration, but subsequently it always showed an increase, and was 1744 c.c. on an average, showing thus an increase of 101 %.

The specific gravity was 1.021 on an average before the vitamin injection, but after it, it was 1.019 on an average, showing a reduction of 0.2 %.

TABLE 3.

Daily variation of Arakawa's reaction and urine of lactating mothers.

Case 3. K. Gonoue, female, aged 19 months. Diagnosis: Dyspepsia. Age of mother, 26 years.

No. of experiment	Date	Arakawa's reaction										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B, mgrms. (subcutaneously)	Time of injection
		Right					Left					grms. per 100 c.c.	grms. per day					
		0' 1' 2' 3' 4' 5'	0' 1' 2' 3' 4' 5'															
1	25. V	— — — — —	— — — — — ±	0.65	8.4	1300	1018	(—)	(—)	(—)								
2	26. "	— — — — — ± ±	— — — — — ±	0.85	4.2	500	1026	"	"	"								
3	27. "	— — — — — ±	— — — — — ±	0.53	4.2	800	1020	"	"	"								
4	28. "	— — — — — ± ± ±	— — ± ± ± ± ±	0.50	8.0	1600	1016	"	"	7 p.m.								
5	2. IV	— — — — — ± ± ±	± ± ± ± ± ± ±	0.58	8.7	1500	1022	"	(—)	(—)								
6	3. "	± ± ± ± ± ± ±	— ± ± ± ± ± ±	1.02	14.8	1450	1023	"	"	"								
7	4. "	— ± ± ± ± ± ±	— ± ± ± ± ± ±	1.01	14.1	1400	1021	"	"	"								
8	5. "	— ± ± ± ± ± ±	± ± ± ± ± ± ±	0.84	19.7	2350	1018	"	"	"								
9	6. "	— — — — — ± ± ±	— ± ± ± ± ± ±	1.10	15.4	1400	1022	"	"	"								
10	7. "	— ± ± ± ± ± ±	— ± ± ± ± ± ±	0.79	15.0	1900	1016	"	"	"								
11	8. "	— — — — — ± ± ±	— — ± ± ± ± ±	1.07	20.3	1900	1018	"	0.25	10 p.m.								
12	9. "	— — — — — ± ± ±	— — — — — ±	1.01	22.2	2200	1019	"	"	"								

Case 4 (Cf. Table 4 and Table 15).

In this case vitamin B was injected subcutaneously in the total amount of 29 mgrms. Arakawa's reaction showed a tendency to become positive after the injection, though it was later restored to the reaction before it. The chlorine content of urine was on an average 1.02 g/dl before the vitamin administration, but after this 0.69 g/dl on an average, showing thus a reduction of 32 %. The total urine contained 5.1 grms. of chlorin before the vitamin administration, but after it, 13.5 grms. on an average, showing thus a very remarkable increase of 165 %. Following the vitamin administration the chlorine content of total urine always showed an increase.

The amount of the urine was 500 c.c. before the vitamin administration. Now after this, it always showed an increase and was 1973 c.c. on an average, showing a very remarkable increase of 295 %. The specific gravity was 1.032 before the vitamin injection, but it was 1.016 on an average after it, showing thus a reduction of 1.6 %.

TABLE 4.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 4. E. Eguchi, male, aged 2 months. Diagnosis: Lues congenita. Age of mother, 39 years.

No. of experiment	Date	Arakawa's reaction										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B ₁ , mgrms. (subcutaneously)	Time of injection
		Right					Left					grms. per 100 c.c.	grms. per day					
		0' 1' 2' 3' 4' 5'	0' 1' 2' 3' 4' 5'															
1	10. V	---	---	---	---	---	---	---	---	---	---	1.02	5.1	500	1032	(-)	(-)	10 a.m.
2	11. "	---	---	---	---	---	---	---	---	---	---	0.78	11.7	1500	1014	"	0.5	
3	12. "	---	---	---	---	---	---	---	---	---	---	0.75	7.5	1000	1018	"	0.5	
4	13. "	---	---	---	---	---	---	---	---	---	---	0.53	11.1	2100	1014	"	0.5	
5	14. "	---	---	---	---	---	---	---	---	---	---	0.74	10.0	1350	1020	"	2.0	
6	15. "	---	---	---	---	---	---	---	---	---	---	0.71	9.2	1300	1014	(+)	3.0	
7	16. "	---	---	---	---	---	---	---	---	---	---	0.70	10.5	1500	1015	(+)	2.5	
8	17. "	---	---	---	---	---	---	---	---	---	---	0.96	10.6	1100	1024	(+)	3.0	
9	18. "	---	---	---	---	---	---	---	---	---	---	0.76	13.7	1800	1014	"	5.0	
10	19. "	---	---	---	---	---	---	---	---	---	---	0.76	14.1	1850	1016	"	5.0	
11	20. "	---	---	---	---	---	---	---	---	---	---	0.63	16.4	2600	1012	"	(-)	5 p.m.
12	21. "	---	---	---	---	---	---	---	---	---	---	0.63	16.4	2600	1012	"	5.0	
13	22. "	---	---	---	---	---	---	---	---	---	---	0.32	7.8	2450	1024	"	(-)	
14	23. "	---	---	---	---	---	---	---	---	---	---	0.71	14.9	2100	1016	"	"	
15	24. "	---	---	---	---	---	---	---	---	---	---	0.69	13.8	2000	1016	"	"	
16	25. "	---	---	---	---	---	---	---	---	---	---	0.71	11.4	1600	1022	"	"	
17	26. "	---	---	---	---	---	---	---	---	---	---	0.62	9.3	1500	1018	"	"	
18	27. "	---	---	---	---	---	---	---	---	---	---	0.50	12.5	2500	1016	(-)	"	
19	28. "	---	---	---	---	---	---	---	---	---	---	0.83	13.3	1600	1010	"	"	
20	29. "	---	---	---	---	---	---	---	---	---	---	0.63	10.7	1700	1014	"	"	
21	30. "	---	---	---	---	---	---	---	---	---	---	0.70	15.4	2200	1012	"	"	
22	31. "	---	---	---	---	---	---	---	---	---	---	0.58	9.9	1700	1018	"	"	
23	1. VI	---	---	---	---	---	---	---	---	---	---	0.66	16.5	2500	1014	"	"	
24	2. "	---	---	---	---	---	---	---	---	---	---	0.68	11.6	1700	1016	"	"	
25	3. "	---	---	---	---	---	---	---	---	---	---	0.78	19.5	2500	1014	"	"	
26	4. "	---	---	---	---	---	---	---	---	---	---	0.53	15.9	3000	1012	"	"	
27	5. "	---	---	---	---	---	---	---	---	---	---	0.64	16.6	2600	1016	"	"	
28	6. "	---	---	---	---	---	---	---	---	---	---	0.72	20.9	2900	1013	"	"	
29	7. "	---	---	---	---	---	---	---	---	---	---	0.78	19.5	2500	1016	"	"	
30	8. "	---	---	---	---	---	---	---	---	---	---	0.81	21.1	2600	1018	"	"	
31	9. "	---	---	---	---	---	---	---	---	---	---	0.72	13.7	1900	1015	"	"	
32	10. "	---	---	---	---	---	---	---	---	---	---	0.82	13.1	1600	1019	"	"	
33	11. "	---	---	---	---	---	---	---	---	---	---	0.81	15.4	1900	1024	"	"	

Case 5 (Cf. Table 5 and Table 15).

In this case 0.5 mgrms. of vitamin B were injected subcutaneously 3 times, making the total amount of 1.5 mgrms. Arakawa's reaction showed a tendency to become more and more positive after the vitamin administration. The chlorine content of urine was 0.90 g/dl before the vitamin administration, but after this 0.83 g/dl on an average, showing thus a reduction of about 8%. The total urine contained

12.6 grms. of chlorin before the vitamin administration, but, after it, 15.5 grms. on an average, showing thus an increase of 23 %. There was one instance in which the total chlorin was 12.3 grms. (in contrast to 12.6 grms. before the vitamin administration) after it, but such an instance with a reduction occurred only once.

The amount of the urine was 1400 c.c. before the vitamin administration. Later, it always showed an increase and 1864 c.c. on an average, showing a rather remarkable increase of 33 %. The specific gravity was 1.024 on an average before the vitamin injection, but after it 1.018 on an average, showing a reduction of 0.6 %.

TABLE 5.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 5. S. Yamada, male, aged 2 months. Diagnosis: Dyspepsia. Age of mother, 23 years.

No. of experiment	Date	Arakawa's reaction										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B, mgrms. (subcutaneously)	Time of injection		
		Right					Left					grms. per 100 c.c.	grms. per day							
		0'	1'	2'	3'	4'	5'	0'	1'	2'	3'								4'	5'
1	1. VII	—	—	—	±	±	±	—	—	—	±	±	±	0.90	12.6	1400	1024	(—)	(—)	9 a.m.
2	2. "	—	—	—	±	±	±	—	—	—	±	±	±	0.91	17.3	1900	1018	"	0.5	
3	3. "	—	—	—	±	±	±	—	±	±	±	±	±	0.89	16.9	1900	1016	"	(—)	
4	4. "	—	—	±	±	±	±	—	±	±	±	±	±	0.92	17.7	1920	1022	"	0.5	
5	5. "	—	—	±	±	±	±	—	±	±	±	±	±	0.71	13.5	1900	1016	"	(—)	
6	6. "	—	±	±	±	±	±	—	±	±	±	±	±	0.72	12.2	1700	1016	"	0.5	

Case 6 (Cf. Table 6 and Table 15).

In this case 0.5 mgrms. of vitamin B were injected subcutaneously as often as 11 times, making the total amount of 5.5 mgrms. Arakawa's reaction became positive after the vitamin administration. The chlorine content of urine was 1.18 g/dl on an average, but after this the average was 0.95 g/dl, showing thus a reduction of 19 %. The total urine contained 5.8 grms. of chlorin on an average before the vitamin administration, but, after it, an average of 8.0 grms., showing thus a remarkable increase of 38 %. After the administration, in only one instance did the total chlorin show the same value as the average value (5.8 grms.) before the vitamin administration.

The amount of urine was 500 c.c. before the administration, but after this 859 c.c. on an average, showing thus a very remarkable in-

crease of 72%. In one instance only the amount showed the same average value after the vitamin administration as before it. The specific gravity was 1.020 on an average before the administration, and 1.018 on an average after it, showing thus a reduction of 0.2%.

TABLE 6.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 6. Y. Sibasaki, male, aged 10 months. Diagnosis: Infantile beriberi. Age of mother, 24 years.

No. of experiment	Date	Arakawa's reaction										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B ₁ , mgrms. (subcutaneously)	Time of injection
		Right					Left					grms. per 100 c.c.	grms. per day					
		0' 1' 2' 3' 4' 5'	0' 1' 2' 3' 4' 5'															
1	3. VII	---	---	---	---	---	---	---	---	---	1.28	5.8	450	1022	(-)	(-)		
2	4. "	---	---	---	---	---	---	---	---	---	1.25	5.7	450	1023	"	"		
3	5. "	---	---	---	---	---	---	---	---	---	1.00	6.0	600	1015	"	"		
4	6. "	---	---	---	---	---	---	---	---	---	1.21	8.5	700	1023	"	"		
5	7. "	---	---	---	---	---	---	---	---	---	1.31	6.5	500	1024	"	0.5	5 p.m.	
6	8. "	---	---	---	---	---	---	---	---	---	0.95	12.3	1300	1016	"	"	"	
7	9. "	---	---	---	---	---	---	---	---	---	0.85	6.8	800	1020	"	"	"	
8	10. "	---	---	---	---	---	---	---	---	---	0.83	5.8	700	1018	"	"	"	
9	11. "	---	---	---	---	---	---	---	---	---	1.03	9.8	950	1018	"	"	"	
10	12. "	---	---	---	---	---	---	---	---	---	0.71	6.0	850	1016	"	"	"	
11	13. "	---	---	---	---	---	---	---	---	---	0.71	7.1	1000	1015	"	"	"	
12	14. "	---	---	---	---	---	---	---	---	---	1.20	10.2	850	1018	"	"	"	
13	15. "	---	---	---	---	---	---	---	---	---	0.75	7.5	1000	1014	"	"	"	
14	16. "	---	---	---	---	---	---	---	---	---	0.89	7.1	800	1018	"	"	"	

Case 7 (Cf. Table 7 and Table 15).

In this case vitamin B was injected subcutaneously in the amount of 0.25 mgrms. for 3 times and in the amount of 0.5 mgrms. on 4 occasions, making the total amount of 2.75 mgrms. Arakawa's reaction became positive after the vitamin administration. The chlorine content of urine was 0.67 g/dl on an average before the administration, but, after this, 0.90 g/dl on an average, showing thus a remarkable increase of 34%. The total urine contained 14.4 grms. of chlorine before the administration. Now after this, it always showed an increase and was 17.8 grms., showing a rather remarkable increase of 24%.

The amount of the urine was 2150 c.c. before the vitamin administration, and after this 2000 c.c., showing a decrease of 7%. The specific gravity was 1.018 on an average before the vitamin administration, the subsequent average value being 1.019, thus representing an increase of 0.1%.

TABLE 7.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 7. H. Numanami, male, aged 2 months. Diagnosis: Infantile beriberi. Age of mother, 28 years.

No. of experiment	Date	A r a k a w a's reaction										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B ₁ mgrms. (subcutaneous/y)	Time of injection	
		Right					Left					grms. per 100 c.c.	grms. per day						
		0'	1'	2'	3'	4'	5'	0'	1'	2'	3'								4'
1	4. VII	-	±	±	±	±	±	-	+	+	+	+	±	0.63	13.2	2100	1018	(-)	1 p.m.
2	5. "	-	±	±	±	±	±	-	+	+	±	±	±	0.71	15.6	2200	1018	"	
3	6. "	-	±	±	±	±	±	-	±	±	±	±	±	0.95	16.1	1700	1018	"	
4	7. "	-	±	±	±	±	±	-	±	±	±	±	±	0.96	18.2	1900	1020	"	
5	8. "	-	±	±	±	±	±	-	±	±	±	±	±	0.82	18.0	2200	1018	"	
6	9. "	-	±	±	±	±	±	±	+	+	±	±	±	0.76	17.5	2300	1018	"	
7	10. "	-	+	+	±	±	±	-	+	+	±	±	±	0.89	17.8	2000	1018	"	
8	11. "	+	±	±	±	±	±	+	±	±	±	±	±	0.91	19.1	2100	1018	"	
9	12. "	+	±	±	±	±	±	+	±	±	±	±	±	0.99	17.8	1800	1021	"	

Case 8 (Cf. Table 8 and Table 15).

In this case 0.5 mgrms. of vitamin B were injected subcutaneously as often as 6 times, making the total amount of 3.0 mgrms. Arakawa's reaction showed no change in spite of the vitamin administra-

TABLE 8.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 8. T. Yahagi, male, aged 2 months. Diagnosis: Osteomyelitisluetica. Age of mother, 24 years.

No. of experiment	Date	Arakawa's reaction										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B ₁ mgrms. (subcutaneously)	Time of injection	
		Right					Left					grms. per 100 c.c.	grms. per day						
		0'	1'	2'	3'	4'	5'	0'	1'	2'	3'								4'
1	11. IX	-	-	-	-	-	-	±	+	+	+	+	0.77	11.5	1500	1022	(-)	0.5	1 p.m.
2	12. "	-	-	-	-	-	-	±	±	+	+	+	0.82	12.7	1550	1020	"		
3	13. "	-	-	-	-	-	±	±	±	+	+	+	0.79	12.2	1550	1021	"		
4	14. "	-	-	-	±	±	-	±	+	+	±	±	0.98	14.7	1500	1020	"		
5	15. "	-	-	-	±	±	-	±	+	+	±	±	0.88	13.6	1550	1020	"		
6	16. "	-	-	-	±	±	-	±	+	+	±	±	0.62	14.3	2300	1020	"		
7	17. "	-	-	-	±	±	-	±	+	+	±	±	0.86	20.6	2400	1023	"		
8	18. "	-	-	-	±	±	-	±	+	+	±	±	0.77	18.9	2450	1017	"		
9	19. "	-	-	-	±	±	-	±	+	+	±	±	0.70	16.4	2350	1019	"		
10	20. "	-	-	-	±	±	-	±	+	+	±	±	0.65	15.3	2350	1018	"		

tion. The chlorine content of urine was on an average 0.84 g/dl, but after this 0.75 g/dl on an average, showing thus a reduction of 11%. The total urine contained an average of 12.8 grms. of chlorine. After this it always showed an increase, the average figure being 16.5 grms. thus showing a rather remarkable increase of 20%.

The amount of urine was on an average 1525 c.c. before the vitamin administration, but after this 2233 c.c. on an average, showing thus a remarkable increase of 46%. After the administration the amount of urine always increased. The specific gravity was 1.021 on an average before the vitamin injection, but after it, it was 1.020 on an average, showing thus a decrease of 0.1%.

Case 9 (Cf. Table 9 and Table 15).

In this case 0.5 mgrms. of vitamin B were injected subcutaneously as often as 9 times, making the total amount of 4.5 mgrms. Arakawa's reaction became positive after the vitamin administration. The chlorine content of urine was on an average 0.59 g/dl before the administration, but after it 0.65 g/dl on an average, showing an increase of 10%. The total urine contained on an average 9.2 grms. of chlorine before the vitamin administration, and after it 10.3 grms. on an aver-

TABLE 9.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 9. K. Takahashi, female, aged 10 months. Diagnosis: Anemia. Age of mother, 25 years.

No. of experiment	Date	A r a k a w a's reaction										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B ₁₂ , mgrms. (subcutaneously)	Time of injection
		Right					Left					grms. per 100 c.c.	grms. per day					
		0' 1' 2' 3' 4' 5'	0' 1' 2' 3' 4' 5'															
1	27. X	±	+	+	+	±	-	±	±	+	±	0.56	9.2	1650	1015	(-)	(-)	
2	28. "	±	+	+	+	±	±	+	+	+	±	0.64	9.9	1550	1016	"	"	
3	29. "	-	±	+	+	±	±	+	+	+	±	0.54	10.5	1950	1016	"	"	
4	30. "	+	+	+	+	±	-	±	+	+	±	0.64	8.3	1300	1018	"	"	
5	31. "	+	+	+	+	±	-	±	+	+	±	0.59	8.3	1400	1015	"	"	
6	1. XI	+	+	+	+	±	±	+	+	+	±	0.75	12.4	1650	1016	"	0.5	5 p.m.
7	2. "	±	+	+	+	±	-	±	+	+	±	0.65	9.1	1400	1017	"	"	
8	3. "	+	+	+	+	±	-	±	+	+	±	0.65	10.1	1560	1018	"	"	
9	4. "	+	+	+	+	±	-	-	±	+	±	0.65	8.4	1300	1015	"	"	
10	5. "	+	+	+	+	±	-	±	+	+	±	0.59	8.5	1450	1016	"	"	
11	6. "	+	+	+	+	±	-	±	+	+	±	0.57	10.5	1850	1015	"	"	
12	7. "	+	+	+	+	±	-	±	+	+	±	0.65	10.1	1550	1015	"	"	
13	8. "	±	+	+	+	±	±	+	+	+	±	0.65	11.4	1750	1017	"	"	
14	9. "	±	+	+	+	±	±	+	+	+	±	0.70	11.9	1700	1018	"	"	

age, showing thus an increase of 12%. After the vitamin administration, in three instances, the chlorine content of the total urine was 9.1, 8.4 and 8.6 grms. respectively, smaller than the average value before the vitamin administration.

The amount of the urine was on an average 1570 c.c. before the vitamin administration and after it 1579 c.c. on an average, showing thus a reduction of 1%. The specific gravity showed no change resulting from the vitamin injection.

Case 10 (Cf. Table 10 and Table 15).

In this case 0.5 mgrms. of vitamin B were injected subcutaneously as often as 5 times, making the total amount of 2.5 mgrms. Arakawa's reaction was already positive before the injection, but it became more strongly positive after it. The chlorine content of urine was on an average 0.86 g/dl before the vitamin administration, but, after this, 0.79 g/dl on an average, showing thus a decrease of 8%. The total urine contained on an average 9.19 grms. of chlorin before the vitamin administration, but, after this, 9.24 grms. on an average, showing an increase of 0.5%.

The amount of the urine was 1082 c.c. on an average before the vitamin administration; afterwards this was 1174 c.c. on an average, showing an increase of 8%. The average specific gravity was 1.027

TABLE 10.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 10. K. Kato, male, aged 11 months. Diagnosis: Pneumonia. Age of mother, 26 years.

No. of experiment	Date	Arakawa's reaction										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B ₁₂ mgrms. (subcutaneously)	Time of injection		
		Right					Left					grms. per 100 c.c.	grms. per day							
		0' 1' 2' 3' 4' 5'	0' 1' 2' 3' 4' 5'																	
1	26. X	—	+	+	+	+	+	—	+	+	+	+	+	0.67	9.4	1400	1027	(—)	(—)	
2	27. "	±	+	+	+	+	+	—	±	+	+	+	+	0.91	9.7	1070	1029	"	"	
3	28. "	—	±	+	+	+	+	—	±	+	+	+	+	0.86	10.3	1200	1022	"	"	
4	29. "	—	±	+	+	+	+	—	±	+	+	+	+	0.91	7.5	820	1028	"	"	
5	30. "	+	+	+	+	+	+	±	+	+	+	+	+	0.94	6.6	700	1029	"	"	
6	31. "	±	+	+	+	+	+	±	+	+	+	+	+	0.89	11.6	1300	1025	"	"	
7	1. XI	+	+	+	+	+	+	±	+	+	+	+	+	0.78	11.3	1450	1027	"	0.5	1 p.m.
8	2. "	—	+	+	+	+	+	—	+	+	+	+	+	0.82	8.2	1000	1021	"	"	
9	3. "	—	+	+	+	+	+	—	+	+	+	+	+	0.75	10.9	1450	1022	"	"	
10	4. "	±	+	+	+	+	+	±	+	+	+	+	+	0.82	8.2	1000	1020	"	"	
11	5. "	±	+	+	+	+	+	±	+	+	+	+	+	0.78	7.6	970	1020	"	"	

and 1.022 before and after the vitamin injection respectively, which means that there was a reduction of 0.5 %.

Case 11 (Cf. Table 11 and Table 15).

In this case 1.0 mgrm. of vitamin B was injected subcutaneously 4 times, making the total amount of 4.0 mgrms. Arakawa's reaction showed a tendency to become more and more positive after the vitamin administration. The chlorine content of urine was on an average 0.91 g/dl before the vitamin administration, but after this 0.98 g/dl on an average, showing thus an increase of about 8 %. The total urine contained on an average 7.7 grms. of chlorin before the vitamin administration, but, after it 9.4 grms. on an average, showing thus a rather remarkable increase of 22 %. Following the vitamin administration the chlorine content of the total urine always showed an increase in contrast to 7.7 grms., the average before it.

The amount of the urine was 865 c.c. on an average before the vitamin administration, but it always showed an increase afterwards, and was 992 c.c. on an average, showing an increase of 15 %. In one instance only it was 700 c.c., smaller than the average before the vitamin administration, but this was an exception. The average specific gravity was 1.025 before the injection, and 1.025 after it, showing a reduction of 0.1 %.

TABLE 11.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 11. R. Sato, male, aged 10 months. Diagnosis: Pneumonia. Age of mother, 22 years.

No. of experiment	Date	Arakawa's reaction		Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B ₁ mgrms. (subcutaneously)	Time of injection
		Right 0' 1' 2' 3' 4' 5'	Left 0' 1' 2' 3' 4' 5'	grms. per 100 c.c.	grms. per day					
1	15. XI	- ± ± ± ± ± ±	- ± ± ± ± ± ±	0.80	8.8	1100	1021	(-)	(-)	
2	17. "	- - ± ± ± ± ±	- ± ± ± ± ± ±	0.59	4.8	810	1020	"	"	
3	18. "	- - ± ± ± ± ±	- ± ± ± ± ± ±	1.08	12.1	1120	1025	"	"	
4	20. "	- - ± ± ± ± ±	- ± ± ± ± ± ±	1.17	5.0	430	1034	"	"	
5	21. "	- - - ± ± ± ±	- ± ± ± ± ± ±	1.14	11.2	980	1024	"	1.0	9 a.m.
6	22. "	- - ± ± ± ± ±	- ± ± ± ± ± ±	1.17	8.2	700	1027	"	"	"
7	23. "	- - ± ± ± ± ±	± ± ± ± ± ± ±	0.76	10.5	1380	1023	"	"	"
8	25. "	- ± ± ± ± ± ±	- ± ± ± ± ± ±	0.87	7.9	910	1024	"	"	"

Case 12 (Cf. Table 12 and Table 15).

In this case 0.5 mgrms. of vitamin B were injected subcutaneously 3 times, making the total amount of 1.5 mgrms. Arakawa's reaction showed a tendency to become more and more positive after the vitamin administration. The chlorine content of urine was on an average 1.08 g/dl before, and 1.03 g/dl on an average after the vitamin administration, showing thus a reduction of about 5 %. The total urine contained on an average 6.2 grms. of chlorin before the vitamin administration, but, after it, 9.4 grms. on an average, thus showing a remarkable increase of 52 %. After vitamin it always showed an increase in contrast to 6.2 grms., the average before the administration.

The amount of urine was 574 c.c. on an average before the vitamin administration, whereas it always showed a very remarkable increase of 70 % afterwards. In only one instance it was 550 c.c., smaller than the average before the vitamin, but this was an exceptional instance. The specific gravity was 1.033 on an average before the vitamin injection, but after it 1.026 was the average amount, thus showing a reduction of 0.7 %.

TABLE 12.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 12. M. Yokokawa, male, aged 12 months. Diagnosis: Pneumoni Age of mother, 24 years.

No. of experiment	Date	Arakawa's reaction										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B ₁ , mgrms. (subcutaneously)	Time of injection		
		Right					Left					grms. per 100 c.c.	grms. per day							
		0'	1'	2'	3'	4'	5'	0'	1'	2'	3'								4'	5'
1	16. XII	—	±	±	±	±	±	—	±	±	±	±	±	1.18	5.2	440	1037	(—)	(—)	
2	17. "	—	±	±	±	±	±	—	±	±	±	±	±	1.04	6.0	580	1034	"	"	
3	18. "	—	—	±	±	±	±	—	±	±	±	±	±	1.13	7.9	700	1034	"	"	
4	19. "	—	±	±	±	±	±	—	±	±	±	±	±	1.11	6.7	600	1034	"	"	
5	20. "	—	±	±	±	±	±	—	±	±	±	±	±	0.90	8.6	960	1026	"	"	
6	21. "	—	—	—	±	±	±	—	±	±	±	±	±	1.09	6.1	560	1033	"	"	
7	22. "	—	—	—	—	—	—	—	±	±	±	±	±	1.10	3.0	270	1036	"	"	
8	23. "	—	±	±	±	±	±	—	±	±	±	±	±	—	—	430	1035	"	"	
9	24. "	—	—	±	±	±	±	—	±	±	±	±	±	—	—	350	1035	"	"	
10	25. "	—	—	±	±	±	±	—	±	±	±	±	±	—	—	850	1026	"	"	
11	26. "	—	±	±	±	±	±	±	±	±	±	±	±	1.18	6.5	550	1030	"	0.5	10 a.m.
12	27. "	—	±	±	±	±	±	—	±	±	±	±	±	0.90	11.5	1280	1023	"	"	
13	28. "	—	—	—	—	±	±	—	±	±	±	±	±	0.93	10.2	1100	1024	"	"	

Case 13 (Cf. Table 13 and Table 15).

In this case 1.0 mgrm. of vitamin B was injected subcutaneously

as often as 6 times, making the total amount of 6.0 mgrms. Arakawa's reaction showed a tendency to become more and more positive after the vitamin administration. The chlorine content of urine was on an average 0.92 g/dl before the vitamin administration, but after this 0.98 g/dl on an average, showing thus an increase of 6%. The total urine contained on an average 7.8 grms. of chlorin before, and 9.6 grms. on an average after the vitamin administration, showing thus a rather remarkable increase of 23%. After the vitamin there was one instance in which the total chlorin was 7.5 grms. (in contrast to 7.8 grms., the average before the administration), but such an instance with a reduction occurred only once.

The amount of the urine was 893 c.c. on an average before the vitamin administration, but after it 1000 c.c. on an average, showing an increase of 12%. In only two instances after the vitamin administration it was 700 c.c. and 750 c.c. respectively, smaller than the average before the vitamin administration. The specific gravity was 1.025 on an average before the vitamin injection, but it was 1.026 on an average after it, showing an increase of 0.1%.

TABLE 13.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 13. I. Yamada, female, aged 10 months. Diagnosis: Pneumonia. Age of mother, 28 years.

No. of experiment	Date	A r a k a w a's reaction										Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B ₁ mgrms. (subcutaneously)	Time of injection		
		Right					Left					grms. per 100 c.c.	grms. per day							
		0'	1'	2'	3'	4'	5'	0'	1'	2'	3'								4'	5'
1	5. XII	—	—	—	—	±	±	—	—	—	—	±	±	0.81	7.8	970	1020	(—)	(—)	10 a.m.
2	6. "	—	—	—	—	±	±	—	—	—	—	±	±	1.15	6.4	560	1031	"	"	
3	7. "	—	±	+	+	+	+	—	—	±	±	±	±	0.81	9.3	1150	1024	"	"	
4	8. "	—	—	—	—	±	±	—	—	—	—	—	—	0.80	8.8	1100	1021	"	"	
5	9. "	—	—	—	—	±	±	—	—	—	—	—	—	1.07	7.5	700	1022	"	"	
6	10. "	—	—	—	—	±	±	—	—	±	±	+	+	1.12	8.4	750	1032	"	"	
7	12. "	—	±	+	+	+	+	±	+	+	+	+	+	1.06	10.1	950	1029	"	"	
8	13. "	±	±	+	+	+	+	—	±	±	+	+	+	0.91	12.7	1400	1022	"	"	
9	15. "	±	±	±	+	+	+	—	±	±	±	+	+	0.90	9.9	1100	1020	"	"	

Case 14 (Cf. Table 14 and Table 15).

In this case 0.5 mgrm. of vitamin B were injected subcutaneously as often as 8 times, making the total amount of 4.0 mgrms. Arakawa's

wa's reaction showed a tendency to become more and more positive after the vitamin administration. The chlorine content of urine was on an average 1.05 g/dl before the vitamin administration, but after this 1.17 g/dl on an average, showing thus an increase of 11 %. The total urine contained on an average 6.6 grms. of chlorin before the

TABLE 14.

Daily variation of Arakawa's reaction and urine of lactating mother.

Case 14. I. Obara, female, aged 7 months. Diagnosis: Healthy. Age of mother, 32 years.

No. of experiment	Date	Arakawa's reaction		Chlorine content of urine		Amount of urine in 24 hours c.c.	Specific gravity	Protein reaction	Administration of vitamin B, mgrms. (subcutaneously)	Time of injection
		Right 0' 1' 2' 3' 4' 5'	Left 0' 1' 2' 3' 4' 5'	grms. per 100 c.c.	grms. per day					
1	17. II	+++++	---++	1.06	10.6	1000	1032	(-)	(-)	
2	18. "	+++++	---++	1.04	6.4	620	1034	"	"	
3	19. "	+++++	---++	1.04	3.6	350	1032	"	"	
4	20. "	+++++	---++	1.09	6.0	550	1034	"	"	
5	21. "	+++++	---++	1.07	11.2	1050	1030	"	0.5	9.30 a.m.
6	23. "	+++++	---++	1.15	7.4	640	1036	"	"	
7	24. "	+++++	---++	1.31	11.8	900	1032	"	"	
8	25. "	+++++	---++	1.18	5.9	500	1034	"	"	
9	26. "	+++++	---++	1.26	10.6	840	1034	"	"	
10	28. "	+++++	---++	1.98	9.8	1000	1028	"	"	

vitamin administration, but, after it, 9.4 grms. on an average, showing thus an increase of 42 %. There was one instance in which the total chlorin was 5.9 grms. (in contrast to 6.6 grms. before the administration) after the vitamin administration, but such an instance with a reduction occurred only once.

TABLE 15.

Average figures of urine chlorin and urine amount before and after the vitamin administration.

Cases and number		Chlorin in urine		Amount of urine	Specific gravity
		grms. per 100 c.c.	grms. per day		
Case 1	Average before the administration	1.03	12.6	1227	1024
	Average after the administration	0.98	15.4	1574	1020
	Deviation	- 5%	+ 22%	+ 28%	- 0.4%

Table 15. Continued.

Cases and number		Chlorine in urine		Amount of urine	Specific gravity
		grms. per 100 c.c.	grms. per day		
Case 2	Average before the administration	0.65	5.7	875	1015
	Average after the administration	0.73	7.6	1028	1019
	Deviation	+ 12%	+ 33%	+ 17%	+ 0.4%
Case 3	Average before the administration	0.68	5.6	867	1021
	Average after the administration	0.88	15.3	1744	1019
	Deviation	+ 29%	+175%	+101%	- 0.2%
Case 4	Value before the administration	1.02	5.1	500	1032
	Average after the administration	0.69	13.5	1973	1016
	Deviation	- 32%	+165%	+295%	- 1.6%
Case 5	Value before the administration	0.90	12.6	1400	1024
	Average after the administration	0.83	15.5	1864	1018
	Deviation	- 8%	+ 23%	+ 33%	- 0.6%
Case 6	Average before the administration	1.18	5.8	500	1020
	Average after the administration	0.95	8.0	859	1018
	Deviation	- 19%	+ 38%	+ 72%	- 0.2%
Case 7	Average before the administration	0.67	14.4	2150	1018
	Average after the administration	0.90	17.8	2000	1019
	Deviation	+ 34%	+ 24%	- 7%	+ 0.1%
Case 8	Average before the administration	0.84	12.8	1525	1021
	Average after the administration	0.75	16.5	2233	1020
	Deviation	- 11%	+ 29%	+ 46%	- 0.1%
Case 9	Average before the administration	0.59	9.24	1570	1016
	Average after the administration	0.65	10.3	1579	1016
	Deviation	+ 10%	+ 12%	+ 1%	0%
Case 10	Average before the administration	0.86	9.19	1082	1027
	Average after the administration	0.79	9.24	1174	1022
	Deviation	- 8%	+ 0.5%	+ 8%	- 0.5%
Case 11	Average before the administration	0.91	7.7	865	1025
	Average after the administration	0.98	9.4	992	1024
	Deviation	+ 8%	+ 22%	+ 15%	- 0.1%
Case 12	Average before the administration	1.08	6.2	574	1033
	Average after the administration	1.03	9.4	977	1026
	Deviation	- 5%	+ 52%	+ 70%	- 0.7%
Case 13	Average before the administration	0.92	7.8	893	1025
	Average after the administration	0.98	9.6	1000	1026
	Deviation	+ 6%	+ 23%	+ 12%	+ 0.1%
Case 14	Average before the administration	1.06	6.6	630	1033
	Average after the administration	1.17	9.4	822	1033
	Deviation	+ 11%	+ 42%	+ 29%	0%

TABLE 16.

Arakawa's reaction before the vitamin administration, and the results (shown in deviation) after it.

Cases and number	Arakawa's reaction		Deviation of chlorin of urine		Deviation of amount of urine in 24 hours	Deviation of specific gravity
	Right	Left	grms. %	grms. per day		
	0' 1' 2' 3' 4' 5'	0' 1' 2' 3' 4' 5'				
Case 1	— — ± + + +	— — ± ± + + +	— 5 %	+ 22 %	+ 28 %	— 0.4 %
Case 2	± ± + + + + ##	± ± + + + + ##	+ 12 "	+ 33 "	+ 17 "	+ 0.4 "
Case 3	— — — — — ±	— — — — — ±	+ 29 "	+ 173 "	+ 107 "	— 0.2 "
Case 4	— — — — —	— — — — —	— 32 "	+ 165 "	+ 295 "	— 1.6 "
Case 5	— — — ± ± +	— — — ± ± +	— 8 "	+ 23 "	+ 33 "	— 0.6 "
Case 6	— — — ± ± ±	— — — ± ± ±	— 19 "	+ 38 "	+ 72 "	— 0.2 "
Case 7	— ± + + + + ##	— ± ± ± + + +	+ 34 "	+ 24 "	— 7 "	+ 0.1 "
Case 8	— — — ± ± +	— ± + + + + ##	— 11 "	+ 29 "	+ 46 "	— 0.1 "
Case 9	+ ## ## ## ## ##	— + ## ## ## ##	+ 10 "	+ 12 "	+ 1 "	0
Case 10	± ± ## ## ## ##	± ± ## ## ## ##	— 8 "	— 0.5 "	+ 8 "	— 0.5 "
Case 11	— — ± ± ± +	— ± ± ± + + +	+ 8 "	+ 22 "	+ 15 "	— 0.1 "
Case 12	— — ± ± ± ±	— + + + + + ##	— 5 "	+ 52 "	+ 70 "	— 0.7 "
Case 13	— ± + + + + +	— — ± ± ± ±	+ 6 "	+ 23 "	+ 12 "	+ 0.1 "
Case 14	± ± ## ## ## ##	— — — ± ± +	+ 11 "	+ 42 "	+ 29 "	0

TABLE 17.

Table 16, very simplified.

Arakawa's reaction	Chlorine content of total urine	Amount of total urine
(-) Negative	165 % - 170 % (170 %)	107 % - 295 % (200 %)
(±) Weakly positive	22 " - 52 " (31 ")	12 " - 72 " (31 ")
(+) Positive	12 " - 0.5 " (6 ")	1 " - 8 " (1 ")

The amount of the urine was 630 c.c. on an average before the vitamin administration, but after this, it always showed an increase, and was 822 c.c. on an average, thus increasing 29%. In only one instance it was 500 c.c., smaller than the average before the vitamin administration, but this was an exceptional instance. The specific gravity was 1.033 on an average before the vitamin injection, and it was 1.033 on an average after it, so no increase came about.

Comment.

1. Arakawa's reaction.

The reaction in Cases 6, 7 and 9 became positive after the vitamin injection. The reaction in Case 10 was already positive before the injection, but became more strongly positive. In Case 4, the reaction showed a tendency to become positive after the injection, though it

was later restored to the reaction before it. Case 8 showed no change of Arakawa's reaction in spite of the vitamin injection. These two cases (Cases 4 and 8) were syphilitic, and it was no wonder that their Arakawa's reaction did not improve, as has already been shown by Ishii (Cf. 87th Report of the Peroxidase Reaction)⁶⁾ and by Yoshino (Cf. 101st Report of same)⁷⁾ especially.

2. Chlorine content of urine.

The percentage of chlorine content did not, as is shown in Table 16, show a definite change after the vitamin administration, but the amount of chlorine in the whole day urine increased definitely in all the cases. This increase was especially remarkable in Case 4, in which Arakawa's reaction was very, very weak with (—) 15', and in Case 3 with almost as weak a reaction as in Case 4. And in Case 9 in which Arakawa's reaction was already almost positive, the increase of chlorin after the vitamin injection was not remarkable. As to Case 10 with positive Arakawa's reaction, the increase was the minimum (0.5%) or zero. The reason why the increase of the whole day amount of chlorin was the most remarkable in cases with negative Arakawa's reaction and the least remarkable in cases with positive reaction is very simply explained, if the results published in my preceding papers¹⁾²⁾ are taken into consideration. In Arakawa-negative cases an abnormal retention of chlorin occurs in the body, while in Arakawa-positive mothers little or no retention is seen. So mothers with negative Arakawa's reaction will show an increase of chlorine excretion per day after an administration of vitamin B, while no increase, or almost no increase will be seen in spite of the administration in mothers with positive Arakawa's reaction.

3. The amount of urine.

As is shown in Table 16, the amount of urine showed after the administration of vitamin B an increase in all the cases except for Case 7, in which a slight decrease was seen. The increase was especially remarkable in Cases 3 and 4 with negative Arakawa's reaction; it was 107% in Cases 3 and 295% in Case 4. In Case 9 with almost positive Arakawa's reaction and in Case 10 with positive reaction before the vitamin administration, the increase was only 1% and 8% respectively, so that it was negligible or insignificant. This result will demon-

6) M. Ishii, *Tohoku J. Exp. Med.*, 1935, **27**, 532.

7) K. Yoshino, *Tohoku J. Exp. Med.*, 1938, **34**, 319.

* (—) 15' means "ever negative" after a lapse of 15 minutes of the performance of Arakawa's reaction.

strate the fact that in mothers with negative Arakawa's reaction, a (-n abnormal) retention of water is present, and that in cases with positive Arakawa's reaction such a retention will not occur. Or, an administration of vitamin B will produce an augmentation of urine excretion in mothers with negative Arakawa's reaction, while it will not increase the amount of urine in mothers with positive Arakawa's reaction.

4. Specific gravity.

As is shown in Table 16, the administration of vitamin B produced no change of specific gravity in Cases 9 and 14, an increase in Cases 2, 7 and 13, and a decrease in all the other nine cases. In Cases 2 and 7, the specific gravity was already low (1.015 in Case 2, 1.018 in Case 7) before the vitamin administration. The above result shows that the administration of vitamin B will make the specific gravity of urine smaller in general, except for cases in which it was already low before the administration. From this result, it is interesting to see that the specific gravity is generally higher in the urine of Arakawa-negative mothers than in that of mothers with positive Arakawa's reaction.

5. The colour of urine.

The urine of Arakawa-positive mothers is generally clean, yellowish and transparent, but that of Arakawa-negative ones is mostly unclean, brown and appears more or less turbid. After treating Arakawa-negative mothers with vitamin B, the unclean urine gradually becomes as clean yellowish and transparent as that of Arakawa-positive ones.

What has been described will be restated below:—

1. In mothers with negative Arakawa's reaction, the administration of vitamin B will shift the reaction toward positive, and increase the whole day chlorine excretion and the urine output.

Now, Uehara, So and Fujinami⁸⁾ made an investigation into chlorin metabolism in beriberi and B-avitaminosis. An administration of vitamin B in avitaminotic cases with edema would, they asserted, result in the excretion 3~4 times as much as chlorine in the urine as these patients had taken. Hasui⁹⁾ also found a decrease of urine chlorin and urine output in the stage of exacerbation of beriberi. Omori, Ohashi, Nakanishi, Hara and Ota¹⁰⁾ fed patients slightly affected with beriberi on a B-avitaminotic diet, and found a de-

8) Uehara, So and Fujinami, Tokyo Igakkai Zasshi, 1922, 36, 142.

9) N. Hasui, Nippon Naika-gakkai Zasshi, 1922, 10, 169.

10) K. Omori, Y. Ohashi, J. Nakanishi, M. Hara and T. Ota, Keio Igaku, 1923, 3, 197.

crease of urine chlorin and urine output in the stage of exaceration of the disease, and an increase of urine chlorin and urine output in the stage of improvement. Then they experimented on feeding healthy persons on a B-avitaminotic diet and found a decrease of urine chlorin and urine output. Inawashiro and Ichimi¹¹⁾ experimented on feeding 2 healthy persons on a B-avitaminotic diet for a long time and found a remarkable increase of urine output after the vitamin administration. Recently Masuko¹²⁾ injected subcutaneously into healthy male rabbits of about 2 kilos 50~10 c.c. of spelzon, paranutrin or 50~20 c.c. of 1% beriberol pur., and saw no increase of urine output. Hecht and Weese¹³⁾ reported that diuresis of rabbits in hunger with a peroral administration of 100 grms. of water and with a subcutaneous injection of vitamin B in the amount of 0.1g. per kilo gram of body became twice as strong as that of the controls without the vitamin injection. Schretzenmayr¹⁴⁾ stated in a symposium that though even in very pronounced cases of hydropic form of a deficiency disease the edema is of such a form between myxedema and true edema, and though finger impressions are often of short duration, in milder cases of B-avitaminosis hydropic symptoms are relatively frequent. Catullo Fiorio¹⁵⁾ investigated the diuretic effect of the vitamin B recently and obtained the following result. He administered healthy and unhealthy persons 900 c.c. perorally in the morning when they were fasting, and then 2 mgrms. of vitamin B subcutaneously. In this water-experiment he saw an augment of diuresis amounting to 200% in unhealthy cases, while no diuretic effect of the vitamin was, he stated, seen in healthy cases. Compare this result with my own; almost no diuretic effect of the vitamin in Arakawa-positive mothers, and the striking effect of it in Arakawa-negative cases.

The result of experiments above cited is in agreement with my own result, and will explain that mothers with positive Arakawa's reaction are generally healthy or almost healthy, and that mothers with negative reaction are unhealthy or B-avitaminotic. This will further prove that human milk with positive Arakawa's reaction is generally a "good" milk, and that Arakawa-negative milk is generally a "bad" milk.

11) R. Inawashiro and T. Ichimi, *Nisshin Igaku*, 1928, **17**, 1798.

12) T. Masuko, Zika Zassi (*Acta Paediatrica Japonica*), 1936, **248**, 147.

13) G. Hecht and H. Weese, *Klin. Wschr.*, 1937, **12**, 414.

14) A. Schretzenmayr, *Klin. Wschr.*, 1937, **50**, 1737.

15) Catullo Fiorio, *Klin. Wschr.*, 1938, **38**, 1054.

Summary.

Human milk negative to Arakawa's reaction is generally B-avitaminotic milk as has been shown by a number of papers from our Laboratory. Mothers with negative Arakawa's reaction will show an increase of chlorine excretion and urine output per day after an administration of vitamin B, while little or no increase will be seen in spite of the administration in mothers with positive Arakawa's reaction.

The reason why the increase of the whole day amount of chlorin was the most remarkable in cases with negative Arakawa's reaction, and the least remarkable in cases with positive reaction is very simply explained, if the results published in my preceding papers are taken into consideration. In Arakawa-negative cases an abnormal retention of chlorin occurs in the body, while in Arakawa-positive mothers very little retention, if any, is seen. A remarkable increase in urine output after an administration of vitamin B will demonstrate the fact that in mothers with negative Arakawa's reaction a (-n abnormal) retention of water occurs.

The result of experiment of other authors above cited is parallel with my own result. It is very probable that, viewed from the effect of vitamin B on urine of mothers with negative Arakawa's reaction, the Arakawa-negative human milk will pass for a B-avitaminotic milk* even to the exclusion of other points of view.

Conclusions.

1. In mothers with negative Arakawa's reaction, the administration of vitamin B will shift the reaction toward positive, and increase the whole day chlorine excretion and the urine output.

2. In the mothers with positive Arakawa's reaction, the administration will make the positive reaction possibly more intense, and may cause a small increase of the whole day chlorin excretion and the urine output.

3. Specific gravity will generally be made lower except for cases in which it is already low before the administration of vitamin B.

4. This will further prove that human milk with positive Arakawa's reaction is generally a good milk, and that Arakawa-negative milk is generally a bad milk.

5. The general impression may be expressed in this way:—

Arakawa-negative mother + vitamin B = Arakawa-positive mother.

* Meaning a milk from a B-avitaminotic body.