**Change of Number and Size of Blood Platelets in Breast-fed
Infants and Intensity of Arakawa's Reaction of
Their Mothers on Vitamin B*
Administration.**

130th Report of the Peroxidase Reaction.

By

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Introduction.

In the first report on the relation between blood platelets in infants and Arakawa's reaction of their mothers I¹⁾ reported that, in the cases of infants fed on milk negative to Arakawa's reaction, anemia and thrombocytosis and especially an increase of pathological large platelets were seen, and that blood platelet count was larger generally according as Arakawa's reaction became weaker. In my second report I²⁾ concluded that an increase of blood platelet count was seen in infants fed on milk negative to Arakawa's reaction and that when infants and/or their mothers had been taking a vitamin B preparation for a longer time, blood platelets were within normal limits even in the group of completely or almost completely negative to Arakawa's reaction. And in my third report on the same article, I³⁾ confirmed, in the 123 cases with no special complications which might influence blood platelets, that the majority of infants fed on human milk completely or almost completely negative to Arakawa's reaction and a part of infants fed on milk of Arakawa's reaction of inter-

* B₁ is meant throughout the article.

1) M. Shindo, Tohoku J. Exp. Med., 1939, **36**, 258.

2) M. Shindo, Tohoku J. Exp. Med., 1939, **37**, 45.

3) M. Shindo, Tohoku J. Exp. Med., 1939, **36**, 233.

mediate strength were either in a state of B-avitaminosis or on the brink of B-avitaminosis from the view point of blood platelet count.

According to Ohta and Suzuki⁴⁾ of our Laboratory, a prolongation of the shortest peroxidase stain-time of blood leucocytes, a sign of avitaminosis B, will occur in infants with a high blood platelet count which is another sign of avitaminosis B.

Later Shiraishi and I⁵⁾ reported that thrombocytosis was seen in B-avitaminotic infants on the study of blood picture of infantile beri-beri, infantile preberiberi and B-avitaminotic dyspepsia without any complications.

So, if an increase of blood platelet count is due to B-avitaminosis in the cases of infants fed on milk negative to Arakawa's reaction, it will be expected that platelet count will decrease to the normal on an administration of vitamin B.

In the present paper, therefore, I set out to study the qualitative and quantitative change of blood platelets in infants on vitamin B administration.

Method of Experiment.

1. Materials. Breast-fed infants who visited our Pediatric Clinic from summer 1934 to autumn 1937.

2. Method used. Thrombocytes were counted according to the method of Fonio⁶⁾ with a slight modification. After cleaning with alcohol and then ether, a cut was made on the ear-lobe and the first drop of blood was mixed with a drop of 14% MgSO₄ by use of a glass-rod. And a couple of films were made on cover glass at one time. After these were air-dried, they were fixed with methyl alcohol for 3 minutes, and then stained with Giemsa (2 drops of the stain in 1 c.c. of distilled water) as long as 10 hours. Horwitz's⁷⁾ classification of platelet was adopted.

- a. Small platelets up to 1/4 diameter of red cell.
- b. Middle-sized platelets from 1/4 to 2/3 of the diameter of red cell.
- c. Large platelets from 2/3 to 1/1 of the diameter of red cell.

3. Administration of vitamin B. All babies were treated with vitamin B perorally, though some of them were also injected* with it subcutaneously at the same time. As to their mothers, in all cases except for 6 cases vitamin B was administered per os.

* Immediate influence of the injection on blood platelets was out of the question, for the interval of blood examination was 7-10 days.

4) F. Ohta and T. Suzuki, Tohoku J. Exp. Med., 1937, **31**, 247.

5) Sh. Shiraishi and M. Shindo, Tohoku J. Exp. Med., 1938, **32**, 470.

6) A. Fonio, Dtsch. Z. Chir., 1912, **102**, 178.

7) S. Horwitz, Kl. Wschr., 1931, **10**, 1613.

International units of vitamin B preparations used are as follows:—"Injectio Oryzanin Fortior" of Sankyo & Co. is the vitamin B₁ preparations contained in 1 c.c. 0.5 mg. of B₁ crystals=333 international units. Powder of Oryzanin and Beriberol (Beriberol purum is ten times as potent as Beriberol) 100 grms.=4,000 and 608 international units respectively. Liquor Oryzanin and Liq. Beriberol 100 c.c.=600 and 102 international units.

4. Detoxicating hormone of the liver, yakriton.

Over half the cases of babies and in some cases of mothers yakriton, which will mobilize vitamin B according to Chiba and Abe⁸⁾ and Takamatsu,⁹⁾ was injected subcutaneously.

Results.

I. Influence of Vitamin B with and without Use of Yakriton on Number and Size of Blood Platelets in the Cases of Infantile Beriberi, Infantile Preberiberi, B-avitaminotic Dyspepsia and so-called Human milk Intoxication.

Results of 6 cases of infantile beriberi, 6 cases of infantile preberiberi, 8 cases of B-avitaminotic dyspepsia and one case of so-called human milk intoxication were tabulated in Table 1. To babies vitamin B preparation was administered perorally in all cases and subcutaneously in only 4 cases, while to mothers in 3 cases (Nos. 9, 12 and 19) no vitamin B preparation was administered.

Yakriton, the detoxicating hormone of the liver, was injected in 11 cases of babies and in 3 cases of mothers.

In 6 cases (Nos. 2, 5, 7, 12, 15 and 18) Arakawa's reaction of mother's milk and blood of infants were examined 3 times and in the others twice. The interval between the two examinations was about 7-10 days.

At the beginning of experiment, Arakawa's reaction of mothers milk was completely or almost completely negative in 12 cases and the reaction was clinically negative in the other cases too. On an administration of vitamin B, Arakawa's reaction became clinically positive* in Nos. 1, 3, 7, 15, 17 and 21, or at least their milk increased in

* "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 became blue on the addition of Arakawa's reagent. The other of these two senses is: Arakawa-positive in 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.

8) M. Chiba and J. Abe, *Zika Zasshi*, 1931, 1431.

9) A. Takamatsu, *Tohoku J. Exp. Med.*, 1934, 23, 372.

intensity of the reaction. And it is to be noticed that Arakawa's reaction did not change in all the 3 cases (Nos. 9, 12 and 19 in Table 1) in which vitamin B was not administered to their mothers.

In 13 cases red cell count was reduced, the minimal value of 4,000 thousands was seen in No. 17 and red cell count showed an increase in 12 cases on vitamin B administration.

In all the 21 cases of B-avitaminosis in Table 1, a decrease of thrombocytes was seen in parallelism with an increase in intensity of Arakawa's reaction on vitamin B administration. As to blood platelet count, in 2 cases (Nos. 2 and 5) platelets began to decrease after showing a temporary increase of them, in 1 case (No. 12 in Table 2) thrombocytes became normal in number after a temporary decrease to a subnormal count, and in the remaining 3 cases (Nos. 7, 15 and 18) platelets decreased gradually. In most cases platelet count returned to normal within from 7 to 10 days and in all the 6 cases in which Arakawa's reaction became clinically positive, platelets reached a value within normal limits.

It is to be noticed that platelet count returned to normal in Nos. 11, 12, 13 and 18 in spite of the fact that it remained negative to Arakawa's reaction on an administration of vitamin B. This reminds one of Takamatsu¹⁰⁾ who said that when mothers with Arakawa-negative milk were taking vitamin B, the milk was losing in its toxicity in spite of the even remaining negative reaction.

The classification of platelets was made in 16 cases out of all 21 cases. Large platelets were over 5% in 7 cases and in these cases small platelets were within normal limits (19–24%) in 5 cases. At the beginning of vitamin B administration, large platelets showed a gradual decrease and small platelets began to increase. In 7 cases (Nos. 3, 5, 6, 9, 11, 12 and 14 in Table 1) the ratio—small: middle: large—returned to normal, but in the remaining 9 cases small platelets were yet larger than 24% while large platelets were within normal limits. The decrease of platelets was not remarkable in 2 cases (Nos. 9 and 19 in Table 1) out of all 3 cases in which vitamin B had not been administered to mothers.

In 8 cases (73%) out of 11 cases in which yakriton (1/2 R.A.U., every other day) was administered to infants subcutaneously, platelet count returned to normal, while in 7 cases (70%) out of 10 cases in which the hormone was not given, platelet count decreased indeed, but

10) A. Takamatsu, *Tohoku J. Exp. Med.*, 1934, 23, 46.

TABLE 1. *Influence of vitamin B on number and size of blood platelet, infantile preberiberi, B-avitaminotic dyspepsia*

Case No.	Date	Name	Sex	Age (m= months, d=days)	Diagnosis	Arakawa's					
						Right					
						0'	1'	2'	3'	4'	5'
1	Aug. 13 22	I. H.	♂	49 d 58 d	Infantile beriberi	— — — — —	++	##	##	##	##
2	Jun. 16 23	H.H.	♀	5 m	Infantile beriberi with hypotrophy	— ± + + + +	—	+	+	+	+
	Jul. 3					+ ## ## ## ##	+	+	+	+	+
3	Apr. 19 28	Y.O.	♀	7 m	Infantile beriberi with hypotrophy	— ± ± ± ± ±	±	+	+	+	+
4	Feb. 15 26	Y.S.	♀	50 d 61 d	Infantile beriberi	— — — — —	—	—	—	—	—
5	Jun. 11 21	T.O.	♂	40 d 50 d	Infantile beriberi	— ± ± ± ± ±	—	±	±	±	±
	Jul. 16					— ± ± + + +	—	±	±	+	+
6	May 13 21	T.A.	♀	4 m	Infantile beriberi	— — + + + +	—	—	+	+	+
						— ± + + + +	—	±	+	+	+
7	Nov. 15 26	Y.K.	♀	62 d 73 d	Infantile preberiberi	— ± ± ± ± ±	—	±	±	±	±
	Dec. 7					— ± ± + + +	—	±	±	+	+
8	Sep. 23 28	M.F.	♀	9 m	Infantile preberiberi	— — ± ± + +	—	—	±	±	+
9	Sep. 25 Oct. 2	S.K.	♂	35 d 42 d	Infantile preberiberi	— — — ± ± +	—	—	—	±	±
10	Feb. 19 28	S.M.	♂	81 d 90 d	Infantile preberiberi + hernia umbilicalis	— — — — ± ±	—	—	—	—	±
11	Apr. 19 28	I. M.	♂	2 m	Infantile preberiberi	— + + + + +	—	+	+	+	+
12	Oct. 7 16	J. I.	♂	60 d 69 d	Infantile preberiberi with hypotrophy	— — — — ± ±	—	—	—	—	±
	22					— — — — —	—	—	—	—	—
13	Sep. 20 Oct. 2	S.S.	♂	54 d 66 d	B-avitaminotic dyspepsia	— — — — ± ±	—	—	—	—	±
14	Nov. 22 Dec. 2	R.S.	♂	12 m	B-avitaminotic dyspepsia	— — — — —	—	—	—	—	—
15	Mar. 6 13	T.K.	♂	9 m	B-avitaminotic dyspepsia	± + + + + +	±	+	+	+	+
	18					± ## ## ## ##	±	##	##	##	##
16	May 8 22	K.T.	♂	5 m	B-avitaminotic dyspepsia	— — — — —	—	—	—	—	—
17	Jul. 13 Aug. 8	E.M.	♂	4 m 5 m	B-avitaminotic dyspepsia	— — — — —	—	—	—	—	—
						— ## ## ## ##	—	##	##	##	##
18	Sep. 18 25	J. T.	♂	4 m	B-avitaminotic dyspepsia	— — ± + + +	—	—	±	+	+
	30					— ± ± + + +	—	±	±	+	+
19	Sep. 18 25	K.G.	♂	12 m	B-avitaminotic dyspepsia	— ± + + + +	—	±	+	+	+
20	Sep. 23 Oct. 2	T.S.	♀	4 m	B-avitaminotic dyspepsia	— — — — — ±	—	—	—	—	±
21	Jul. 31 Aug. 5	A.T.	♂	9 m	"Intoxication of human milk"	— — — — —	—	—	—	—	—
						± ## ## ## ##	±	##	##	##	##

* Vitamin B (+)=has been taking vitamin B. Liq. ory.=Liquor Oryzanin, and Liq. spel.=Liquor Spelzon. 0.5 mg.=0.5 mg. of Injection Oryzanin Fortior

red cell count and Arakawa's reaction in the cases of infantile beriberi, and so-called human milk intoxication.

reaction	Red cell count per cmm. (thou- sands)	Blood platelets				Administration	
		Total count per cmm. (thou- sands)	Classification			To	
			Small	Middle	Large	Per os daily (grs.)	
Left							
0' 1' 2' 3' 4' 5'							
— — — — —	4,600	510	20	71	9	B. p.	0.03
+ # # # # #	4,700	270	27	70	3		
— ± + + + +	4,700	423	30	67	3	Liq. ory.	5.0
— — — — —	4,550	441	34	66	0		
± ± ± ± ± +	4,980	353	25	74	1	Ebios	0.3
— ± ± ± ± ±	5,860	713	23	74	3	Liq. ory.	5.0
± + # # # # #	6,130	356	22	78	0		
— — ± ± ± +	4,150	575	19	77	4	Liq. ory.	5.0
— — — — ± +	5,180	394	27	72	1	B. p.	0.03
— — — — —	4,160	359	28	72	0	Liq. ory.	5.0
± + + + + #	3,610	492	35	64	1		
— + + + + +	3,330	253	22	78	0	Ebios	0.5
— ± ± ± ± ±	4,860	435	21	70	9	Liq. ory.	3.0
— ± + + + +	4,760	433	24	72	4		
— — — — —	4,030	323	25	72	3	Liq. ory.	3.0
— — ± ± ± ±	4,260	290	35	63	2		
— + + # # # #	4,440	242	31	69	0	B. p.	0.03
— — — — —	4,530	472	23	70	7	Liq. spel.	5.0
— + + # # # #	4,910	411	28	68	3	B. p.	0.03
— — — ± ± +	4,100	553	22	73	5	Liq. ory.	3.0
— ± + + + +	3,980	464	20	77	3	B. p.	0.03
— — — — —	5,300	830	—	—	—	Liq. Berib.	5.0
— ± ± ± ± ±	5,800	560	—	—	—	B. p.	0.03
— + + + + +	5,190	368	20	76	4	Liq. ory.	3.0
— — — — —	4,030	258	24	76	0	B. p.	0.03
— — — ± ± ±	4,100	260	19	78	3	Liq. Berib.	5.0
— ± ± ± + +	4,530	193	23	75	2		
— — — — —	4,750	230	23	77	0	B. p.	0.05
— — — — —	4,610	511	24	73	3	Vitamin B (+)	
— ± ± + + +	4,620	280	34	67	2		
— — — — —	4,050	606	23	70	7	Liq. ory.	3.0
— ± ± ± ± +	5,800	480	24	73	3		
± + + + + +	6,850	780	—	—	—	Liq. Berib.	5.0
± + # # # # #	6,950	750	—	—	—		
± # # # # #	5,550	270	—	—	—	B. p.	0.03
— — — — ±	5,000	520	—	—	—	Liq. Berib.	5.0
— — ± ± + +	4,880	421	—	—	—	B. p.	0.03
— — — — —	4,000	380	—	—	—	Liq. Berib.	5.0
— + # # # # #	4,570	230	—	—	—	B. p.	0.03
— — ± + + +	4,300	637	34	59	7	Liq. Berib.	5.0
— ± ± ± + +	4,450	451	31	68	1		
— ± ± + + +	4,510	313	25	74	1		
— ± + + + +	5,240	688	19	76	5	Liq. ory.	3.0
— ± + + + +	5,140	502	33	64	3		
— — — — —	3,820	502	26	70	4	B. p.	0.03
— — — — —	4,260	423	30	66	4		
— — — — —	6,350	533	—	—	—	Liq. Berib.	5.0
— + + # # # #	5,190	331	—	—	—	B. p.	0.05

Ory. = Oryzanin (powder), Liq. Berib. = Liquor Beriberol, B. p. = Beriberolum purum (B₁ crystal).

Table 1. Continued.

of vitamin B*			Subcutaneous injection of yakriton (R.A.U.) every other day		Remarks
sucklings	To mothers		To sucklings	To mothers	
By injection every other day	Per os daily (grs.)	By injection every other day			
0.5 mg.	Liq. oryz. 30.0	—	½	—	
—	Vitamin B (+)	—	—	—	
—		—	—	—	
—		—	—	—	
—	Ory. Ebios 5.0 3.0	—	½	—	
—	Ory. Ebios 5.0 3.0	—	—	½	
0.5 mg.	Vitamin B (+)	—	—	1	
Spelzon 5.0	Liq. ory. 40.0	Spelzon 5.0	½		
—	Liq. ory. 20.0	—	½	—	
—	Vitamin B (+)	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
—	Liq. ory. 20.0	—	½	—	
—	Ebios 6.0	—	—	—	
—	—	—	—	—	Mother's milk and cow's milk.
—	—	—	½	—	
—	—	—	—	—	
—	Vitamin B (+)	—	½	—	
—	Liq. ory. 20.0	—	—	—	
—	Liq. ory. 20.0	—	½	—	
—	Liq. ory. 20.0	—	—	—	
—	Liq. ory. 20.0	—	½	—	
—	Liq. ory. 30.0	—	½	½	
—	—	—	—	—	
—	Liq. ory. 20.0	—	—	—	
0.5 mg.	Liq. ory. 20.0 Liq. Berib. 20.0	0.5 mg.	½	—	

did not attain the normal count. In all these cases vitamin B was given, so it is very probable that yakriton will act to mobilize vitamin B in its effect.

II. Influence of Vitamin B with or without Use of Yakriton on Number and Size of Blood Platelets in Such Diseases as with no Influence on the Platelet Count or in Such Diseases as accompanied by a Decrease of the Platelet Count.*

According to their influence on the blood platelet count, the cases in Table 2 may be divided into 2 groups :—

1. Group of infantile diseases with no influence on the platelet count. Hypotrophy, eczema seborrhoicum and dyspepsia levis.
2. Group of infantile diseases accompanied by a decrease of the platelet count. Influenza, rhinopharyngitis, pharyngitis and bronchitis.

Of course, sick babies who were more or less in a serious condition were excluded. Thus, the change of blood platelet of 14 cases in which babies were expected to be in B-avitaminosis were shown in Table 2 (Cf. Table 2).

Blood was examined 4 times in one case (No. 10 in Table 2), 3 times in 6 cases (Nos. 4, 6, 8, 9, 13 and 14 in Table 2) with an interval of 7–10 days on principle.

In 11 cases among all 14 cases Arakawa's reaction was completely or almost completely negative on the first examination.

In the group of diseases with no influence on the platelet count, platelet count showed a decrease without exception reaching normal limits in 5 cases (Nos. 1, 2, 4, 5, and 14 in Table 2) in about 10 days. In one case of them (No. 4 in Table 2) in which blood was examined 3 times repeatedly, platelets returned to normal limits after showing a slight increase and in the other (No. 14 in Table 2) blood platelets decreased gradually in parallelism with an increase in intensity of Arakawa's reaction of their mothers.

And in another group of diseases accompanied by a decrease of platelet count (Nos. 6–13 in Table 2), it will be seen that these babies were possibly in a condition of B-avitaminosis, because in 7 cases out of 8 cases a remarkable increase of platelets was seen even in the period in which thrombopenia ought to have occurred. And in one case (No. 10 in Table 2) blood platelets decreased showing fluctuation of the platelet count.

* or almost no influence.

TABLE 2. *Influence of vitamin B on number and size of blood platelet, influence on the platelet count or in such diseases*

Case No.	Date	Name	Sex	Age (M=months, d=days)	Diagnosis	Arakawa's					
						Right					
						0'	1'	2'	3'	4'	5'
1	Dec. 16 27	K.Y.	♀	71 d 82 d	Atrophy	—	—	—	—	—	—
2	Sep. 20 Oct. 2	K.I.	♂	3 m 4 m	Hypotrophy	—	—	—	—	—	—
3	Nov. 8 25	S.A.	♂	3 m	Hypotrophy	—	—	—	—	—	—
4	Nov. 12 18 25	Y.H.	♂	9 m	Hypotrophy	—	—	—	—	—	—
5	Dec. 14 19	T.K.	♂	6 m	Eczema seborrhoicum	±	±	±	+	+	+
6	Jan. 15 23 28	K.Y.	♂	7 m	Rhinopharyngitis	—	—	—	—	—	—
7	Dec. 29 Jan. 20	K.I.	♂	4 m 5 m	Rinopharyngitis	—	±	±	±	±	+
8	Jan. 6 11 Feb. 7	T.A.	♀	8 m	Influenza	—	±	±	±	±	±
9	Jan. 2 7 17	A.I.	♂	9 m	Influenza	—	—	—	—	—	—
10	Jan. 6 11 18 24	T.A.	♂	47 d 52 d 59 d 65 d	Pharyngitis	—	—	—	—	—	—
11	Jan. 14 23	Y.Y.	♀	25 d 34 d	Bronchitis	—	—	—	±	±	±
12	Jan. 29 Feb. 10	K.N.	♂	13 m	Bronchitis	±	+	±	±	±	±
13	Jan. 14 21 28	S.M.	♂	5 m	Bronchitis with dyspepsia	—	—	—	—	—	—
14	Sep. 28 Oct. 5 9	N.W.	♀	13 m 14 m	Dyspepsia with decomposition	—	±	+	±	±	±

* Vitamin B (+)=has been taking vitamin B.

Liq. Ory.=Liquor Oryzanin, Ory.=Oryzanin, Liq. Berib.=Liquor Beriberol,

As to the change of size of blood platelets, at the first examination a percentage of large platelets was over 5% in 7 cases (Nos. 1, 2, 8, 11, 13 and 14 in Table 2), and except for No. 2 the percentage of large platelets returned to normal limits at the second examination. In 6 cases out of all the cases (Nos. 3, 5, 6, 8, 12 and 14) the ratio of small: middle: large returned to normal, while in the remaining 7 cases

red cell count and Arakawa's reaction in such diseases as with no as accompanied by a decrease of the platelet count.

reaction						Blood platelets			Administration	
Left						Total count per emm. (thou- sands)	Classification			To
0'	1'	2'	3'	4'	5'		Small	Middle	Large	Per os daily (grs.)
---	---	---	---	---	---	4,460	25	69	6	Berib. 2.0
---	---	---	---	---	---	4,160	30	70	0	
---	---	---	---	---	---	3,240	26	64	10	B. p. 0.03
---	---	---	---	---	±	3,330	26	68	6	
---	---	---	---	---	---	3,700	22	74	4	Liq. Para. 5.0
---	---	---	---	±	±	3,950	24	72	4	
---	---	---	---	---	---	5,480	22	71	7	Berib. 3.0
---	---	---	---	---	---	6,100	23	76	1	
---	---	---	---	---	---	5,330	28	72	0	
±	+	+	+	+	±	4,930	25	74	1	
---	---	±	±	±	±	4,940	24	75	1	B. p. 0.03
---	±	±	±	+	+	4,900	28	71	1	Liq. Ory. 5.0
---	---	---	±	±	±	5,120	25	74	1	
±	+	+	+	+	±	5,640	19	80	1	B. p. 0.03
---	±	±	±	±	+	4,830	30	67	3	B. p. 0.03
---	±	+	+	+	±	4,220	25	73	2	
---	---	---	---	---	---	5,370	16	77	7	B. p. 0.05
---	±	±	±	±	±	6,350	28	68	4	
---	---	±	+	+	+	5,150	24	73	3	
---	---	---	---	---	---	5,100	—	—	—	Liq. Berib. 5.0
---	---	---	---	---	---	5,450	—	—	—	
+	+	+	+	+	±	6,600	—	—	—	
---	---	---	---	---	---	4,780	22	74	4	Since 4 days B. p. 0.05
---	---	---	---	---	±	4,690	25	74	1	
---	---	---	---	---	---	4,670	30	70	0	
---	---	±	±	+	+	4,630	27	73	0	
---	---	---	---	---	---	5,100	24	71	5	B. p. 0.03
---	---	---	±	±	±	4,920	32	66	2	
---	---	---	---	---	---	5,250	19	77	4	Liq. Ory. 5.0
---	±	+	+	+	+	4,500	23	74	3	
---	---	---	---	---	---	5,450	14	80	6	B. p. 0.05 Liq. Abery 5.0
---	---	---	---	---	---	4,400	30	69	1	
---	---	---	---	---	---	5,550	25	74	1	
---	---	---	---	---	---	5,780	31	64	5	B. p. 0.03 Liq. Berib. 10.0
---	---	---	±	±	±	6,100	35	63	2	
---	±	+	+	+	±	5,680	24	75	1	

Berib.=Beriberol, B. p.=Beriberolum purum, Liq. Para.=Liquor Paranutrin.

small platelets remained over normal count. It is interesting that B-avitaminosis was of a slight degree in No. 6, because in this case an increase of small platelets was seen and large platelets had not yet increased at the first examination, and the ratio of platelets returned to normal after 2 weeks. And in No. 3 in which vitamin B had not been administered to the mother, both Arakawa's reaction and blood plate-

Table 2. Continued.

of vitamin B*			Subcutaneous injection of yakriton (R.A.U.) every other day		Remarks
sucklings	To mothers		To sucklings	To mothers	
By injection every other day	Per os daily (grs.)	By injection every other day			
Ory. 0.05 mg.	—	Paranutrin 5.0	½	½	
—	Liq. Oryz. 20.0	—	—	—	
—	—	—	½	—	
Spelzon 3.0	Liq. Ory. 20.0	—	½	—	
—	Liq. Ory. 30.0	—	—	—	
—	Liq. Ory. 20.0 Liq. Berib. 20.0	Oryzanin 0.5 mg.	½	—	
—	Liq. Ory. 20.0	—	—	—	
—	Vitamin B (+)	—	½	—	Almost recovered
Paranutrin 5.0	Liq. Ory. 20.0 Liq. Berib. 20.0	—	½	—	
—	Liq. Ory. 20.0	—	¼	½	Recovered
—	—	—	½	½	
—	Liq. Ory. 20.0 Liq. Berib. 20.0	—	½	½	
—	Vitamin B (+)	—	½	—	
—	Liq. Ory. 30	—	½	—	

let did not show a remarkable change in number.

III. Influence of Vitamin B on Blood Platelets in a Healthy Infant and a Healthy Adult.

In both cases of a healthy infant and a healthy adult, not a change of platelets was seen even on an administration of a large amount of vitamin B by way of subcutaneous injection.

TABLE 3.
Influence of vitamin B on blood platelets in a healthy
infant and a healthy adult.

Case No.	Date	Name	Sex	Age (m = months, y = years)	Red cell count per cmm. (thousands)	Total count per cmm. (thousands)	Blood platelets			Remarks
							Classification			
							Small	Middle	Large	
1	Dec. 13	I. G.	♂	10 m	5,200	332	17	72	1	After 5 injections of 0.5 mgr. of Oryzanin crystal every other day
	23				5,740	298	27	73	0	
2	Dec. 7	S. Y.	♂	27y	5,970	232	26	74	0	After 4 injections of 0.5 mgr. of Oryzanin crystal every other day After intravenous injections of 0.5 mgr. of Oryzanin crystal daily for 6 days
	14				5,460	175	27	72	1	
	20				5,610	227	29	71	0	

Comment.

In human B-avitaminosis and beriberi an increase of blood platelets occurs. Kimura¹¹⁾¹²⁾ showed already on the basis of an increase of blood platelet count that most of "healthy" mothers secreting human milk negative to Arakawa's reaction are in a state of avitaminosis B. And in my preceding paper I¹⁾²⁾³⁾ have shown from an increase of blood platelets that infants fed on human milk negative to Arakawa's reaction are more or less inclined to a state of B-avitaminosis.

Now Nakamura¹³⁾ reported that blood platelets decreased gradually on vitamin B administration in 14 cases of beriberi in adults. Sarai¹⁴⁾ said that in beriberi blood platelets decreased once at the beginning of treatment and showed an increase at one time, then decreasing again till they attained the normal in the convalescence. Accord-

11) J. Kimura, Tohoku J. Exp. Med., 1934, 23, 494.

12) J. Kimura, Tohoku J. Exp. Med., 1935, 27, 360.

13) M. Nakamura, Nippon Naika Gakkai Zasshi, 1925, 13, 317.

14) S. Sarai, Rinsho Byorigaku Ketsuekigaku Zasshi, 1934, 3, 626.

ing to Iijima,¹⁵⁾ an increased platelet count in beriberi returned to normal after decreasing to subnormal count in the convalescent period. In the cases of infantile beriberi Kohda¹⁶⁾ said that blood picture returned to normal and that especially platelets showed a remarkable decrease when they were treated with vitamin B. In the third report of Kimura¹⁷⁾ he showed that mothers with a weak or negative Arakawa's reaction showed a decrease of platelets on an administration of vitamin B.

From the results above mentioned and my own result of 345 cases in which I²⁾ pointed out that when infants and/or their mothers had been taking vitamin B preparation, platelet count was within normal limits even in the Arakawa-negative group, it will be expected that platelet count of infants fed on human milk weakly or completely negative to Arakawa's reaction will decrease on an administration of vitamin B. And the results were as was expected. It can be said, therefore, that high platelet count in infants fed on human milk negative to Arakawa's reaction was due to avitaminosis B.

As to the decrease of blood platelets in B-avitaminosis, two modes will be seen. In the cases in which an increase of platelets is in high degree platelet count decreased gradually (Cf. Nos. 7, 15 and 18 in Table 1, Nos. 6, 8, 9, 13 and 14 in Table 2), and in the other (Cf. Nos. 2, 5 and 12 in Table 1, Nos. 4 and 10 in Table 2), platelet count became smaller after showing a rise or fall of the count. In these latter cases, the platelet count was not so large, so it is not to be considered that the infants were in a more advanced stage of B-avitaminosis, though Kimura¹⁸⁾ said that the increase of blood platelet count became less pronounced in the paralytic stage in the animal experiment.

Port and Akiyama¹⁹⁾ said that blood platelets decreased more or less during the fever period of acute infectious diseases and they showed a reactive increase with a fall of temperature. According to Inada and Kubo²⁰⁾ there were 2 types of influenza. In one of them thrombopenia was seen during fever period and returned to normal gradually, and in the other platelets were within normal limits during fever period and returned to normal after showing a temporary in-

15) Ry. Iijima, *Rinshio Byorigaku Ketsuekigaku Zasshi*, 1935, 4, 531.

16) S. Kohda, *Zika Zassi*, 1935, No. 420, 607.

17) J. Kimura, *Tohoku J. Exp. Med.*, 1935, 27, 374.

18) J. Kimura, *Tohoku J. Exp. Med.*, 1936, 28, 55.

19) Port and Akiyama, *Dtsch. Arch. f. Klin. Med.*, 1912, 106, 362.

20) S. Inada and K. Kubo, *Chugai Iji Shimpō*, 1921, 453.

crease in the convalescent period. Tokuta²¹⁾ reported that platelets decreased in the fever period of acute infectious disease in general, and showed an increase in the convalescent state. Mc. Lean and Caffy²²⁾ said "In ten cases of acute bronchitis, platelet counts were normal with an average of 352,000."

Now at the first blood examination in our own cases of rhinopharyngitis, pharyngitis, influenza and bronchitis etc., a decrease of platelet count was to be seen. However, from the fact that in these diseases platelet count showed a decrease on an administration of vitamin B even in convalescence, it can be said that these infants fed on human milk negative to Arakawa's reaction were in a state of B-avitaminosis. It may be due to an increase of platelets in convalescent period that in 3 cases (Nos. 9, 11 and 12 in Table 2) platelet count remained at the upper limits of the normal count.

As to the classification of platelets, the percentage of large platelets was larger than 5% in 7 cases out of 16 cases in Table 1 and 6 cases out of 13 cases in Table 2 at the first blood examination. In all the cases, the percentage of large platelets showed a decrease gradually, and then small platelets began to increase and the ratio of platelets returned to normal gradually when they had been treated with vitamin B.

Summary.

1. In a healthy infant and a healthy adult not a change of blood platelets was seen on an administration of a large amount of vitamin B.
2. B-avitaminotic infants fed on human milk negative to Arakawa's reaction showed an anemia and thrombocytosis.
3. When vitamin B₁₂ was administered to babies and their mothers, blood platelet count showed a decrease, and anemia began to recover in parallel with an increase in the intensity of Arakawa's reaction.
4. There were some cases in which platelet count returned to normal in spite of the fact that Arakawa's reaction of mother's milk remained negative. This is not strange if Takamatsu's¹⁰⁾ and others' works are taken into consideration.
5. Blood platelets decrease more rapidly on an administration of vitamin B to both infants and their mothers than on an administration to the former only.

21) K. Tokuta, Tohoku Igakkai Zasshi, 1925, 8, 512.

22) S. Mc. Lean and J. P. Caffy, Am. J. Dis. Child., 1925, 30, 810.

6. As to the classification of platelets, large platelets showed a decrease at first and small platelets began to increase and then returned to the normal ratio of platelets on vitamin B administration.

Conclusions.

In B-avitaminotic infants fed on human milk negative to Arakawa's reaction, an administration of vitamin B makes the increased platelet count smaller and restores the ratio of platelets among themselves to the normal.