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The Effect of High Single Dosage Vitamin A supplementation on Newborn and Village Children

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Xerophthalmia is still a common and serious problem in many technical developing countries and the study of Oomen et al. (1) indicated the wide geographic distribution of this condition. The prevalence was reported to be high in Asia, the Middle East, Africa, Central America and South America. It occurs in infants and young children and is often associated with protein calorie malnutrition. The prevalence of vitamin A deficiency associated with PCM is notably high in India, Indonesia, Jordan and Thailand (2,3,4,5). In Uganda and West Africa (6) where red palm oil is commonly consumed, only 1% of the PCM cases have eye lesions. McLaren (7) has shown that liver storage of vitamin A was depleted before any clinical signs develop. The liver storage of vitamin A and the serum level were low among children with PCM who had no signs of vitamin A deficiency.

Reports from India (8,9) showed that the etiologic factors responsible for vitamin A deficiency in their infants and children were due to the nutritional state of the mother during pregnancy and lactation, and to delayed food supplementation and low vitamin A content of the supplementary food.

Vitamin A can be stored in the body for a long period of time. The cost of vitamin A preparations is very low and it is both practical and feasible to study the effectiveness of vitamin A supplementation in population groups prone to the deficiency of this vitamin. For the public health implementation a single massive dose is the most practical procedure. In a study by Perira et al (10) in healthy pre-school children it was shown that a single oral dose of 100,000 I.U. vitamin A in oil maintained the serum vitamin A level higher than those of the control children for 13 weeks. Swaminathan et al. (11) studied 2,000 pre-school children with an annual massive single dose of 300,000 I.U. in oil solution and found a considerable reduction of the incidence of signs of vitamin A deficiency in these children, but 4% developed toxic manifestations of hypervitaminosis. Srikentia (12) gave 100,000 I.U. of vitamin A to children 1% - 4 years of age and found that the serum level increased significently when the vitamin was given orally or parenterally in a water miscible form. The serum level was also increased significantly when the vitamin was given orally or parenterally in a water miscible form. The serum

level was also increased significantly when vitamin A in an oil preparation was given orally but did not change when it was given parenterally. Experiments in the rat also demonstrated that the content of liver vitamin A was highest when the vitamin was given orally in the form of an oil preparation. Ajan et al. (13) have shown that single injections of 600,000 I.U. vitamin A in oil to pregnant women failed to increase the vitamin A content of early colostrum while an oral administration did cause an increase. Vakatachalem et al. (14) found that supplementation of 15,000 ug vitamin A in an emulsion form to the nursing women increased the level of breast milk vitamin A significantly, 14-15 hours after oral administration. They also demonstrated that an increase in the amount of protein intake of the lactating women resulted in a high level of maternal serum vitamin A but not in the breast milk. A meeting on hypovitaminosis A in the American in 1969 (15) recommended a massive oral dose of water miscible vitamin A of 100,000 I.U. quarterly to lactating women after delivery and to infants at 3 months of age in areas where avitaminosis A is a public health problem.

There are only a few diseases in the nutrition field which are more tragic than children losing their eyesight for life as a result of vitamin A deficiency. In Chiang Mai, Thailand, vitamin A deficiency is the most common type of all vitamin deficiencies in PCM children. It was observed in 56% of the PCM children. Irreversible eye changes were occasionally present at the time of admission. Ten percent of these PCM children remained partially or totally blind even with prompt therapy (16).

In Chiang Mai infants from the poor socio-economic group consume only breast milk, rice and a small amount of bananas during their first year of life, Meat, fruits and vegetables are not commonly given until after one year of age. The vitamin A-rich colostrum is ordinarily discarded, because of the general believe that it will cause diarrhea of fever. Because of the seriousness of the morbidity from vitamin A deficiency among infants, pre-school age and school age children, a pilot study was initiated at the Anemia and Malnutrition Research Center, Faculty of Medicine, Chiang Mai University, to determine the effectiveness

of a massive single dose of vitamin A supplementation. In the first part of the study, a massive single dose of vitamin A was given to lactating women and to their newborn children. In the second part it was given to preschool and school age children.

Materials and Methods

Study I : The study was undertaken in lactating women who were admitted to the Obstetric ward. The subjects were full term pregnant women who had a normal labour process without complications to the mothers and the newborns. They were divided into three groups.

Group 1 consisted of 59 controls, no vitamin A was given to either the mothers or the newborns.

Group 2 consisted of 70 mothers who received a single dose of 300,000 I.U. of vitamin A in oil during the first 3 days after delivery, but no vitamin A was given to the newborns.

Group 3 consisted of 62 newborn babies to whom a single dose of 50,000 I.U. of vitamin A in oil was given during the first three days of life, but no vitamin A was supplemented to the mothers.

Maternal blood, cord blood and breast milk were collected at the beginning of the study before vitamin A supplementation. The maternal and infant blood samples and the breast milk were collected at six week intervals for a period of 11 months. The medical, obstetric history and the findings of the physical examination in the mothers were recorded. The physical examination in the newborn included body weight, height and head circumference. The incidence and type of infection were also recorded at about 6 week intervals.

Results

The obstetric history, medical history and the results of the physical examination of the mothers as well as their geographic distribution are recorded and shown in Table I to VII. The mothers in this study were from various districts of Chiang Mai and Lampoon provinces. The ages range from 18-40 years,

the body weight range is from 42-71 kg. All of the mothers had a full term pregnancy with normal delivery. Over 50% of the mothers in all groups were primigravidae. The obstetric history revealed that 15% of the mothers in group 1, 24% in group 2 and 14% in group 3 had a history of either stillbirth or miscarriage. The past medical history revealed that 1 mother in group 1 had a history of night-blindness. A history of numbness of hands and feet was recorded in 17% of the mothers in group 1, none in group 2 and 5% in group 3. The results of the physical examination at the time of admission revealed than 9% of the mothers in group 1, 5% in group 2 and about 2% in group 3 were underweight. No sign of vitamin A deficiency was observed among these women at the time of admission. Six percent of the mothers in group 1, 9% in group 2 and 5% in group 3 had signs suggestive of thiamine deficiency as evidenced by impairment of sensation and a decrease in the superficial tendon reflex.

All of the newborns in this study were normal and no congenital abnormalities were detected. The body weight and head circumferences are shown in Table VIII to X. The birth weight range from 2.0 - 3.6 kg. the body height range from 42 - 54.5 cm.

The levels of vitamin A in the maternal blood, newborn blood and breast milk and the result of vitamin A supplementation to the different groups are shown in Figure 1 - 3 and Table XI - XIII. The average value of vitamin A levels on admission in all groups were 38, 15 and 63 ugm% for the maternal, cord blood and breast milk, respectively. The vitamin A content in the colostrum was high with an average value of 179.5 ugm%. It can be seen that in group 2 in which the lactating women received a supplementation of 300,000 I.U. of vitamin A in oil, the maternal serum vitamin A level was higher than in the other two groups. There was a definite increase of the serum vitamin A at 6 weeks after supplementation. This higher level is maintained for a 9 months period.

The cord blood vitamin A levels in all groups on admission were compared. It is evident that in group 2 where the mothers received supplementation and in group 3 in which the newborns received supplementation directly the serum levels

were higher than the control, group 1. The serum vitamin A level in the control group also increased of 6 month which might be from the exogenous source. The newborn serum vitamin A values in these two groups remained significantly higher than the control group for 7½ months.

The breast milk was collected during the first 3 days after delivery. The colostrum is very rich in vitamin A with an average value of 179.5 ± 8.7 ugm%. The breast milk content of vitamin A on admission in the three groups was not statistically different. The finding of a high vitamin A content in the breast milk in all 3 groups on admission indicates that the milk contains part of the colostrum. The breast milk vitamin A level declined in all groups during lactation. In group 2, in which the mothers received vitamin A supplementation, the reduction of the vitamin A content was less than in the other groups. The difference in the breast milk vitamin A content is maintained for 6 months after supplementation.

No toxic effects of vitamin A were observed in either the mothers or the newborns receiving the massive dose of vitamin A. When the dose of 100,000 I.U. was used with 10 newborns, four of them developed vomiting with slightly tense fontanel. The regimen of 100,000 I.U. of vitamin A to newborns was, therefore, discontinued.

The incidence of infection among these 3 groups of infants was also recorded. The result is shown in Fig. 4 and Table XIV. The rates of infection was high during January to March. Upper respiratory tract infection and diarrhea was, among the most common infection in these children. Diarrhea and the skin infection were the second most common infection. It is shown in Table That the rate of individual infection was highest in Group I (control group), and lowest rate was seen in group II who had vitamin A supplemented in the mother. Other disease not related to infection was also recorded. It is shown that eczema of the skin in those infants were observed in all groups. Two infants in group III developed seborrhea several time during the first year of life. Vitamin A has been used widely by the dermatologist for treatment of the skin problem. It is

shown from our study that vitamin A has no effect on the incidence of the skin disease such as eczema among those who has vitamin A supplementation. Other diseases associated among these children during the course of study were beri beri, measles, thrush. There is no different in the incidence of those disease among the different group of children.

During the study period no signs of vitamin A deficiency were observed in any group of children. Two of the newborns in group I developed signs of thiamine deficiency including hoarseness of the voice and cardiomegaly at 1½ and at 3 months of age. The mothers also had clinical manifestations of thiamine deficiency. The symptoms and signs disappeared when thiamine was given parenterally to both the mother and the child.

Ajan et al. (13) have found that a signle injection of 600,000 I.U. of water miscible vitamin A elevated the vitamin A levels of the colostrum and the early milk of lactating women over the untreated controls for about 30 days. Venkatachalam et al. (14) demonstrated that 1,500 ugm of vitamin A in an emulsion form given to the nursing mother failed to increase the breast milk vitamin A content at 4 hours after ingestion. However, when the dosage was increased to 15,000 ugm, the breast milk vitamin content was slightly increased at 4 hours, and showed a definite increase at 14-15 hours after supplementation. The same study also demonstrated that prolonged supplementation of the mother with various doses of vitamin A (600-3,000 ugm/d) as an oily solution did not increase the vitamin A content of the breast milk.

In this study the samples of blood and breast milk were collected at 6 week intervals after supplementation. It is very important to know what happens to these lactating women before the 6 week period after the second samples were collected. To obtain this information a vitamin A absorption study was initiated in lactating women. The mothers serum and the breast milk were collected at the beginning of the study before 300,000 I.U. of vitamin A in oil were given orally. At the beginning of the study the blood and breast milk samples were

collected at ½ or 1 hour intervals for 6 hours. Later samples were collected at 12, 18, 24, 48 and 72 hours after ingestion; in two patient we were able to collect the breast milk samples every day for one week.

McCoord in 1948 (17) had shown that the highest serum vitamin A in children and adults was at about 4 hours after vitamin A ingestion. Arroyave (18) demonstrated that children with kwashiorkor did not respond to vitamin A palmitate orally on admission but responded well after 5 days therapy with adequate protein. The serum vitamin A level reached its peak at 4 hours after ingestion of 75,000 I.U. of vitamin A palmitate in oil.

The results of our study are shown in Fig.5-6. In the first part of the study the mother was fasting and the test meal was given 2 hours after 300,000 I.U. of vitamin A in oil was given. Subject Anong and Buapad consumed 300 c.c. of cows milk as the test meal, while subject Oun and Kesara received food consisting of sticky rice, chilli sauce, pork rind and vegetables. These latter two women received considerable quantities of fat from the pork rind. It is evident that the maternal serum vitamin A was highest when the mother ingested larger amounts of fat in her diet. The highest peak in the vitamin A value was at 4 hours after vitamin A supplementation. The highest value of serum vitamin A is over ten folds higher than the pretreatment value. When the milk was used as a test meal, the highest peak of vitamin A value was at 5 hours after ingestion and the highest value was also about 10 times higher than the pretreatment value, but the peak level was lower than then the high fat diet was given. However, the patient who was fasting during study period (Dang), the peak value did not reach as high as when the diet was added.

Arroyave (18) demonstrated that adequate protein intake in malnourished children improved the vitamin A absorption. Since vitamin A is a fat soluble vitamin, the absorption will be increased when the fat is added to stimulate the pancreatic enzymes. The absorption of vitamin A which was done here in Chiang Mai, however, from only a few subjects shows that the absorption is improved when the diet was given. The best results are obtained when the high

fat diet was added. There was a marked difference in the starting level of breast milk vitamin A which probably reflects the different stages of lactation in our subjects. The results indicate that when vitamin A was given to the lactating women the vitamin A content of either colostrum or breast milk was noted to rise in at least four out of five subjects at about 2 hours after ingestion. Six to seven hours after vitamin A supplementation the breast milk vitamin A level was still high and did not show any indication to decline, while the serum level of vitamin A was started to decrease. This study indicates that there is no relation between the level of the serum and breast milk vitamin A.

The second part of the study was carried out over a longer period to see when the peak level occurred and to note how long this elevated levels of vitamin A in the breast milk maintained after supplementation. The lactating women were studied on the third day after the lactation started to eliminate the possible contamination with colostrum. The results are shown in Fig 7-8.

The results show that after a supplementation of 300,000 I.U. of vitamin A to the mother, the breast milk level increased at 2-4 hours with the peak at 12-24 hours, and then decline. The peak of vitamin A in the serum again occured before the one in the breast milk. It seems that after ingestion of vitamin A, it is stored in the body and later on released into the breast milk.

Kagan et al in 1953 (19) indicated that the serum vitamin A level following the test dose was lowest in infant under six month old. Several reports showed that the premature and full term infant can absorb the water miscible vitamin A better than the vitamin A in oil (20,21).

Vitamin A absorption was also carried out in newborns to elucidate the effect of a massive dose of vitamin A in oil supplementation. The results is shown in Figure 8.

It is observed that the absorption of 50,000 I.U. of vitamin A in oil is good in the newborn. The highest blood level is seen at 4-6 hours after ingestion. In two newborns, (Sriwan and Boonnam) the study was started after the patient

had taken the early part of the breast milk, consequently, the initial levels of serum vitamin A were relatively high. However, after supplementation of vitamin the serum level still showed a definite increase. One patient developed diarrhea from patho E. coli and the serum level did not increase as markedly as in the other patient. Without ingestion of either colostrum, breast milk or supplementation of vitamin A (Oun), the serum level remained low during the 6 hour period.

The effect of supplementation of a massive single dose of 100,000 I.U. in children aged 2-8 years.

This study was initiated in two villages in Hed district which is 85 Km from the city of Chiang Mai. There were 74 children in village I and 88 children in the village II. A summary of the age, sex, medical history, diet history and family history including the health, occupation and income of the family are presented in Table XV-XXI. Fourty-five percent and 35% of the children were below 4 years old in village I and II, respectively. None of them had a history of night blindness and only one child in village II had a history which might suggest thiamine deficiency.

There were no abnormal physical findings observed among all of these children. The diet history shows that 85% of children in village I and 83% of children in village II had been on breast feeding over one year. The longest duration was for 24 months. Most of the children in both villages had consumed mainly breast milk, rice and abnanas during the first 6 months of life. Vegetables, meat, egg and fruit were mostly supplemented after 6 months of age and in a considerable number of children only after 12 months of age. Family histories revealed that 5% of the parents in village I and 6% in village II had history of night blindness. A history of numbness of hands and feet, which is considered as a symptom of thiamine deficiency was more common. It was seen in 15% and 11% among the parents in village I and II, respectively. Most of the parents in this study are farmers or laborers. Over 90% of the parents in both groups had annual incomes of less than $200 per year.

To avoid any possible variables that might arise in different location the children of the same village were used as both control and a study group.

The results of this study are shown in Figure 9-10 and Table XXII - XXIII. It can be seen that a massive single dose of vitamin A of 100,000 I.U. to children 2-8 years old, will result in a significant increase of the serum vitamin A for 6 weeks on one village children when compared with the control group. After that there is no statistical difference between the two groups of children. Because of the inconsistency of the results in two villages, therefore, it is not justified to conclude that the rising of serum vitamin A level in one village group of children is entirely because of the vitamin A supplementation alone. It is important to mention that the children were visited at both villages every two weeks. Any infection was treated promptly and adequately. Medical care and education to the parents can play an important role to improve the overall nutrition status of the children. The parents stated that the children who participated in this study were doing better when compared with their siblings.

The growth rate and incidence of infection were recorded among these children; no difference between the control and supplemented group was observed.

None of the children had developed signs of vitamin A intoxication after receiving the single massive dose of 100,000 units of vitamin A.

Discussion

The results of the massive single dose of vitamin A in oil to lactating women and their newborns show that it is effective to sustain the maternal blood and the breast milk level when 300,000 I.U. vitamin A in oil were supplemented to the mother. The level of the maternal blood vitamin A was sustained for about 9 months, and the breast milk vitamin A was also sustained for 9 months when compared with the control group who had no supplementation. After 300,000 I.U. vitamin A in oil were given to the mothers the peak level in the blood of lactating women occurred at 4-5 hour after ingestion. The peak in the milk is seen later than in the blood. There was no definite correlation between the blood and the breast milk vitamin A concentration. The conditions affecting the transfer of vitamin across the mammary gland are not entirely understood and need further

investigation. The newborn can absorb the vitamin A in an oily suspension well. The peak of the vitamin A level is at 4-6 hours after ingestion. It is save to give 50,000 I.U. of vitamin A in oil to the newborn. The dose of 100,000 I.U. to the newborn is not recommended due to the adverse effects that might arise. The cord blood vitamin A level is commonly low; the level in the serum is high at 6 weeks when compared with the cord blood level. The vitamin A in newborn serum is influenced by the intake of colostrum, breast milk and supplementation of vitamin A. The best results are obtained in the group in which vitamin A was supplemented to the mother. The colostrum is very rich in vitamin A and feeding of this rich source of vitamin A should be encouraged.

Vitamin A deficiency is occasionally underreported in many areas. In Chiang Mai Bitot's spot is seen among the people in rural area and describe as the "salty eye" since it is believed to be due to a high intake of salt. When it occurs the parents will restrict the salt intake in those children. There is an abundance supplies of vegetables and fruits with a high content of vitamin A in Thailand. Because of traditional beliefs it is not given to children under 1 year of age. Nutrition education and health education are very important, but it will take a long time to effectively change the cultural and feeding habits of the people in technical developing countries, especially in areas where there is a high prevalence of vitamin A deficiency. The key for an immediate and rapid plan to improve the vitamin A status by a massive single dose program should be encouraged. Lactating women should be stimulated to take 300,000 I.U. of vitamin A palmitate biannually. Infants can be put in this program as early as the first week of life. When vitamin A is given the dose should be as small as 50,000 I.U. to avoid toxic affects and the dose should ideally be repeated every 6 months. The vitamin A status in perschool aged and school aged children can be influenced by several factors. It is clear from the village study that in the control group who had no supplementation of vitamin A the level also increased, which might reflected the improvement of medical care and nutritional education. Even though a massive dose supplementation program among lactating women and newborn is proved to be effective, without adverse effect. Efforts are also needed to improve the health and nutritional education to be able to reach a long range goal to prevent the problem of xerophthalmia.

REFERENCES

1. Oomen, H.A.P.C., McClaren, D.S. and Escopeni, H. Tropical Geograph. Med., 16: 271, 1964.

2. Periera, S., Begum, A. and Dunn, M.E. Amer. J. Clin. Nutr., 19: 182, 1966.

3. Gyorgy, P. Federation Proc., 27: 349, 1968.

4. McClaren, D.S., Shinajian, E., Tchalian, M. and Khoury, G. Am. J. Clin. Nutr., 17: 117, 1965.

5. Thanangkul, O., Whitaker, J.A., Fort, E.G. Am. J. Clin. Nutr., 18: 379, 1966.

6. Jelliffe, D.B. Infant Nutrition in Tropic, page 94, 1968.

7. Belevady, B. and Gopalan, C. J. Med. Res., 47: 234, 1959.

8. Venkatacham, P.S., Belavary, B. and Gopalan, C. J. Pediat., 61: 262, 1962.

9. McClaren, D.S. International Symposium on the Metabolic Function of Vitamin A. Am. J. Clin. Nutr., 22: 1135, 1969.

10. Periera, S.M. and Bigum, A. Am. J. Clin. Nutr., 22: 858-862, 1969.

11. Swaminathorn, M.C., Sushula, T.P. and Thimmayamma, B.V.S. Am. J. Clin. Nutr., 23: 119, 1970.

12. Srikantia, S.G., Reddy, V. Am. J. Clin. Nutr., 23: 114, 1970.

13. Ajan, Z.A., Samif, A., Husband, M. Am. J. Clin. Nutr., 17: 139, 1965.

14. Vakatachalam, P.S., Belavady, B., Gopalan, C. J. Pediat., 61: 262, 1962.

15. Report of UNICEF, E/ICEF/NCO/132, E/ICEF/CRP/72-73, April, 1972.

16. Thanangkul, O., Whitaker, J.A. Chiang Mai Medical Bulletin, Vol. 8, No. 4, 1969.

17. McCoord, A.B., Katsamples, C.P., Lavender, C.F., Marlin, F.J., Ulstrom, R.A., Tully, R.H., Keenan, A. Pediatrics, 2: 652, 1948.

18. Arroyave, G. Am. J. Clin. Nutr., 22: 1119, 1969.

19. Kagen, . Current Research on Vitamins in Trophology. New York Nutrition Vitamin Foundation, page 31-45, 1953.

20. Morales, C., Chung, A.W., Lewis, J.M., Massena, A. and Holt, L.H., Jr.

21. Sobel, A.E., Beaman, L., Kramer, B. Amer. J. Dis.Child., 77: 756. 1949.

TABLE I

GEOGRAPHIC DISTRIBUTION

	Group I Control	Group II 300,000 I.U. Vit A to Mother	Group III 50,000 I.U. Vit A to Newborn
CHIANG MAI			
Muang	18	21	19
Sarapee	3	7	5
San-pa-tong	7	5	6
Fang	-	2	1
Sansai	6	2	3
Chiang-dow	2	1	1
Doi Saket	5	2	4
Hang Dong	8	6	1
Mae tang	1	3	4
Mae Rim	6	2	4
San Kampang	8	4	8
Chom Tong	3	1	2
LAMPOON			
Muang	1	2	1
Pa-sang	-	1	2
Ban Hong	1	-	-
Miscelleneous	1	-	1
TOTAL	70	59	62

TABLE III

PREVIOUS PREGNANCY AND THE OBSTRIC HISTORY

	Group I Control	Group II 300,000 I.U. Vit A to Mother	Group III 50,000 I.U. Vit A to Mother
Para 0	42	35	43
Para 1	13	13	9
Para 2	4	5	4
Para 3	8	6	2
Para 3	-	6	-
History of still born	-	1	3
History of miscarriage	10	14	7

TABLE IV

MATERNAL PAST MEDICAL HISTORY

	Group I (70) Control		Group II(59) 300,000 I.U. Vit A to Mother		Group III(62) 50,000 I.U. Vit A to Newborn	
	No.	%	No.	%	No.	%
Night blindness and photophobia	1	1.4%	0	0%	0	0%
Number of hands and feet	12	17 %	0	0%	3	5%
Chronic diarrhea	0	0 %	0	0%	0	0%
Parasitic infestation	2	3 %	0	0%	1	2%

TABLE V

PREVIOUS MEDICATION TO MOTHERS

	Group I (70) Control		Group II(59) 300,000 I.U. Vit A to Mother		Group III(62) 50,000 I.U. Vit A to Newborn	
	No.	%	No.	%	No.	%
Received vitamins	53	36%	33	56%	47	75%
Received other medications	0	0%	0	0%	1	1.5%

TABLE VI

MATERNAL BODY WEIGHT (KG)

Weight in Kg	Group I Control	Group II 300,000 I.U. Vit A to Mother	Group III 50,000 I.U. Vit A to Newborn
40 - 45	8	7	5
46 - 50	13	17	12
51 - 55	13	17	17
56 - 60	6	10	14
60	7	6	4
Not Recorded	23	2	10
TOTAL	70	59	62

TABLE VII

CLINICAL DIAGNOSIS OF MOTHERS

	Group I Control	Group II 300,000 I.U. Vit A to Mother	Group III 50,000 I.U. Vit A to Newborn
Normal Weight	62	53	58
Overweight	2	3	3
Underweight	6	3	1
Vitamin Def.	4	5	3
Infections	1	2	-
TOTAL CASES	70	66	65

TABLE VIII

NEWBORN BODY WEIGHT

Body Weight(gm)	Group I Control	Group II 300,000 I.U. Vit A to Mother	Group III 50,000 I.U. Vit A to Newborn
2500	11	10	2
2500 - 3000	18	25	26
3001 - 3500	14	19	19
3501 - 4000	4	4	4
Not Recorded	23	1	11
TOTAL	70	59	62

TABLE IX VIII

NEWBORN HEIGHT

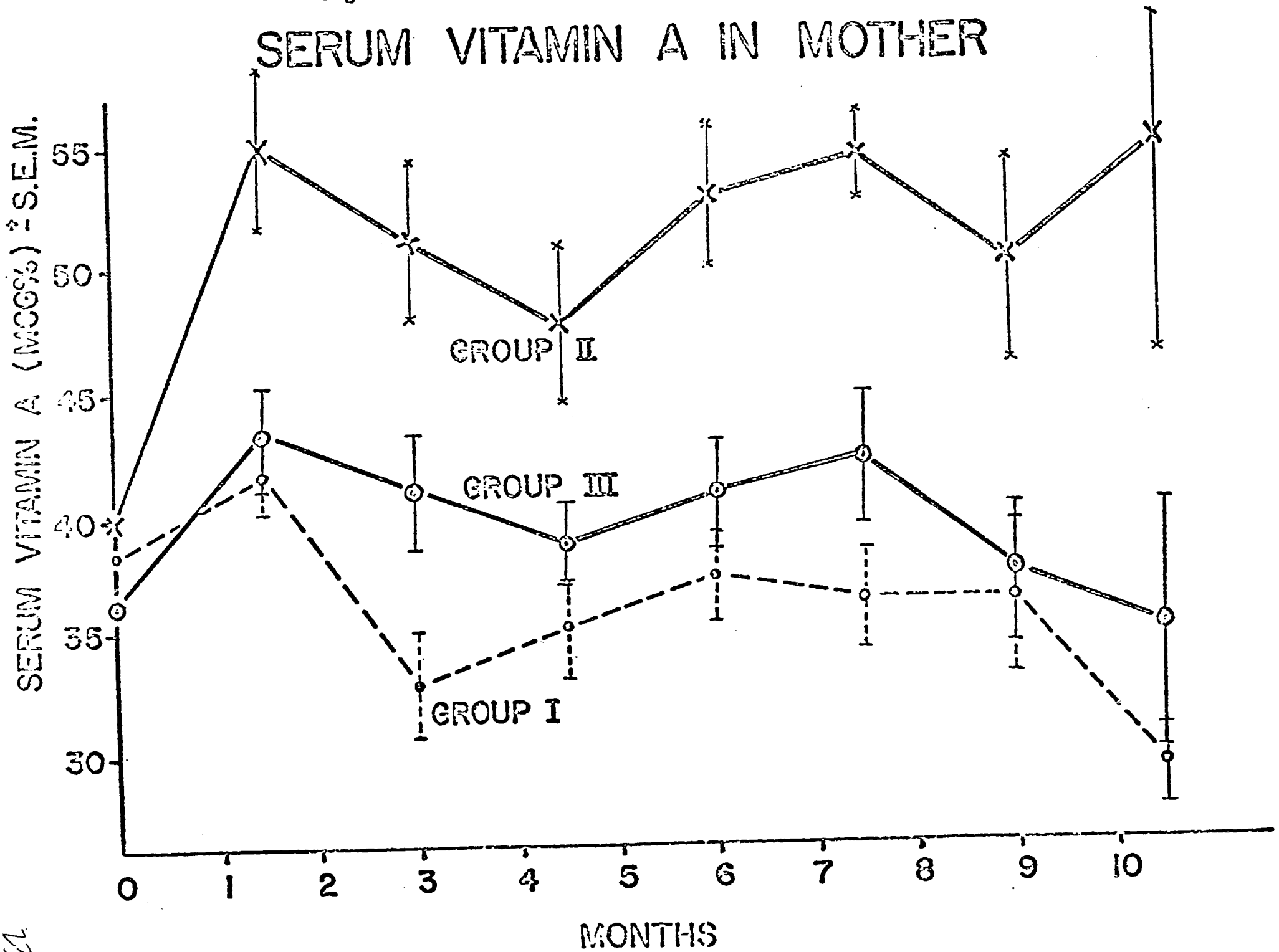
Height (cm)	Group I control	Group II 300,000 I.U. Vit A to Mother	Group III 50,000 I.U. Vit A to Newborn
50	16	20	18
50	13	11	4
50	18	26	29
Not Recorded	23	2	11
TOTAL	70	59	62

TABLE IX

NEWBORN HEAD CIRCUMFERENCE

Head Circumference (cm)	Group I Control	Group II 300,000 I.U. Vit A to Mother	Group III 50,000 I.U. Vit A to Newborn
<30	1	1	1
30 - 35	43	52	48
36 - 40	3	5	3
>40	-	-	-
Not Recorded	23	1	10
TOTAL	70	59	62

Figure I


SERUM VITAMIN A IN MOTHER
SERUM VITAMIN A (MCG%) ± S.E.M.
55
50
45
40
35
30
GROUP II
GROUP III
GROUP I
0
1
2
3
4
5
6
7
8
9
10
MONTHS

22

Effect of Massive Single Dose of Vitamin A Supplementation on Maternal Serum Vitamin A Levels

Time (months)	Gr I	Gr II	Gr III	P value between groups		
				Gr I vs Gr II	Gr I vs Gr III	Gr II vs Gr III
0	38.0 ± 2.1	38.8 ± 2.4	36.2 ± 2.4	.6	.6	.3
1½	41.5 ± 1.8	55.0 ± 3.3	43.1 ± 1.9	.01	.6	.01
3	32.7 ± 2.1	50.9 ± 3.3	40.7 ± 2.4	.001	.02	.02
4½	35.0 ± 1.9	47.6 ± 3.2	38.3 ± 1.7	.01	.2	.05
6	37.1 ± 1.8	52.7 ± 2.8	40.4 ± 2.1	.001	.3	.01
7½	36.1 ± 2.0	54.4 ± 1.4	41.9 ± 2.7	.001	.02	.001
9	28.6 ± 2.8	50.0 ± 4.2	37.1 ± 2.8	.05	.8	.05
10½	29.2 ± 1.7	54.7 ± 8.7	34.8 ± 6.8	.1	.5	.2

Figure II

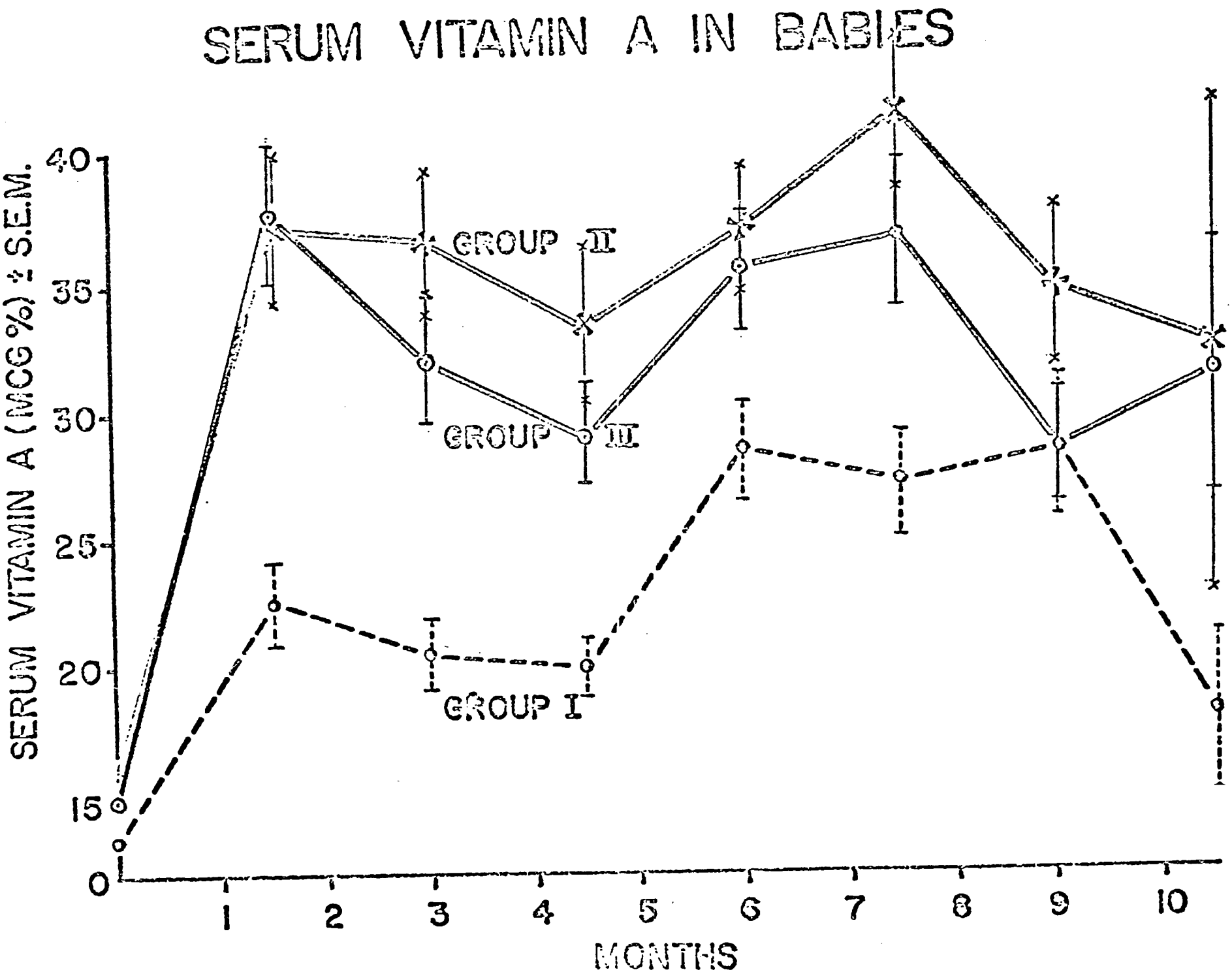
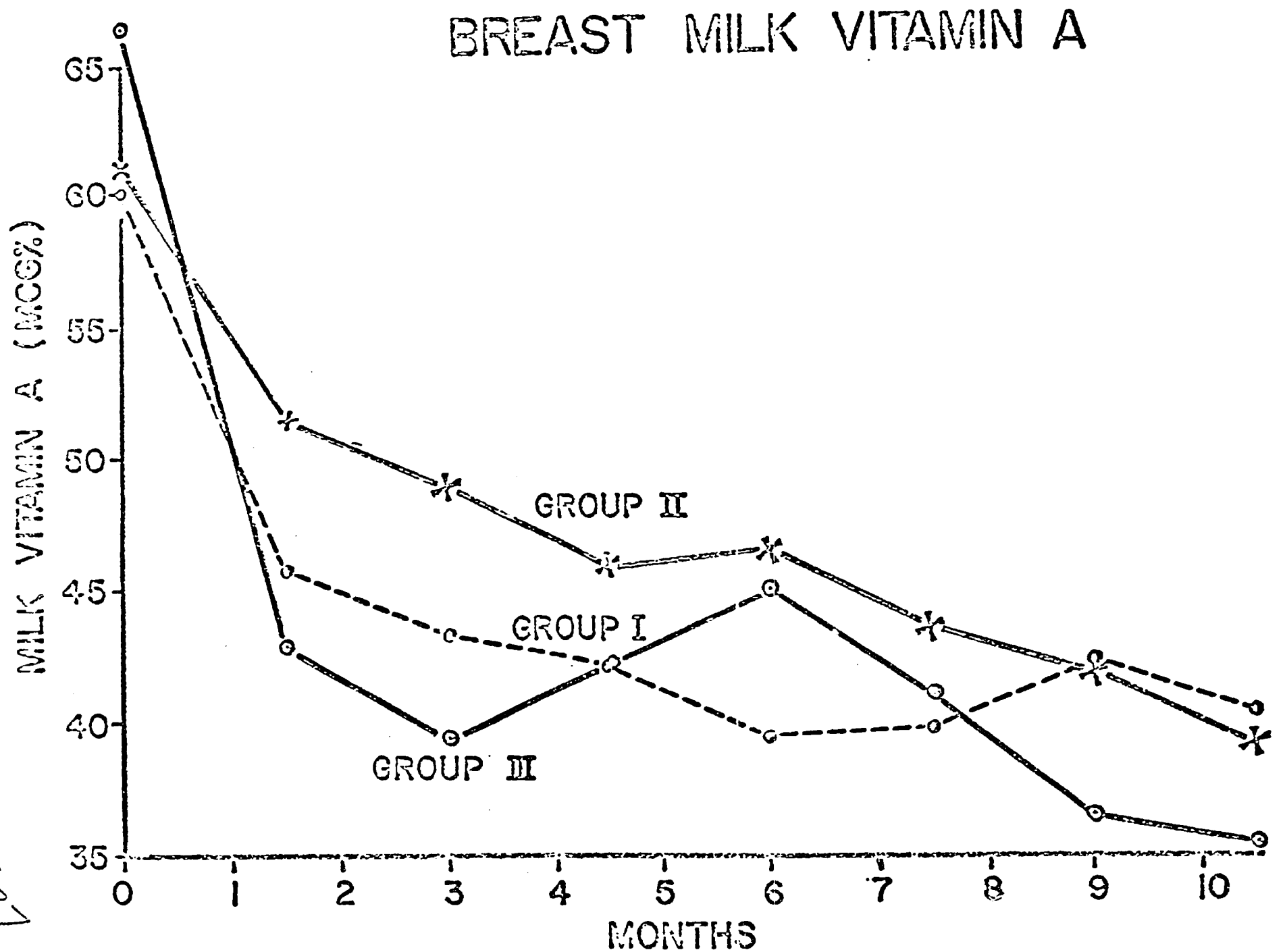

SERUM VITAMIN A IN BABIES
SERUM VITAMIN A (MCG %) ± S.E.M.
40
35
30
25
20
15
0
GROUP II
GROUP III
GROUP I
1
2
3
4
5
6
7
8
9
10
MONTHS

Table XII

Effect of Massive Single Dose of Vitamin A Supplementation on Newborn Serum Vitamin A Levels

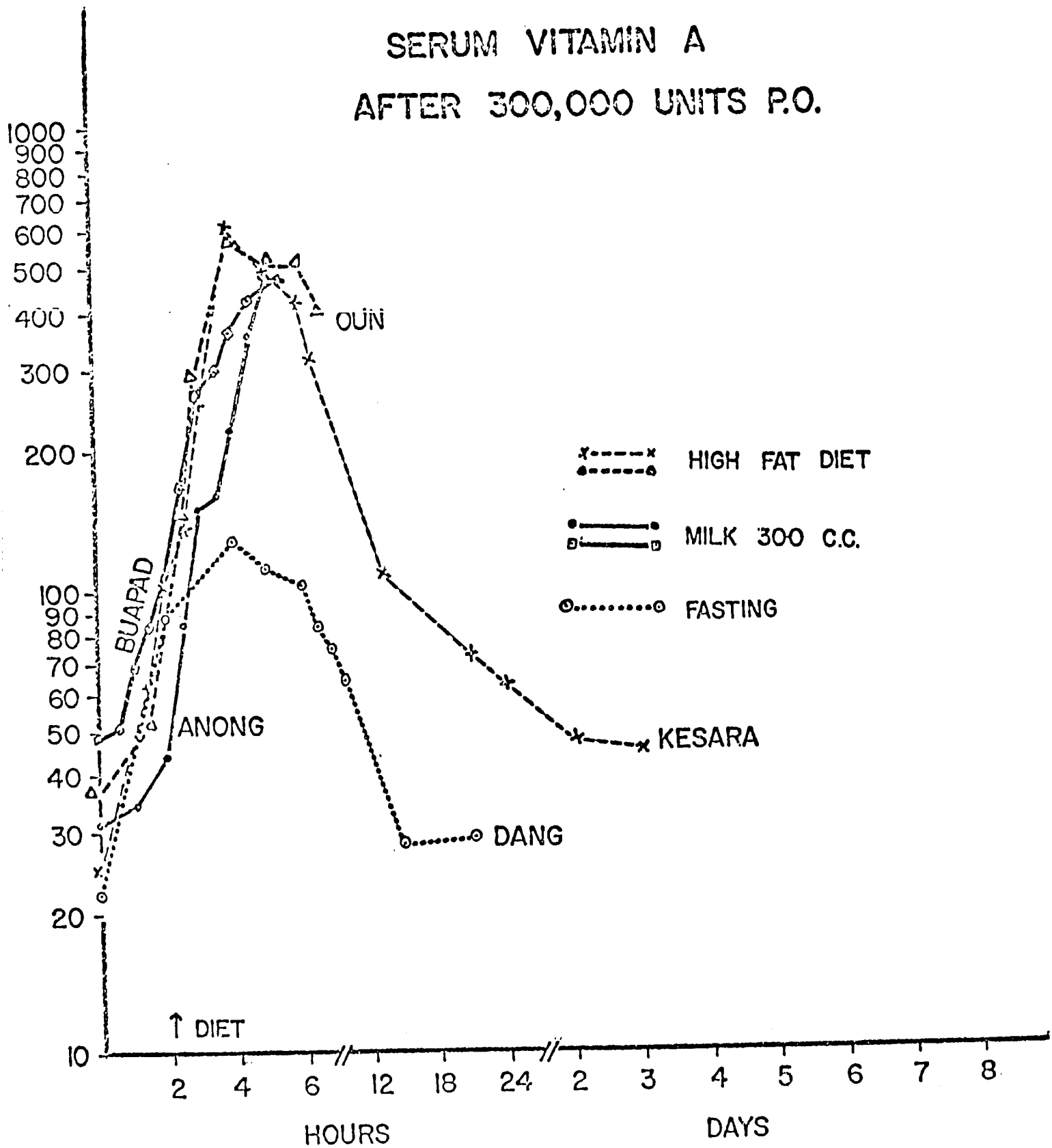
Time months	Gr I	Gr II	Gr III	P value between group		
				I vs II	I vs III	II vs III
0	13.2 ± 0.9	15.8 ± 0.8	15.0 ± 0.9	.05	.2	.6
1½	22.6 ± 1.6	37.4 ± 2.9	38.0 ± 2.9	.001	.001	.9
3	20.6 ± 1.4	36.9 ± 2.7	32.1 ± 2.6	.001	.001	.1
4½	19.9 ± 1.3	33.3 ± 3.0	29.2 ± 2.2	.01	.001	.3
6	28.5 ± 2.0	37.2 ± 2.4	35.6 ± 2.4	.02	.05	.7
7½	26.3 ± 2.1	41.8 ± 2.9	37.0 ± 3.0	.001	.01	.3
9	28.6 ± 2.8	34.8 ± 3.2	28.6 ± 2.8	.3	.9	.2
10½	18.2 ± 3.2	32.7 ± 9.6	31.7 ± 5.1			

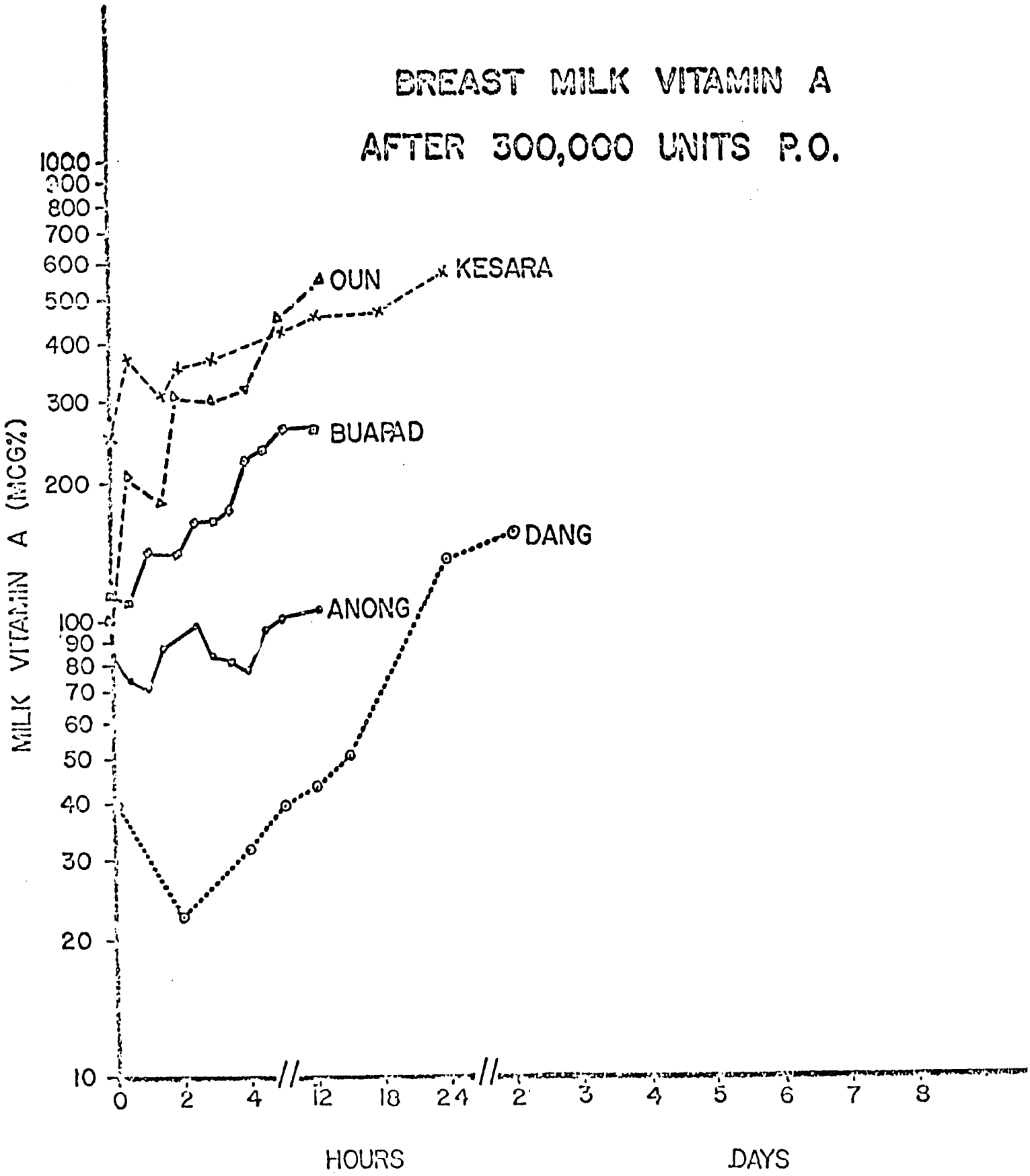
Figure III

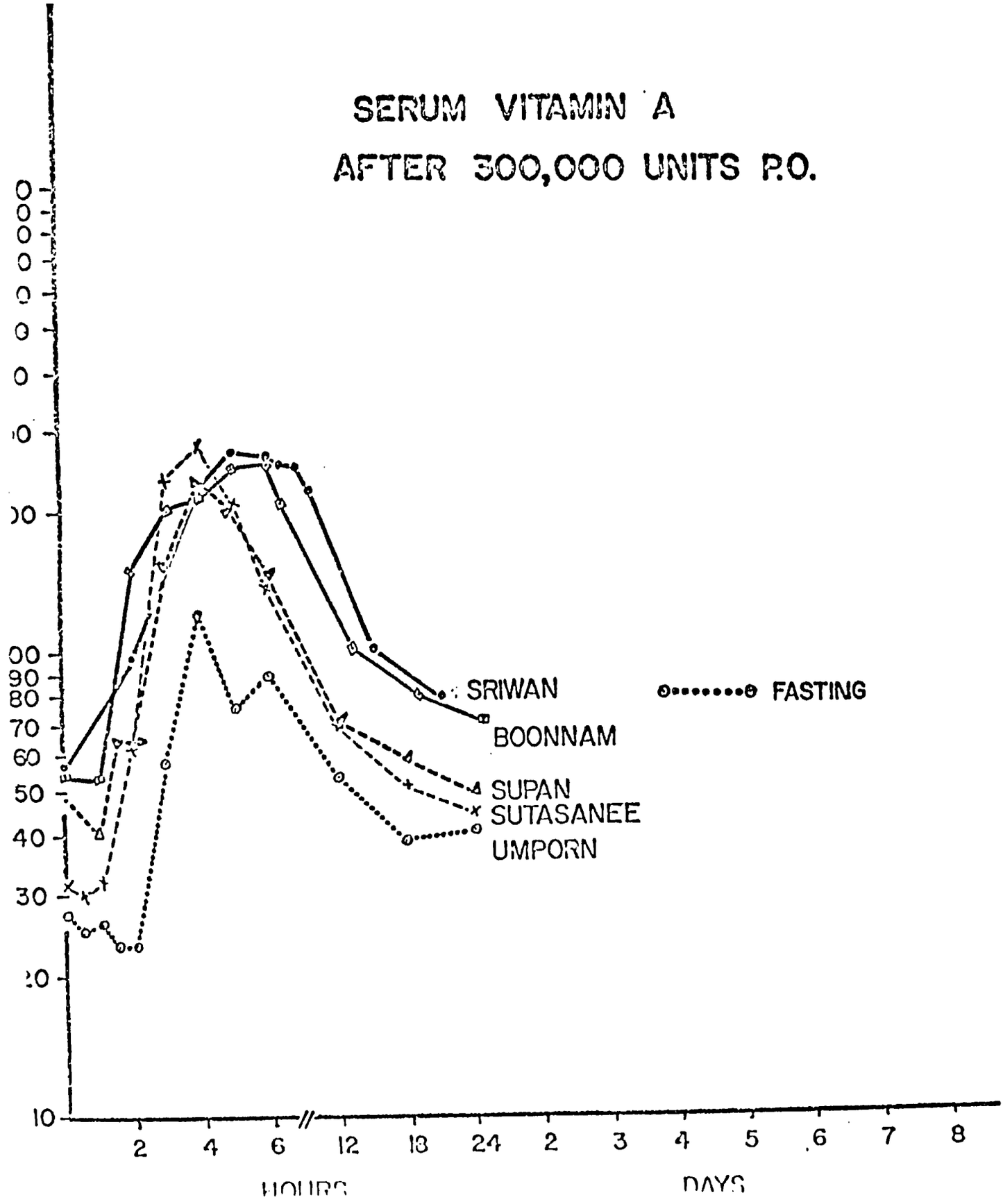

BREAST MILK VITAMIN A
MILK VITAMIN A (MCG%)
65
60
55
50
45
40
35
0
1
2
3
4
5
6
7
8
9
10
MONTHS
GROUP II
GROUP I
GROUP III

Effect of Massive Single Dose of Vitamin A Supplementation on the Breast Milk Vitamin A Levels

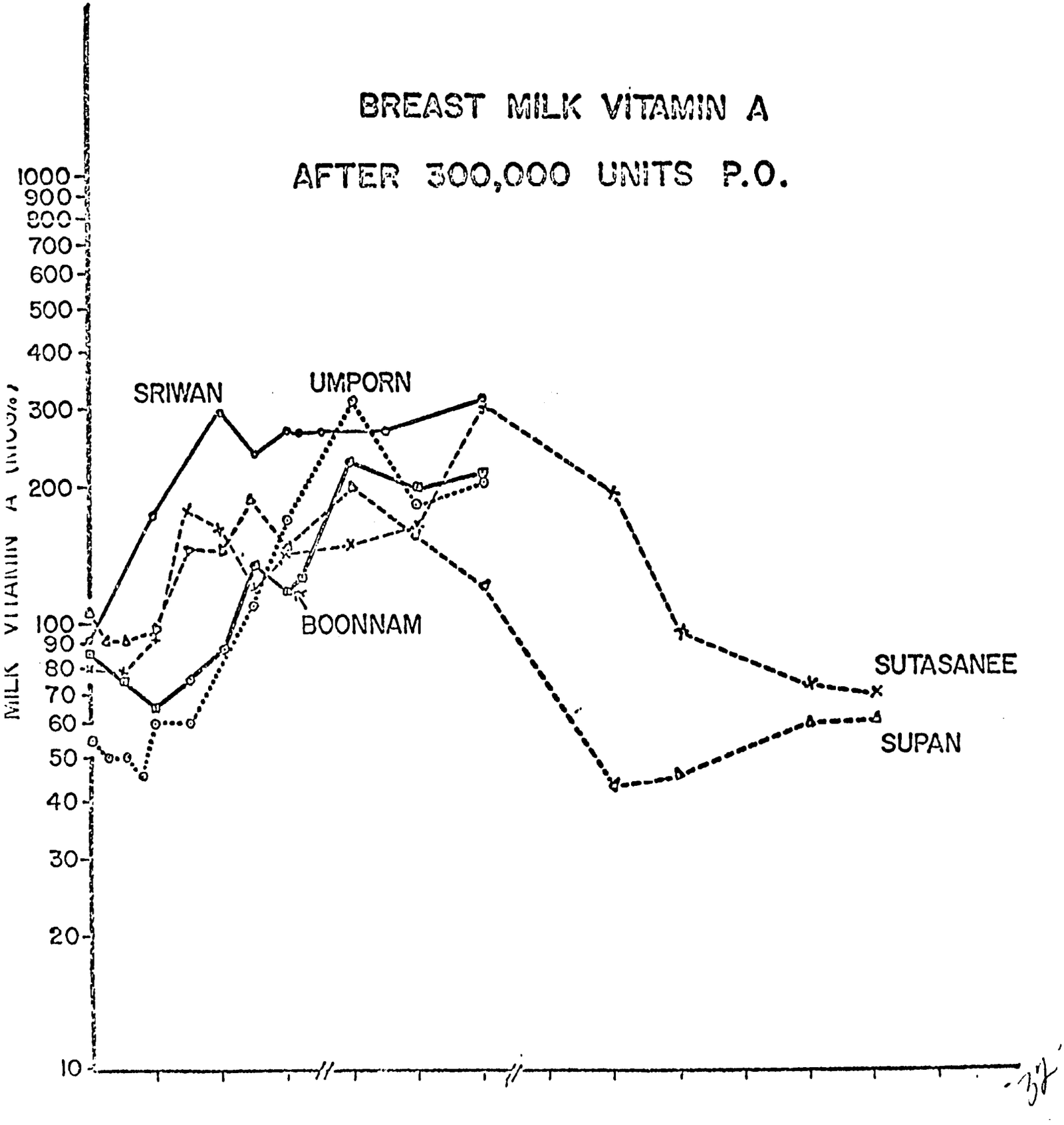
Time months	Gr I	Gr II	Gr III	P values between groups			
				I vs II	I vs III	II vs III	I + III vs II
0	59.8 ± 3.1	61.1 ± 2.1	66.3 ± 9.2	.8	.6	.6	.8
1½	45.3 ± 2.6	51.4 ± 1.9	42.9 ± 2.4	.1	.5	.01	.01
3	43.4 ± 2.3	48.9 ± 1.5	39.3 ± 3.5	.05	.4	.01	.01
4½	42.2 ± 1.6	45.8 ± 0.9	42.3 ± 1.4	.05	.9	.05	.02
6	39.5 ± 2.2	46.5 ± 1.0	45.0 ± 1.5	.001	.05	.4	.02
7½	39.9 ± 2.2	43.6 ± 1.0	41.1 ± 1.3	.1	.7	.2	.1
9	42.3 ± 1.6	41.9 ± 1.3	36.3 ± 0.9	.9	.01	.01	.05
10½	40.3 ± 4.7	39.2 ± 2.8	35.3 ± 3.0	.9	.5	.6	.9


SERUM VITAMIN A
AFTER 300,000 UNITS P.O.
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
OUN
BUAPAD
ANONG
KESARA
DANG
HIGH FAT DIET
MILK 300 C.C.
FASTING
↑ DIET
2
4
6
12
18
24
2
3
4
5
6
7
8
HOURS
DAYS


BREAST MILK VITAMIN A
AFTER 300,000 UNITS P.O.
MILK VITAMIN A (MCG%)
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
OUN
KESARA
BUARAD
DANG
ANONG
0
2
4
12
18
24
2
3
4
5
6
7
8
HOURS
DAYS


SERUM VITAMIN A
AFTER 300,000 UNITS P.O.
SRIWAN
BOONNAM
SUPAN
SUTASANEE
UMPORN
FASTING
10
20
30
40
50
60
70
80
90
100
2
4
6
12
18
24
2
3
4
5
6
7
8
HOURS
DAYS

31


BREAST MILK VITAMIN A
AFTER 300,000 UNITS P.O.
MILK VITAMIN A
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
SRIWAN
UMPORN
BOONNAM
SUTASANEE
SUPAN

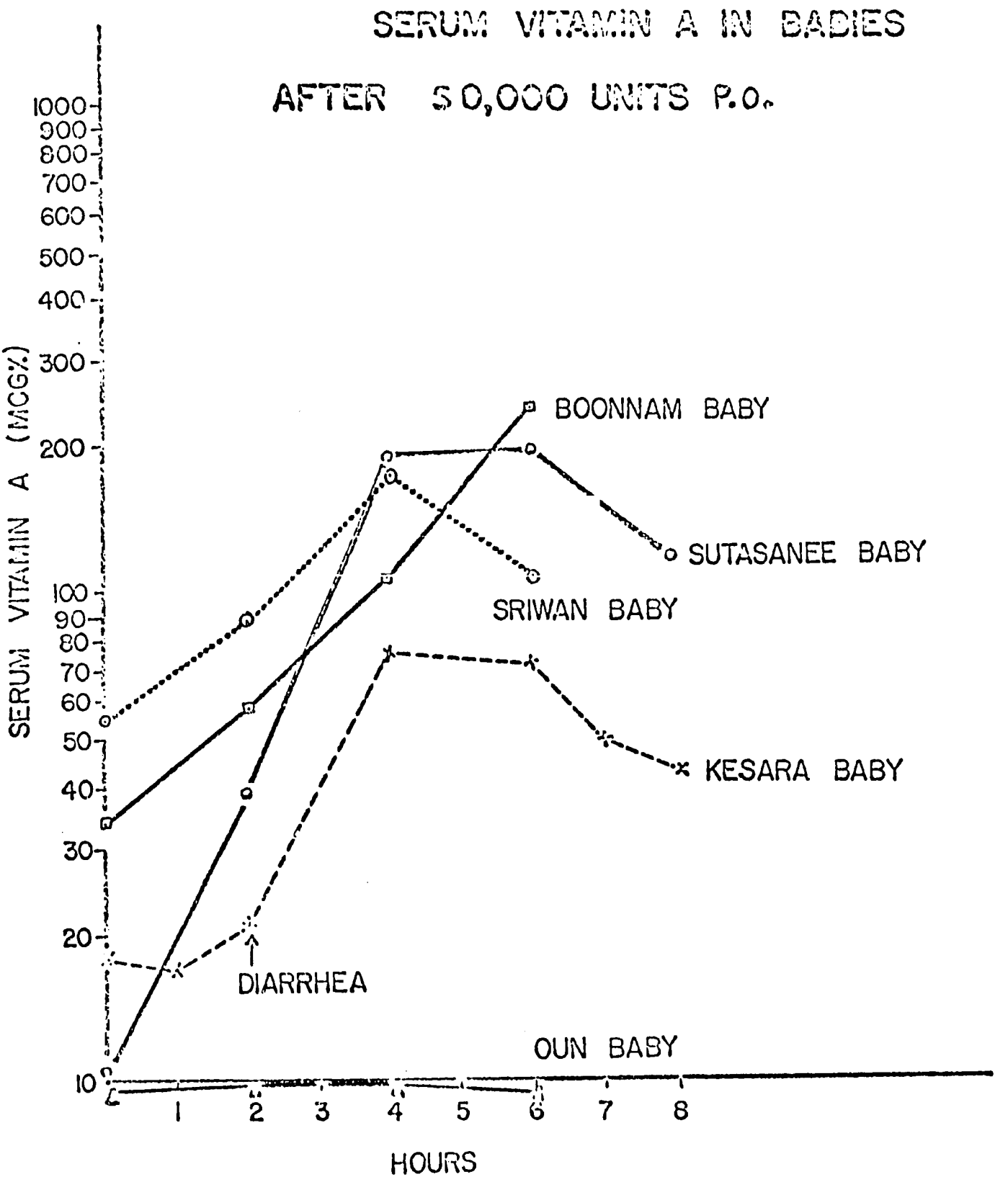

SERUM VITAMIN A IN BABIES
AFTER 50,000 UNITS P.O.
SERUM VITAMIN A (MCG%)
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
BOONNAM BABY
SUTASANEE BABY
SRIWAN BABY
KESARA BABY
DIARRHEA
OUN BABY
1
2
3
4
5
6
7
8
HOURS

Figure IX

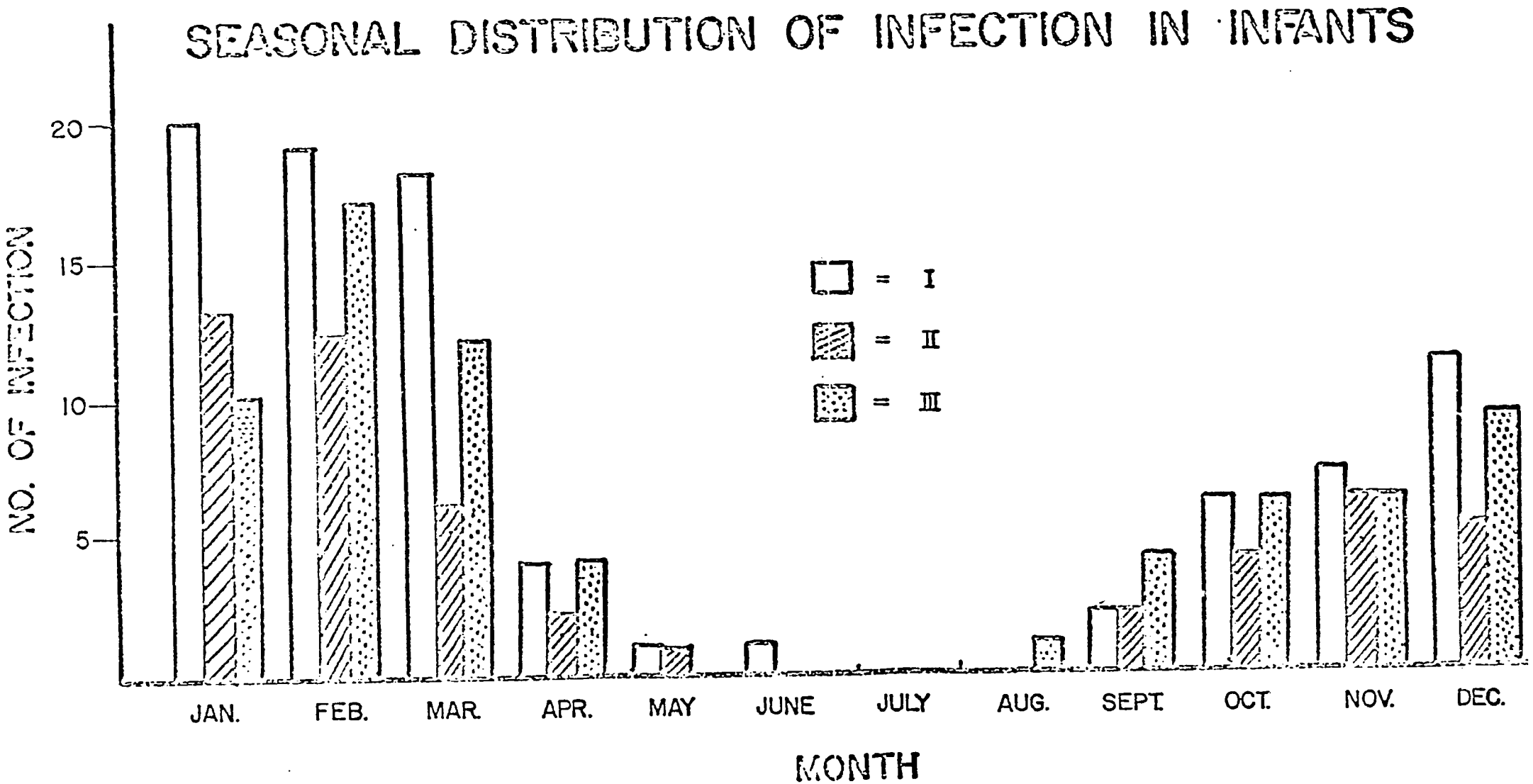

SEASONAL DISTRIBUTION OF INFECTION IN INFANTS
NO. OF INFECTION
20
15
10
5
= I
= II
= III
JAN.
FEB.
MAR.
APR.
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
MONTH

Table XIV

INCIDENCE OF INFECTION/PERSON/YEAR

	Group I	Group II	Group III
URI	1.41	1.0	1.2
Pneumonia	.05	.07	0
GI	.12	.07	.19
Skin Infection	.16	.02	.06
Otitis Media	.02	.02	.04

Figure X

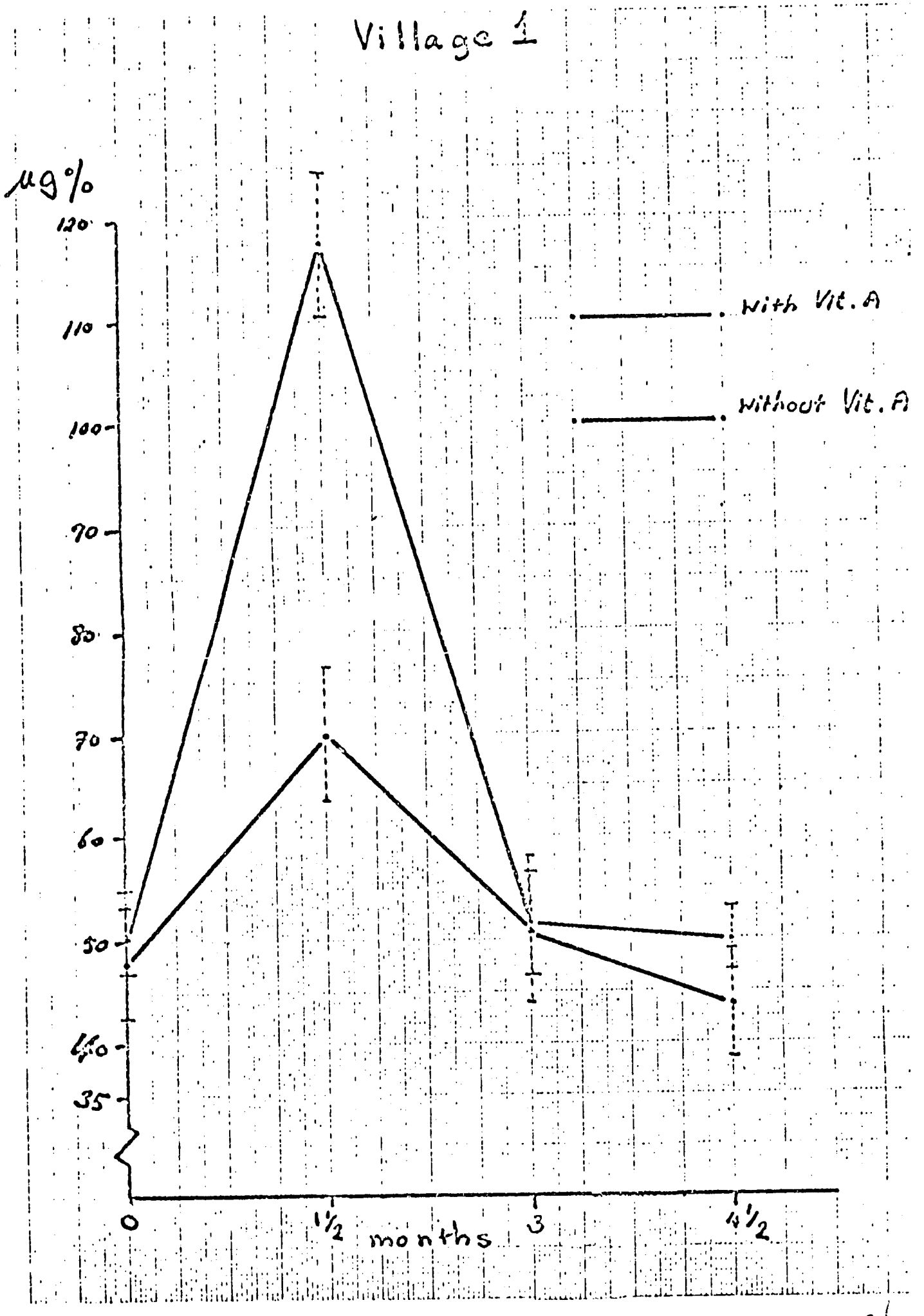

Village 1
µg%
120
110
100
90
80
70
60
50
40
35
With Vit. A
Without Vit. A
0
1½
3
4½
months

Figure XI

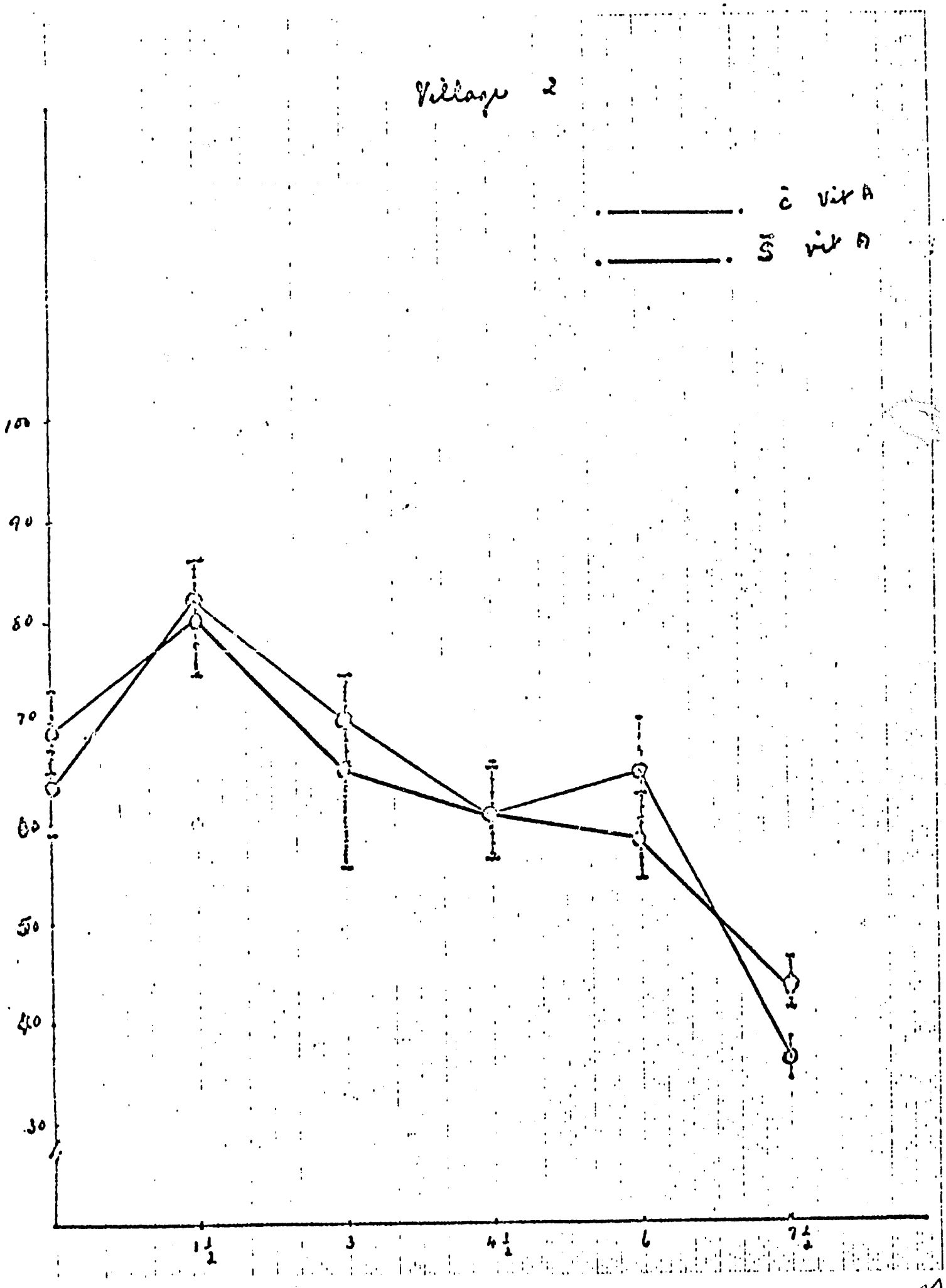


Table XV

AGE DISTRIBUTION OF VILLAGE CHILDREN

Age	Number of Children	
	Village A	Village AA
2	-	1
2 - 4	34	31
5 - 7	33	40
7	5	6
Not known	2	10
Total	74	[illegible]

Table XVI

HISTORY OF BREAST FEEDING IN VILLAGE CHILDREN

	Village I	Village II
Less than 12 months	11	11
More than 12 months	63	77
Total	74	88

Table XVII

PRESENT HISTORY IN VILLAGE CHILDREN

	Village I	Village II
No abnormal symptom	74	75
Frequent diarrhea	-	5
Night blindness	-	-
Numbness of hand & Feet	-	1
Parasite pass in the stool	-	7
Total	74	88

Table XVIII FAST DIET HISTORY OF VILLAGE CHILDREN

	First Introduction rice		banana		vegetable		egg		meat		fruit		milk	
	V.I	V.II	V.I	V.II	V.I	V.II	V.I	V.II	V.I	V.II	V.I	V.II	V.I	V.II
< 7 day	49	51	49	47	-	-	-	-	--	-	-	--	-	1
7 - 30 day	3	9	3	9	-	-	-	-	-	-	-	-	-	-
7 - 3 mo.	17	12	17	13	3	3	3	3	3	2	3	1	-	-
4 - 6 mo.	5	4	5	4	3	-	3	4	3	3	3	1	1	-
7 - 12 mo.	-	5	-	9	33	26	33	25	33	27	33	23	-	2
Over 12 ml.	-	7	-	5	32	49	32	46	33	46	33	43	-	5
Not consume	-	-	-	1	3	-	3	-	3	-	3	-	73	80
Total	74	88	74	88	74	88	74	88	74	88	74	88	74	88

Table XIX

PARENTS MEDICAL HISTORY

	Village I		Village II	
	Father (71)	Mother (74)	Father (86)	Mother (88)
Fatigue	7	21	4	11
Night blindness	3	5	3	8
Numbness of hand and foot	2	20	3	16

Note 3 Father in village I died.
2 Father in village II died.

Table XX

ANNUAL FAMILY INCOME

Income	Village I	Village II
<1,000	35	48
1,000 - 2,000	20	13
3,000 - 4,000	13	21
5,000 - 6,000	2	-
>6,000	2	5
Not report	2	1
Total	74	88

Table XXI

PARENTS OCCUPATION

	Village I		Village II	
	Father	Mother	Father	Mother
Farmer	42	40	58	59
Labourer	23	17	1	1
House work	-	13	-	5
Business	3	1	23	23
Employer	3	3	4	-
Other	-	-	2	-
	71	74	88	88