

THE INFLUENCE OF NUTRITION ON THE COURSE OF PREGNANCY¹

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"The Child is Nutritionally Nine Months Old at Birth." K.U.T.

IN THE new dental health plan for the preschool children in Oslo, started 1938, a plan for systematic health supervision of the pregnant and nursing mothers, the infants, and the preschool children was included. This prophylactic health supervision was undertaken as a scientific experiment in order to see to what extent it would be possible to decrease the very high caries frequency in the preschool children.

A so-called health station was erected in the Northeast part of Oslo, covering about one-fourth of the population, or 70,000 people. The station was opened in the spring of 1939 with Dr. K. Utheim Toverud as the medical director. After the plan was fully built up the personnel consisted of: one pediatrician (the director), one obstetrician, two other physicians as assistants, one dentist, one dental hygienist, one dental attendant, four public health nurses, two social workers, one laboratory assistant, one dietitian, and a qualified physical trainer. A psychologist gave lectures in mental hygiene for the mothers. From the public standpoint this health supervision was a voluntary one.

The plan for this health station was the following:

A pregnant woman was expected to report at the station for examination and advice as early as possible in the pregnancy. After the first visit she was given an appointment for return to the station every fourth week during the first six months of pregnancy, every other week during the seventh and eighth months, and every week during the

¹ Compiled at the request of the Milbank Memorial Fund from Dr. K. Utheim Toverud's report on the first six years of activity of the Sagene Health Station in Oslo. See Toverud, K. Utheim: BERETNING—OM DE FÖRSTE 6AAS ARBEID VED OSLO KOMMUNES HELSESTASJON FOR MOR OG BARN PAA SAGENE (1939-1944). Oslo, Fabritius & Söner, 1946.

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last month. As soon as possible after the delivery, usually two weeks, the mothers were asked to come to the station with the infants. The mothers, as well as the infants, were carefully examined. The infants were then seen once a month during the six first months and once every sixth week during the last half of the first year. From one to one and one-half years the children returned every second month, and later every third month. When the children reached one and one-half years they visited the dentist for the first time and received their dental record cards.

The Diet Regimen at the Station. The general plan with respect to diet can be divided into two main divisions: (a) prescribing a diet which met the needs of the particular individual; and (b) keeping the amount of sugar, sweets, and other refined carbohydrates as low as possible.

As the war broke out soon after the health station started, and with it the rationing of most of the foods set in, many difficulties arose in getting enough of the protective foods. As far as (b) is concerned, the strict rationing of sugar and other refined carbohydrates assisted that part of the plan.

In spite of the food difficulties, it was possible to meet fairly well the following standards set up at the start:

Recommended Food Intake During Pregnancy. One to 1½ gm. of protein per kg. of body weight was considered as optimum. During the war, however, there was very little meat protein and except for the protein in the three-quarter to one liter of milk and an egg now and then, the chief source of animal protein was fish (to a large extent salted and dried).

The calcium and phosphorus intake was figured at about 1.5 and 2 gm., respectively, and probably was kept up during the whole time. The need for iron was set at 20 mg., but on account of the low meat diet, it was not possible to obtain this amount in many cases without addition of iron salts.

Vitamins A and D were secured by giving one tablespoon of cod liver oil from September to May. Through this source alone the women got 7,000 I.U. of A, and 700 I.U. of D. Very

few women refused to take the cod liver oil, and these were given oil concentrates.

The optimum intake of Vitamin B₁ was set at 4 mg. In spite of using 95 per cent extraction flour and much potatoes, it was necessary to supplement the ordinary dietary intake of thiamine with brewer's yeast or synthetic vitamin B₁.

An intake of 75 mg. of vitamin C was sought. As very little citrus fruit was imported during the war, it was necessary in many cases to give ascorbic acid in synthetic form as a supplement.

After it was found early in the study that the amount of vitamin K in the green vegetables given to the pregnant woman was not sufficient to secure a low clotting time of the blood of the newborn, the routine procedure of giving 10 mg. of vitamin K daily during the last two to three weeks of pregnancy was adopted.

The amount of the different foodstuffs recommended was chiefly based upon earlier metabolism studies on pregnant and nursing mothers in Norway. But in order to obtain information about the nutritional status of the women in respect to some of the important nutritional factors, the following analyses very frequently were made: hemoglobin every or every other month, ascorbic acid of the blood and urine, serum calcium, and thiamine of the urine. The blood pressure was taken routinely and urine was tested for albumin.

Diet Recommendations During Lactation. Almost the same dietary regimen that was recommended during pregnancy was set up as a standard during the lactation period. Most of the same laboratory determinations were also performed; and calcium, vitamin B₁ and vitamin C studies of the breastmilk were included.

Infant Feeding. Breast feeding was of course encouraged as much as possible. The artificially fed babies were given a two-thirds milk mixture. From the age of two weeks, all infants, whether breastfed or not, received 1 to 2 teaspoons of cod liver oil (300-600 I.U. vit. D); and the premature infants, 900 I.U.

Fruit juice for all the infants also was started at that time. The premature infants routinely were given 100 mg. of reduced iron a day from the second month of age, and the same was given to other infants showing a low hemoglobin at four months of age. From the fourth month all the infants were given a vegetable-fruit dish in addition to the breast milk or the milk mixture.

I. THE INFLUENCE OF THIS HEALTH SUPERVISION ON THE PREGNANT MOTHER

A. *The Frequency of Anemia.* As has been mentioned before, hemoglobin determinations were performed on every pregnant woman at the first visit and later, usually every month. A standardized Zeis Ikon hemometer was used.

In Table 1 is recorded the number of women during the different years on whom hemoglobin determinations were conducted and the per cent showing a hemoglobin concentration less than 12 gm. per 100 cc blood. These have been considered to be anemic. As will be seen, the anemia percentage during the first year was rather high—23, but dropped steadily during the next three years to the lowest value of 6, in 1942. Even in the two worst years of war, 1943 and 1944, the rates were as low as 11 and 8, respectively. And over the entire period there was never a person with a severe anemia.

With figures covering the six years of the study, Table 2 demonstrates that 75 per cent of 109 women who had had a hemoglobin value below 12 gm., reached normal blood values,

Table 1. The frequency of anemia in pregnant women.

YEAR	NUMBER OF WOMEN EXAMINED	WOMEN WITH LESS THAN 12 GM. HEMOGLOBIN PER 100 CC.	
		Number	Per Cent
1939	101	23	23
1940	85	15	18
1941	155	20	13
1942	201	13	6
1943	202	23	11
1944	333	26	8

YEAR	NUMBER OF RE-EXAMINED WOMEN WITH LESS THAN 12 GM. HEMOGLOBIN PER 100 CC. ORIGINALLY	RE-EXAMINED WOMEN WITH 14.4 GM. OR MORE HEMO- GLOBIN PER 100 CC.	
		Number	Per Cent
1939	19	17	90
1940	12	10	83
1941	17	16	94
1942	8	8	100
1943	25	14	56
1944	28	17	61
TOTAL	109	82	75

Table 2. Improvement of anemia in pregnant women by regulating diet and adding iron.

i.e., 14.4 or above after diet regulation and iron addition. Only during the two last years with the most difficult food conditions, did the annual percentages of correction of anemia drop below 83 to the levels of 56 and 61, respectively.

It may be concluded that the regimen practiced at this station prevented to a high degree the very common anemic conditions in pregnant women and cured to a large extent an existing anemia. This happened in spite of the very severe restrictions in iron-containing foods during the war.

A low hemoglobin reading alone is, of course, not always a certain diagnostic sign of anemia. The fact, however, that a high percentage of low hemoglobin values were increased by iron medication, gives strong evidence to the supposition that the lowering of the hemoglobin was caused by a real iron deficiency.

B. *Hypocalcemia in Pregnancy.* Serum calcium determinations were conducted on 1,003 pregnant women. Very few showed an unequivocally low calcium value, and it is difficult to know where to put the borderline between normal and pathological or subnormal values. In this study, 9 mg. per cent was characterized as the lower limit of the normal range. On this basis, Table 3 shows that during the two first years 15 per cent demonstrated subnormal values, compared with not more

YEAR	NUMBER OF WOMEN EXAMINED	WOMEN WITH SERUM CALCIUM LESS THAN 9 MG. PER CENT	
		Number	Per Cent
1939	101	15	15
1940	85	13	15
1941	146	5	3
1942	178	13	7
1943	205	9	4
1944	288	16	6
TOTAL	1,003	71	7

Table 3. Blood calcium in pregnant women.

than 3 to 7 per cent during the last four years. That the values below 9 mg. per cent may be characterized as real subnormal levels is strengthened by the fact that of forty-nine women showing values below 9, forty-five very soon reached "normal" values after improvement in the diet alone or together with provision of a calcium-phosphorus supplement. See Table 4.

C. *Ascorbic Acid in Serum in Pregnant Women.* Determinations of ascorbic acid were performed on the sera of 1,092 pregnant women. The micro-method of Farmer and Abt³ was used, and the value of 0.6 mg. per cent or above was taken as normal.

Table 4. Change in blood calcium in pregnant women after diet regulation alone or in combination with addition of calcium-phosphorus supplement.

YEAR	NUMBER OF RE-EXAMINED WOMEN ORIGINALLY SHOWING SERUM CA. <9 MG. PER CENT	NUMBER OF WOMEN WITH RE-EXAMINATION VALUES FOR SERUM CA.-OR > 9 MG. PER CENT
1939	10	10
1940	10	9
1941	9	9
1942	7	5
1943	7	7
1944	6	5
TOTAL	49	45

³ Farmer, C. J. and Abt, A. F.: Determination of Reduced Ascorbic Acid in Small Amounts of Blood. *Proceedings of the Society for Experimental Biology and Medicine*, 34, 1936, p. 146.

YEAR	NUMBER OF WOMEN EXAMINED	WOMEN WITH LESS THAN 0.6 MG. PER CENT	
		Number	Per Cent
1939	97	15	15
1940	86	10	12
1941	153	57	37
1942	211	105	50
1943	207	105	51
1944	338	201	60

Table 5. Percentage of pregnant women with serum ascorbic acid values less than 0.6 mg. per cent.

As will be seen from Table 5, the percentage of values below 0.6 mg. increased greatly during the war, from 15 and 12 per cent in 1939 and 1940, respectively, to 60 per cent in 1944. The mean value for this last year was 0.55 mg. per cent, compared with 0.93 in 1940. The cause of the steady decrease in serum ascorbic acid during the war was the restricted sources of vitamin C-rich foods for the pregnant women coupled with the great demand for this food factor. But no manifest clinical signs of vitamin C deficiency were observed in the women, except for a few cases of gum bleeding. Women with an ascorbic acid value below 0.4 mg. per cent were given synthetic vitamin C. As described before, the aim was to plan the diet so that it would provide at least 75 mg. of ascorbic acid a day. From the data of blood analyses it would appear that an intake of 75 mg. a day was not reached, or that this amount is not sufficient during pregnancy to keep the blood level of ascorbic acid at or above 0.6 mg. per cent.

D. *The Excretion of Thiamine in the Urine in Pregnant Women.* In order to look into the status of vitamin B₁ in the pregnant women the excretion of thiamine in the urine was determined in 671 of them. The method of Jansen, modified by Wang and Harris,⁴ was used. Healthy adult non-pregnant and non-lactating women on an average good diet showed an excretion of about 200 micrograms per 24 hours. As will be seen

⁴ Wang, Y. L. and Harris, L. J.: Estimation of Vitamin B₁ in Urine by the Thiochrome Test. *Biochemical Journal*, 33, 1939, p. 1356.

from Table 6, as many as one-third of the pregnant women did not show any thiamine in the urine. The percentage of women not excreting any thiamine varies by year from 20 to 44, and there is no consistent trend in the values during the six observation years.

Corresponding to this high percentage of women not excreting any thiamine, many women were complaining of cramps in their legs, numbness of fingers and toes, and neuralgic pains. After administration of brewer's yeast or synthetic vitamin B₁ so that the total intake of thiamine reached 6-9 mg. daily, these symptoms as a rule disappeared and thiamine was recovered from the urine. As a consequence, brewer's yeast was given routinely to the pregnant women during the last years. Those not able to take the yeast were given synthetic B₁.

The very common symptom—constipation—during pregnancy was also frequently present in the entire group, especially in the women first entering the station. This symptom usually disappeared after taking brewer's yeast. Whether the vitamin B₁ or other factors in the yeast were responsible for this effect could not be stated.

E. *Tuberculin Tests in Pregnant Women.* Of 914 pregnant women observed during the six years, 65 per cent reacted positively to the Pirquet or Mantoux test. By x-ray inspection of the positive ones, only three were found to have an active tuberculosis.

Table 6. Per cent of pregnant women with no thiamine excretion in the urine.

YEAR	NUMBER OF WOMEN EXAMINED	WOMEN WITH NO EXCRETION	
		Number	Per Cent
1939	78	28	36
1940	75	33	44
1941	109	26	24
1942	131	26	20
1943	144	58	40
1944	134	52	39
TOTAL	671	223	33

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F. *Wassermann Reaction in Pregnant Women.* Of 1,025 pregnant women given the Wassermann test, six showed a positive reaction.

G. *Pre-eclamptic Signs.* The three most common signs of a beginning pregnancy intoxication: albuminuria, increased blood pressure, and edema were carefully watched for in every pregnant woman supervised at the station. It is seen from Table 7 that the percentage of albuminuria was fairly high—12 and 19 per cent in 1939 and 1940, respectively (soon after the station was opened), but during the next four years it varied between 2 and 7. These last figures must be characterized as very low. It cannot be stated whether or not this decreased frequency of albuminuria was due to the regimen at the health station or to the low intake of meat protein during those years.

The figures for elevated blood pressure, compared by years, show considerable differences. During the first and the last two years the percentage of women having a systolic blood pressure greater than 140 mm. was very low (5 to 7) but during the other years it was as high as 17 to 27.

The third sign—edema—was very frequent, and did not show any tendency to reduction in the later years of observation. This high percentage of edema may be accounted for by the low intake of animal protein, and, partly also, by a low in-

Table 7. The frequency of albumin in urine, hypertension and edema in pregnant women.

YEAR	NUMBER OF WOMEN EXAMINED	WOMEN WITH SPECIFIED CONDITION					
		Albumin in Urine		Systolic Blood Pressure > 140 mm.		Edema	
		Number	Per Cent	Number	Per Cent	Number	Per Cent
1939	113	14	12	8	7	6	5
1940	86	16	19	23	27	43	50
1941	138	3	2	23	17	43	31
1942	147	10	7	35	24	62	42
1943	203	11	5	10	5	84	41
1944	338	7	2	20	6	132	40
TOTAL	1,025	61	6	119	12	370	36

take of thiamine. (The frequency of edema was very high in the adult population in Norway during the war, and especially among the women.)

Among the pregnant women examined up to the last week before partus not a single case of eclampsia occurred. Two women, however, *not* visiting the station during the last weeks of pregnancy, developed a mild eclampsia just before delivery, but recovered very soon postpartum. If these two cases are included, the health station had an eclampsia frequency of 0.2 per cent. But it should be remembered that these two had not followed the regimen of the station during the last part of pregnancy. Although not strictly comparable to this material, it can be mentioned that other statistics from Norway showed an eclampsia rate of from 0.6 to 1.6 per cent.

Thus, it may be stated that the health of the women supervised at the station was extremely good.

II. THE INFLUENCE OF THE HEALTH SUPERVISION DURING PREGNANCY ON THE NEWBORN INFANT

A. *The Stillbirth Rate.* Table 8 presents the stillbirth rate of the City of Oslo as a whole, of the Sagene Health Station, and of Sagene and Torshov districts. The Health Station operates in these districts, but not more than about one-third of the total population of pregnant women has attended it. As will be seen from the table, the stillbirth rate for the whole City is 23.6 per 1,000 births, compared with 14.2 for births to women attending the Health Station. On the other hand, the districts

Table 8. Stillbirth rate at Health Station compared with that of the City of Oslo.

AREA	YEAR	TOTAL NUMBER OF INFANTS BORN	NUMBER OF STILLBORN INFANTS	STILLBORN PER 1,000
City of Oslo	1939-1946	29,191	688	23.6
Sagene and Torshov	1939-1946	4,522	128	28.3
Health Station	1939-1947	1,553	22	14.2

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served by the station have a higher rate, 28.3, than the City as a whole. The reduction of the stillbirth rate in the women attending the Health Station is in reality even greater than appears from the figures, as one-third of the total for the Sagene and Torshov districts is the data from the Health Station. Thus it cannot be questioned that the regimen as practiced for the pregnant women at the Health Station has a very great beneficial influence on the stillbirth rate. This may be said to have reduced the rate by 50 per cent.

B. *The Infant Mortality.* The total infant mortality, deaths before one year, may be influenced to a certain extent by the health status of the newborn and also by conditions during pregnancy. The death rate in Oslo has dropped from 12.5 per cent of total live born in 1900 to 3.0 per cent in the years 1939–1944. (Table 9.) During the latter period, for infants born of mothers supervised during pregnancy in the Health Station, the total infant death rate was not more than 1.4 per cent, but in the surrounding districts of the Health Station it was 2.6 per cent. The difference between the rate for the City of Oslo and for the Health Station is significant statistically.

The neonatal mortality, deaths before one month, has not decreased to the same extent during the last years as has the total infant mortality. The neonatal mortality expressed as percentage of the total infant mortality has steadily increased from 24 per cent in Oslo in 1900 to 65 per cent in 1939–1944.

Table 9. Total infant mortality and neonatal mortality in the City of Oslo.

AREA	YEARS	NUMBER OF LIVE BORN INFANTS	DEATHS DURING			
			First Year		First Month	
			Num- ber	Per Cent	Num- ber	Per Cent
City of Oslo	1939–43	14,547	437	3.0	287	2.0
Sagene and Tors- hov Districts	1939–43	2,276	59	2.6	32	1.4
Health Station	1939–44	728	10	1.4	8	1.1

In the data from the Health Station study during the latter five-year period, it is 80 per cent. But the rate of neonatal mortality of total live-born infants is lower in the Health Station material than in the City of Oslo. The figures are 1.1 and 2.0, respectively, for the five-year period. Of 728 live-born infants born of supervised mothers from the Health Station, eight died during the first month, and of these, five were prematures.

C. *The Influence on Prematurity.* It is well known that the prematurely born infants make up the bulk of the morbidity as well as of the mortality groups in infancy. Reducing the number of premature infants, therefore, would be a very important prophylaxis. In order to evaluate the possible influences of prenatal supervision on this rate, the data from the Health Station are divided into two groups: children born of supervised mothers, and children born of unsupervised mothers. On the basis of prematurity at a birth weight of 2,500 gms. or less (five pounds, eight ounces or less), the premature birth rates are 2.2 and 4.6 per cent, respectively, and prematurity among supervised mothers was less than 50 per cent as frequent as among the non-supervised. The difference between these prematurity rates is nearly three times the standard error of the difference. (See Table 10.)

Table 10. Frequency of premature births based on birthweight 2,500 gms. or less (5 lbs., 8 ozs. or less).

YEAR	INFANTS BORN OF MOTHERS					
	With Prenatal Supervision			Without Prenatal Supervision		
	Total No. Born	Premature		Total No. Born	Premature	
		Number	Per Cent		Number	Per Cent
1939	67	1	1.5	236	15	6.4
1940	95	2	2.1	308	15	4.9
1941	92	3	3.3	363	17	4.7
1942	102	0	0.0	410	14	3.4
1943	145	5	3.4	426	27	6.3
1944	227	5	2.2	648	21	3.2
TOTAL	728	16	2.2	2,391	109	4.6

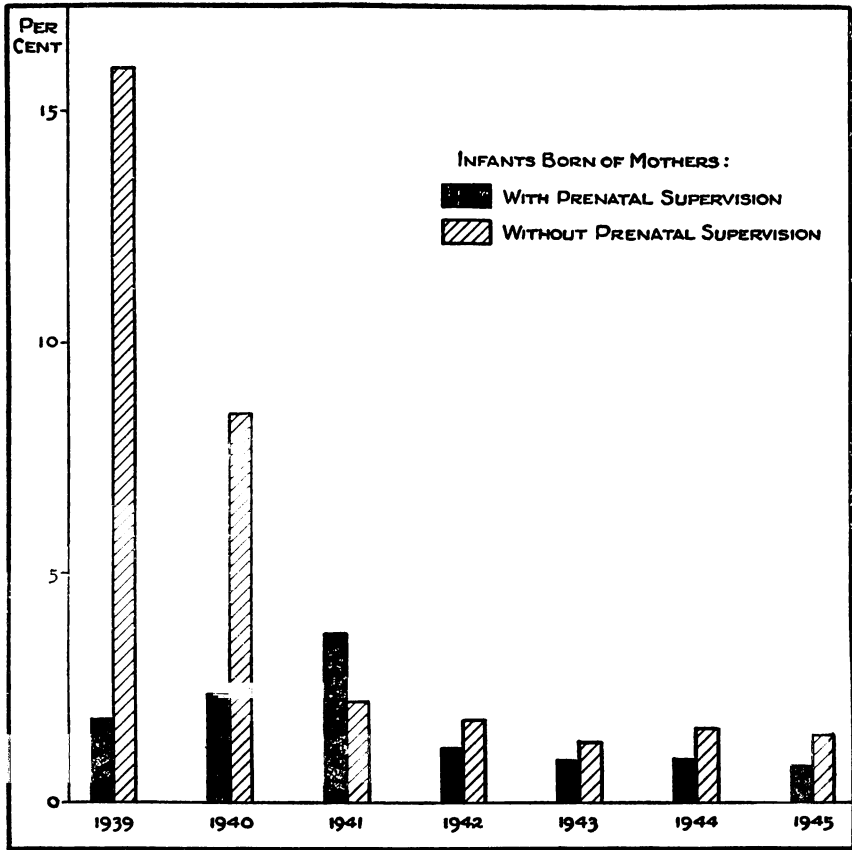


Fig. 1. Comparison of the frequency of rickets or osteoporosis in infants born of mothers having prenatal supervision at the Health Station and in infants born of mothers not having this prenatal supervision.

Thus, the regimen practiced at the Health Station during pregnancy had a beneficial influence on the rate of prematurity.

D. *The Influence on the Frequency of Rickets and Osteoporosis.* For a short time, calcium, phosphorus, and phosphatase determinations were made on the infants' blood and x-rays were taken in conjunction with a clinical examination in order to ascertain the status of mineralization. But on account of shortage of technical assistance other methods than the clinical ones had to be dropped. The signs watched for and taken as indicative of a disturbance in the mineralization were the following: craniotabes, the furrow of Harrison, rosary, en-

larged epiphysis, and bowing of the legs. In all cases of bowing of the legs x-ray pictures were taken. Figure 1 shows that the percentage of such bone changes in prenatally unsupervised children in the year when the Health Station opened was as high as 15.9 per cent and has dropped down to 1.5 per cent in 1945. But the frequency in the prenatally supervised children was even lower, 0.9 during the same year. In the prematurely born infants and in twins prenatally and postnatally supervised, not a single instance of such bone changes has been discovered. It is clear from this that prenatal supervision will reduce the incidence of osteoporosis and rickets in infancy and early childhood.

E. *The Influence on the Clotting-Time of the Blood of the Newborn Infant.* As birth hemorrhages are a very frequent cause of early death or various paresthesias in children, and in turn are caused to a certain extent by a high clotting-time of the blood, vitamin K was given routinely to the women during the two to three last weeks of pregnancy. It has been pointed out by some authors that the prophylaxis against the bleeding tendency in the newborn was to give cow's milk at birth. By bacterial action, this would produce enough of vitamin K. The logic of this, however, is not rational. When the child is born, the bleeding has already started and may have caused irrepar-

Table 11. Average coagulation time in minutes of infants' blood during first week after birth.¹

AGE OF THE INFANT IN DAYS	IN 35 INFANTS BORN OF MOTHERS WITHOUT VITAMIN K	IN 23 INFANTS BORN OF MOTHERS WITH 10 MG. VITAMIN K PER DAY	DIFFERENCE	STANDARD ERROR OF DIFFERENCE
1		2.7		
2	5.7	3.4	2.3	± 0.34
3	5.2	3.5	1.7	± 0.40
4	4.9	3.5	1.4	± 0.36
5	4.9	3.3	1.6	± 0.40
6	4.9	3.4	1.5	± 0.38

¹ Cow's milk mixture given at birth to both groups.

able damage to the child. A factor in the bleeding possibly may be found also in pathology of the vessel wall. Moreover, as Table 11 shows, the clotting-time is much lower in infants given cow's milk from birth and born of mothers given vitamin K in pregnancy than in infants given cow's milk from birth but born of mothers not taking vitamin K. The difference is statistically significant. Furthermore, the administration of cow's milk to newborn infants born of mothers having taken vitamin K, does not lessen the coagulation time of the infants' blood materially, so this procedure may be of no value when vitamin K is given during pregnancy.

Not a single case of brain damage has been diagnosed clinically among 1,531 live-born infants born of mothers given vitamin K. As the average incidence of brain damage due to so-called birth injury is 0.5 per cent, one would expect seven to eight such cases in the material of the Health Station. One woman, however, supervised but *not* having taken vitamin K gave birth to a child with brain hemorrhage.⁵

III. THE INFLUENCE OF THE HEALTH SUPERVISION DURING PREGNANCY ON THE NURSING MOTHERS

As has been pointed out earlier, the lactating mothers have been carefully supervised by clinical examinations and various laboratory tests. The time does not allow me to refer to anything but:

The Influence on the Lactating Power. In order to evaluate the influence of the Health Station regimen on nursing capability, the mothers were divided into two main groups: those who have been supervised at the station during pregnancy, and those who have not been supervised. For each of these groups, the percentage of mothers whose infants were breast fed only for nine months, without addition of cow's milk, was determined. (As will be remembered from the description of the regime of infant feeding, all infants at four months of age are

⁵ Toverud, K. Utheim: Prophylactic Pediatrics. *Medical Woman's Journal*, 55, November, 1948, p. 39.

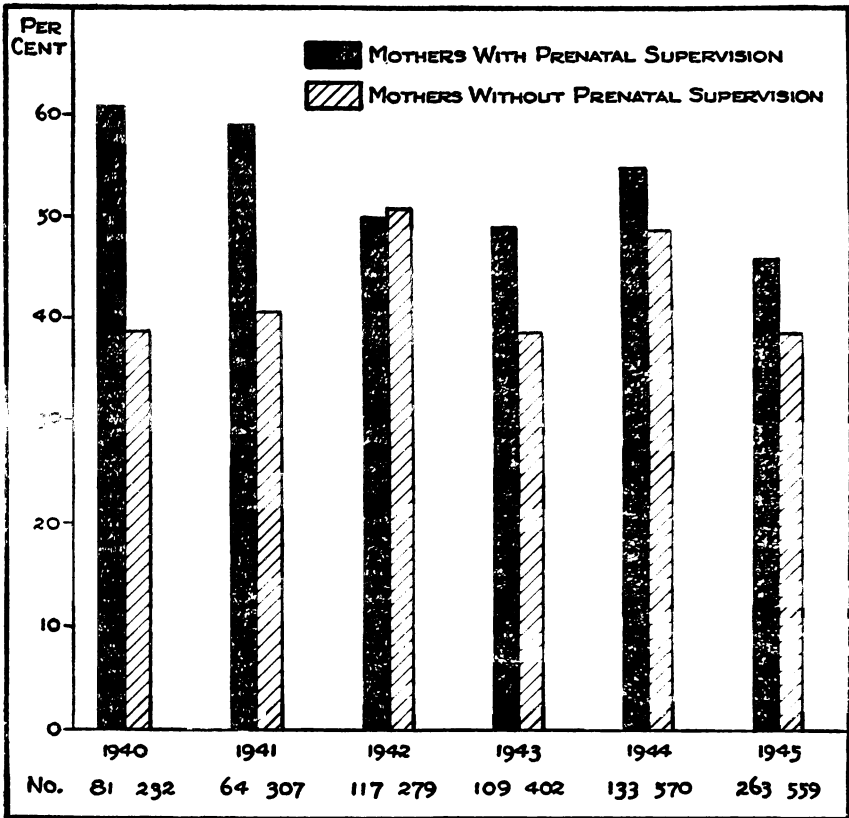


Fig. 2. Per cent of mothers whose infants were breast fed only for nine months among the group that had prenatal supervision at the Health Station and among a group that did not have this prenatal supervision.

given a fruit-vegetable dish.) As will be seen from Figure 2, the percentage that breast fed their babies for nine months is high in both groups, comprising 2,466 mothers. But, except for the year 1942, the percentage of mothers capable of nursing their babies is always higher in the prenataally supervised group than in the other group. The difference is highest during 1940 and 1941 before the severest rationing period. The higher lactating power of the prenataally supervised women may be ascribed to a better preparation of the lactating glands before partus, chiefly on account of the dietary regimen. As the knowledge of this regimen became more and more widespread among all women in the district, the unsupervised pregnant

women may have changed their diet. Such a change is a plausible explanation for the lessening of the difference in the lactating performance of the two groups. The greater restriction in the sources of food for all women as the war went on may also have played a role in partly leveling the figures for both groups.

It cannot be questioned that the supervision of the pregnant woman was of great value in her ability to nurse her baby.

SUMMARY

From this brief review of the activities of the Sagene Health Station in Oslo it has been shown that the regimen was of great value in improving the general health of the pregnant and lactating women and of the infants and children. The common disorders during pregnancy such as anemia and albuminuria were greatly reduced by supervising the pregnant women. The lactating power of the mothers increased in spite of the fact that this ability is commonly high in Norway. The stillbirth rate, the neonatal as well as the total infant mortality rates have been reduced about 50 per cent, compared with the respective figures for the City of Oslo. The prematurity rate was markedly lowered and no birth hemorrhages occurred. Rickets was totally eliminated and even the milder pathological bone changes practically disappeared.

The great improvement in health of mother and child was accomplished by a regimen comprising medical supervision and dietary management, including provision of supplements. To evaluate the importance of each of these factors separately is not possible. However, together they raised the nutritional status of the subjects.

“The child is nutritionally 9 months old at birth” has for more than twenty years been a working hypothesis in research as well as in clinical activities of the late Dr. K. Utheim Toverud. The results from this Health Station together with results obtained by other investigators have transferred the phrase from an hypothesis to a reality.

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