

## DIETARY REQUIREMENTS FOR FERTILITY AND LACTATION

### XXIII. THE SPECIFIC EFFECT OF VITAMIN B ON LACTATION\*

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In previous publications (1) records were presented showing that lactating rats given diets deficient in vitamin B consume approximately 50 per cent less of food daily than nursing mothers receiving the same rations fortified with an abundance of this vitamin. It was, therefore, tentatively concluded that the reduction of the plane of nutrition was the determining factor responsible for failure of nursing young on the above dietary regimen. In order to subject this hypothesis to a critical examination, the paired-feeding type method of experimentation was adopted (2).

Briefly stated, the technique used was as follows: Female rats were transferred on the day of the birth of their litters, which were reduced to six in number, from our Stock Diet 1 (3) to the following experimental ration: casein,<sup>1</sup> 20; Salt Mixture 185 (4), 4; autoclaved yeast, 10; butter fat, 10; dextrin, 56. Litter mates were allowed the same ration, but the autoclaved yeast was replaced by the same proportions of untreated yeast<sup>2</sup> in the diet, and the mothers were restricted to the same daily amounts of food and water intake as were consumed by the lactating rats receiving the vitamin B-deficient ration. With the plane of nutrition kept constant, any improvement in the lactation performance of the latter

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<sup>1</sup> Purified by extraction for 10 days with acidulated water.

<sup>2</sup> Northwestern Yeast Company dehydrated yeast was used. The autoclaving of the yeast was performed in shallow glass Pyrex dishes for 6 hours at 20 pounds pressure.

70 Effect of Vitamin B on Lactation

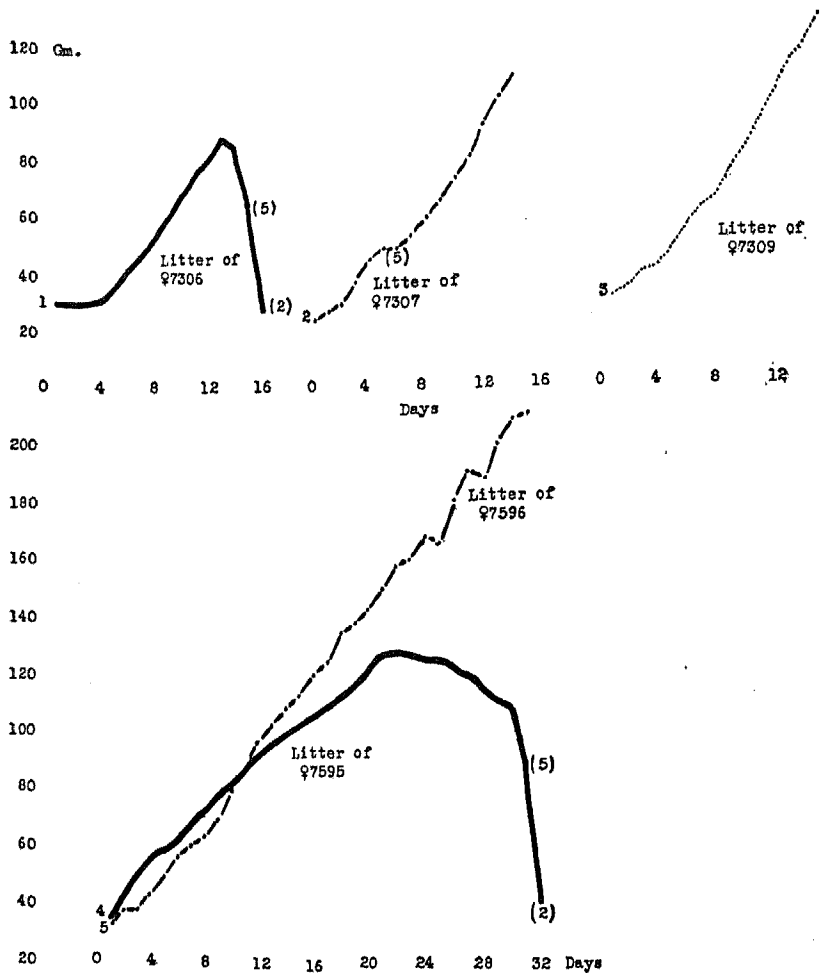


CHART I. Curve 1 represents the lactation record of Female 7306, the diet of which was deficient in vitamin B; Curve 2, the lactation record of Female 7307, on the same diet containing an abundance of vitamin B. This lactating rat was restricted to the same daily food and water intake as that consumed by its litter mate, Female 7306. Curve 3 represents the lactating record of Female 7309, also a litter mate, which is a positive control; in other words, this lactating female was allowed the same diet given Female 7307 containing an abundance of vitamin B, but was not restricted to its food and water intake. Curve 4 represents the lactation record of Female 7595, whose diet was deficient in vitamin B; Curve 5, the lactation

group must necessarily be credited to the specific influence of vitamin B. Such was actually the case in all the paired-feeding trials performed. In order, however, to determine the influence of inanition, which is an accompanying symptom complex in vitamin B deficiency during lactation as well as growth, a number of positive controls were studied, which were given the above synthetic diet containing 10 per cent untreated dehydrated yeast, and were not restricted to the daily food and water intake. Our results are summarized in Charts I to III.

On Chart I it will be noted that Female 7307 received the same diet and same daily food and water as its litter mate, Female 7306, the only difference being that the ration contained in addition an abundance of vitamin B. On the 15th day of lactation Female 7307 was still rearing its litter of five young out of six, weighing collectively 109 gm., while Female 7306, on the same plane of nutrition, but on a vitamin B-deficient ration, had at that period encountered considerable infant mortality, having reduced its litter of six to two, which were in an emaciated dying condition when the experiment was terminated. The specific influence of vitamin B is, then, very pronounced. Female 7309 served as a positive control. This lactating animal received the same diet as its litter mate, Female 7307, but was allowed food and water *ad libitum*. On the 15th day its litter collectively weighed 125 gm. The inanition effect is, therefore, represented by the difference in the collective weight of the litter of Female 7309 and that of Female 7307, which is 16 gm.

The specific effect of vitamin B on lactation is even more pronounced in the case of litters of Females 7595 and 7596, represented in Curves 4 and 5. The prolongation of the lactation period of

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record of Female 7596, which was given the same diet but fortified with an abundance of vitamin B, and was restricted to the same daily food and water intake as that consumed by its litter mate, Female 7595.

10 per cent Northwestern yeast in the diet supplied adequate amounts of the vitamin B complex for successful lactation. The females whose rations were deficient in vitamin B received in their diets 10 per cent Northwestern yeast, autoclaved for 6 hours at 20 pounds pressure. This yeast provided an abundance of vitamin G for lactation, so that uncomplicated vitamin B deficiency was produced in the nursing young. Figures in parentheses represent the number of young left on the date indicated.

Female 7595 can be explained on the basis of greater storage of vitamin B. This gave us an opportunity of studying the lactation performance of a litter mate on the reduced plane of nutrition, which takes place during this avitaminosis over a longer nursing

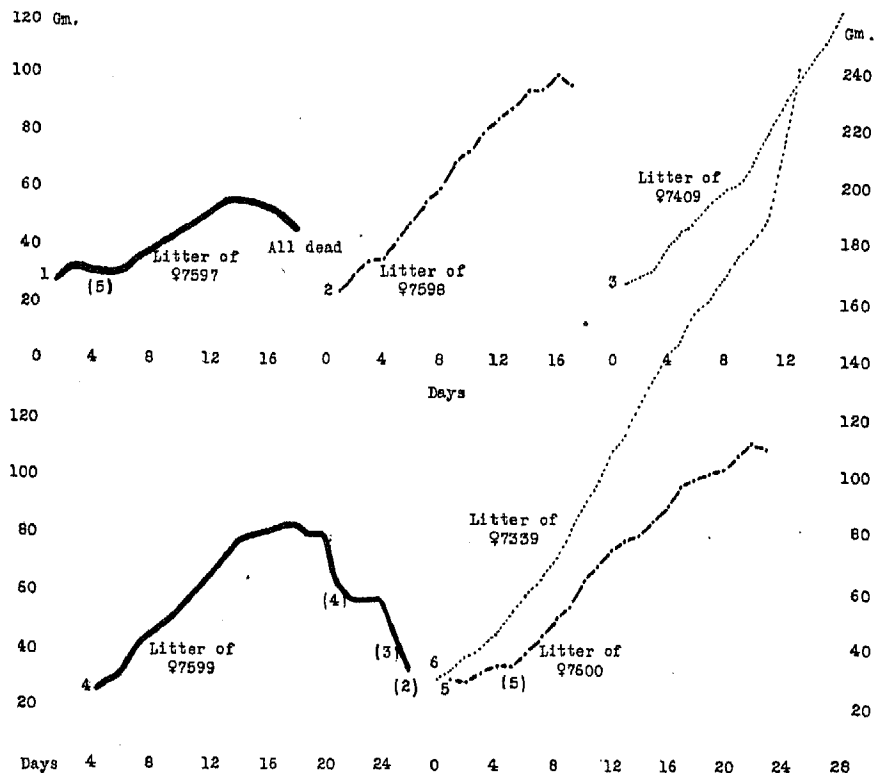


CHART II. Curves 1 and 4 represent the lactation records of Females 7597 and 7599 whose diets were deficient in vitamin B. Curves 2 and 5 represent the lactation records of Females 7598 and 7600 which were given the same diet, containing an abundance of vitamin B, but were restricted to the same daily amounts of food and water as were consumed by their litter mates, Females 7597 and 7599. Curves 3 and 6 represent the lactation records of Females 7409 and 7339, which are positive controls. These females received the same diet as Females 7598 and 7600, but were unrestricted in the daily food and water intake. Figures in parentheses represent number of young left on the date indicated.

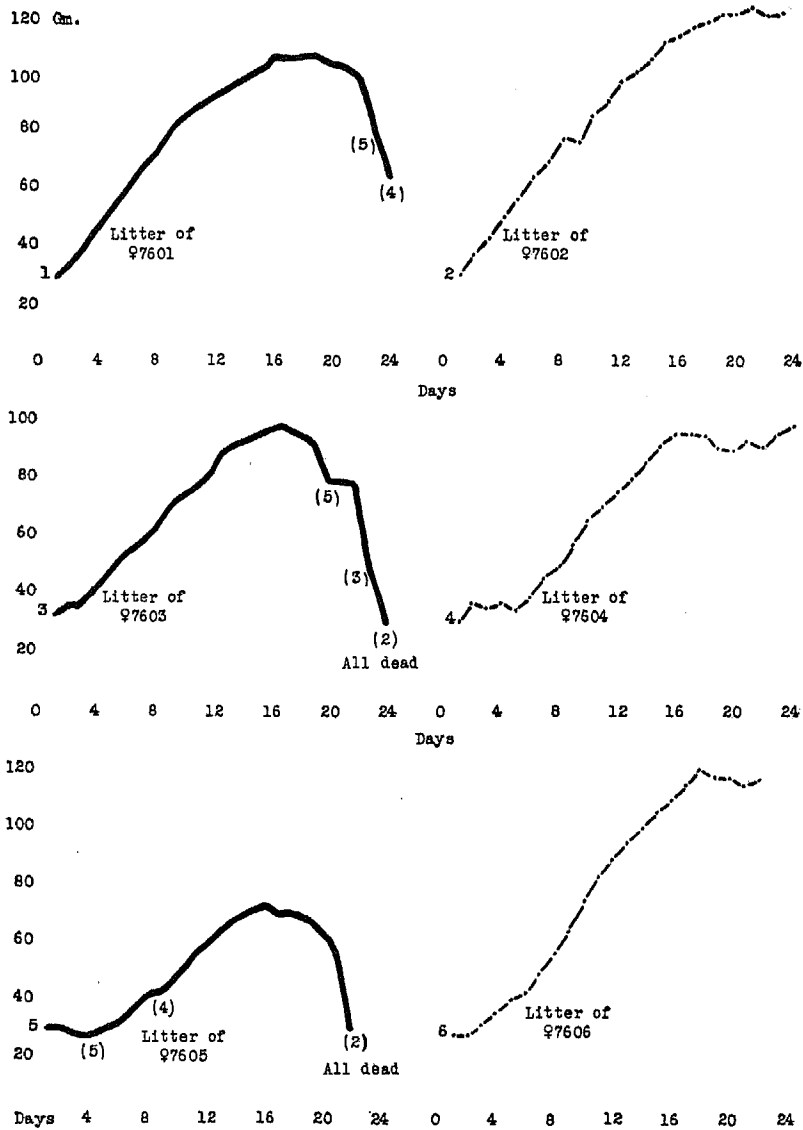


CHART III. Curves 1, 3, and 5 represent the lactation records of Females 7601, 7603, and 7605 whose diet was deficient in vitamin B. Curves 2, 4, and 6 represent the lactation records of Females 7602, 7604, and 7606, which were given the same diet but fortified with an abundance of vitamin B, and were restricted to the same daily amounts of food and water as were consumed by their litter mates, Females 7601, 7603, and 7605. Figures in parentheses represent number of young left on the date indicated.

period. The specific influence of vitamin B on growth of the nursing young became apparent only after the 11th day. From then on the litter of Female 7595, receiving the vitamin B-deficient ration, gradually began to grow slowly, then declined, and finally collapsed on the 32nd day of lactation, four young out of six having died at that time. During the entire lactation period the litter of Female 7596, on the same food and water intake, and on the same maternal diet containing an abundance of vitamin B, made appreciable and continuous gains in weight, and on the 31st day of lactation was in excellent state of nutrition, and collectively weighed 210 gm.

Curves 1, 2, 4, and 5 of Chart II furnish additional evidence which conclusively demonstrates the specific effect of vitamin B on lactation. During a period in lactation when the infant mortality on the maternal diet, deficient in vitamin B, was 70 to 100 per cent, litter mate females on the same plane of nutrition, and receiving the same diet containing an abundance of vitamin B, were still rearing their entire litters of six to a collective weight of 100 to 120 gm. The same picture is also apparent from Curves 1 to 6 inclusive, submitted in Chart III.

The effect of a restricted food and water intake on lactation is best illustrated by a comparison of the lactation records of Female 7600, which was restricted, and Female 7339 (Curves 5 and 6, Chart II), which was not restricted in food and water intake. Both animals received the same ration containing adequate amounts of vitamin B for lactation. The inanition effect is represented by the difference between the collective weight of the litter of Female 7339 and that of Female 7600, which is 132 gm.

It is quite evident, then, from the data presented that vitamin B, in addition to being an influencing factor in controlling the plane of nutrition, also exerts a specific effect on lactation, characterized by the growth and survival of nursing young, unrelated to food and water intake.

We are at present finding similar results on the specific effect of vitamin B on the growth of non-lactating animals.

#### SUMMARY

Vitamin B, in addition to influencing food consumption, plays a specific rôle in lactation, unrelated to the plane of nutrition.

BIBLIOGRAPHY

1. Sure, B., *J. Biol. Chem.*, **76**, 685 (1928); *J. Nutr.*, **1**, 139 (1928).
2. Gulick, A., *Am. J. Physiol.*, **59**, 483 (1922); **68**, 131 (1924). Drummond, J. C., and Marrian, G. F., *Biochem. J.*, **20**, 1929 (1926). Mitchell, H. H., and Beadles, J. R., *J. Nutr.*, **2**, 225 (1930).
3. Sure, B., *J. Biol. Chem.*, **69**, 65 (1926).
4. McCollum, E. V., and Simmonds, N., *J. Biol. Chem.*, **33**, 63 (1918).