

PERIODIC ADMINISTRATION OF VITAMIN B₂ AND ITS EFFECT ON DEMAND

A.A. Lapina

From the Department of Vitamins A, D and E (Head - Prof. S.N. Matsko) of the
Research Institute of Vitaminology (Director - Active Member Acad. Med. Sci. USSR B.A. Lavrov)
of the Ministry of Health of the USSR, Moscow

(Received August 19, 1957. Submitted by Active Member Acad. Med. Sci. USSR B.A. Lavrov)

The action of vitamin B₂ administered periodically has not so far been mentioned in the literature, which led us to undertake its study.

In order to deal with this problem we carried out (in succession) two prophylactic experiments, identical in their duration and in the method of performance.

EXPERIMENTAL METHOD

The experiments were performed on male rats one month old (weighing 50-60 g), obtained from the nursery of our Institute where they were kept under identical conditions and on the same diet. The animals selected were divided into seven groups. The animals of the first four groups received vitamin B₂ daily in doses of 5, 10, 20 and 25 γ respectively, while rats of groups V and VI received vitamin B₂ periodically in a dose of 20 γ a day: the animals of group V - one weekly dose of 140 γ and the animals of group VI - one dose of 280 γ every two weeks. Group VII consisted of control rats - they received no vitamin B₂ at all.

The minimum prophylactic dose of riboflavin was taken to be 20 γ . This dose corresponds roughly to the dose of vitamin B₂ (25 γ) which is considered [2] to be fully adequate to maintain the normal condition of animals.

The first six groups of the first experiment consisted of 15 animals each, and in the corresponding groups of the second experiment, 20 animals each, while in the control group there were 10 animals. The experiment lasted 90 days. The animals were weighed on the day the experiment started and thereafter every 10 days.

After the first day of the experiment all the rats received a diet practically free from vitamin B₂, made up as follows: Osborn-Mendel salt mixture - 4%, sunflower oil - 8%, vitaminized fish oil - 2%, casein, ground and washed free from vitamin B₂ - 18%, corn starch - 68%.

In addition to this diet each animal received daily an aqueous solution of vitamins of the B group: vitamins B₁ and B₆, 20 γ , nicotinamide 25 γ , choline 5 mg and calcium pantothenate 150 γ (as advised by the Institute of Nutrition). Furthermore all the experimental animals received once a week vitamins A and D in oily solution (in a dose of 60 I.U. of vitamin A and 2 I.U. of vitamin D per rat per day).

Vitamin B₂ was given to the rats in the form of an aqueous solution. The condition of the animals was gauged by their gain in weight during the 90 days of the experiment.

EXPERIMENTAL RESULTS

The experiments showed that with daily administration of vitamin B₂ the gain in weight was greater, the greater the dose of riboflavin received by the animals. A gradual increase in the average gain in weight of the

animals was observed, beginning with the group receiving 5 γ and continuing to the group receiving 20 γ of vitamin B₂ daily. On increasing the dose of vitamin B₂ to 25 γ , no further gain in weight was observed. By mathematical treatment of the results it was found that the difference in the gain in weight was significant ($t > 3$) between the groups receiving vitamin B₂ in doses of 20 and 5 γ , 20 and 10 γ , and 5 and 10 γ a day in each experiment. The results of the experiments are shown in Figures 1 and 2.

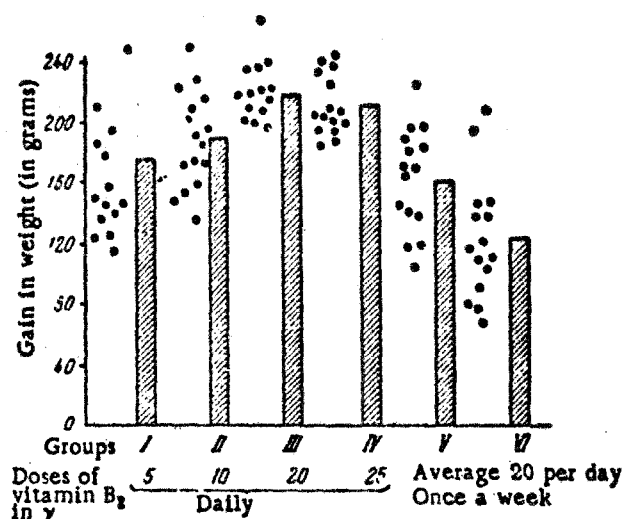


Fig. 1. Individual and mean gain in body weight of rats (in g) during the 90 days of the first experiment. The dots represent results pertaining to individual animals, the columns — mean values for each group.

Thus, the gain in weight may be related to the amount of vitamin B₂ ingested by the animal. In the group of animals receiving vitamin B₂ at weekly intervals (group V, receiving an average daily dose of 20 γ), the gain in weight was smaller than in group III, receiving the same dose of riboflavin daily (the difference between the gains in weight of these groups is statistically significant), and was equal to the gain in weight of the animals in group I, receiving a dose one fourth as large.

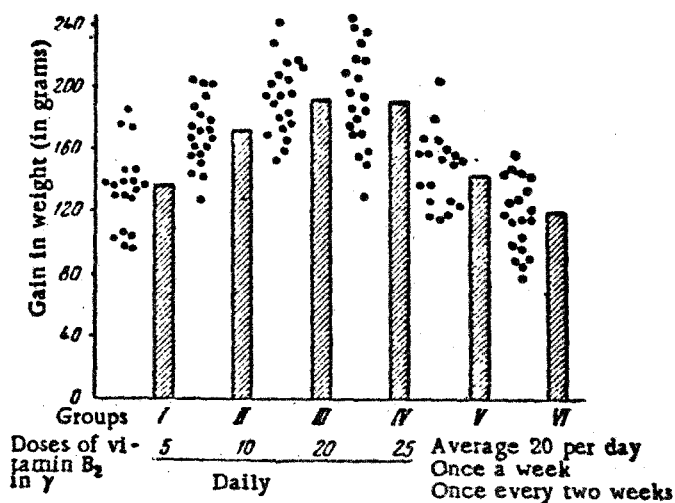


Fig. 2. Individual and mean gain in body weight of rats (in g) during the 90 days of the second experiment. Symbols as in Figure 1.

With administration of vitamin B₂ at intervals of two weeks (group VI) the gain in weight was considerably smaller (the difference was statistically significant) by comparison with that of the rats in group III, receiving the same dose of vitamin B₂ daily, and by comparison with animals in group I, receiving a dose one fourth as large every day (i.e., 5γ).

This relationship mentioned above was observed individually in each experiment.

Similar results were obtained by other workers [3] in experimental studies of the vitamin C demand of animals, and in our own earlier experiments to study the vitamin B₁ demand of animals [1] on periodic administration. However, the activity of thiamin was reduced only to one half by weekly intervals, and to one third by intervals of two weeks between the administration, compared with daily intake.

This is evidently due to the fact that the tissues have less ability to hold surplus riboflavin than surplus thiamin.

Thus, the action of vitamin B₂ administered periodically is shown to be considerably less effective than when administered daily. This shows that the body evidently possesses insignificant powers of storage of vitamin B₂.

The results obtained justify advising the systematic administration of vitamin B₂ in practice.

As an illustration, in the table are shown the collective results of the mathematical treatment of the gain in weight of the animals in Experiments I and II.

Change in the Weight of Various Groups of Animals 90 Days After the Commencement of the Experiment

Group	Conventional signs	Periodicity of administration and doses of vitamin B ₂ in γ		Number of animals	Minimum and maximum weight (in g)	Change in weight $M \pm m$	Difference in gain in weight* between groups
I	M ₁	Daily	5	34	95-248	146.3±5.9	M ₃ -M ₁ = 7.9
II	M ₂	"	10	35	128-250	177.9±4.7	M ₃ -M ₂ = 4.2
III	M ₃	"	20	34	151-267	205.1±4.4	M ₃ -M ₄ = 0.9
IV	M ₄	"	25	35	151-245	199.1±4.9	M ₃ -M ₅ = 7.8
V	M ₅	Once a week	Average 20 per day	34	105-227	153.0±5.0	M ₃ -M ₆ = 12.4
VI	M ₆	Once every two weeks	Average 20 per day	35	67-210	119.1±5.3	M ₅ -M ₁ = 0.9 M ₁ -M ₆ = 3.4 M ₂ -M ₁ = 4.2 M ₅ -M ₆ = 4.7

* t was calculated by the formula:
$$t = \frac{M_1 - M_2}{\sqrt{\frac{m_1^2}{n_1} + \frac{m_2^2}{n_2}}} = t.$$

SUMMARY

This experiment took 90 days and was performed on rats. It was established that when vitamin B₂ is introduced with the interval of one week in the dose of 20γ per day, its action is decreased by four times in comparison with that when the vitamin is given daily. If the interval between the feedings equaled 2 weeks the action of vitamin B₂ decreased even more. Increase in weight was taken as a criterion of vitamin B₂ activity.

The above data allow us to recommend systematic administration of vitamin B₂.

LITERATURE CITED

- [1] A.A. Lapina, Voprosy Pitaniia 2, 35-36 (1957).
- [2] E.M. Maslennikova, Voprosy Pitaniia 5, 11-18 (1954).
- [3] S.N. Matsko et al., Bull. Eksptl. Biol. i Med. 1, 22-26 (1956) [Original Russian pagination. See C.B. translation].