ASCORBIC ACID EXCRETION AND INSOMNIA

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Within recent years it has been found that the excretion of ascorbic acid is a measure of the degree of saturation existing in the body (Abbasy et al. 1935, Belser et al. 1939, Harris et al. 1936). Various factors, such as increased metabolic rate, pregnancy, lactation, infections, in addition to the diet, influence the requirements for this vitamin and the amount necessary for saturation of the tissues (Gaehtgens and Werner 1937, King and Menten 1935, King et al. 1940). Sherman (1941) reports that "a single prolonged athletic performance" increased the degree of destruction of ascorbic acid in the body and the body's need for this vitamin. Lewis (1938) found that previous to thyroidectomy, in the case of toxic goiter, the excretion of ascorbic acid was below normal and did not return to normal until after the operation. In such cases the basal metabolic rate is increased over the normal. Maurer et al. (1938) gave 1 to 3 gm L-cevitamic acid (ascorbic acid) to patients suffering from insomnia and found that normal sleep resulted. Karnosh (1939) feels that elderly people suffering from insomnia should be given massive doses of the B vitamins and ascorbic acid rather than sedatives. Because there is a possibility that persons suffering frequently from insomnia have a slightly higher metabolic rate, they would have a greater need for ascorbic acid.

In the present study an attempt was made to determine whether the amount of sleep has any effect on the body's need for ascorbic acid as shown by the excretion of this vitamin. Two women who frequently suffer from insomnia were used as subjects. Subject I is irregular in her sleeping habits, in that one night she may lie awake until four or five o'clock in the morning before falling asleep and sleep well the next night. Subject II seldom has more than five or six hours of sleep per night.

EXPERIMENTAL

The subjects followed their usual dietary habits. Subject I chose to eat the same foods in the same amounts during the seven-day experimental period. Her diet included orange, lemon juice, squash, lettuce, tomatoes, potatoes, carrots, pear sauce, apple sauce, bread, graham crackers, butter, milk, sugar, beef, eggs, and cheese. Subject II followed similar dietary plans each day except for slight changes such as alternating the canned vegetables, varying the amounts of foods eaten, preparing the meat in two different ways, etc. She also used two seven-day experimental periods, one period on a fairly high ascorbic acid intake and the other on a much lower intake. In Period I, a typical day's diet included orange juice, boiled potatoes, lettuce, canned peas and carrots, canned peaches, watermelon, fruit salad, meat loaf, bread, butter, and milk, while Period II included apple sauce, stewed prunes, boiled potatoes, canned green beans, lettuce, tomatoes, bread, meat loaf, milk, and butter.

All food eaten by both subjects was weighed and all of the foods except bread, crackers, fats, and cereals were analyzed for ascorbic acid. Samples for analysis were weighed into covered glass containers and were kept in a refrigerator until they were analyzed. The same foods were not analyzed daily, but samples were tested two to three times during the study. Averages were then used. In the case of canned vegetables, the same brand of each was used throughout the test and samples from each can

were analyzed once. All foods were analyzed as soon after the samples were taken as practicable.

The twenty-four hour samples of urine were kept in stoppered, dark brown glass bottles, in the refrigerator, until used. A mixture of metaphosphoric and sulphuric acids (Belser et al. 1939) was placed in the bottles before the urine was collected. The urine was analyzed daily, soon after breakfast. Figures for both urine and food samples represent averages of at least three tests.

In preparation for the analyses, weighed samples of each food were ground in a mortar with acid-washed ignited sand. A mixture of metaphosphoric and trichloracetic acids (Bessey and King 1933) was added as soon as the sample was placed in the mortar. Repeated grinding with the acid mixture and centrifuging followed. The supernatant liquids were made up to volume in a volumetric flask and analyzed. Orange juice, after the acids were added, was strained through cheesecloth and analyzed at once.

All solutions were made with glass-distilled water. This water was likewise used whenever urine or food samples had to be diluted. Contact with metals was avoided wherever possible.

The method of testing for ascorbic acid was the indophenol or dye method (Bessey and King 1933). To prevent the action of ascorbase, two percent metaphosphoric acid and three percent trichloracetic acid were added to all food samples (Musulin and King 1936). The dye, sodium 2,6-dichlorophenolindophenol, was made up twice weekly using 50 mg of dye per 100 ml glass-distilled water. No solution that was more than three days old was used. The dye was standardized daily (Menaker and Guerrant 1938).

RESULTS AND DISCUSSION

Subject I used a diet as uniform in composition, amount, and content of ascorbic acid as it was possible to secure for seven days. Results show that the average excretion of ascorbic acid was slightly greater on the days when the nights were restful and less when they were wakeful. Also, the percentage of the intake excreted was greater after the restful nights than after the wakeful nights. However, both the greatest and the lowest rates of excretion of ascorbic acid occurred on days when there was insomnia.

So far as Subject II is concerned, the figures did not show any special trend. There was considerable variation from day to day whether Subject II was on the high or low ascorbic acid diet. Such variations are not unusual, for other studies show similar results (Abbasy et al. 1935, Storvick and Hauck 1942, Todhunter and Fatzer 1940). Subject II had no night during the two experimental periods when she experienced a quiet night's sleep of eight hours. There is thus no means of comparison in this subject. As the excretions were fairly high, however, one would be inclined to conclude that insufficient sleep, at least in this subject, did not have much effect on the need for ascorbic acid.

With the decreased intake for Subject II, the excreted ascorbic acid was likewise reduced but not to the extent that the intake was lowered. In fact, the daily amount excreted in Period II was greater than the intake except on two days. The continued high excretion of ascorbic acid, even on the lowered intake, might indicate the presence of other reducing substances in the urine or a continuous loss of ascorbic acid from the tissues (Levcowich and Batchelder 1942). In both subjects the amount of ascorbic acid excreted was always greater than 13 mg, the amount considered minimal in normal individuals by Harris et al. (1936).

Belser, Hauck, and Storvick (1939), found some relationship between temperature and the excretion of ascorbic acid. In general, their subjects had a slightly higher requirement for ascorbic acid during warm weather than during cold weather. The present study was carried out during warm weather. However, as there are no figures for a period during a cooler season, no comparisons can be made. As all of the excretions in the present study were fairly high, apparently the heat did not have any great effect on the requirements of these two subjects.

SUMMARY

The excretion of ascorbic acid by two women who frequently suffer from insomnia was investigated. In one subject there was a slightly decreased excretion following the wakeful nights. As Subject II, however, did not have any nights when she slept well, there was no chance to make comparisons. The excretions were somewhat irregular and did not show any consistent relationship to the intake. The tissues of both subjects were apparently well saturated with ascorbic acid as the excretions were all fairly high, even when Subject II was on a low intake.

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