

EXCRETION OF VITAMIN C IN URINE BY NORMAL ADULTS

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Excretion of vitamin C in normal healthy adults is extremely variable. It depends upon the daily intake, its utilization and the nutritional status of the subjects regarding this vitamin.

Harris and Ray (1935) reported that 11.74 to 38.1 mg of vitamin C was excreted in urine per day in healthy European subjects. Most of the Indian Workers have noted a lower output. Chakraborty and Roy obtained an average of 9.65 mg vitamin C excretion per day in two subjects. Ranganathan and Sankaran (1937) found low figure of 7.6 to 9.4 mg per day in four adults, and 10.8 to 27.0 mg in 5 Sikh and 5 British soldiers in their series in Coonoor and Wellington. Basu and Ray (1940) obtained a daily excretion in 6 adults from 2.4 to 19.0 mg per day. Banerjee (1950) reported the urinary ascorbic acid excretion of 16 ± 92 mg in 24 hours in his subjects which after the administration of 5 mg of ascorbic acid per pound body weight rose to 288 ± 67 mg on the first day and 349 ± 92 mg on the second day. Hence excretion of vitamin C by normal adults in Baroda, was studied in May, 1960.

METHODS

Healthy men, staff and students connected with the Medical College, Baroda, were taken as subjects. None of the subjects exhibited any sign of bleeding from gums, loosening of teeth or other signs of scurvy or any other disorder. Since the subjects belonged to different economic groups an attempt was made to correlate the findings with their economic status.

Further experiments were devised to study the effects of saturating the body with vitamin C. Here 700 mg of vitamin C was given daily for 7 days and its daily excretion was noted for these 7 days and subsequently for a week after the daily dose was discontinued.

The urine samples were collected in bottles in which oxalic acid was added as preservative to stabilize ascorbic acid and to bring the acidity of

the specimen to pH 3 to 5. The titrations were conducted in presence of metaphosphoric acid to inhibit aerobic oxidation catalyzed by certain metallic ions and to inactivate the enzymes. The samples were titrated against the dye 2 : 6 dichlorophenol indophenol for their ascorbic acid contents.

RESULTS AND DISCUSSION

In 107 observations made on 59 healthy adults in Baroda, a mean excretion of 9.45 mg per day was obtained with S. D. \pm 6.76 and S. E. of \pm 0.6537. The vitamin C excretion varied between 2.33 mg to 38 mg per 24 hrs in them. These observations were taken in summer months. The results are presented in the following table.

TABLE I
Excretion of vitamin C in the subjects of different income groups, Baroda

	Low income group	Middle income group	Upper income group	Total all classes
	Income Rs. upto 100	Income Rs. 100 to 300	Income Rs. 300 above	
No. of subjects	19	21	19	59
Vitamin C mean excretion in 24 hrs	5.754 mg	6.344 mg	16.47 mg	9.45 mg
Standard Deviation	\pm 3.3347 mg	\pm 3.615 mg	\pm 10.583 mg	\pm 6.7624 mg
Standard Error	\pm 0.7650 mg	\pm 0.7892 mg	\pm 2.4279 mg	\pm 0.6537 mg
Range	2.33 to 13.43 mg	2.74 to 17.67 mg	5.28 to 38.0 mg	2.33 to 38.0 mg

The upper income groups derived better nutrition regarding all items including vitamin C. Diet survey in this class of subjects in Baroda has revealed an amount of about 80 mg vitamin C per day in their raw foods (Pathak and Bhatt, 1954). However, the actual intake cannot be inferred from this since more than 75 per cent is possibly lost in the methods of cooking adopted here (Pai, 1958). The Food and Nutrition Board of the National Research Council of America has recommended the daily intake of 75.0 mg vitamin C for an adult.

In the present series the upper income group excreted 2 to 3 times more vitamin C than the lower income group.

TABLE II

Daily excretion of vitamin C in adults of various income groups with test dose of 700 mg for 7 days, dose stopped on 8th day

GROUP	No. of subjects	Excretion and Percentage	1	2	3	4	5	6	7	8	9	10	11
Low income group income upto Rs. 100	3	Urinary excretion in 24 hrs in mg	14.59	15.80	13.85	22.50	144.90	132.44	195.22	24.90	23.09	15.42	12.29
		% of test dose excreted in urine in 24 hrs	2.08	2.25	1.98	3.21	20.70	18.92	27.88	3.55	3.29	2.20	1.75
Middle income group income Rs. 100 to 300	5	Urinary excretion in 24 hrs in mg	8.63	75.97	98.65	218.39	398.93	278.64	239.25	14.38	12.88	13.25	13.92
		% of test dose excreted in urine in 24 hrs	1.23	10.85	14.09	31.19	56.99	39.80	34.17	2.05	1.28	1.89	1.98
Upper income group income Rs. 300 or above	2	Urinary excretion in 24 hrs in mg	260.77	348.59	395.33	390.4	419.83	463.48	374.94	61.53	40.98	246.06	69.97
		% of test dose excreted in urine in 24 hrs	37.28	49.79	56.47	55.74	59.97	66.21	53.56	8.79	5.85	35.15	9.99

Harris and Ray (1935) from their observations on healthy adults concluded that the estimation of daily excretion of vitamin C was not a correct index regarding the nutritional status of vitamin C of an individual. On giving 600 mg per day for some days they obtained a progressive increase in vitamin C before a steady output was obtained. Youman *et al.* (1936) employing 600 mg test dose arrived at the conclusion that 20 to 30 per cent of this dose, if excreted in urine in 24 hours, indicated a satisfactory saturation state of tissues. In the experiment of Farmer and Abt (1938) the excretion of 27.1 mg of ascorbic acid after a dose of 1000 mg in a subject weighing 200 lbs. did not change much even after giving a pint of orange juice daily for a week to the subject. However on continuing juice daily for another week the test was again repeated after the ingestion of 1000 mg ascorbic acid and the excretion rose to 290 mg per 24 hrs.

All the above workers have observed that maximum excretion is obtained after a variable period after such huge test doses depending upon the previous state of saturation of the subject regarding vitamin C.

In this series the subjects belonging to various income groups were given 700 mg vitamin C daily for 7 days. Their urinary excretion in 24 hours is detailed in table II.

Looking to the reponse to the test dose, a high excretion of vitamin C after test doses is seen in the upper income group but the lower income group came upto a similar rise not before 5 days. Within 24 hours of discontinuation of this 700 mg test dose, their excretion fell down considerably early, which indicates that they were subsisting on sub-nutritional levels regarding vitamin C. This also shows that the vitamin is either utilized or excreted very quickly but not stored in the tissues. Hence vitamin C should be supplied regularly in the man's diet.

SUMMARY

The excretion of vitamin C in urine in 24 hours in healthy adults connected with the Medical College, Baroda, in summer revealed an average output of 9.45 mg with a range 2.33 to 38.0 mg in 107 observations. These figures agree with the findings of the other workers and support the statement that an average Gujarati is normally on a mild deficiency state of vitamin C.

Amongst the subjects the upper income group showed 2 to 3 times higher excretion of vitamin C than the lower income group.

The healthy subjects belonging to various income groups were given 700 mg vitamin C daily for 7 days. Soon after test doses the upper

income group began to excrete large amount of vitamin C but the lower income group showed a similar rise after five days.

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