

## **An Urinary Excretion Profile of 500 mg Ascorbic Acid in Healthy Adults**

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### **Abstract**

High doses of ascorbic acid have been commercially available as adjuvant. However, the pharmacological importance of this supplement is yet questionable. The aim of this study is to investigate the 24 hours excretion profile of ascorbic acid after oral administration of 500 mg single dose in healthy volunteer. The urine samples were collected at 2, 4, 6, 8, and 24 hours after administration. The samples were extracted with trichloroacetic acid, followed by colorimetric measurement. The excretion profile showed a curve with concentrations of 14.4, 15.2, 15.6, 14.9, and 14.2% at 2, 4, 6, 8, and 24 hours, respectively. This suggests that 74.3% of ascorbic acid to be excreted via urine as an excessive amount and a high adjuvant dosage should be reconsidered.

**Key words:** Ascorbic acid, oral administration, single dose, excretion profile

## **Profil Ekskresi 500 mg Asam Askorbat dalam Saluran Urin pada Orang Dewasa Sehat**

### **Abstrak**

Asam askorbat dosis tinggi telah tersedia secara komersil sebagai suplemen. Akan tetapi, kegunaan secara farmakologi pada suplemen ini masih dipertanyakan. Tujuan dari penelitian ini adalah untuk mengetahui profil ekskresi asam askorbat selama 24 jam setelah pemberian oral 500 mg dosis tunggal pada sukarelawan sehat. Sampel urin dikumpulkan pada jam ke-2, 4, 6, 8, dan 24 setelah pemberian. Sampel diekstraksi dengan asam trikloroasetat lalu diukur dengan metode kolorimetri. Profil ekskresi menunjukkan bahwa terbentuk kurva pada konsentrasi secara berurutan 14,4; 15,2; 15,6; 14,9; dan 14,2% pada jam ke-2, 3, 6, 8 dan 24. Hal ini menunjukkan bahwa 74,3% asam askorbat diekskresikan melalui urin dalam jumlah besar dan pemakaian dosis tinggi suplemen seharusnya dipertimbangkan.

**Kata kunci:** Asam askorbat, pemberian oral, dosis tunggal, profil ekskresi

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## Introduction

Ascorbic acid or vitamins C is essential substances that the body needs in small amounts. The specific function of vitamin in the body is to maintain life and growth. Ascorbic acid, like other vitamins, is stored in the body in small amount and the excess will be excreted through the urine.<sup>1</sup>

Ascorbic acid is synthesized naturally in both plants and animals. It can be found in fresh fruits and vegetables, but not in the dried grains. It also easily synthesized from sugar with a very low cost. However, ascorbic acid is the most easily damaged one than the other existing vitamins. Being highly water soluble, ascorbic acid is easily oxidized which is accelerated by heat, alkali, enzymes, oxidizing agents.

The vitamin is widely used adjuvant, either as a dietary supplement or drug dosage. It is also used to and to treat of various diseases.<sup>2</sup> The sufficient intake of ascorbic acid in adults is approximately 75 mg. Lower intake is to cause prescorbutic conditions with a tendency to bleeding due to increased vascular permeability.<sup>3</sup> On the contrary, intake of more than one gram per day can cause diarrhea, renal impairment and cell cycle crisis.<sup>4</sup>

The market availability of mega dose of ascorbic acid is a challenge for the scientist to prove the pharmacological importance of high dose ascorbic acid for the healthy human body. Therefore, the aim of this study is to evaluate urinary excretion profile of ascorbic acid after single dose administration.

## Methods

The research was conducted on November 2003–April 2004. All subjects are healthy volunteer screened by dipstick test (Combur® test). Urine samples were collected from five healthy male volunteers aged 22–23 years and BMI 20–21 kg/m<sup>2</sup>. The subjects were administered a single dose of 500

mg ascorbic acid and their urine samples were collected at intervals of 2, 4, 6, 8, and 24 hours. The subjects voluntarily provided inform consent and the study protocol was assured to be in accordance with Helsinki Declaration 1964 on Ethical Principles for Medical Research Involving Human Subjects.<sup>5</sup>

### *Spectrometric measurement*

Into 16×150 mm tubes containing 12 ml of 6% trichloroacetic acid (Merck®), 3.0 ml of urine sample was added and stirred to form a white suspension (5 seconds). After centrifugation for 5 minutes, the supernatant was poured into another clean tube. After the addition of 130mg carbon adsorbent, the solution was mixed well and slowly filtered using Watman® 40 paper. Two tubes were prepared for a blank and test to transfer 4 ml of each filtrate. One drop of thiourea solution and 1 mL dinitrophenylhydrazine (Merck®) solution were added to each tube and mixed for 5 seconds. After incubation periods of 3 hours at 37°C, the tubes were stored in the refrigerator and 5 ml 85% sulfuric acid (Merck®) were slowly added and stirred. Read the absorbance at 540 nm on a Spectrometer (UV-VIS Shimadzu® 1201).<sup>6</sup>

## Results

Table 1 shows characteristics of urinalysis result of five subjects. All subject had a normal value in the urinalysis results. The dipstick test determined that there was no detectable abnormality of specific gravity, pH, leukocytes, nitrite, protein/albumin, glucose, ketones, urobilinogen, bilirubin, erythrocytes, and hemoglobin of the urine samples. These parameters can detect the diseases status of subject. For example, a detectable nitrite may show urinary tract infections, high glucose indicates the diabetes mellitus, high urobilinogen showed impaired liver function, and urine pH reflects the ability of the kidneys to keep the concentration normal hydrogen

**Table 1** Characteristics of urinalysis result of subjects (n=5) taken 500 mg ascorbic acid in a single dose administration

Parameters	Measured Value	Normal Value*
Specific gravity (g/cm <sup>3</sup> )	1.020	1.002–1.022
pH	6.0	4.6–8.0
Glucose	Normal	0–15mg/dL
Protein	Negative	Negative-trace
Ketone	Negative	Negative
Leukocyte	Negative	Negative
Erythrocyte	Negative	Negative
Bilirubin	Negative	Negative
Hemoglobin	Negative	Negative
Urobilinogen	Normal	0.2–1.0 Ehr U/dL
Nitrite	Negative	Negative

\* Normal value for a healthy subject

ions in the plasma and extracellular fluid.

The excretion profile of ascorbic acid is shown in Figure 1. The excretion has been commenced within 2 hours after oral administration with a concentration of 14.4%. The peak was reached within 6 hours with an amount of 15.6%, and the lowest excretion concentrations occurred after 24 hours by 14.2%. Therefore, a total of 74.5% or 370 mg of ascorbic acid was found in the 24 hours urine. This suggests that only around 25% of ascorbic acid remains in the body or disposal through defecation. Figure 1 shows the excretion profile of ascorbic acid within 24 hour after administration of 500 mg generic vitamin C tablet.

## Discussion

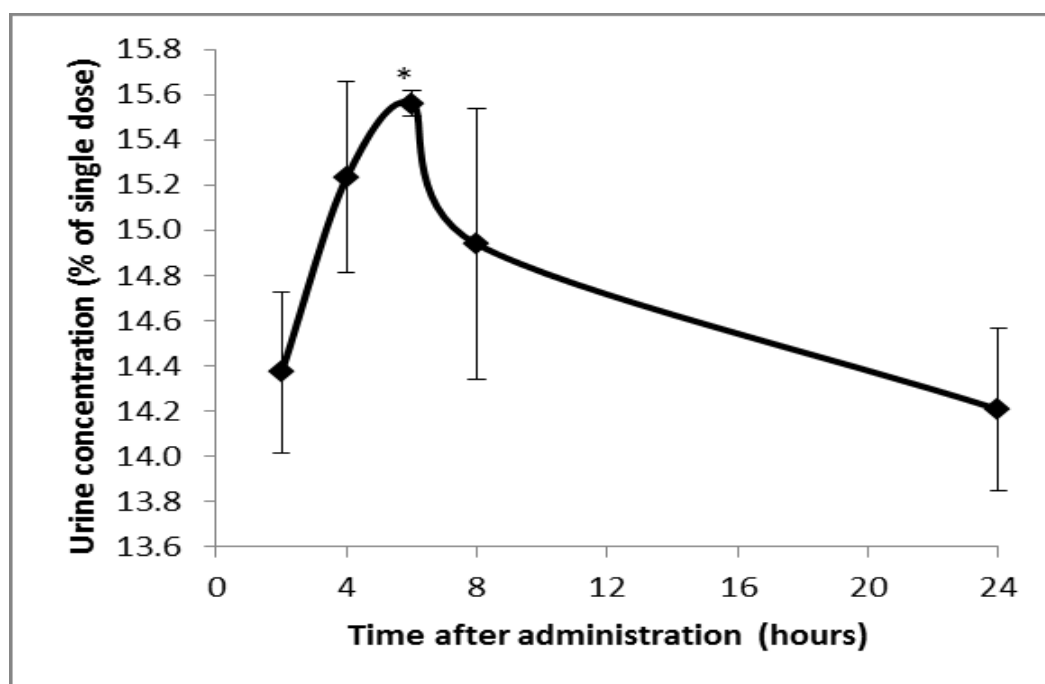
As the public aware on health care issue is increasing, the advertisement of self-medication such as taking high dose ascorbic acid has dramatically increased. This study has been encouraged by the logical background of such commercial impact on public health.

The urination process is greatly influenced

by age, gender, the body metabolic condition (healthy/normal), BMI, and diet.<sup>7</sup> Therefore, we selected volunteers that are homogeneous in terms of age, gender, and have no history of disease. The reasons of male subjects being selected are because their urine composition is not affected by the hormonal system<sup>8</sup>. Another reason is the side effect of a drug is more common in women.<sup>9</sup>

Our data is different with the result of Brigden study in 1992. Brigden et al examined 4,379 routine urinalysis specimens and found that 22.8% were positive for ascorbic acid at a mean concentration level of over 37 mg/dL. This same study went on to show that even a modest 250 mg dose of ascorbic acid produces a mean urinary ascorbic value of 31 mg/dL urine, and this increases to 62 mg/dL with a 500 mg dose.<sup>10</sup>

Although all subjects have been considered homogeneous in terms of age, gender, and BMI, the concentrations of urine ascorbic acid were varied. The reason could be due to variation in endogenous factors such as enzymatic system, body surface area, and nutritional intake, genetic and pathological conditions.



**Figure 1** Urinary excretion profile of high dose ascorbic acid after oral administration (n=5)

Exogenous factor may such as differences in diet and drinking habit, changes in light conditions, temperature, and humidity can affect the metabolism and biological rhythms that affect enzymatic activity and urine output.<sup>9</sup> Our study is limited by small sample size and uncontrolled dietary intake of subjects. However, the strength is that it represents a specific group of healthy adults.

### Conclusions

The large amount of ascorbic acid were excreted to urine within 24 hour after oral administration of a higher single dose of 500 mg vitamin C tablet. Therefore, there should be further research to examine the pharmacological importance of high dose ascorbic acid for healthy adults using other biomedical data.

### Acknowledgement

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### Conflict of Interest

The author declares no conflict of interest.

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