

[CASE REPORT]

An Unbalanced Diet Limited to the Consumption of Boiled Vegetables Led to the Onset of Scurvy

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Abstract:

Scurvy is a rare disease caused by a vitamin C deficiency. Vitamin C is a water-soluble vitamin found in vegetables and fruits, but it is lost after boiling. A 59-year-old man presented with gingival pain after having a tooth extracted five years previously. Following the procedure, his diet comprised boiled vegetables to prevent pain. He then experienced bilateral lower leg pain, and computed tomography revealed intramuscular bleeding. His serum vitamin C level was below the detectable limit. His symptoms immediately improved with vitamin C administration. This case emphasized that consuming only boiled vegetables can lead to the onset of scurvy.

Key words: scurvy, vitamin C deficiency, boiled vegetables

(Intern Med 61: 1795-1798, 2022)

(DOI: 10.2169/internalmedicine.8122-21)

Introduction

Scurvy is a rare disease among developed countries, where most foods are nutritious and provide adequate vitamin C. However, it can occur in psychiatric, alcoholic, socially isolated, elderly, or homeless patients (1-3). Its early symptoms are fatigue, followed by perifollicular hemorrhaging, leg edema, poor wound healing, gingival overgrowth, purpura, and ecchymosis (3). Scurvy is challenging to diagnose because of its rarity, and because its clinical symptoms are similar to those of disorders such as vasculitis and bleeding diatheses, such as hemophilia (4). Scurvy symptoms promptly improve and disappear within days to weeks after replenishing vitamin C (5).

Vitamin C is not synthesized in the human body, so humans require exogenous sources. The body pool of vitamin C is approximately 1,500 mg. This patient's clinical symptoms emerged when his vitamin C levels fell below 300 mg (6). The "Dietary Reference Intakes for Japanese (2020)," presented by the Ministry of Health, Labour and Welfare, recommended taking 100 mg/day of vitamin C to prevent cardiovascular events and it also acts as an antioxidant (7). The amount of vitamin C required to prevent

scurvy is equal to the dosage needed to treat scurvy at 10 mg/day (8). Vitamin C, a water-soluble found in vegetables and fruits, however, it is lost after boiling (9). We herein present the case of a 59-year-old man with scurvy. He had a regular diet until he experienced gingival pain after having a tooth extracted five years previously, following which, he only ate boiled foods.

Case Report

A 59-year-old man presented to the emergency department with bilateral lower leg pain and swelling for one week. He experienced fatigue for five months and frequent nasal bleeding for two months. His medical history included retinal detachment and appendicitis when he was 30 years old. He had an eccentric character but was never diagnosed with any mental health disorder. He did not smoke or drink alcohol, and took no medication. He did not have a low socioeconomic status. He had no family history of hemophilia. He was 182 cm tall and, weighed 57.6 kg, and his body mass index was 17.4 kg/m². He had pain, ecchymosis, and edema in both lower legs, with his left leg being worse than the right (Fig. 1). A coagulation study revealed normocytic anemia and mild disorders. Computed tomography showed

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Received: June 10, 2021; Accepted: September 27, 2021; Advance Publication by J-STAGE: November 13, 2021

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Figure 1. Ecchymosis, and edema in his both lower legs.

bilateral biceps femoris, tibialis anterior, and peroneal muscle bleeding (Fig. 2). He suffered from gingival pain after a tooth extraction five years previously. After the procedure, he avoided eating foods stimulating the gingiva. He limited his diet to boiled rice (300 g), natto (100 g), tofu (150 g), and fish sausage (90 g), which have no vitamin C at all, and boiled vegetables (70-140 g) which contain 14.5 (4.8-24.2) mg vitamin C. He consumed boiled vegetables including carrots, broccoli, cabbage, Chinese cabbage, green onions, and onions. He did not consume fruit, fish, or meat to prevent pain, and he also avoided instant foods, which reportedly contain several vitamins. His gingival pain improved two years ago, but he did not change his diet because he became accustomed to it. His serum vitamin C level was significantly low ($<0.2 \mu\text{g/mL}$), and he was diagnosed with scurvy. The serum levels of vitamin A, vitamin B1, folic acid, and zinc were also slightly low (Table 1).

After the diagnosis, he received a multivitamin drip comprising vitamin C (200 mg/day), followed by daily oral multivitamin tablets, including vitamin C (600 mg/day). The pain, ecchymosis, and edema notably improved within a few days, and serum vitamin C levels normalized two weeks after treatment.

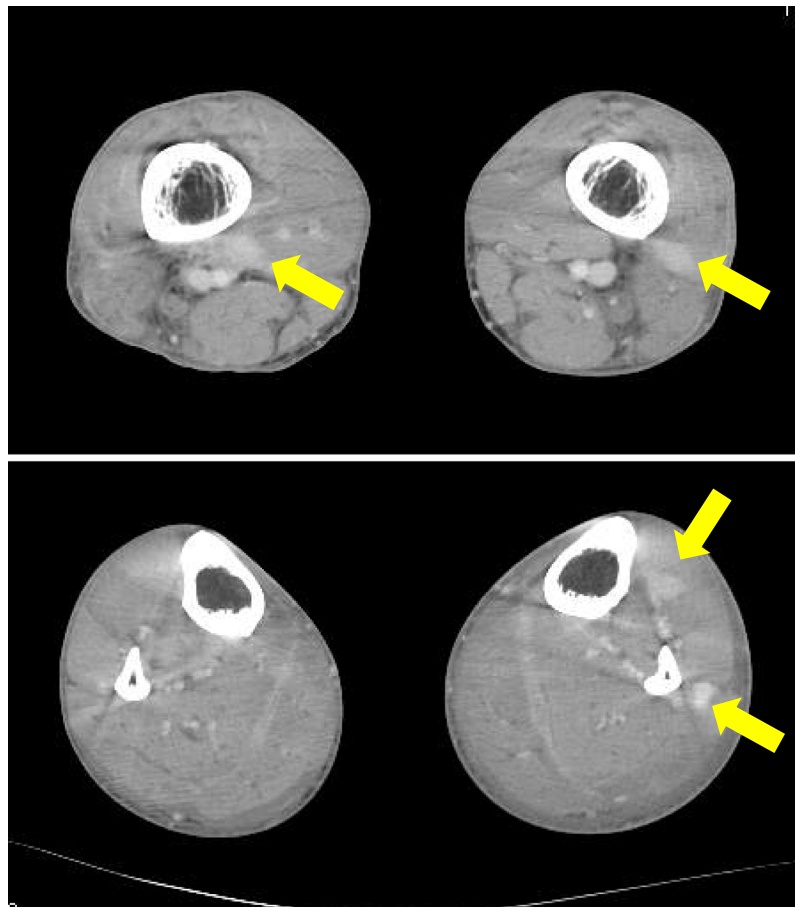


Figure 2. CT scan showed contrast media leaking in the bilateral biceps femoris, tibialis anterior, and peroneal muscle.

Table 1. Laboratory Data on Admission.

Parameter (unit)	First visit	Standard level
WBC (μL)	5,750	3,300-8,600
Hb (mg/dL)	7.8	13.7-16.8
HCT (%)	23.6	40.7-50.1
MCV (fL)	91.5	83.6-98.2
PLT ($\times 10^3/\mu\text{L}$)	173	158-348
PT (%)	67	70-130
APTT (s)	33.2	26.9-38.1
D-Dimer ($\mu\text{g/mL}$)	2.3	<1.0
Fibrinogen (mg/dL)	356	200-400
TAT (ng/mL)	3.1	<3.0
PIC ($\mu\text{g/mL}$)	0.5	<0.8
FXIII (%)	51	≤ 70
TP (mg/dL)	6.0	6.6-8.1
Alb (mg/dL)	3.4	4.1-5.1
AST (IU/L)	15	13-30
ALT (IU/L)	6	10-42
T-Bil (mg/dL)	2.23	0.4-1.5
BUN (mg/dL)	23	8-20
Cre (mg/dL)	1.01	0.65-1.07
Vitamin C ($\mu\text{g/mL}$)	<2.0	5.5-16.8
Vitamin B1 ($\mu\text{g/dL}$)	1.7	2.6-5.8
Foliamine (ng/mL)	2.3	3.6-12.9
Vitamin B12 (pg/mL)	270	233-914
Zn (mg/dL)	54	80-130

WBC: white blood cell, Hb: hemoglobin, HCT: hematocrit, MCV: mean corpuscular volume, PLT: platelet, PT: prothrombin time, APTT: activated partial thromboplastin time, TAT: thrombin-antithrombin complex, PIC: plasmin-alpha2-plasmininhibitor-complex, FXIII: factor XIII, TP: total protein, Alb: albumin, AST: aspartate aminotransferase, ALT: alanine aminotransferase, T-Bil: total-bilirubin, BUN: blood urea nitrogen, Cre: creatinine, Zn: zinc

Discussion

Vitamin C is present in fruits and vegetables, and their inadequate consumption results in scurvy. Typical scurvy cases involve patients who refuse to ingest fruits and vegetables (4, 10-12). However, this patient ate vegetables daily. The minimal daily requirement of vitamin C to prevent scurvy is only 10 mg or less (7). In this case, his daily diet consisted of rice, natto, tofu, and fish sausage, which provided inadequate amounts of vitamin C. He consumed approximately 70-140 g of vegetables, which were boiled for 40-50 minutes. Vitamin C is a water-soluble vitamin, and in vegetables, approximately 50-80% is lost after boiling (9). His diet and the amount of vitamin C are shown in Table 2. His caloric intake was less than the recommendation of Dietary Reference Intakes for Japanese (2020). If the patient did not boil the vegetables, he would have ingested 24.2-48.6 mg of vitamin C per day. However, he only ingested approximately 4.8-24.2 mg of vitamin C per day due to boiling.

Additionally, he stored these boiled vegetables in his refrigerator for a few days and heated them in the microwave before eating. Vitamin C is also lost in foods that are stored then heated. The storage method of foods is also important for preventing scurvy; for example, refrigerated food loses more vitamin C than frozen food (10). Recently pre-cooked and chilled under the new cook-chill system are adopted in many hospitals, scurvy is not common among in-hospital patients. The symptoms of scurvy appear 29-90 days after complete deprivation of vitamin C (6). Some cases exhibit an indolent disease course, developing over five to 10 years (4, 11-13), wherein the vitamin C deficit is only par-

Table 2. Vitamin C Contents of the Patient Diets.

Food name	*Total weight (g)	Density of vitamin C (mg/100g)	Weight of Vitamin C (raw) (mg/day)	Weight of Vitamin C (boiled) (mg/day)	Energy (kcal)
Boiled rice	300	0	0	0	1,060
Natto	100	0	0	0	200
Tofu	150	0	0	0	120
Fish sausage	90	0	0	0	160
Total					1,540
Chopped vegetables paste					
Carrot	17.6 (11.7-23.4)	6	1.1 (0.7-1.4)	0.4 (0.1-0.7)	
Broccoli	17.6 (11.7-23.4)	120	21 (14-28)	8.4 (2.8-14)	
Cabbage	17.6 (11.7-23.4)	41	7.2 (4.8-9.6)	2.9 (1-4.8)	
Chinese cabbage	17.6 (11.7-23.4)	19	3.3 (2.2-4.4)	1.3 (0.4-2.2)	
Green onion	17.6 (11.7-23.4)	14	2.5 (1.6-3.3)	1.0 (0.3-1.6)	
Onion	17.6 (11.7-23.4)	8	1.4 (0.9-1.9)	0.6 (0.2-0.9)	
Total	70-140		36.4 (24.2-48.6)	14.5 (4.8-24.2)	

*Total weight of foods is presented by mean value and range of maximum and minimum value based on the self-assessment of this patient. His daily food is the chopped vegetable paste which equally includes these vegetables and he had eaten that one or two small bowls per a day. Weight of vitamin C and energy are calculated with reference to the "Standard Tables of Food Composition in Japan (2020)".

tial. In our case, the patient maintained minimal amounts of vitamin C for five years, which resulted in the indolent course of scurvy. Scurvy prevention involves prescribing sufficient vitamin C intake through multivitamin supplementation and dietary modification.

The various treatment regimens for scurvy include oral multivitamins (vitamin C 60 mg) for 10 days (4); vitamin C (100 mg) three times a day (3); and vitamin C (1-2 g) daily for the first two to three days, followed by 500 mg/day for the next week, and 100 mg/day for one to three months (14). Scurvy symptoms usually improve within a few days. In this case, 200 mg of vitamin C was administered intravenously daily for the first one to four days, followed by oral multivitamin supplementation (vitamin C 600 mg/day). His leg pain, swelling, purpura, and anemia all improved within two weeks.

Conclusion

This case emphasized that while vegetables provide vitamin C, boiling significantly reduces this, thereby resulting in scurvy.

The authors state that they have no Conflict of Interest (COI).

Acknowledgement

The authors would like to thank the patient and medical staff for their contributions to the case report.

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