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Epidemiology of scurvy linked with ascorbic acid

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ABSTRACT

Scurvy is a nutritional disorder caused by a severe deficiency of ascorbic acid, a water-soluble vitamin. The human body is incapable of producing ascorbic acid also known as Vitamin C, due to the lack of L-gulonolactone oxidase, i.e, an essential enzyme required for the biosynthesis of ascorbic acid. Scurvy was discovered by pirates and British sailors for the first time. This leads to cutaneous skin lesions, swollen and bleeding gums, corkscrew hairs, hemorrhage, poor wound healing and blood vessel fragility. Regular consumption of fruits and vegetables can head off this condition. This review highlights the chemistry, sources, mechanism of action of ascorbic acid, and the history, consequences, and prevention of scurvy.

Keywords: Vitamin C, Scurvy, Nutritional disorders, Hypovitaminosis C

Introduction:

Scurvy is the deficiency of ascorbic acid or Vitamin C marked by skin lesions [1]. For the first time It was diagnosed by James Lind, a navy phisician [2]. Scurvy is characterized by bruising (skin discoloration due to rupture of small blood vessels beneath the skin), delayed wound healing, swollen gums, bleeding of the gums, muscular fatigue, and hemorrhages. Ascorbic acid (AA) is a water-soluble vitamin. The human body cannot produce or storing Vitamin C; therefore, it is dependent on a diet especially fruits and vegetables [3,4]. Vitamin C deficiency is at higher risk among patients suffering from an inflammatory bowel disease (IBD) that leads to Bone fragility [5]. A retrospective study was conducted at a single-care tertiary center in New York From 2014 to 2019 that revealed those people who were suffering from (IBD) were more vulnerable to malnutrition and Vitamin C deficiency becaus of Inflammation of Intestinal mucosa leadingled to malabsorption of macro-and micronutrients. Scurvy has an association with pulmonary arterial hypertension, aplastic anemia, and respiratory infections such as pneumonia, which is one of the major complications and causes of death in cases of scurvy [6].

Aims and objectives

- To analyze vitamin C health perspective
- To scrutinize characteristics, sources and clinical outcomes of patients with Hypovitaminosis C

Epidemiology of scurvy

"Epidemiology" is the study of diseases or health-related events and factors that determine their occurrence in the human population. It is derived from the Greek terms Epi (Upon), demos (the people) and logos (to Study). It actually incorporates much wider concepts in controlling health problems through this Study. James Lind was the first British Navy doctor who designed the clinical trial. He made the hypothesis that scurvy was caused by the lack of fruit intake to sailors who were on long sea journeys. He registered 12 sailors suffering from scurvy and divided them into "six" different preventive groups. Two sailors who were given "two oranges and a lemon per day" recovered almost completely. The remaining groups received treatments with "apple cider", "seawater" and "vinegar". In 1753, James Lind published his study in which he concluding that "Oranges and Lemons" are a remedy for scurvy rather than prevention. It took many years until evidence emerged that scurvy could be completely avoided if fruits and vegetables are part of the diet because they are the best source of Vitamin C. Limes have been included in " UK Sailors " from 1795 onwards. This practice is still reflected by English sailors. So that present-day British sailors are called " limeys" [7].

Chemistry and sources of Ascorbic Acid

Vitamin C is derived from glucose via the uronic acid pathway.The enzyme L-gulonolactone oxidases is responsible for the conversion of gulonolactone to ascorbic acid, which is absent in the human body. That's why the human body cannot synthesize AA, making it essential through diet. It is a white crystalline and hydrophilic molecule [8]. Sources of AA are foods of plant origin, especially fruits and vegetables. All thouh it may be found in all the fruits but rich sources of AA among fruits are guava, kiwi and citrus fruit (orange, lime, grapefruit). While among the vegetables, green pepper, tomatoes, cauliflower, cabbage, spinach, turnip and peas contain appreciable amounts (Table 1). Dry cereals, legumes, nuts and foods of animal origin, i.e., meat, milk, fish and eggs are deficient in AA [9].

Table 1: Vitamin C amount in selected foods (per 100g)

Fruits	Ascorbic acid (mg)
Apple	08
Banana, ripe	10
Guava, whole	217
Mango, ripe	37
Orange,sweet	43
Apricot	10

Vegetables	Ascorbic acid(mg)
Cauliflower	48
Cucumber	24
Spinach	57
Tomato	23

Physiological role of ascorbic acid

Ascorbic acid (AA) is a vitamin that acts as an antioxidant [10]. It acts as a free radical scavenger to prevent damage to the cells by lowering the oxidative stress in the body and also serves as a reducing agent in respiratory chain reactions [11]. AA is required for the formation and maintenance of body tissues, especially connective tissues, and is also essential for the synthesis of collagen and strengthens the walls of the blood vessels and osteoid tissue of the bones. AA prevents mutation and has a protective effect on white blood cells. Furthermore, it contributes to carbohydrate metabolism, enhances iron absorption from the intestines, melanin synthesis and vitamin E and glutathione recreation [12,13]. Some scientists claim that large doses of vitamin C prevent and reduce symptoms of the common cold, but this has not been proved, and it is not advisable to take large doses of medicinal vitamin C for a long period.

Diagnosis

To diagnose vitamin C deficiency and scurvy, serum levels of vitamin C must be checked (greater than 11 micromoles/L) [14,15].

Prevention

In 4 to 12 weeks, the vitamin C pool in the body will be depleted if one stops taking it. Many factors that can hinder the absorption and functions of ascorbic acid. Regularly eating fruits and vegetables is the best way to prevent diseases associated with vitamin C deficiency. The recommended daily intake of this vitamin is around 40 to 120 mg/day, depending on their gender and age. With scurvy, increase the dosage to 300 mg/day.

Adverse Effects of Hypervitaminosis C

Excessive consumption of this vitamin leads to diarrhea and stomach aches. A significant amount is metabolized into oxalic acid and uric acid, which increases the risk of kidney stones because it acidifies the urine.

Summary

Vitamin C deficiency is the leading cause of the nutritional disorder, e.g.; scurvy and other health-related issues. Vitamin C is the most sensitive of all vitamins to processing. It is destroyed by exposure to high temperatures during cooking, boiling, baking, commercial sterilization and frying. Losses of AA also occur during storage, i.e., during increased storage time. Thus, consuming a sufficient amount of fruits and vegetables prevents this vitamin deficiency.

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References

[1] Mayland CR, Bennett MI, Allan K. Vitamin C deficiency in cancer patients. Palliative medicine. 2005 Jan;19(1):17-20.

[2] Essien F, Jacocks C, Carroll M. Sailing the ship of life: scurvy and autoimmunity... Therapeutic Advances in Chronic Disease. 2022 Mar;13:20406223221078080.

[3] Khalife R, Grieco A, Khamisa K, et al. Scurvy, an old story in a new time: the hematologist's experience. Blood Cells Mol Dis 2019; 76: 40–44.

[4] Deirawan H, Fakhoury J, Zarka M, et al. Revisiting the pathobiology of scurvy: a review of the literature in the context of a challenging case. Int J Dermatol 2020; 59: 1450–1457.

[5] Ratajczak AE, Szymczak-Tomczak A, Skrzypczak-Zielińska M, Rychter AM, Zawada A, Dobrowolska A, Krela-Kaźmierczak I. Vitamin C deficiency and the risk of osteoporosis in patients with an inflammatory bowel disease. Nutrients. 2020 Jul 29;12(8):2263.

[6] Rowe S, Carr AC. Global vitamin C status and prevalence of deficiency: a cause for concern?. Nutrients. 2020 Jul 6;12(7):2008.

[7] Dresen E, Lee ZY, Hill A, Notz Q, Patel JJ, Stoppe C. History of scurvy and use of vitamin C in critical illness: A narrative review. Nutrition in Clinical Practice. 2023 Feb;38(1):46-54.

[8] Njus D, Kelley PM, Tu YJ, Schlegel HB. Ascorbic acid: The chemistry underlying its antioxidant properties. Free Radical Biology and Medicine. 2020 Nov 1;159:37-43.

[9] Hasan MM. Environment-Friendly Ascorbic Acid Fuel Cell. Electrochem. 2023 Jan 30;4(1):31-41.

[10] Hasan MM, Rakib RH, Hasnat MA, Nagao Y. Electroless deposition of silver dendrite nanostructure onto glassy carbon electrode and its electrocatalytic activity for ascorbic acid oxidation. ACS Applied Energy Materials. 2020 Feb 24;3(3):2907-15.

[11] Hasan M, Nagao Y. Christmas‐Tree‐Shaped Palladium Nanostructures Decorated on Glassy Carbon Electrode for Ascorbic Acid Oxidation in Alkaline Condition. ChemistrySelect. 2021 Jun 28;6(24):5885-92.

[12] Jarmakiewicz, S.; Piątek, D.; Filip, R. Macro and micronutrient deficiency in inflammatory bowel diseases. Eur. J. Clin. Exp. Med. 2017, 15, 342–348.

[13] Ioannidis, O.; Varnalidis, I.; Paraskevas, G.; Botsios, D. Nutritional Modulation of the Inflammatory Bowel Response. Digestion 2011, 84, 89–101.

[14] Montalto, M., Porceddu, E., Pero, E., Lupascu, A., Gallo, A., De Simone, C., Nucera, E., Aruanno, A., Giarretta, I., Pola, R., & Landolfi, R. (2021). Scurvy: A Disease not to be Forgotten. Nutrition in clinical practice : official publication of the American Society for Parenteral and Enteral Nutrition, 36(5), 1063–1067.

[15] Abdullah M, Jamil RT, Attia FN. Vitamin C (ascorbic acid). InStatPearls [Internet] 2022 Oct 25. StatPearls Publishing.