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Charge The Immune System With Cashew Apple(Anacardiumoccidentale L.) -Torrent In Vitamin C And Iron – A Review

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Abstract

The cashew apple is a tropical natural fruit and is a significant byproduct of the cashew nut handling industry. It is plentiful in vitamins, polyphenols, sugars, minerals, amino acids, and dietary fiber and can be considered as a practical food.It is usually used in the fortification of the nutritional quality of some tropical foods, because of its high percentage of vitamin C, which is a fundamental supplement to redox capacity under ordinary physiologic conditions. The principal physiological capacity of this nutrient is identified with its ability to act as a cofactor for a substantial group of compounds. Ascorbate acts to invigorate transferrin-subordinated iron uptake by an intracellular reductive mechanism, strongly suggesting that it may act to stimulate iron mobilization from the endosome. The capacity of ascorbate to direct moving iron take-up could help clarify the metabolic imperfection that contributes to ascorbate-insufficiency initiated anemia. This paper presents a jointreview of the cashew apple, the function of vitamin C in iron absorption, and treating iron deficiencyanaemia through combinational treatment.

Key words: cashew apple, ascorbate-vitamin C, iron metabolism, anaemia

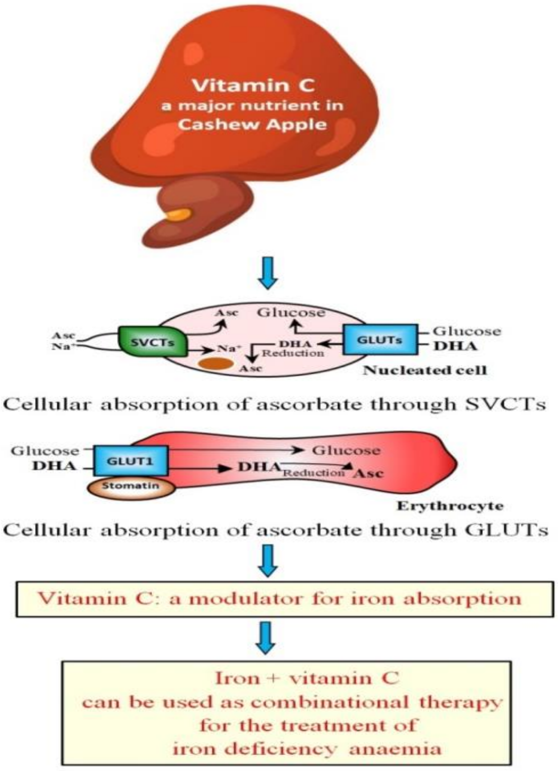
INTRODUCTION

Cashew(*AnacardiumOccidentale L.*)fruit is an organic product which has a place in the Anacardiaceae family. It is local to tropical America and is broadly accessible in a few nations of Asia, Africa, and Central America as a financially significant horticultural harvest [14]. Cashew apple is a thick repository or pseudo product of the cashew tree (*AnacardiumOccidentale L.*), to which the cashew nut is joined. Around 10-15 tonnes of cashew apples are acquired as a result of each ton of cashew nuts created [15,62,63,64,65,66]. The cashew apples, which weigh around 5 to 10 fold the amount of the nuts are left unused under the trees. This waste will increase in the long term running with the expanded region planted with cashew. Likely close to 10 percent of potential cashew apple yield is used in either new or processed structures[3].Cashew squeezed apple has extraordinary potential for bio-processing of fermented products. It is generally utilized in the fortification of the nutritional quality of some tropical foods, because of its high rate of vitamin C. The sugar content of cashew apple is 8.4% to 21.0% and the vitamin· C content from 156 to 455 mg for each 100 ml of juice[18].Cashew apple contains phenolic mixes commonly identified with cancer prevention agents[17].

Vitamin C or ascorbic acid (AscH2) is a powerful water-soluble antioxidant, found in nature and presented in fresh fruit and vegetables [41,45,49]. Ascorbic acid (AscH2) is one of the most significant nutrients found in the human diet, with numerous organic capacities including cancer prevention agents, chelating, and coenzyme exercise.

Ascorbic acid is likewise broadly utilized in clinical practice, particularly for increasing iron absorption[68].The basic function of nutrient C (L-ascorbic corrosive) is to participate in collagen crosslinking. Vitamin C lack can cause scurvy because of deficient collagen crosslinking [10,20,54,74].Vitamin C is merely a passive dietary factor that upgrades non-heme dietaryiron absorption.A number of studies indicates vitamin C is an active molecular participant in cellular and perhaps systemic,iron metabolism [29].

Figure 1:
Vitamin C as a combinational factor.



Iron is one of the basic micronutrients for most types of life and assumes a pivotal part in an assortment of cycles, for example, oxygen transport, energy creation, and DNA arrangement. The normal individual's body contains around 4 g iron. About 2.5 g of body iron is found in hemoglobin[24].Iron inadequacy is often portrayed as a progressive conditionthat starts with normal body iron status, which becomes odd or exhausted because of low dietary iron intake,lacking intestinal iron retention or increased iron loss.As this process proceeds, the synthesis of iron-containing proteins, such as haemoglobin (Hb), becomes traded off. Finally, when Hbconcentration falls under a predetermined cut-off value, the iron deficiency has progressed to Iron Deficiency Anaemia (IDA)[23].This article reviews the significance of cashew apple which has a high substance of vitamin C associated with iron metabolic and its capacity as a modulator that helps in preventing iron-deficiency anemia.

3. KEY NUTRIENTS OF CASHEW APPLE

The cashew (*Anacardiumoccidentale L.*) began in the upper east of Brazil and is accepted to have been trained before the appearance of the Portuguese in the sixteenth century[61].From Brazil, the cashew was acquainted with the West Indies and Central America [56].The Portuguese perceived the estimation of the cashew apple and nut and took the harvest to their Old World colonies [61]By 1590 the cashew tree had been acquainted with East Africa and India where it was additionally used to help control disintegration along the seaside districts[8].Cashew-squeezed apple is a significant source of water, minerals, and plentiful in vitamin C [6]. It is reported to contain five times as much vitamin C as citrus juice [3] and ten times as pineapple juice. De Carvalho*et al*, [16]also reported that cashew-squeezed apples can be a good source of vitamin C and sugar in the prepared nourishments. Vitamin C in natural products assumes a significant part in the use of amino acid tyrosine, lipid digestion, and collagen arrangement [67].The vitamin C content varies between 370.9 and 480.3 mg/100 g. At the level of organic acids, citric acid lead levels (µg/ml) ranged from290.7 and 1092.1, tartaric acid 497.5 to 693.3,acetic acid 48.2 to 266.5, oxalic acid 197.8 to204.3 and finally to fumaric acidfollowed by total sugars ranging from 162.7 to 168.1 g/L. Concentrations (g/L) of glucose, fructose, and sucrose vary, respectively, between 47.2 to 65.8, 100.7 to 110.3, and 2.5 to 5.3 and the pH of the juice is between 4.37 to 4.5, titratable acidity between 0.5 to 0.85 %,the total soluble solids content between 10.2 to 10.9 °Brix; dry matter between 7.80 -10.0 % and ash from 1.31 to 1.88%. The protein content varies from 0.51 to 0.53 g/100 g and the key amino acids in order of size are leucine, cysteine, andasparagine[2].

4. ECLIPSED NUTRIENT VITAMIN CIN CASHEW APPLE

Vitamin C (ascorbic acid) is required for thebiosynthesis of collagen, carnitine, and catecholamines. Aninsufficiency of vitamin C in the diet causes the deficiency diseasecurvy, which is prevented by as little as 10 mg/day of vitaminC. The 1989 RDA for vitamin C was 60 mg/day, anintake level that prevents the development of scurvy forabout 1 month on a diet lacking vitamin C. Vitamin C is an important dietary antioxidant, as per the panel, vitamin C is ‘a substance in foods that significantly decreases the adverse effects of reactive species, such as reactive oxygen and nitrogen species, on Redox Reports, a typical physiological functions in humans.The unfriendly effects of these reactive species are oxidative damage to biological macromolecules, such as lipids, DNA, and proteins, which has been implicated in numerous chronic diseases, including heart disease, stroke, cancer, severalneurodegenerative diseases and cataract genesis [19].Plasma concentrations serve as the most accessible biomarker forvitamin C status. Values below 11µmol/L specify deficiency corresponds with the clinical symptoms of scurvy [35,55].The highest concentrations observed in pharmacokinetic studies are between 70 and 80µmol/L [31,32] rarely more than 100µmol/L has been reported and concentrations plateau in that range even during very high dietary supplementation. However, concentration as low as 28µmol/L are considered satisfactory and consequently, values between 11 and 28µmol/L indicate a marginal deficiency (often referred to as hypovitaminosis C), where scurvy is absent but the risk for chronic disease is elevated.[21]

5. CELLULAR ABSORPTION OF VITAMIN C

Most mammalian cells, with the notable exception of human erythrocytes [39], maintain intracellular Asc concentrations that are higher(e.g., upto30-fold in some cases)than those in the

Extracellular fluid[37,57,72]. For example, lymphocytes accumulate in extracellular Ascs with concentrations of approximately 4mM in the context of plasma concentrations of 40–80 μM[32]. Furthermore, neurons maintain intracellular Asc concentrations of upto10mM, whereas extracellular concentrations of Asc are maintained at 200–400 μM [51,50]. This outward-facing concentration ingredient generates a predominantly sodium-dependent import of Ascs into cells by sodium–vitamin C cotransporters(SVCTs)1and2 [25,72,59,38], which utilize the sodium concentration gradient across the plasma membrane [29].

The SVCTs are pivotal for the maintenance of intracellular Asc concentrations in most nucleated cell types [38,9]. SVCT1 is mainly expressed in epithelial tissues (e.g., intestinal epithelialcells), where it plays a major role in managing whole-body Asc levels [9]. In different, SVCT2 has a more widespread expression and is largely responsible for cellular loading with Ascs against a concentration gradient in most tissues [9].The Expression of SVCT2 within the brain is important as its function and to maintain Asc homeostasis in the brain [25].

Cells can also assemble intracellular Ascs against a concentration gradient through lower affinity, higher-capacity transport of DHA through the facilitative GLUTs1,3, and 4 [72,5,22,46,70]. Interestingly, unlike most ascorbate-producing species, human erythrocytes can efficiently accumulate intracellular Asc from extracellular DHA, with slight competition from relatively high plasma glucose concentrations [27,40]. This alteration rises from the association of GLUT1 with the integral membrane protein stomatin(band7.2b) [42] and appears to be a compensatory constructive mechanism for the lack of endogenous Asc production [42,43,11,69] With respect to DHA uptake by cells, an inward-facing DHA gradient is maintained by the rapid reduction of imported DHA back to Asc, which largely occurs in an NADPH- and GSH-dependent manner [27,29,58,72].

6. VITAMIN C: A MODULATOR FOR IRON ABSORPTION

Iron is essential for cell survival, as confirmed by the beginning of cell demise after unreasonable iron exhaustion [30,53]. Practically, all life forms require iron for digestion and it assumes a large number of parts in microbes, plants, and creatures. Adult human shave3–5g of iron in the body [75],>80% of which is found in the hemoglobin of erythrocytes, and 10 - 15% in muscle myoglobin and other iron-containing proteins and chemicals. Normally, only 0.1% circles in the plasma bound to the significant plasma iron-restricted protein, transferrin (Tf) [30]. Cell iron stockpiling transcendently happens inside protein Nano cages made by ferritin [4]. While generally iron in mammalian frameworks is contained inside the oxygen-binding haemoglobin and myoglobin,many other cellular proteins also rely on iron for their function. [29].

Asc adds to cell physiology to some degree by working as a modulator of cellular iron metabolism. Indeed, accumulating evidence strongly suggests that in addition to the known ability of dietary Ascs to enhance nonheme iron absorption in the gut, Ascs can direct cell iron take-up and downstream cell metabolism. VitaminC controls iron digestion by expanding Tf-subordinate and non-Tf iron take-up, the last of which happens by a novel transplasma layer, the ascorbatecycling system, invigorating ferritin blends, hindering lysosomal ferritin corruption through autophagy, and diminishing cell iron efflux [29].

Ongoing proof demonstrates that Asc stimulates iron take-up by the classical Tf–iron take-up pathway, which gives practically all iron for cell request and erythropoiesis under physiological conditions. Ascorbate acts to enhance Tf-subordinate iron take-up by an intracellular reductive mechanism, emphatically recommending that it may act to invigorate iron assembly from the endosome into the cell. The capacity of Ascs to control Tf–iron take-up could help explain the metabolic defect that contributes to Asc deficiency-induced anemia [29].

As too much or too little iron is detrimental, cellular iron homeostasis must be firmly controlled through the guideline of import, storage, and efflux [30,44,52]. A long way from the traditional view that Asc is just a latent dietary factor that upgrades nonheme dietary iron assimilation, a developing assortment of proof shows Asc is a functioning subatomic member in a cell, and maybe fundamental, iron digestion[29].

7. COMBINATION THERAPY: IRON AND VITAMIN C

Iron is essential for many metabolic processes important for the maintenance and survival of the human body[60,1,73].Iron deficiency anemia (IDA) is one of the most common causes of morbidity and mortality worldwide, and affects people of all ages in both developed and developing countries.1correspondingly; iron supplementation is the most significant therapy. To date, iron supplements remain one of the main treatments for anemia [34,33,73]. To prevent iron deficiency, iron-containing health products have emerged [33]. In nature, the absorbed ferrous iron is highly unstable, while ferric iron is stable but cannot be absorbed[60,1] Since vitamin C is an excellent reducing agent, it can act as a “booster”, increasingabsorbable ferrous iron. Therefore, combination therapy with iron supplements and vitamin C is highly recommended for the treatment of iron deficiency anemia[12,13,26,28].

8. CONCLUSION

In this review, it is clearly expressed that the high content of vitamin C in cashew apple can be used as a combinatory factor with iron, regardless of astringency, which can be nullified when it is treated with 2% brine solution by the steaming process for better consumption to treat iron deficiency anaemia through a combinational therapeutic approach. Hence, the function of vitamin C in iron uptake at the cellular level through SVCTs and GLUTs transporters plays a significant role in the utilization of storage iron to metabolize heme and non –heme compounds and many iron-dependent metabolic activities.

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