

# The Ultimate Guide to Vitamin C

Author - Jackie Newson  
BSc Hons, Nutritional Therapist

Editor - Susie Debice  
BSc Hons, Dip ION, Food Scientist and  
Nutritional Therapist

With comments from cardiologist  
Dr Thomas E Levy MD, JD

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## Introduction

Vitamin C is essential for the body to maintain good health. Although it's not needed in large quantities to support energy metabolism like other macronutrients, the body does require more of it than any other known micronutrient vitamin. You can gain vitamin C through your diet from foods that are naturally present in vitamin C or from foods that have been fortified such as breakfast cereals and vitamin C is also available as a dietary supplement.

## What is vitamin C?

Vitamin C is the generic name for L-ascorbic acid, D-ascorbic acid and dehydroascorbic acid, which exist together in nature. L-ascorbic acid is the biologically active form of vitamin C that is useful therapeutically and considered essential for normal health and wellbeing.<sup>1</sup>

Most plants and animals can produce their own vitamin C, as and when required<sup>2</sup>, however, humans, guinea pigs, apes and fruit eating bats lack the specific enzyme required to make this important vitamin. Hence, the importance of acquiring vitamin C from food sources such as green leafy vegetables, peppers, berries and citrus fruits. You could also supplement with vitamin C to support a diet low in fresh fruit and vegetables.



## The many roles of vitamin C

Vitamin C is absorbed in the stomach and small intestine through the normal process of digestion and enters the bloodstream, where it reaches peak levels after about 2 hours. Vitamin C is certainly kept busy by the body and many of its physiological effects are credited to its ability to donate or receive electrons, the essential characteristics of a true antioxidant nutrient.<sup>3</sup>

This specialised activity means that vitamin C plays a key role in many enzyme pathways and biological processes found in all corners of the body, from contributing to the normal function of the nervous system, immune system, skin function and metabolism to supporting mind and mood. Let's take a closer look at how vitamin C influences these areas of health.

### 1. Vitamin C facilitates the action of numerous enzymes

Vitamin C is known to be an electron donor for fifteen enzymes<sup>3</sup> involved in numerous biological processes including:

- **Conversion of dopamine to noradrenaline**
- **Synthesis of adrenal steroid hormones**
- **Synthesis of carnitine, which helps transport fatty acids into mitochondria for energy production**
- **Metabolism of tyrosine**
- **Transformation of cholesterol to bile acids**
- **Metabolism of carbohydrates**
- **Synthesis of fats and proteins**
- **Absorption and metabolism of iron**
- **Cellular respiration**
- **Immune system function**

## 2. Vitamin C and the link with energy, tiredness and fatigue

The earliest symptom of scurvy is fatigue, which research has identified as a symptom of vitamin C deficiency. As well as enhancing the absorption of iron, which allows red blood cells to carry oxygen throughout the body, studies have also established that vitamin C contributes to normal energy yielding metabolism and the reduction of tiredness and fatigue.<sup>4</sup>

## 3. Vitamin C and the signs of premature ageing

Evidence suggests that oxidative damage to the energy producing mitochondria in our cells may be associated with premature ageing.<sup>5</sup> This reinforces the importance of eating a diet rich in fruits and vegetables to help provide a good source of natural vitamin C which contributes to the protection of cells from oxidative stress.

## 4. How does vitamin C help protect against oxidative stress?

Research supports that vitamin C is a potent scavenger of free radicals and as such is probably best known for its capacity to act as an antioxidant. Vitamin C helps to protect cells from oxidative stress by continuously donating electrons, which chemically bind to cells and neutralise free radicals.

This beneficial activity has the potential to help offset some of the tissue damaging effects. The oxidised form of vitamin C then gets converted back to active vitamin C by an enzyme with the help of glutathione.<sup>6</sup> This process helps vitamin C continue to perform as an effective defence nutrient.

Vitamin C also contributes to the regeneration of glutathione and vitamin E, another nutrient recognised for its contribution to the protection of cells from oxidative stress.

## 5. What's the deal with vitamin C and the common cold?

Vitamin C is known to contribute to the normal function of the immune system so for those prone to picking up frequent infections, vitamin C is a key nutrient to focus on. Several clinical trials with varying doses of vitamin C showed that although vitamin C does not prevent the common cold it could help reduce the severity and duration of symptoms during the period of infection.<sup>7</sup> According to research, the benefits are greater with higher doses.

## 6. Vitamin C is a key nutrient for collagen synthesis

Research shows that vitamin C contributes to normal collagen formation (the body's major structural and building protein), which is important for the growth and health of bones, cartilage, teeth, gums, ligaments, skin and blood vessels.<sup>8</sup>

## 7. Does vitamin C support dental health?

Periodontal disease is an inflammatory disease initiated by bacterial infection, which if not treated, may progressively destroy the bone that supports teeth. Oxidative stress is thought to be the primary reason for the damage of bone tissue in periodontal disease. The results from several studies suggest that vitamin C may offer valuable nutritional support in periodontal disease<sup>9</sup> because of its ability to help protect cells from oxidative stress.

## 8. How does vitamin C nourish skin from within?

Looking after healthy skin involves targeting the underlying skin cells responsible for collagen production and renewal. Collagen is a major component of the extracellular matrix that supports skin cells within the deep layers of the skin. As we age, our ability to produce new collagen declines which tends to affect skin hydration, elasticity and tone resulting in the appearance of fine lines, wrinkles and the visible signs of ageing. Diminished collagen levels could also mean that the skin becomes less able to provide an effective barrier to infection.

Maintaining adequate collagen as we grow older may be part of the youthful skin solution, but this requires the help of vitamin C. Studies have established that vitamin C is an essential nutrient that contributes to the formation of collagen for the normal function of skin. How? Well, vitamin C helps to reactivate two enzymes involved in collagen formation - prolyl hydroxylase which helps stabilise a collagen molecule and lysyl hydroxylase which creates the cross-linking that helps strengthen collagen.

Without vitamin C these specialised enzymes would struggle to work efficiently, halting the production of collagen.<sup>11</sup> In addition to this, vitamin C is one of a complex group of enzymatic and non-enzymatic antioxidants that the body utilises to help protect the skin from reactive oxygen species and UV rays.

The remarkable skin benefits of vitamin C were demonstrated recently in a clinical study, which looked specifically at the effects of liposomal Altrient C on skin health and collagen production. Favourable results were seen in terms of skin tone, elasticity and hydration after taking just 3 sachets of Altrient C for 16 weeks.<sup>10</sup>

### 9. Vitamin C for mood and mind

Maintaining good levels of vitamin C may help to support a balanced mood, as according to research vitamin C contributes to the normal functioning of the nervous system and to normal psychological function. This may be due in part to its involvement in the synthesis of neurotransmitters and hormones and its ability to protect cells from oxidative stress, which is thought to trigger neuropsychological disorders.<sup>11</sup>

### 10. Vitamin C and the cardiovascular system

Some heart problems may be linked to the integrity of blood vessel walls and heart tissue. Vitamin C is known to contribute to normal collagen formation which is an important component of connective tissue and blood vessels.<sup>12</sup> Healthy blood vessels are also important for maintaining normal blood pressure and carrying oxygen and nutrients to the heart. Some research investigating the effects of vitamin C on reducing blood pressure has shown favourable results.<sup>13</sup>

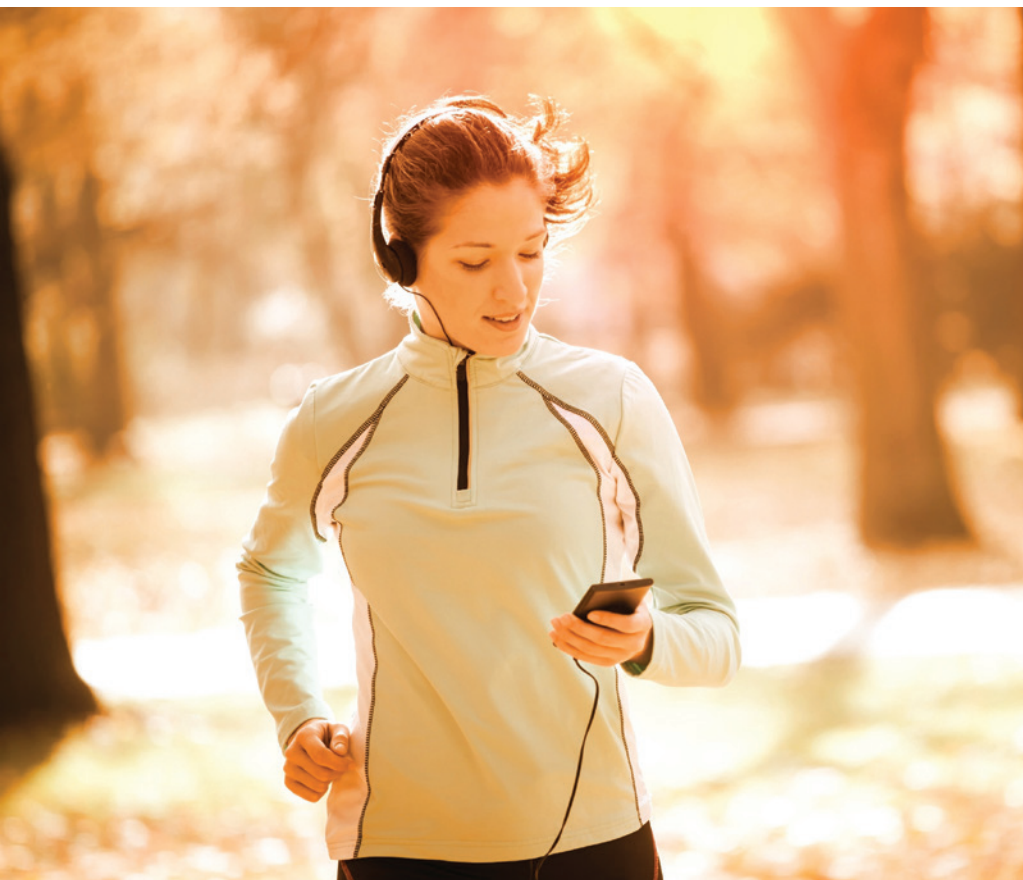
### 11. Is vitamin C helpful for wound healing?

The absence of wound healing is one of the classically recognized features of scurvy, a disease caused by a deficiency of vitamin C, which is attributable to impaired collagen formation. Research shows that there is a rapid utilisation of ascorbic acid for the synthesis of collagen at the site of wounds following post-operative surgery.<sup>14</sup>



## How much vitamin C do you need?

The adult Nutrient Reference Value (NRV) for vitamin C is 80mg per day. This is the level of vitamin C considered to help maintain normal health for healthy individuals. Since vitamin C is found in so many fruits and vegetables it's generally considered that most balanced diets contain adequate vitamin C. However, if you feel unwell, have a stressful lifestyle or have one or more of the vitamin C risk factors then supplementing your diet with vitamin C becomes more important.



## What are the best food sources of vitamin C?

Vitamin C is widely distributed in fresh fruits and vegetables, but the content may vary greatly. The World Health Organisation recommends 400g or five portions a day, although other countries such as Canada suggest up to ten portions a day may be more beneficial to health.

FOOD	VITAMIN C (mg/100g)*
Rosehips	250-800
Lemon fresh, (1 month old)	240, (60)
Peppers	150-200
Blackcurrants	15-200
Brussels sprouts	100-120
Broccoli	90-150
Strawberries	40-90
Cauliflower	50-70
Cabbage	30-70
Oranges	50
Spinach	35-40
Tomatoes	10-40
Onions (raw)	5-32
Potatoes (raw)	10-30
Aubergine	15-20
Potatoes (cooked)	5-15

\* Data Source for table - <https://ods.od.nih.gov/factsheets/VitaminC-HealthProfessionals>.



## Are there risk factors for vitamin C deficiency?

Nowadays access to fruit and vegetables is common so actual cases of vitamin C deficiency are relatively rare in healthy individuals. However, the elderly, people with eating disorders, AIDS, cancer, diabetes, gastrointestinal conditions, tuberculosis or people undergoing surgery may experience a vitamin C deficiency.<sup>15,16</sup> Smoking, alcohol misuse, stress, burns and infections may also rapidly deplete the ascorbic acid reserves in the body.<sup>17</sup>

A prolonged deficiency of vitamin C interferes with normal tissue synthesis, which is the problem that underlies the clinical symptoms of scurvy. Typical signs of vitamin C deficiency<sup>18</sup> include:

- Weakness and fatigue
- Aching muscles and joints
- Poor wound healing
- Loose teeth, swollen and bleeding gums
- Skin ulcers
- Easy fracturing of bones
- Nail clubbing
- Easy bruising
- Alopecia

## Six quick facts about vitamin C

1. Smokers need 35 mg more vitamin C per day than non-smokers.<sup>19</sup>
2. Food processing may destroy vitamin C, as can exposure to air, drying, processing and salting.
3. High temperatures, long cooking times and boiling vegetables cause particularly severe losses of vitamin C.<sup>20</sup>
4. Alcohol interferes with the absorption of vitamin C.
5. Certain prescription drugs such as aspirin may impair vitamin C absorption.<sup>21</sup>
6. After surgery vitamin C concentrations in the blood tend to be lower.<sup>22</sup>

## Are there different types of vitamin C supplements?

There are numerous ways to take vitamin C including tablets, lozenges, capsules, powders, sublingual sprays, chewables, liquids and liposomal gels. There are also many different forms of vitamin C, with variable absorption rates, including:

- **Liposomal vitamin C** – by far the most superior way to take vitamin C when it comes to nutritional supplements. Liposomes are super clever phospholipid bubbles that surround, protect and enhance the vitamin C they contain, aiding absorption and rapid uptake in the body.
- **Ascorbic acid** – the basic, most common form of vitamin C and the cheapest form. However, this form may not be suitable for those with sensitive digestion, especially when taken in high doses because of its acidic nature, which is known to trigger digestive discomfort.
- **Mineral ascorbates** – also known as buffered vitamin C. This form contains the ascorbate molecule joined to a mineral such as sodium ascorbate, magnesium ascorbate, potassium ascorbate and calcium ascorbate. Mineral ascorbates (such as sodium ascorbate) are less acidic and considered to be gentle on the stomach.



- **Bioflavonoids** – some vitamin C supplements also contain bioflavonoids, which are natural polyphenols that may help increase the absorption of vitamin C.
- **Vitamin C metabolites** – some vitamin C supplements also contain natural substances known as metabolites such as dehydroascorbic acid (oxidized ascorbic acid), calcium threonate, and trace amounts of xylonate and lyxonate.
- **Hidden ingredients** – many lower quality products add unnecessary fillers and excipients to enhance the flavour, add colour, bulk up the product, bind the ingredients together, enhance the flow during processing and preserve the ingredients. These are not necessarily harmful, but some may affect the absorption of vitamin C. Check the ingredients list for maltodextrin, sucrose, cellulose, magnesium stearate, carrageenan, stearic acid, silicon dioxide, titanium dioxide and potassium ascorbate. Altrient C doesn't contain any of these excipients.

Dr Thomas E. Levy a highly respected cardiologist and expert in the field of vitamin C, explains why in his opinion liposomal vitamin C is far superior to other standard forms of vitamin C.

*“Comparing the bioavailability of all other oral vitamin C delivery with Altrient’s oral liposomal delivery is like comparing a squirt gun to a fire hose. Not only am I convinced that the efficacy of Altrient Vitamin C far surpasses any traditional oral vitamin C supplement, but my recent personal experience with it suggests that it may sometimes be better than IV injection.”*

**Dr Thomas E. Levy**

## What exactly are liposomes?

Liposomes are sub-microscopic bubbles with an outer membrane consisting of a double layer of phospholipids, very similar in structure to the phospholipid membrane that surrounds human cells. Liposomes are able to encapsulate nutrients like vitamin C and transport them rapidly to the bloodstream and to the cells whilst protecting them from oxidation and degradation. The contents of the liposome are effectively delivered when it fuses with the cell membrane. The unique delivery system of liposomes helps ensure far superior absorption of vitamin C compared to other standard forms of vitamin C supplements.

Liposomal Altrient C is manufactured by LivOn labs in the US using unique patented Liposomal Encapsulation Technology (LET). One sachet of liposomal Altrient C contains 1000mg of vitamin C in the buffered form of sodium ascorbate.

## Why are phospholipids so important?

Phospholipids are naturally occurring fatty substances, that have additional biological actions in the body other than being a key component of cell membranes. They provide an important source of essential fatty acids (EFAs), which play a significant role in many body functions and structures. Phospholipids are converted into regulatory compounds called prostaglandins, which together with EFAs are involved in many biological processes. One sachet of Altrient C provides 1000mg of phospholipids, which includes 500mg of phosphatidylcholine.

## Why choose a liposomal form of vitamin C?

Dr Levy who is a passionate advocator of liposomal vitamin C summarises the clear advantages of this form of vitamin C supplementation:

*“One of the primary benefits of Altrient’s liposomal vitamin C is a near complete absorption of the encapsulated ascorbate into the bloodstream. The physical qualities of the liposome also eliminate the need for digestive activity before absorption and there is no intestinal flush effect with large doses. What’s more, liposomal vitamin C appears to have a slower excretion rate and the highest absorption factor. The enhanced absorption along with the phospholipid dose absorbed has uniquely positive benefits and provides the best intracellular delivery of vitamin C.”*

**Dr Thomas E. Levy**

Dr Levy is not alone in his opinion, a substantial number of studies have already documented the versatile advantages of using liposomes for targeted site-specific delivery and efficient absorption through cells.<sup>23-28</sup>

## The top 5 advantages of Altrient C

1. **Survives digestion** – the microscopic phospholipid bubble surrounding the vitamin C protects it from oxidation and resistance to digestive enzymes, gastric juices, bile salts, alkaline solutions, intestinal bacteria and free radicals produced by the body.
2. **Gentle on the stomach** – Altrient C delivers high doses without the gastrointestinal discomfort.
3. **More efficient absorption** – Altrient C by LivOn labs is the world’s first premium liposomal health and beauty supplement, using cutting edge LET, to deliver maximised absorption that is proven to exceed standard vitamin C absorption rates.
4. **Convenient** – Altrient C convenient single dose sachets are portable and easy to take.
5. **Two nutrients for the price of one!** – Altrient C contains 1000mg of vitamin C plus 1000mg of EFA rich phospholipids.

## How safe is vitamin C?

Vitamin C is considered safe to take in large doses. However, in some people large doses may lead to abdominal discomfort and diarrhoea. During illness or when exposed to toxins and other stresses, the body’s need for vitamin C is greater and the laxative effect may not be present.





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# The Ultimate Guide to Vitamin C

IE: +353 (0)1 254 8889  
UK: +44 (0) 20 3239 4907  
[info@abundanceandhealth.com](mailto:info@abundanceandhealth.com)

[www.abundanceandhealth.co.uk](http://www.abundanceandhealth.co.uk)