

Good nutrition matters: hypovitaminosis C associated with depressed mood and poor wound healing

Vitamin C is concentrated intracellularly from the circulation and levels in the body's tissues are thought to reflect its function as a required cofactor for a number of important enzymes. Most well-known is its ability to enhance immunity and to act as a cofactor for the hydroxylase enzymes required for collagen synthesis, thereby aiding wound healing.¹

It is also known that vitamin C is highly concentrated in the brain, suggesting a vital role in this organ, and it may have a biochemical role in depression by acting as an essential cofactor for specific biosynthetic enzymes which generate the neurotransmitter norepinephrine from dopamine, and peptide hormones such as oxytocin.² However, although depression, fatigue and irritability have been associated with scurvy and subclinical hypovitaminosis C,³ the link between vitamin C and subjective mood is not well established.

The association of hypovitaminosis C and fatigue could be explained by its role as a cofactor for the hydroxylase enzymes involved in the synthesis of carnitine, a compound essential for the generation of metabolic energy.²

Supporting evidence for a role of vitamin C in subjective mood was gathered as we followed the case of an 18-year-old male with a history of poor wound healing and depressed mood. The subject was identified during screening for a vitamin C supplementation study and his fasting plasma vitamin C levels over 4 weeks were determined to be between 23–28 μ M, which is considered inadequate (healthy vitamin C levels are >50 μ M).

Analysis of a 7-day food and beverage record indicated that the subject consumed an average of only 1.2 servings of fruit and vegetables per day comprising 20mg/d of vitamin C, significantly below the recommended dietary intake of 40mg/d.

Prior to the intervention phase of the study, the subject withdrew due to general ill health. He had protracted issues with wound healing and concurrent infection of a surgically-treated pilonidal sinus, diagnosed 18 months earlier. Two surgeries had been performed to initially lay open and subsequently excise the granuloma. At the point of withdrawal from our study, he was also about to begin treatment for depression.

Because of his poor dietary habits and inadequate plasma vitamin C levels, a vitamin C supplement (1g/day) was recommended. Within 2 weeks of commencement of the supplement there was a noticeable improvement in the subject's mood. Less than 2 months later, the subject underwent a third scheduled surgical procedure to excise the granuloma. This healed normally and no further issues were experienced with this.

At a follow-up appointment 17 weeks after withdrawal from the clinical study, a Profile of Mood States (POMS) questionnaire was completed which showed an 83% decrease in his total mood disturbance, a complete reversal of signs of depression, a

35% decrease in anger, an 88% decrease in fatigue, a 43% decrease in confusion and a 2.4 fold increase in vigour. At this time, the subjects fasting plasma vitamin C levels had risen significantly to 60µM, i.e. close to saturating.

Although vitamin C's well-known role in collagen formation likely explains the improved wound healing, the role that vitamin C plays in subjective mood is likely due to the vitamin's role as a cofactor for the specific hydroxylase enzymes involved in the formation of carnitine, norepinephrine and specific peptide hormones.

That the improvement in overall mood, and in particular decreased depression and fatigue, observed in our subject was due to elevated vitamin C levels is supported by other studies that have shown decreased depression following vitamin C supplementation.⁴⁻⁸

Supplementation of hypovitaminosis C individuals with vitamin C also resulted in a 34% reduction of total mood disturbance.⁹ Fatigue and irritability are common symptoms in individuals with subclinical vitamin C deficiency³ and provision of vitamin C has been shown to provide up to a 33% decrease in fatigue.^{5,10}

Overall, this case highlights the fact that not only is hypovitaminosis C found in the general population, but in the absence of any major markers of clinical scurvy, it can be associated with the clinical conditions of impaired wound healing and depression, the latter of which is not generally acknowledged in the medical community.

Although some may argue that a vitamin C-dependent improvement in wound healing may have contributed to the improvement in overall mood, there are known cofactor activities of vitamin C that support a definite role in the generation of carnitine, norepinephrine and peptide hormones that will affect energy levels and mood, and may themselves also have a role to play in wound healing.

Thus, vitamin C needs to be seen as having a significant role to play in clinical practice, with potential impact on many areas of patient wellbeing, not just aiding wound healing through the stimulation of collagen formation.

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