

Relationship Between Depression and Vitamin C Status: A Study on Rural Patients From Western Uttar Pradesh in India

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Abstract

Aim & Objective: To study vitamin C status of rural depressed population of Western U.P vis-a-vis age- and sex-matched healthy controls.

Materials & Methods: From patients visiting the Psychiatric outpatient department of TMMC & RC, thirty depressed patients, diagnosed according to Structured Clinical Interview DSM-IV-TR schedule, were selected randomly and their serum vitamin C levels were measured by dinitrophenyl hydrazine method. These levels were compared with 30 age- and sex-matched healthy controls.

Results: Mean (\pm SD) serum vitamin C levels of depressed patients and controls were 0.18 ± 0.09 mg/dl and 0.41 ± 0.07 mg/dl respectively. The difference between these two groups of subjects was statistically significant (p value < 0.001).

Conclusion: This study shows low vitamin C status in depressed patients as compared to normal individuals, and suggests that vitamin C supplementation can have a positive effect in the treatment of these patients.

Keywords: Depression, Vitamin C

INTRODUCTION

Depression is a state of extreme sadness that reaches a point where it affects a person's day to day activities and also disturbs socio-occupational functioning. Depression may have a relationship with vitamin C deficiency. When a group of patients were deprived of Vitamin C they experienced symptoms like sad mood, reduced concentration, reduced energy, fatigue and hypochondriasis. They were significantly more anxious and people deficient in vitamin C were also significantly more depressed based on ratings from the Symptom adjective checklist, but the Frieburg personality inventory scale showed no significant depressive scores.¹

Among diverse functions of vitamin C, one is its role in the synthesis of some neurotransmitters. Vitamin C is a cofactor for dopamine beta-hydroxylase² which is involved in the conversion of dopamine to nor-epinephrine.

According to an August 2003 article in vitamin C acts as the co-factor for the enzyme dopamine-beta-hydroxylase to convert dopamine into nor-epinephrine (Figure 1), which plays an important role in the regulation of mood.³ Evidence for the involvement of Norepinephrine in depression is abundant, and latest studies on neural

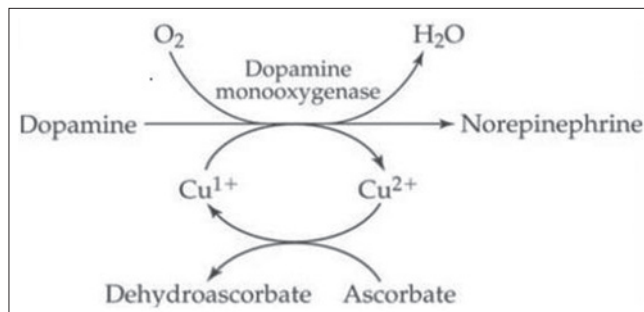


Figure 1: Role of vitamin C in norepinephrine synthesis

pathways and mechanisms highlight the specific role of Norepinephrine in this disorder.⁴ Norepinephrine plays a significant & determinant role in executive functioning regulating cognition, mood, interest, and intelligence, which are fundamental in social relationships.⁵

Vitamin C is also a cofactor for tryptophan-5-hydroxylase required for the conversion of tryptophan to 5-hydroxytryptophan in serotonin production. Vitamin C may therefore be valuable for patients with depression associated with low levels of serotonin.⁶ Deficiency of serotonin produces depressant effect and excess of serotonin in brain tissue produces stimulation of cerebral activity.⁷ Vitamin C has broad-spectrum antioxidant properties and is essential for the mitochondrial metabolism of fats.⁸ Vitamin C is also required for the activity of peptidylglycine alpha-amidating mono-oxygenase.⁹ This enzyme catalyses the rate-limiting step in the biosynthesis of neuropeptides.¹⁰

In a 2011 study, investigators used an objective assessment of physical function and a range of socio-demographic, dietary, and health behaviours to explore the possible factors that could explain the association between depression and mortality in community-dwelling elderly participants aged 65 years and older. Depression was assessed from the 15-item Geriatric Depression Scale (GDS) and physical functioning. Subjects were followed up till death over an average of 9.2 years. At baseline, 20.9% of participants demonstrated depression (GDS-15 score ≥ 5). Depressed participants were at a higher relative risk of all-cause mortality during follow-up (age- and sex-adjusted hazard ratio = 1.24, 95% confidence interval: 1.04-1.49). These factors collectively explained an estimated 54% of the association between depression and death. Low-grade inflammatory changes and low plasma vitamin C were also independently associated with depression and mortality but did not explain any of the association between depression and mortality. Physical dysfunction might partly explain the co-relation although studies are required to fully elucidate the mechanisms.¹¹

Trials were carried out to find out whether patients with generalized anxiety disorder (GAD) and depression have any difference in blood serum levels of vitamins A (β -carotene), C, and E in comparison to normal healthy controls and whether supplementation of adequate doses of vitamins A, E, and C leads to significant reduction in anxiety and depressive scores of the subjects. It was observed that patients with GAD and depression had significantly lower levels of vitamins A, C, and E in comparison to healthy controls. After supplementing these deficient vitamins in the diets of the subjects, a significant reduction in anxiety and depressive scores was observed.¹²

AIM OF THE STUDY

Keeping the above reports in mind, the present study was carried out on a random sample of 30 patients from rural background in Western U.P. diagnosed as depressed as per the Structured Clinical Interview DSM-IV¹³ to find out the levels of vitamin C in their serum and to compare these with 30 healthy age- and sex-matched controls.

MATERIAL AND METHODS

The study was conducted over a period of six months in Teerthankar Mahaveer Medical College and Research Centre, Moradabad situated in rural surroundings in the western part of U.P. From amongst the patients attending the Psychiatric outpatient department, thirty depressed patients, diagnosed according to SCID schedule,¹³ were selected randomly. A thorough physical examination and relevant investigations were done to rule out any physical disease. Thirty age- and sex-matched controls from healthy population belonging to the same area were also included in the study. Serum vitamin C levels were measured in all the subjects by dinitrophenyl hydrazine method.¹⁴ The mean (\pm SD) serum vitamin C levels of patients with depression were compared with those of controls by Student's t-test.

RESULTS

Serum vitamin C levels ranged from 0.3 to 0.6 mg/dl in controls with a mean \pm SD of 0.41 ± 0.07 mg/dl. In patients with depression, the levels ranged from 0.1 to 0.4 mg/dl with a mean \pm SD of 0.18 ± 0.09 mg/dl. The difference between the two groups was highly significant with a p value of <0.001 (Table 1) (Figure 2).

Table 1: Mean \pm SD serum vitamin C levels in controls and depressed patients

Analyte	Control Group (n=30)	Depressed Patients (n=30)	p value
Vitamin C (mg/dl)	0.41 \pm 0.07	0.18 \pm 0.09	<0.001

DISCUSSION

Vitamin C is an anti-oxidant, commonly used to boost immunity in the cases of cold and flu. In the treatment of Vitamin C is also very important, because it is needed for the conversion of tyrosine into dopamine, norepinephrine and epinephrine. These are the neurotransmitters providing with both physical and motivational energy and feelings of reward and satisfaction.

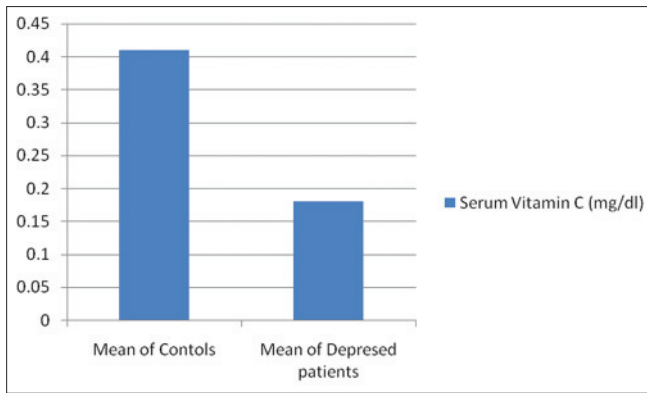


Figure 2: Comparison between mean serum vitamin C level of control and depressed patients

Vitamin C is needed to convert tryptophan, amino acid present in the animal proteins in the diet, into serotonin, major neurotransmitter of the brain.

Without Vitamin C these biochemical reactions can't be properly carried out and that will result in lesser amounts of neurotransmitter in the brain and body, and consequently, in lower mood and motivational energy.

Serum vitamin C in patients with depression was found to be significantly lower as compared to healthy controls indicating poor vitamin C status in depressed patients. As described above, vitamin C is a cofactor for dopamine beta-hydroxylase, which converts dopamine to nor-epinephrine, and a cofactor for tryptophan-5-hydroxylase required for the conversion of tryptophan to 5-hydroxytryptophan in serotonin production.

Since synthesis of serotonin, dopamine and nor-epinephrine requires vitamin C, it is to be expected that their synthesis would be impaired if vitamin C is deficient. It is an established fact that serotonin, dopamine and nor-epinephrine play important roles in maintaining mood. Deficiency of nor-epinephrine can cause clinical depression and poor memory, and deficiency of serotonin can produce a depressant effect.

Results presented here demonstrate poor vitamin C nutrition in depression in the sample of population studied. Whether this under-nutrition is prevalent in other sections of population needs to be investigated.

Vitamin C under-nutrition may be a causative or contributory factor in the genesis of depression. Hence

correction of this deficiency alongside the conventional treatment of depression is expected to yield better results in patient management.

CONCLUSION

This study shows low vitamin C status in depressed patients as compared to normal individuals, and suggests that vitamin C supplementation can have a positive effect in the treatment of these patients. Vitamin C has an important role in the formation of neurotransmitters required for normal neuronal functioning and the lack of this important factor can be a cause of treatment failure and resistance in the depressed population.

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