

Concentrations of vitamins A, C and E in elderly patients with Parkinson's disease

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Summary: Concentrations of the naturally occurring antioxidant vitamins A, C and E were measured in 27 patients with Parkinson's disease and 16 age-matched control subjects, from a similarly disabled patient group. There was no significant difference in the serum concentrations of vitamins A and E in the two groups. Vitamin C was significantly higher ($P < 0.05$) in the Parkinson's disease group, however, the mean leucocyte vitamin C concentration in the control group was low (101 nmol/10⁶ WBCs) compared to established data in healthy young individuals (119–301 nmol/10⁶ WBCs). There was no correlation between the severity or duration of Parkinson's disease and concentrations of vitamins A, C and E. There is therefore no evidence from this study that a deficiency of these antioxidants contributes to the onset or progress of Parkinson's disease.

Introduction

Parkinson's disease is a major chronic neurodegenerative condition of the elderly.¹ The basic aetiology of Parkinson's disease remains unknown,² although recent evidence implicating environmental toxins and free radical damage has accumulated.^{3–6}

It has been postulated that antioxidants may have a role in the prevention and/or management of Parkinson's disease.⁶ The DATATOP trial⁷ has shown that the antioxidant Deprenyl (selegiline) significantly delays the need for introduction of levodopa therapy in previously untreated patients. Selegiline has its effect by inhibition of the enzyme monoamine oxidase type B. The data for subjects receiving vitamin E in this study is currently being analysed.

Vitamins A, C and E are all naturally occurring antioxidants. As endogenous oxidative mechanisms appear to be a major factor in the continuing death of dopaminergic neurones and the progression of Parkinson's disease, we have measured concentrations of these vitamins in patients with Parkinson's disease and in a similarly disabled patient group which acted as controls.

Methods

Subjects were recruited over a 6 month period. Two groups were studied; subjects with idiopathic Parkinson's disease and a control group matched for age and sex. The control group was deliberately taken from patients with equivalent disability, albeit from non-neurological disease. The primary diagnoses in this group were: congestive heart failure (7), chronic bronchitis (2), diabetes mellitus (2), peripheral vascular disease (3), rheumatoid arthritis (1) and Paget's disease (1). All these patients had no evidence of Parkinson's disease and a normal blood count and liver function test. The diagnosis of idiopathic Parkinson's disease was established by two of the authors independently. All patients with drug-induced parkinsonism were excluded and all had at least two of the triad: tremor, rigidity and bradykinesia. All patients were on levodopa to which they had had a good response. The duration of the disease was recorded and the degree of disability using the established scale of Hoehn and Yahr.¹ All subjects gave informed consent before entering the study. Twenty-seven subjects with Parkinson's disease (16 females) with a mean age of 77.1 years (range 58–89 years), and 16 control subjects (nine females) with a mean age of 77.4 years (range 68–87 years) were recruited. All subjects were outpatients.

A sample of venous blood was taken at 9.00 a.m. after an overnight fast. The serum was collected

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and stored at -20°C before analysis within 2 weeks. Vitamins A and E were extracted simultaneously into hexane and then quantified by reverse phase high performance liquid chromatography as described previously.⁸ Leucocyte vitamin C concentration was measured within one day of blood collection by the method of Denson and Bowers.⁹ Although serum concentrations of vitamins A and E and cholesterol do not significantly change in response to a meal,¹⁰ to obtain constant conditions all subjects were asked to undergo an overnight fast. The biochemical assessment of vitamin E status is problematic since hyperlipidaemia or hypolipidaemia can increase or decrease serum vitamin E without reflecting similar alterations in tissue levels. Hence a ratio of vitamin E : total lipids or vitamin E : cholesterol is a more reliable reflection of vitamin E stores.¹¹ Serum cholesterol was therefore determined (cholesterol oxidase procedure, SMAC Technicon UK Ltd) and the vitamin E : cholesterol ratio calculated. All subjects with abnormal liver function tests were excluded as this would potentially reduce the absorption of fat-soluble vitamins.

Statistical analysis was performed using SPSS.

Results

The vitamin concentrations and the vitamin E : cholesterol ratio can be seen in the two groups in Figure 1. There was no significant difference in serum concentrations of vitamins E ($t = 0.21$, $P > 0.84$) and A ($t = 0.31$, $P > 0.76$) and the vitamin E : cholesterol ratio ($t = 0.21$, $P > 0.84$) in the two groups. Subjects with Parkinson's disease had a significantly higher leucocyte vitamin C level ($t = 2.06$, $P < 0.05$). However, the leucocyte vitamin C concentration in the control group was low (101 nmol/ 10^8 WBCS) when compared with that of healthy young individuals (119–301 nmol/ 10^8 WBCS).¹² The Parkinson's disease group had leucocyte vitamin C concentrations comparable to the healthy young. Of the eight control subjects with vitamin C concentrations below 119 nmol/ 10^8 WBCS, one lived in a nursing home. The latter accounted for the lowest recorded value of vitamin C (8 nmol/ 10^8 WBCS).

There were 10 in the Parkinson's disease group who had concentrations of vitamin C below 119 nmol/ 10^8 WBCS, of whom one lived in a nursing home. Only one Parkinson's disease subject had a vitamin A concentration (139 $\mu\text{g/l}$) below the lower limit of the range for the healthy young (300–650 $\mu\text{g/l}$).¹² All subjects had vitamin E concentrations within the normal range for the healthy young (5–20 mg/l).¹²

There was no correlation between the severity or duration of Parkinson's disease and the levels of

vitamins A, C and E and the vitamin E : cholesterol ratio.

Discussion

Vitamins A, C and E are naturally occurring antioxidants which prevent lipid peroxidation and destruction of cell membranes by scavenging free radicals. Vitamin E has a propensity for neuronal cell membranes and hence the neurological consequences of its deficiency include ataxia, dorsal column loss, ophthalmoplegia and nystagmus.^{13,14} Animal studies on the protective role of these antioxidants on dopaminergic cells exposed to the free radical MPP⁺ have been conflicting.^{15–17} The effect of vitamin E on the progression of Parkinson's disease is currently being investigated in the DATATOP trial.⁷ However, an isolated case report describes the onset of Parkinson's disease in a 56 year old man who had taken vitamin E for 20 years thus not affording him protection.¹⁸

In Parkinson's disease the increased dopamine synthesis demanded of surviving nigral neurones increases the production of free radicals,² and therefore there would be a greater need for scavenging enzymes and antioxidants. It may be postulated therefore that patients with Parkinson's disease would have a reduced level of vitamins A, C and E as these become used up and so afford some protection. Indeed a reduced level of these vitamins due to dietary deficiency or malabsorption may predispose to Parkinson's disease. However, our study shows that patients with Parkinson's disease have normal concentrations of vitamins A and E, and a significantly higher leucocyte vitamin C when compared to certain diseases giving comparable disability. The mean leucocyte vitamin C concentration in the control group was, however, below that of healthy young individuals.

We conclude that elderly patients with Parkinson's disease generally have normal concentrations of the antioxidant vitamins when compared with a similarly disabled elderly group. Vitamin C levels are significantly higher than expected in the Parkinson's disease group. This along with the fact that vitamin A and E are similar in both groups implies it is unlikely that these vitamins have a role to play in the prevention and/or management of elderly Parkinsonian patients.

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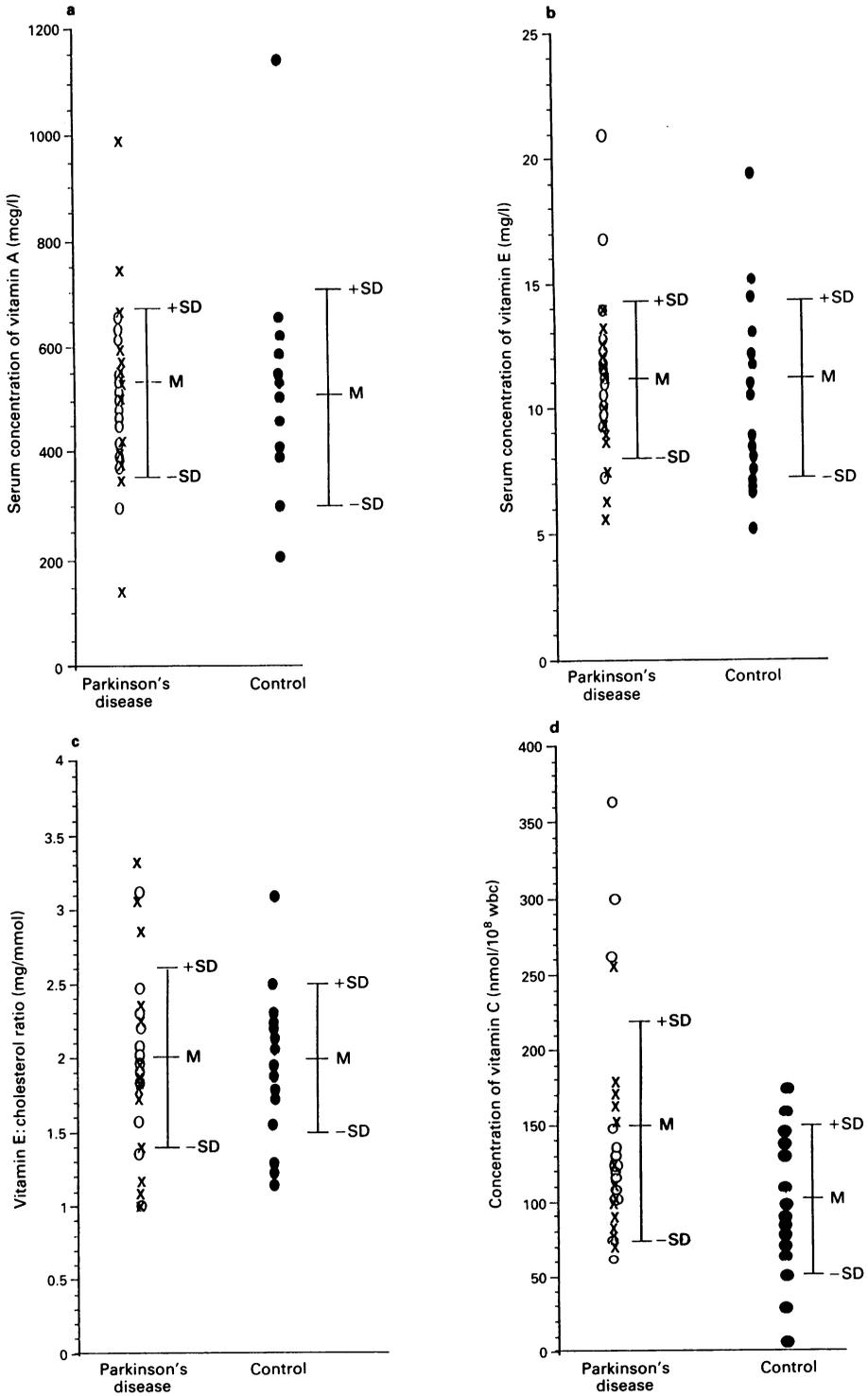


Figure 1 Concentration of serum vitamin A (a), E (b) and vitamin E to cholesterol ratios (c), and leucocyte vitamin C (d) in patients with Parkinson's disease and age-matched control subjects. ○ = H + Y Group 1 + 2; X = H + Y Group 3 + 4; ● = control.

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