

Relation between erythrocyte selenium concentrations and glutathione peroxidase (EC 1.11.1.9) activities of New Zealand residents and visitors to New Zealand

BY HEATHER M. REA, CHRISTINE D. THOMSON,
DIANNE R. CAMPBELL AND MARION F. ROBINSON

(Received 20 December 1978 – Accepted 2 May 1979)

1. Erythrocyte, plasma and whole blood selenium concentrations and glutathione peroxidase (EC 1.11.1.9; GSHPx) activities were measured (1) in 104 healthy New Zealand residents living in Otago, a low-soil-Se area (2) in sixty-four surgical patients, including nineteen patients on total parenteral nutrition and twenty-three cancer patients (3) in fifty-two 'overseas subjects' (twenty-five visitors to Otago from outside New Zealand and twenty-seven Otago residents on return from overseas travel).

2. Blood Se concentrations reflected dietary Se intake; means for Otago patients, healthy subjects and overseas subjects were different (0.043, 0.059, 0.136 $\mu\text{g Se/ml}$ blood respectively) and mean for overseas residents was greater than for New Zealand overseas travellers.

3. Erythrocyte Se concentration was always greater than plasma Se, and plasma Se was a smaller proportion of erythrocyte Se for patients compared with the controls.

4. GSHPx activities were different in the three groups, and varied directly with erythrocyte Se until a plateau was reached at approximately 0.14 $\mu\text{g Se/ml}$ erythrocytes.

5. Overseas subjects showed no relationship between erythrocyte Se and GSHPx activity. This agrees with some overseas studies and the significance of this finding is discussed.

6. Plasma Se concentration remained the most sensitive index of short-term changes in Se status, and erythrocyte Se and GSHPx activities for long-term changes in New Zealand subjects. Use of these measurements for overseas subjects with higher blood levels is discussed.

The selenium concentration in whole blood, erythrocytes or plasma has been used until recently as a measure of Se status of animals and human subjects. Since the discovery that Se is an integral part of the enzyme glutathione peroxidase (EC 1.11.1.9; GSHPx), the more rapid measurement of enzyme activity has been used as an indicator of blood Se status in animals (Hafeman *et al.* 1974; Reddy & Tappel, 1974; Hoekstra, 1975), and a simplified technique has been developed for field tests for Se deficiency in sheep (Board & Peter, 1976). Linear correlations of erythrocyte or whole blood GSHPx activity with blood Se concentrations have been demonstrated for animals (Thompson *et al.* 1976; Millar, 1977).

Less is known about human Se metabolism but a linear relationship between blood Se and GSHPx activity has been demonstrated for New Zealand residents (Thomson *et al.* 1977). A similar relationship has been described for some American residents (Rudolph & Wong, 1978) but not for others (Schrauzer & White, 1978), and not for some German residents (Schmidt & Heller, 1976).

This paper reports Se concentrations of patients and healthy residents of Otago (a very low-soil-Se area of New Zealand), visitors to Otago from overseas, and Otago residents returning from visits overseas. Where possible, GSHPx activity has been assayed and Se concentrations measured in erythrocytes and plasma as well as in whole blood. The suitability of using these measurements for evaluating Se status is discussed.