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Zinc supplementation and erythropoiesis in the elderly

Our previously reported group of geriatric patients with senile purpura, who proved to have low plasma zinc concentrations,¹ did not have obvious related haematological abnormalities. The haemoglobin concentrations, however, did lie at the lower end of the normal range established for normal younger adults. As falls in haemoglobin related to age have been found in several studies, including those reporting on healthy subjects where no underlying cause was found,² we undertook a pilot study of serum zinc, erythropoietin, and androgen concentrations in addition to full blood counts in 10 men and 10 women aged between 65 and 95 years. They were attending a day hospital for social reasons and had no physical or biochemical evidence or disorders known to influence erythropoiesis. Serum erythropoiesis was measured using a modification of the fetal mouse liver cell bioassay.³ Zinc concentra-

tions were obtained by atomic absorption spectrophotometry, and testosterone by radioimmunoassay.

The red blood cell counts and the haematocrit values following zinc supplementation were significantly improved for men ($p < 0.025$) but not for women ($p < 0.80$ and $p < 0.60$, respectively). The other results are given in the table. The haemoglobin concentrations in women were in the lower half of the normal range, but those for men were significantly decreased as a group compared with the normal range. Three women and one man had high erythropoiesis values. This suggests that a decrease in erythropoiesis had been recognised by the body as a pathological process, and in an attempt to correct this the kidneys were stimulated to produce higher levels of erythropoiesis. Despite increased production of this hormone the haematological indices had not been completely corrected.

Reported declining concentrations of androgens in both men and women⁴ suggest that the relative lack of testosterone, and particularly its biologically active metabolites, may be responsible for decreasing erythropoiesis in the elderly. Lowered androgen concentrations may be decreasing the number of committed stem cells available to develop along the erythroid line, thus making the marrow relatively insensitive to increased erythropoiesis concentrations. In addition, the concentration of erythropoiesis induced when androgen concentration is lowered may not compensate the degree of disturbance in red cell production.

Studies have shown that whole body zinc concentrations decrease with age.⁵ Our correlation between zinc and testosterone values suggest that zinc may possibly be exerting an effect on erythropoiesis via androgen metabolism.

The results seen in this small pilot study of elderly subjects after three months of oral zinc supplementation are compatible with the hypothesis that there is a true anaemia of

old age which may be related to lowered androgens, which in turn may be due to a lack of zinc. Clearly, investigations of larger numbers of aged subjects, particularly the concentrations of bound and free testosterone, as well as the effect of its biologically active metabolites at the various levels of the erythron pathway, may yield a clearer picture of the underlying pathological process.

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Table Haematological and biochemical results for elderly subjects before and after three months of oral zinc supplementation

		Before			After			p value
		Mean	95% CI of mean	Range	Mean	95% CI of mean	Range	
Hb (g/dl)	F	12.5	0.5	11.4-13.7	12.9	0.46	11.9-14.0	0.110
	M	13.5	1.22	11.1-15.5	13.8	1.12	11.4-15.5	0.035
Erythropoiesis (mIU/ml)	F	80.8	26.6	25-169	63.2	15.16	36-115	0.041
	M	69.0	20.6	33-98	70	16.2	32-99	0.447
Testosterone (nmol/l)	F	1.3	0.3	0.6-2.0	1.5	0.32	0.6-2.2	0.060
	M	10.6	4.06	0.7-16.0	14.1	5.22	1.8-23.5	0.010
Zinc (umol/l)	F	11.2	0.74	9.9-12.9	16.4	4.2	9.6-31.2	0.025
	M	11.7	1.28	9.9-14.7	15.9	3.58	10-21.7	0.017