Preliminary Communication
reprinted from THE LANCET, *November* 11, 1967, *pp.* 1019-1020

PLASMA-ZINC CONCENTRATIONS IN PATIENTS WITH PSORIASIS, OTHER DERMATOSES, AND VENOUS LEG ULCERATION

Summary Significantly lowered plasma-zinc concentrations were found in patients with psoriasis, other dermatoses, and venous leg ulceration. The significance of this finding requires further investigation.

INTRODUCTION

ZINC is an essential dietary constituent; it is a component of several metalloenzymes and behaves as a co-factor for many other enzymes. Although in man low plasma or serum zinc concentrations have been associated with cirrhosis of the liver [1] and the postoperative period,[2] and reduced amounts of zinc have been found in the hair of patients with atherosclerosis,[3] systematic studies of zinc metabolism in human skin disease have not been reported. We have, therefore, determined plasma-zinc concentrations in a group of patients with psoriasis, a group with ichthyosis, and a group with miscellaneous skin conditions. Because of the recent observation by Pories et al.[4] of accelerated wound healing after zinc administration, we also studied a small group of patients with chronic venous ulceration of the leg.

SUBJECTS AND METHODS

The subjects studied were aged 15–64 years, and were in five groups: (1) 41 healthy subjects (including 17 females) with no past history of skin disease; (2) 20 patients (including 9 females)

1. Prasad, A. S., Oberleas, D., Halstead, J. A. *J. Lab. clin. Med.* 1965, **66**, 508.
2. Strain, W. H., Rob, C. G., Pories, W. J., Hennessen, J. A., Montaya, J., Barker, W., Haskins, J. *Trans. Am. nucl. Soc.* 1967, **10**, 60.
3. Strain, W. H., Pories, W. J. *in* Zinc Metabolism (edited by A. S. Prasad); p. 371. Springfield, Ill., 1966.
4. Pories, W. J., Henzel, J. H., Rob, C. G., Strain, W. H. *Ann. Surg.* 1967, **165**, 432.

with psoriasis involving 10% or more of the body-surface; (3) 13 patients (including 7 females) with miscellaneous skin conditions in which neither dyskeratosis nor chronic ulceration was a feature; (4) 10 patients (including 2 females) with ichthyosis; (5) 9 patients (including 8 females) with chronic venous leg ulceration.

Venous blood samples, collected using disposable plastic syringes and stainless-steel needles, were each transferred to a polystyrene specimen tube and mixed with 1 drop of heparin (heparin injection *B.P.*, 5000 units per ml., Weddell Pharmaceuticals Ltd.). Within 2 hours of collection, the specimens were centrifuged at 3000 r.p.m. (M.S.E. ' Minor ' centrifuge) for 10 minutes; the plasma was separated, and stored at $-20°C$ in polystyrene tubes.

PLASMA-ZINC CONCENTRATIONS IN PATIENTS WITH SKIN DISEASES AND IN HEALTHY CONTROLS

Subjects	No.	Age (yr.) (mean and range)	Mean plasma-zinc (μM)	Standard deviation†
Controls ..	41	30·6 (19–64)	18·1	1·92
Psoriasis ..	20	48·3 (19–64)	15·5	2·49 $P<0.001$
Ichthyosis ..	10	35·1 (16–63)	16·5	2·43 $P<0.05$
Chronic venous leg ulcers ..	9	58·4 (51–61)	15·4	1·71 $P<0.001$
Other skin diseases* ..	13	45·5 (15–61)	15·4	2·39 $P<0.001$

* Diagnosis: lichen planus (3), eczema (3), urticaria (2), scleroderma (1), pemphigoid (1), dermatitis herpetiformis (1), rosacea (1), chronic discoid lupus erythematosus (1).

† P = significance of difference between test and control means.

The method was based on that described by Prasad et al.[1] for use with liquid plasma. Polystyrene tubes were used throughout because of variable amounts of zinc found in glass tubes cleaned with chromic acid. This made it necessary to reduce the incubation temperature to 80°C, and each period of incubation was therefore increased to 10 minutes.

The zinc content of ready-heparinised specimen tubes was variable and rather high. Liquid heparin containing approximately 30 μM zinc was therefore used instead. No detectable zinc was eluted with water from needles or polystyrene tubes, but the mean content of the syringes was $1·4 \pm 0·25$ (S.D.) *n*moles. The results were corrected for zinc introduced from syringes and anticoagulant by subtracting 0·4 μM. One batch of tubes, syringes, and heparin was used throughout the investigation.

The atomic absorption spectrophotometer employed was a ' Unicam SP 90 ', with a 10 cm. burner set at 1·0 cm. below the optical centre. The flow-rate for air was 4·5 litres per minute, and for acetylene 1·2 litres per minute. Maximum

scale expansion was used, giving approximately full-scale deflection for the highest standard (15 μM zinc).

RESULTS

Mean plasma-zinc concentrations for the five groups are given in the accompanying table.

DISCUSSION

The mean plasma-zinc value in control subjects of the present study agrees well with recent data from other sources.[5] We have demonstrated a significant reduction of plasma-zinc concentration in patients with psoriasis, ichthyosis, and other skin disorders, and in those with venous leg ulceration. The reduction cannot be attributed to the higher average age of these groups than of the controls, since there was no correlation between age and plasma-zinc concentration in the control group. That skin diseases can induce various metabolic disorders as well as abnormalities of renal and intestinal function has become widely recognised.[6–8] In localised eczema and psoriasis, low serum-iron has been demonstrated,[7] associated in some cases with reduced serum-iron-binding capacity, intestinal malabsorption, or loss of iron in the scales.[9] The finding of abnormally low zinc concentrations in the plasma of patients with widely differing dermatoses suggests that similar non-specific mechanisms may be responsible, and it is of interest that Eggleton [10] estimated that human epidermis contains 97 parts per million of zinc.

Low plasma-zinc concentrations have not previously been reported in human skin disease, although Prasad [11] mentions thickening and roughening of the skin in patients with dwarfism and other abnormalities associated specifically with long-standing dietary zinc deficiency. In animals the relation of zinc deficiency to dermopathy is well known. There have been several reports of a psoriasis-like condition affecting rats,[12] pigs,[13] lambs,[14] and calves,[15] in

5. Prasad, A. S., Miale, A., Farid, Z., Sandstead, H. H., Schubert, A. R. *J. Lab. clin. Med.* 1963, **61**, 537.
6. Shuster, S., Marks, J. *Lancet*, 1965, i, 1367.
7. Shuster, S. *ibid.* 1967, i, 907.
8. Shuster, S., Marks, J. *Br. J. Derm.* 1967, **79**, 393.
9. Marks, J. *J. R. Coll. Physns., Lond.* 1967, **1**, 367.
10. Eggleton, W. G. E. *Biochem. J.* 1939, **33**, 403.
11. Prasad, A. S. *in* Zinc Metabolism (edited by A. S. Prasad); p. 302. Springfield, Ill., 1966.
12. Day, H. G., McCollum, E. V. *Proc. Soc. exp. Biol. Med.* 1940, **45**, 282.
13. Tucker, H. F., Salmon, W. D. *ibid.* 1955, **88**, 613.
14. Ott, E. A., Smith, W. H., Stob, M., Beeson, W. M. J. *Nutr.* 1964, **82**, 41.
15. Ott, E. A., Smith, W. H., Stob, M., Parker, H. E., Beeson, W. M. *J. Anim. Sci.* 1965, **24**, 735.

which the ætiological role of zinc deficiency was convincingly demonstrated. The present study indicates the necessity for more comprehensive investigations, at present in progress, of the distribution and metabolic fate of zinc in patients with psoriasis and other dermatoses.

We thank Prof. Sam Shuster and Prof. A. L. Latner for their advice and criticism of the manuscript.

Requests for reprints should be addressed to M. G., Department of Dermatology, Royal Victoria Infirmary, Newcastle upon Tyne 1.

MALCOLM GREAVES
M.D. Lond., M.R.C.P.

T. R. C. BOYDE
M.B. Lond., B.Sc. Durh.

University Departments of
Dermatology and Clinical Biochemistry,
Newcastle upon Tyne

The Lancet Office,
7, Adam Street, Adelphi, London, W.C.2