in a xylol-based or alcohol-based mountant.

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Effect of hyperglycaemia as assessed by glycosylated haemoglobin concentrations on red cell enzyme activities in diabetes mellitus

Our study was initiated to study the effects of hyperglycaemia on the key catalytic proteins of erythrocytes, namely, glucose-6-phosphate dehydrogenase, phosphohexose isomerase, and pyruvate kinase, in an attempt to understand known abnormalities that have been demonstrated in the erythrocytes of diabetics. These include reduced red cell deformability,[1] and increased erythrocyte half-life, along with other haematologic parameters, namely, increased leucocyte adherence, and change in platelet function in response to epinephrine as measured in a group of diabetics before and after achievement of glucose control.[2]

Interest in explaining the pathophysiology of the sequelae of diabetes mellitus has been sparked by the recognition that tissues which are not dependent on insulin for glucose transport are altered when exposed to excess glucose in diabetes. Changes resulting from the incorporation of glucose or its metabolic products have been observed in erythrocytes, as raised glycosylated haemoglobin concentrations,[3] in the accumulation of sorbitol in lens, sciatic nerve, and renal papilla, via the conversion of glucose by aldose reductase,[4] and an increase in glycosylation of hydroxylysine in the glomerular basement membrane in diabetics.[5] The latter effect has been postulated to account for the increased permeability of glomerular basement membrane in diabetics. In our study the glycosylated haemoglobin concentrations served as a measure of the degree of hyperglycaemia.

Glycosylated haemoglobins are synthesised throughout the life span of the mature erythrocyte by attachment of glucose to N-terminal valine of the betaglobin peptide chains by a post-translational nonenzymatic reaction.[6] This condensation process is practically irreversible under physiological conditions and depends on the circulating concentration of blood glucose; thus, the concentration of the glycosylated haemoglobin fraction reflects the plasma glucose concentration integrated over an extended period of time determined by the life span of the erythrocyte.[7] Glycosylation is an indiscriminate process and can affect all proteins containing free amino groups.

Blood samples were obtained from fasting diabetic patients managed as outpatients and in the emergency room and non-diabetic outpatients at the Kaiser Foundation Hospital in Honolulu. Assays were performed on fresh blood in batches consisting of equal numbers of diabetic and non-diabetic subjects.

Whole blood was used for the measurement of glycosylated haemoglobin, glucose-6-phosphate,[8] pyruvate kinase,[9] and phosphohexose isomerase[10] activities. Glycosylated haemoglobin was measured by cation exchange chromatography.[11]

As shown in the Table glycosylated haemoglobin concentrations were significantly raised in the diabetic group over the non-diabetic control. The three enzymes demonstrate insignificant variation in activity between diabetic and normal groups as indicated by the Student's *t* test. Plasma glucose concentrations among fasting diabetic outpatients ranged from 82 to 305 mg/100 ml (4·55 – 17 mmol/l). The red cell enzyme activities in two patients, who were initially seen in the emergency room, with highly raised plasma glucose concentrations (650 and 804 mg/100 ml (36 and 44 mmol/l)) and glycosylated haemoglobin concentrations (17·9 and 24·9 g/dl), were in the normal range—clearly demonstrating lack of effect of extreme hyperglycaemia on the activities of these enzymes. Although exposure to excess glucose has deleterious effects on some tissues, glucose-6-phosphate dehydrogenase, phosphohexose isomerase, and pyruvate kinase do not appear to be functionally altered in hyperglycaemia. However, the possibility remains that these proteins may be glycosylated at residues which do not affect the active site. McMillan *et al.*[1] postulate that observed reduction in erythrocyte deformability is caused by increased cytoplasmic viscosity due to glycosylation of haemoglobin. If this is the case, it is tempting to suggest that glycosylation of other soluble proteins in the red cell may contribute to this effect.

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Enzyme activities and glycosylated haemoglobin concentrations the erythrocytes of normal and diabetic subjects

	Normal		Diabetic		Significance
	No.	Mean ± SD	No.	Mean ± SD	
Glycosylated haemoglobin (g/dl)	41	7·97 ± 0·89	42	10·96 ± 3·32	p < 0·001
Glucose-6-phosphate dehydrogenase (IU/g Hb)	41	7·0 ± 1·0	42	6·8 ± 1·1	NS
Phosphohexose isomerase (IU/g Hb)	27	33·2 ± 5·5	30	34·1 ± 7·7	NS
Pyruvate kinase (IU/ml RBC)	27	2·60 ± 0·43	25	2·44 ± 0·52	NS

NS = not significant.

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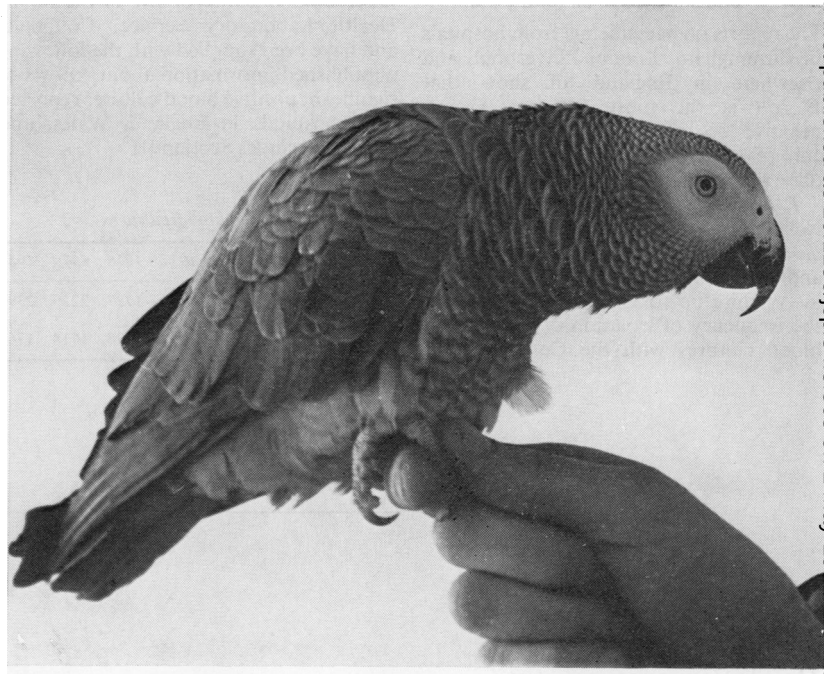

Polly-pica treated by xerography

In these days of photocopying it is difficult to know why so many reprints are requested. Below is one reason: it concerns our article which appeared at the front of this journal in 1977.[1] Extracts of a letter received from the PHLS Lab (Preston) are reproduced below.

"In this laboratory until the *J Clin Pathol* is sent to the binders they are kept well hidden. Recently, contrary to normal practice, two years' issues prior to binding were lent to an MLSO preparing for her examinations. She returned them after two days, white-faced and solemn with the following story:

Her pet parrot (Fig.), a bird that seldom flies or even walks, had been left alone in the room with the journals. On her return a half-eaten apple, a vandalised plant, and the front of *J Clin Pathol* 1977;**30**:1-12 were spread over the carpet.

May we please therefore request a reprint of your article.

As well as her interest in gastrointestinal pathology, "Polly" can whistle Col Bogey and blow raspberries. Her owner Mrs Catherine Seed sends her apologies."

We thought you would like to know that your journal is so widely appreciated and well chewed over.

AB PRICE*
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**Northwick Park Hospital, Harrow*
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Reference

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Aetiological agents and laboratory diagnosis of bacteraemic shock

In your report of a symposium on septic shock,[1] Dr Shanson claimed that "during the last 30 years in Britain the incidence of bacteraemias due to Gram-negative organisms has greatly increased." He gave the numbers of isolates from blood cultures during 1977 in a district hospital in London; *Escherichia coli* was the most frequent cause of bacteraemia.

In Ayrshire we have found that during the past two years *E coli* has decreased in importance as a cause of bacteraemia, probably due to increasing use of short courses of perioperative antibiotics for gastrointestinal and pelvic surgery. Thus from 1974-8, *E coli* was the most frequent pathogen isolated each year from blood cultures in Ayrshire. In 1979 the most frequent pathogen was *Staphylococcus aureus*, which was isolated from 27 (26%) of 102 patients with bacteraemia, *E coli* from 22%, and other coliform species from 14%.[2] In 1978 the most frequent pathogens were *E coli* from 28%, coliform species from 20%, and *Staph. aureus* from 15%. Isolates of *Bacteroides* species decreased from 9% in 1978 to 5% in 1979. The decrease in Enterobacteriaceae and *Bacteroides* species was associated clinically with fewer cases of bacteraemic shock.

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