ADRENAL FUNCTION IN DIABETES: AN INTERRACIAL STUDY

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Retinopathy appears to be an uncommon complication of diabetes among the Bantu when compared to European, Coloured and South African Indian diabetics.[1-3] An association between increased adrenal function and diabetic retinopathy has been suggested[4-12] and, as the urinary 17-ketogenic steroid output has been stated to be lower among non-diabetic Bantu than Europeans,[13] we wondered whether the relative freedom from retinopathy among Bantu diabetics might be related to decreased excretion of urinary steroids. This study has been primarily undertaken to provide evidence concerning this hypothesis.

Material and Methods

54 diabetics belonging to 3 racial groups were examined, comprising 23 Bantu, 16 European and 15 Coloured patients.* None of these had any retinal complication. Two separate 24-hour urine collections were made and the quantities of 17-ketosteroids and 17-hydroxycorticoids (OHCS) in each specimen were measured.

The 3 racial groups were age-matched and an approximately equal number in each group were on the same therapy — i.e. insulin, an oral hypoglycaemic agent, or diet alone. No patient had recently been in coma or had myocardial ischaemia. Blood urea and chest radiographs were normal in all patients.

Urinary steroid levels were also measured in 18 non-diabetic Europeans and 22 non-diabetic Bantu. Total 17-ketosteroids were assayed by the method of Norymberski *et al.*[14] (1953) and 17-hydroxycorticoids by the method of Appleby *et al.*[15] (1954).

Results

1. *Non-diabetic controls — Bantu and European (Table I).* The mean 24-hour hydroxycorticoid excretion among 22 non-diabetic Bantu was 11·9 mg. compared to 10·5 mg. among 16 non-diabetic Europeans. Eight male Bantu had a lower mean ketosteroid output than 9 male Europeans (11·2 mg. per 24 hours compared to 14·4 mg. per 24 hours). The female Bantu had slightly higher levels than Europeans (11·3 compared to 10·4 mg). None of these differences are significant.

2. *Diabetics compared to non-diabetics (Table I).* The mean hydroxycorticoid excretion was slightly higher among 31 European diabetics (13·2 mg per 24 hours) than among

*'European' refers to all 'White' (Caucasian) persons. 'Coloured' refers to the Cape Province people of mixed European and Hottentot origin with some Bushman and later Bantu addition.

TABLE I. URINARY STEROID OUTPUT IN DIABETIC AND NON-DIABETIC ADULTS (*mg. per 24 hours*)

	European						*Bantu*					
	Diabetic			*Non-diabetic*			*Diabetic*			*Non-diabetic*		
17-hydroxycorticoids	**13·2**	(6·6)	[31]	**10·5**	(4·6)	[16]	**11·2**	(3·6)	[23]	**11·9**	(4·5)	[22]
17-ketosteroids:												
Male	**13·8**	(4·6)	[12]	**14·4**	(6·7)	[9]	**12·7**	(4·1)	[14]	**11·2**	(3·0)	[8]
Female	**11·6**	(4·4)	[21]	**10·4**	(4·7)	[9]	**13·7**	(5·0)	[10]	**11·3**	(2·9)	[14]

Figures in round brackets (5) = S.D. Figures in square brackets [5] = No. of subjects.

16 non-diabetic Europeans (10·5 mg. per 24 hours). Male ketosteroid levels were slightly lower among diabetics, but the female levels slightly higher. None of these differences are significant.

Bantu diabetics had slightly lower hydroxycorticoid levels than non-diabetics, but both male and female Bantu diabetics had higher ketosteroid levels than non-diabetics. Again, none of these differences are statistically significant.

3. *Diabetics of 3 racial groups (Table II).* The mean hydroxycorticoid excretion was 11·2 mg. per 24 hours among 23 Bantu diabetics. This was slightly higher than the mean excretion of 16 European diabetics (11·0 mg. per 24 hours) and 11 Coloured diabetics (10·3 mg. per 24 hours). Owing to the wide range, none of these differences are statistically significant. Likewise, the ketosteroid excretion was slightly but not significantly higher among Bantu males and females. 14 Bantu male diabetics had a mean 24-hour excretion of 12·7 mg. compared to 12·6 mg. among 8 Coloured male diabetics, and 11·9 mg. per 24 hours among 6 European male diabetics. 10 Bantu female diabetics had a mean 24-hour ketosteroid excretion of 13·7 mg. compared to 13·1 mg. among 7 Coloured female diabetics, and 13·7 among 8 European female diabetics.

TABLE II. URINARY STEROID OUTPUT IN DIABETES: A COMPARISON OF 3 RACIAL GROUPS (*mg. per 24 hours*)

	European		*Coloured*		*Bantu*	
17-hydroxycorticoids ..	**11·0**	[16]	**10·3**	[11]	**11·2** (3·6)	[23]
17-ketosteroids:						
Male	**11·9**	[6]	**12·6**	[8]	**12·7** (4·1)	[14]
Female	**13·7**	[8]	**13·1**	[7]	**13·7** (5)	[10]

Figures in round brackets (5) = S.D.
Figures in square brackets [5] = No. of subjects.

Discussion

The urinary output of ketogenic steroids (KGS) has been reported to be lower in non-diabetic Bantu than in non-diabetic Europeans.[13] We have not confirmed this (at least with regard to 17-OHCS); in fact the mean 17-OHCS output in our normal Bantu group was higher than that in the European group.

Earlier work suggested that the output of adrenal steroids was considerably higher in diabetics than in non-diabetics.[16-19] Our results do not support this, although the mean 17-OHCS was higher in our European diabetics than in the European controls. The two levels were 13·2 and 10·5 mg. per 24 hours and the difference is not statistically significant. Jakobson's thorough study[20] of European patients also failed to reveal any significant difference in 17-KGS output, in 17-OHCS output or in plasma cortisol levels between diabetics and non-diabetics, except that he found a 'just significantly' increased output of 17-KGS only following corticotrophin (ACTH) stimulation of the adrenals in the diabetic group.

Turning to the diabetics in the 3 racial groups, we found no significant differences among their urinary steroid outputs under 'resting' conditions. (We did not examine the steroid levels after ACTH administration.) We found no support, then, for the idea that the low incidence of vascular disease in Bantu diabetics might be related to a lower adrenal steroid output. None of the diabetics in our series had evident retinopathy at the time of testing, but it is reasonable to assume that a large proportion must be 'potential retinopaths', since we have found that 50% of our Coloured and European patients with diabetes of over 10 years' duration develop this condition.[2]

SUMMARY

The urinary output of 17-ketosteroids and 17-hydroxycorticoids has been studied in 54 diabetics belonging to 3 racial groups—European, Coloured and Bantu—and in 40 European and Bantu non-diabetics. We found:

1. No significant difference in urinary steroid output between non-diabetics of the two races — European and Bantu.

2. No significant difference in urinary steroid output between diabetics and non-diabetics, either European or Bantu.

3. No significant difference in urinary steroid output among diabetics of the 3 racial groups. The rarity of diabetic retinopathy among Bantu is therefore probably unassociated with lower adrenal cortical activity.

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