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Prisoners of XYY Constitution: Biochemical Studies

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The XYY constitution has achieved some measure of clinical definition, having been found in association with tallness, asocial personality, dilution of intelligence (Griffiths, 1971) and a tendency to psychopathic disorder (Griffiths, Richards, Zaremba, Abramowicz and Stewart, 1970). In addition, neurological, endocrinological, skeletal and other abnormalities have been reviewed (Griffiths, 1971), and the condition, like mongolism, has come to be regarded as affecting many systems of the body to a greater or lesser extent. Biochemical investigations, hitherto largely concerned with sex hormones, especially testosterone, have in general revealed no significant difference from matched controls. Some authors have, however, reported increased plasma testosterone levels both in 46 XY and 47 XYY patients of maximum security hospitals as compared to patients in other psychiatric hospitals and to the general population (Ismail, Harkness, Kirkham, Loraine, Whatmore and Brittain, 1968; Rudd, Galal and Casey, 1968; Price and Van de Molen, 1970). The pre-eminent desirability of rigorously selected controls has been remarked on in these investigations.

A cytogenetic survey has been proceeding among consenting prisoners of height 71 inches (cm. 180.3) or over, resident in a large London prison, mainly for recidivists. Leucocytes were cultured from 10 ml. venous blood by the technique of Moorhead, Nowell, Mellman, Battips and Hungerford (1960), the preparations being air-dried and stained by Giemsa. Out of 446 specimens successfully cultured 12 were karyotype 47 XYY. Sociological, criminological and psychological features of most of these individuals have been reported elsewhere (Griffiths, Richards, Zaremba, Abramowicz and Stewart, 1970; Griffiths, 1971), and the present communication is concerned with biochemical investigations undertaken on the 9 individuals of XYY constitution who were available for study.

Each subject was matched with a control of normal karyotype whose age lay within twelve months, height within three inches, and who with one exception had been admitted to the prison nearest in time to the subject. (The exception arose because in one control venepuncture was unsuccessful, so the next most closely admitted control was selected instead.) Data concerning age, height and weight are presented in Table I.

TABLE I

Height, weight and age of nine XYY subjects and their controls

	9 XYY subjects			9 controls		
	Height (metres)	Weight (kg.)	Age (years)	Height (metres)	Weight (kg.)	Age (years)
Mean	1·88	76·3	27·7	1·86	80·3	27·3
± S.D.	0·063	4·40	5·41	0·062	12·4	5·34
± S.E.M.	0·021	1·47	1·80	0·020	4·15	1·78

6 out of 9 subjects were taller than their controls

All procedures took place as far as possible under identical conditions. Subjects and controls were at rest in the prison hospital for 24 hours preceding venesection, which took place at the same time of day and after 16 hours fasting. Laboratory measurements were performed 'blind'. Serum insulin and growth hormone measured by radioimmunoassay, and blood glucose measured by glucose oxidase, were determined in fasting subjects and serially after the ingestion of 50 g. glucose. Plasma-protein-bound iodine, cholesterol, T3 resin uptake and testosterone measured by competitive protein binding, were estimated in the fasting sample only. Twenty-four hour urinary creatinine, 5HIAA and VMA were measured by conventional laboratory methods. Urinary cortisol was measured by the MRC's recommended method for the determination of plasma corticosteroids.

Results

These are shown in Table II and the graph. Data were examined by the Wilcoxon (2-tailed) signed ranks test. With regard to the curves, fasting, maximum, minimum and summated serial values were compared. Significant differences between subjects and controls emerged only in respect of the following variables:

Fasting plasma P B I concentration lower in XYY group ($0{\cdot}02 < P < 0{\cdot}05$).

Maximum blood glucose concentration lower in XYY group ($P = 0{\cdot}05$).

Fasting plasma HGH concentration higher in XYY group ($0{\cdot}02 < P < 0{\cdot}05$).

Sum of serial values in each curve of plasma HGH concentration higher in XYY group ($P = 0{\cdot}05$).

The differences in growth hormone concentration were related to the slightly increased stature of subjects as compared with their controls (coefficient of correlation 0·48: $P = <0{\cdot}05$).

Discussion

Our findings confirm the conclusion reached by most other workers (Goodman, Smith and Migeon, 1967; Rudd, Galal and Casey, 1968; Ismail, Harkness, Kirkham, Loraine, Whatmore and Brittain, 1968; Wiener, Sutherland, Bartholomew and Hudson, 1968; Nielson, Yde and Johansen, 1969; and Santen, De Kretser, Paulsen and Vorhees, 1970) that the XYY constitution is not associated with abnormal testosterone secretion. Indeed significant differences emerged in respect of only 3 biochemical variables, and one of these, plasma growth hormone, was related to stature, the higher concentration in the XYY group being at least in part a reflection of their slightly greater average height. This, of course, by no means negates the possibility that the unusual tallness of XYY subjects is growth hormone mediated. Nevertheless, our results are not incompatible with reports of plasma growth hormone levels within the normal range in the small number of individuals

Table II

Comparison of biochemical parameters (Mean ± S.E.M.) and range of results in 9 XYY subjects and their controls

	Fasting plasma				24 hour urine			
	PBI μg./100 ml.	T_3 uptake	Cholesterol mg./100 ml.	Testosterone μg./100 ml.	Cortisol μg.	Creatinine g.	5HIAA mg.	VMA mg.
Normal range ..	3·5–7·5	0·8–1·15	150–320	0·7–1·7	80–375	1·1–2·5	<10	<7
Subjects XYY ..	5·58±0·26 (4·0–6·5)	0·98±0·01 (0·92–1·01)	185±13 (145–260)	1·02±0·07 (0·65–1·4)	359±99 (81–865)	1·7±0·2 (0·8–2·6)	4·52±0·5 (3·1–8·3)	4·05±0·5 (2·1–6·7)
Controls ..	6·34±0·19 (5·1–7·0)	0·98±0·01 (0·91–1·08)	220±18 (140–295)	1·14±0·14 (0·46–1·7)	243±38 (96–485)	1·9±0·1 (1·4–2·6)	6·18±0·6 (4·0–9·5)	3·8±0·6 (1·8–7·1)
P	<0·05	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

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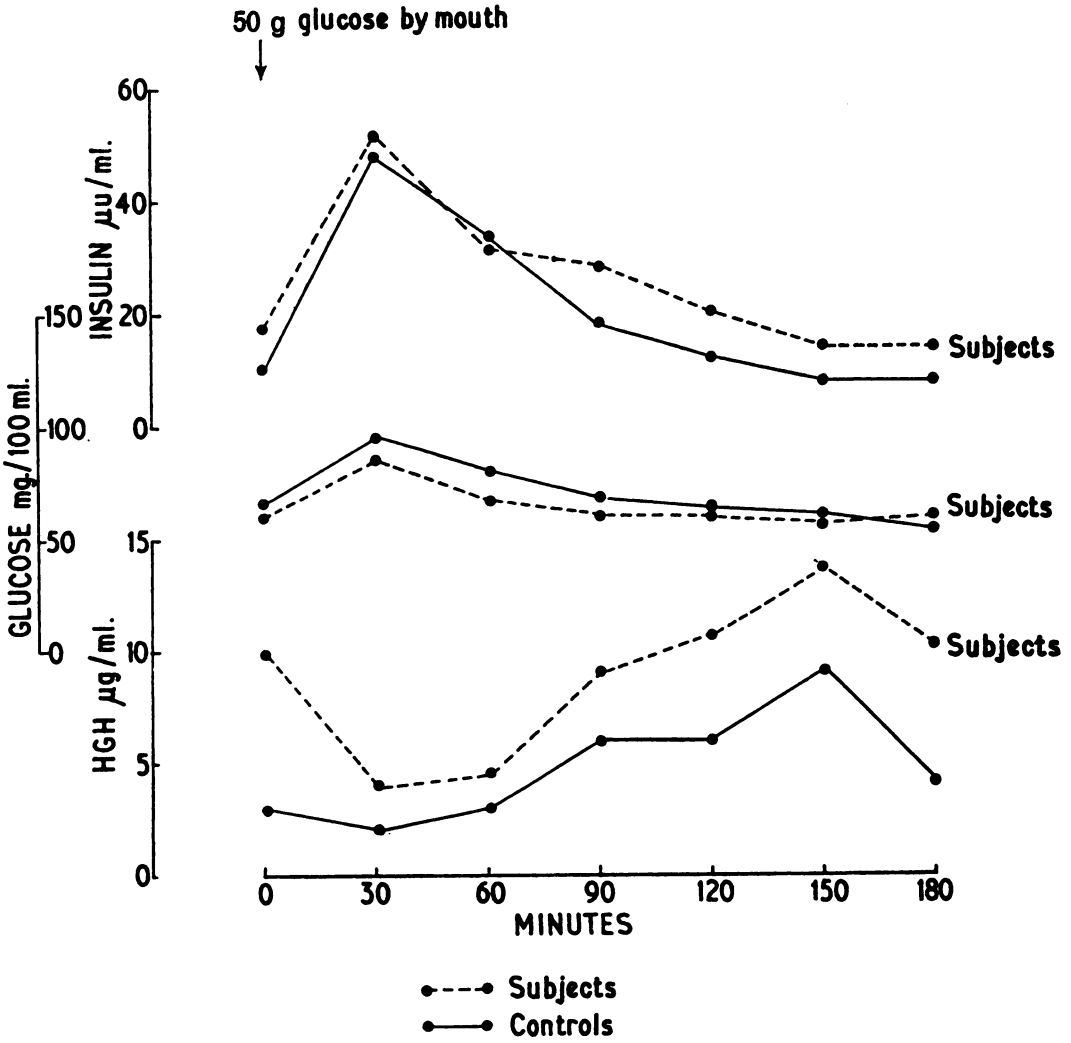

of XYY constitution studied by previous workers (Nielson, Yde and Johansen, 1969; Lundberg and Wahlstrom, 1970).

The correlation between height and mean plasma growth hormone levels after glucose is an interesting side finding of this investigation, and appears to indicate that suppression of HGH secretion by hyperglycaemia is less efficient in taller subjects and may indeed be causally related to body height.

As might be expected in healthy young adults, the glucose tolerance curves were generally somewhat flat. In both groups there was a close similarity, only maximum levels being significantly different at the 0·05 level.

It would be premature at this stage to attempt to explain the decreased P.B.I. and maximum blood glucose levels which were demonstrated in the XYY group. The former finding could reflect either a decrease in thyroid function or, more likely, some difference in thyroid-binding globulin between XYY constituted individuals and normal subjects.

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