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SHORT COMMUNICATION

URINARY EXCRETION OF ANDROSTERONE AND ETIOCHOLANOLONE IN OBESE WOMEN: CORRELATION WITH THE CELLULARITY OF ADIPOSE TISSUE

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SUMMARY

Urinary androsterone and etiocholanolone and the number and the size of fat cells were measured in 43 non diabetic, non hypertensive, non dislipidemic obese women without clinical evidence of any endocrinopathy. Androsterone and the androsterone/etiocholanolone ratio were significantly ($P < 0.005$) higher in the obese women. The androsterone/etiocholanolone ratio was significantly ($P < 0.01$) correlated with the mean fat cell weight. These findings might be in keeping with the frequent cases of oligo-amenorrhea and of slight hypertricosis that can be frequently observed in obese women.

Investigation of urinary excretion of steroids in obesity has often led to conflicting results [1–4]; recently we have found a significant increase of urinary androsterone in obese women [5].

To clarify the interrelation between hormonal impairment and obesity, we have compared urinary androsterone and etiocholanolone with body fat, mean fat cell weight and mean total number of fat cells in a group of obese women.

We examined 43 obese women (mean body weight 93 ± 19 Kg S.D.; mean body fat 43 ± 12 Kg ± S.D.; mean fat cell weight 1.08 ± 0.25 pg ± S.D.; mean total fat cell number $4.1 \pm 1.5 \times 10^{10} \pm$ S.D.) and 28 normal women as controls.

Their ages ranged from 18 to 40 years. All had normal cardiac, hepatic and renal functions. None were diabetic, hypertensive, dislipidemic and none showed clinical evidence of any endocrinopathy. During the investigation period they maintained stable weight, no drugs were used and they ate *ad libitum*.

Androsterone and etiocholanolone were measured in 12 h urine, collected from 18.00 to 06.00 h, during the preovulatory period. We adopted a gas-chromatographic method using a glass capillary column according to Sommerville and Ros [6]; this method gives a coefficient of variation ranging from 2.6% to 7.7%, and a recovery of 90% for androsterone and 83% for etiocholanolone.

Total body fat, and mean size and number of fat cells were determined by the method used by Sjöström *et al.* [7].

Statistical elaboration of data used Student's "*t*" test to compare means, and the "*r*" calculation for linear regression.

Urinary androsterone was significantly ($P < 0.005$) higher in obese women than in controls (Table 1). Urinary etiocholanolone was, on the contrary, the same for both groups. As a consequence the androsterone/etiocholanolone groups. As a consequence the androsterone/etiocholanolone ratio (An/Et) was significantly ($P < 0.005$) higher in obese women. Table 2 gives the values of linear regression correlation coefficients between hormonal data and adipose tissue data in obese women. The correlation between androsterone/etiocholanolone ratio and mean fat cell weight was statistically significant ($r = 0.44$; $P < 0.01$). Increased urinary excretion of androsterone in obese women seems tied to the increased amount of urinary glucocorticoids already a common feature of obesity [8, 9]. This probably is a consequence of increasing weight, and is completely reversible [10].

The meaning of normal urinary excretion of etiocholanolone and of the consequent androsterone/etiocholanolone ratio in obese women is not clear, however. Furthermore the significant correlation between the androsterone/etiocholanolone ratio and mean fat cells weight in obese women suggest a peculiar significance of this hormonal ratio. The increased androsterone/etiocholanolone ratio shows a higher conversion of androgens into their 5-α metabolites, which are the most active.

We think this hormonal alteration might cause the frequent cases of oligo-amenorrhea manifested in obesity.

The high incidence of slight hypertricosis in obese women could also be explained by this hormonal alteration. However the correlation of high androsterone/etio-

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Table 1. Urinary androsterone and etiocholanolone levels (MG/12 h SD) and androsterone/etiocholanolone ratio (An/Et) in normal and obese women

	Normal women	Obese women	*P* Value
Androsterone	0.50 ± 0.29	0.80 ± 0.49	< 0.005
Etiocholanolone	0.49 ± 0.34	0.50 ± 0.40	NS
An/Et	1.26 ± 0.80	1.90 ± 1.00	< 0.005

Table 2. Correlation coefficients between steroid data and data concerning total body fat and adipose tissue cellularity in obese women

	Total body fat	Total fat cells number	Mean fat cell weight
Androsterone	− 0.13	− 0.22	0.16
Etiocholanolone	− 0.14	− 0.19	− 0.08
An/Et	0.10	− 0.25	0.44*

* $P < 0.01$.

cholanolone ratio with real hirsutism, as Hendricks *et al.* seem to propose [4] is not confirmed by our findings.

Finally we must remember that plasma androsterone is in correlation with caloric food intake [11] and its level falls during fasting or during strongly hypocaloric dieting. These findings, together with those showing a drop in plasma Testosterone during oral glucose tolerance tests [12], suggest an interrelation between androgens, energy balance and, as a consequence, modifications of body weight.

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