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RESPONSES TO SUSTAINED USE OF ANABOLIC STEROID

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ABSTRACT

Description is given of six body-builders who had been taking Methandrostenolone (up to 20 mg/day in intermittent courses for a year or more). At the time of examination there was no subjective disturbance of sexual function, but testosterone levels were low relative to laboratory standards and luteinizing hormone levels were also reduced – particularly in relation to testosterone concentrations. Abnormal liver function tests were seen in three of the six subjects, and one had mild diabetes with high serum cholesterol, triglycerides and uric acid. The weight gain of the group was not outstanding, and the only possible positive finding was a high haemoglobin and haematocrit in one of the six subjects.

INTRODUCTION

Committees supervising human experimentation are understandably reluctant to authorise controlled trials involving more than brief and relatively light courses of anabolic steroids (Sperryn, 1975). There is thus some interest in the case reports of athletes who admit using moderate quantities of such compounds over extended periods.

MATERIAL

The subjects were six members of a body-building club. All treated themselves with methandrostenolone (Dianabol, Fig. 1); the first subject admitted to using the preparation for many years, while the other five subjects had been taking Dianabol over a period of 7-10 months. In an attempt to avoid side-effects, courses of 3 weeks to 3 months duration were being alternated with equal "rest" periods. Recent dosage is summarized in Table 1. Methandienon: "Dianabol" in U.K., "Danabol" in U.S.A. and Canada."

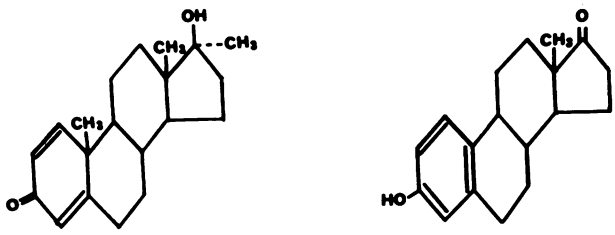

Figure 1. Chemical structure of methandrostenolone ("Dianabol" and Oestrone).

TABLE I

Characteristics of six athletes treating themselves with anabolic steroids

Subj.	Age (yr)	Height (cm)	Weight (kg)	Excess weight* (kg)	Dosage of Dianabol**
1	52	163.8	79.5	18.2	15 mg/day, terminated 3 wk ago
2	23	174.0	80.9	12.3	10 mg/day, terminated 2 wk ago
3	33	167.6	86.4	22.3	10 mg/day, 6th wk of present course
4	31	172.7	85.0	17.3	10 mg/day for 3 months, stopped 7 months ago
5	30	170.2	63.6	2.3	10 mg/day, terminated 4 wk ago
6	25	182.9	101.8	25.9	20 mg/day, 8th wk of present course

* *relative to modified actuarial standards (Shephard, 1974).*

** *the recommended clinical dose is 5 mg/day, although there are examples in the literature where 10-100 mg have been administered for short periods (Harkness, Kilshaw et al., 1975; Hervey, 1975).*

All subjects were also consuming large quantities of protein powder and wheat germ oil, obtained from a local health-food store. Body-building training was carried out six times a week, individual sessions lasting 2-3 hours. On three days, attention was directed to individual muscle groups of the shoulders and chest; typical activities included 8-10 repetitions of 110-140 Kg "bench presses", 45-70 Kg biceps "curls", and 45-70 Kg triceps "french-presses". On alternate days the emphasis was on the leg and abdominal muscles.

In addition to a history and clinical examination, detailed measurements were of blood composition (haemoglobin, haematocrit, white cell count), liver function (S.G.O.T., alkaline phosphatase), endocrine function (plasma testosterone (Ismail, Niswander et al., 1972), plasma luteinizing hormone LH (Faiman & Ryan, 1969), plasma follicular-stimulating hormone FSH (Faiman & Ryan, 1969), blood sugar, serum thyroxine, and T-3 resin uptake†) and general metabolism (serum cholesterol, serum uric acid). Except where specifically referenced, standard clinical techniques were used for the various estimations, and normal values for our laboratories are shown in Table II.

† Radioactive tri-iodothyronine, T-3, is added to the patient's serum, and after an appropriate incubation period unbound T-3 is taken up by a resin sponge.

RESULTS

The clinical examination of the six subjects disclosed no remarkable features. None of the group had noted any loss of sexual function or other symptoms during the period that they had been taking the drug. Subject No. 1 was unmarried, but despite many years of Dianabol treatment claimed that he still "chased the girls" with great vigour. All except one of the group had some excess weight relative to the ideal for a person of their height (Shephard, 1974). Subject No. 1 had no clear recollection of his original weight; subject No. 6 had gained 14 Kg, and the remainder of the group had gained 7-9 Kg over the period of treatment and training. We have no evidence on the relative contributions of muscle, fat and water to this weight gain. However, it is fair to comment that both the gain and the final excess weight is much smaller than that seen in many body-builders. It could easily have been attained by a combination of selection and training without recourse to drugs.

It was only possible to obtain blood samples from the group on one occasion. Clinical test results are thus

TABLE II

Clinical test results for six athletes treating themselves with anabolic steroids. Abnormal findings marked with an asterisk

Variable	Laboratory normal	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Subject 6
Current dosage (see Table I)	–	No	No	Yes	No	No	Yes
Blobd composition							
Haemoglobin (g/100 ml)	14-16	15.5	14.9	14.4	15.4	15.5	16.8*
Haematocrit (%)	43-47	44	42*	44	44	45	49*
White cell count (/mm^3)	4000-9000	4900	5600	3300	7300	–	–
Liver function							
S.G.O.T. (units)	5-19	10	35*	17	14	12	27*
Alkaline phosphatase (units)	25-90	107* 105*	77	55	88	81	90(*)
Endocrine function							
Plasma testosterone (ng/100 ml)	400-1000	439	362*	104*	399*	726	189*
Luteinizing hormone (μg/100 ml)	2-10	<0.5*	0.5*	3.4	<0.5*	<0.5*	3.1
Follicle stimulating hormone (μg/100 ml)	10-35	48.7*	19.6	9.4*	8.1*	11.3	8.5*
Serum thyroxine (μg/100 ml)	4-11	8.5	4.2	4.6	8.2	11.4*	4.1
T_3 resin uptake (%)	25-35	31	42*	39*	32	30	43*
General metabolism							
Blood sugar (mg/100 ml)	< 110	125* 118*	76	58	56	–	–
Serum cholesterol (mg/100 ml)	<220	223* 233*	248*	194	161	206	188
Serum triglycerides (mg/100 ml)	50-145	349* 185	88	76	111	88	82
Serum uric acid (mg/100 ml)	3-7.6	8.5*	3.2	4.5	5.6	–	–

compared with the normal range for our laboratory.

Subject No. 1 had an elevated blood sugar, and a glucose tolerance curve revealed a previously unrecognised mild diabetes, easily treated by a regulation of his diet.

The blood composition (Table II) was not particularly abnormal, although one of the two subjects who was actually taking the Dianabol at the time of study showed a moderate elevation of both haemoglobin and haematocrit readings.

Liver function tests showed elevation of S.G.O.T. in two of the six subjects (including the man with a high haemoglobin level) and an increase of serum alkaline phosphatase in two subjects.

Testosterone levels were depressed in 4 of the 6 subjects, this being most evident in those taking Dianabol at the time of sampling. Luteinizing hormone levels were very low in four subjects, and in the remaining two were low relative to the testosterone levels. Follicle-stimulating hormone levels were slightly depressed in three subjects, but substantially increased in a fourth. Since gonadotrophins are secreted episodically throughout the day, unusual isolated values must be interpreted with caution. Serum thyroxine was generally normal, but in three subjects the T- resin uptake was increased; this is probably due to a diminution of thyroxine-binding globulins in the serum.

The subject who had treated himself most persistently with the Dianabol showed serum cholesterol, triglycerides and uric acid values that were all greater than normal.

COMMENT

An ever-increasing proportion of athletes in "muscular" sports have been treating themselves with anabolic steroids. In 1976, for the first time, Olympic victors were disqualified for this practice. Medical scientists have disputed both the safety and the effectiveness of steroid administration (Williams, 1974; Sperryn, 1975; Kochakian, 1976). Postulated dangers have included disturbances of liver function, depression of sexual function, oedema, an increase of prothrombin time, impaired glucose tolerance, increased blood cholesterol, and premature union of epiphyses.

Some athletes have reputedly taken doses of as much as 100 mg of "Dianabol" per day, and against this background intermittent doses of 10-20 mg per day must be regarded as "moderate". Nevertheless, three of our six subjects showed some impairment of liver function relative to anticipated normal values, and the man who had used Dianabol for the longest total period showed mild diabetes, with an abnormal glucose tolerance curve. The abnormalities of cholesterol and triglyceride levels in his case could be due to the diabetes, although there have been previous reports suggesting that prolonged use of Dianabol increases the serum cholesterol (Wynn, 1975).

Despite the absence of clinical complaints regarding sexual performance, there was plainly a marked depression of both testosterone levels and levels of luteinizing hormone; levels of follicle-stimulating hormone were also somewhat reduced in three subjects, including the two currently receiving Dianabol.

The mechanics whereby Dianabol affects pituitary gonadal function remains to be completely resolved. Among possible hypotheses (i) Dianabol could replace testosterone in the negative feedback system (Fig. 2), suppressing gonadotrophin release from the pituitary by either a direct action on the pituitary gland or a suppression of the hypothalamic release of luteinizing hormone releasing hormone (LHRH).

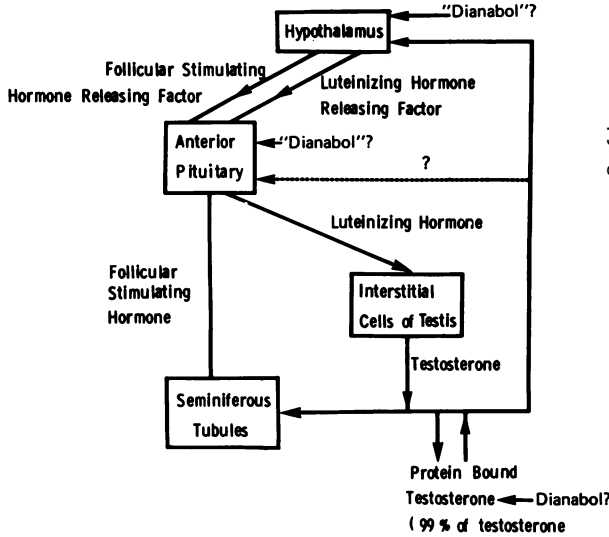

Figure 2. The relationship between the testis and the hypothalamus.

(ii) Dianabol could displace testosterone from testosterone-binding globulin (TeBG) – the serum protein which binds testosterone during its transport through the blood. This displacement would increase blood levels of free, unbound testosterone, suppressing gonadotrophin release by normal testosterone feedback mechanisms.

(iii) Dianabol could decrease the synthesis of testosterone-binding globulin in the liver. This would have an effect similar to the displacement of testosterone from TeBG.

These hypotheses are not mutually exclusive, and all three mechanisms could thus contribute to the overall effect.

Previous unpublished experiments with healthy young subjects (Killinger & Goode) suggest that the depression of testosterone levels and associated reductions in sperm count are temporary phenomena; with a 3 week course, recovery occurred within 2-3 weeks of ceasing treatment. In the present study also, the main effect was observed in the two athletes who were still taking the drug (Table II). Providing there is no obvious loss of libido, reversible changes of testosterone levels may be of little practical concern to a young unmarried athlete.

The only evidence on the effectiveness of the therapy is the apparent increase of red cell mass in subject 6. This observation must be interpreted with caution, since the haematocrit could be influenced somewhat by the water retention which also complicates estimates of muscle hypertrophy.

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