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Anabolic Steroids and Enhanced Aggressiveness
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**Anabolic Steroids and Enhanced Aggressiveness**

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The actual effect of doping agents is no precondition for a doping offense, so that any psychological side-effects in particular are not relevant for the analytical laboratory. But enhanced aggressiveness seems to play an increasing role in forensic toxicology in connection to violent crimes.

In those cases, the question of causality arises, and the courts have to decide whether an enhanced aggressivity possibly caused by doping agents might give reason of diminished responsibility for the criminal behaviour, possibly even for the exclusion of guilt (in German “Schuldfähigkeit” or “inability to be guilty”).

When having asked for several corresponding expertises and expert witnesses in courts during the recent years, we began a literature survey on the problem of the postulated enhancement of aggressiveness. In total, we have found more than 100 associated papers, which of course cannot be commented here in detail. The principal results, observations, the different opinions, possible conclusions and the remaining questions can only be outlined in this frame.

Aggressivity is a behavioural phenomenon; it can be approached only by psychological terms and tests, and it implies genuinely subjective aspects of evaluation, not being comparable at all with our analytical findings. Therefore it must be expected, that objective conclusions seem not to be the most probable outcome.

An objective approach to the effect in question of anabolic steroids could be seen in animal experiments, and in addition those would encounter less ethical impediments than studies on human beings.
Numerous studies of behavioural changes of animals by anabolic steroids have been found to

- motoric activity
- dominance or submission
- couple fights
- sexual activity.

Unfortunately, the meaning of the observations is mostly weakened by several marginal factors like

- different species
- sometimes small numbers of animals
- different agents
- combinations of several agents
- greatly varying dosages
- usage of various specimens (blood, urine, saliva) and of different methods for analysis
- differing durations of medications and/or observations
- influence of strongly varying endogenous steroids onto the action of exogenous agents.

A generalisation of the observations is therefore hardly possible, and the transformation to humans has the well-known additional uncertainties. But that psychic factors play no role in animals is an advantage with respect to the objectivity of observations.

In the light of the final aim of the evaluation, we have to take into consideration even the opposite fact: a human being is no animal due to his or her conscious control of their own. Any "animalic" component of an external effect should normally be additionally controlled in men compared to animals, and just the loss of control under the influence of drug would be the deciding criterion of diminished poenetarial responsibility.

Examples of studies on animals
LUMIA et al. (1994) reported results on gonadally intact rats under high doses testosterone propionate (in parallel to propylene glycol as a vehicle control) three times
a week for 10 consecutive weeks. While not any parameter of sexual activity (copulation frequency etc.) was altered, aggressivity was increased. The males exerted more often dominance and threat, less submission, but no increase of body contacts in the sense of fight.

BRONSON et al. (1996) reported observations on female mice under application of four anabolic steroids in doses either equal or five times higher than the maintenance level for male mice.

There was no influence onto the recovery time after exercise stress (enforced treadmill running). Increased aggressiveness and other behavioural chances were not proportional to the dose. (A suspected threshold dose would be well below the common dosage in female athletes or body builders.)

MARTINEZ SANCHIS et al. (1996) came to an opposite conclusion after administering stanozolol to young and adult mice. Although there was trend of a slight increase of aggressiveness in young animals and rather the opposite effect in the older ones, there were no significant differences in “ethologically assessed social behaviour including aggression”.

Studies on humans
To make a comparison easier and to show the difficulties of generalisation, some examples for studies on humans are presented in Table 1.

Most authors confess a low overall significance of their results concerning the correlation between anabolics and aggressiveness, and the more of a respective causality. This refers also to the majority of the papers not commented here.

Nevertheless, the following consideration lets guess a rather low probability of a strong influence of anabolics onto aggressiveness in the sense of offenses against life and health of humans: the worldwide population of anabolic (mis)users counts certainly for millions. In case of a causality the violent outbursts had probably led to an undisputable incidence and correlation since long. So we assume, that the possible connection was restricted to a “weak aggressiveness” like the readiness and urge to compete, feeling of irresistible power and superiority, “elbow-behaviour” etc.
Violence to the harm of others seems to be exceptional and/or caused by complex conditions. 
So this correlation remains an uncertain possibility in our opinion.

Factors to be considered are
- the practically unavoidable preselection of study groups (prisoners, violent offenders, athletes, adolescents instead of average population) can by definition not be representative for human beings in general, and even the readiness to take part in studies implying the administration of anabolics constitutes a certain preselection
- the special emphasis onto the retrospective investigation of psychic "outbursts" has to take into consideration a possibly preexisting psychopathology
- partly small groups of individuals studied
- studies partly relying on self-evaluations of the individuals studied
- subjective moments of observations hardly avoidable in not-blinded studies
- often inadequate control groups
- agents, dosages and time schedules of administration partly unknown, unprecise or uncertain (black market origin), combinations
- expectancy of effects might influence behaviour and self-evaluation.
- possible dominance of additional factors (other hormones, alcohol, drugs, pharmaceuticals, social environment).

Therefore one should try to find a way to score the surveyed papers according to their content of objective information, to their significance for generalisable conclusions.
Table 1  Literature observations on associations between anabolics and aggressiveness

<table>
<thead>
<tr>
<th>Author(s), Year</th>
<th>Population</th>
<th>Anabolics, dosage</th>
<th>Observations</th>
<th>Conclusions, comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Endogenic anabolics</strong></td>
<td></td>
<td></td>
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<tr>
<td>Ehrenkranz et al. 74</td>
<td>36 male prisoners 12 chronic aggressive 12 social dominant 12 control</td>
<td></td>
<td>correlation of testosterone to dominance</td>
<td></td>
</tr>
<tr>
<td>Bergman et al. 94</td>
<td>18 imprisoned wife-beaters</td>
<td></td>
<td>psychological characterisation; T-level correlates only marginal; alcohol and drugs dominante the asocial behaviour</td>
<td>reflects necessarily preselection</td>
</tr>
<tr>
<td>Brooks et al. 96</td>
<td>194 male offenders 15 – 17 y serum testosterone</td>
<td></td>
<td>violent offenders (n = 75) had higher T levels than sexual (n = 17) or nonviolent offenders (n = 102)</td>
<td>ethinical differences, strange criteria</td>
</tr>
<tr>
<td><strong>Studies with positive correlation of anabolics use / psychic effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Burnett et al. 94</td>
<td>24 adolescent athletes with reported use 24 nonusers 24 nonathletic adolescents substances and dosages not known</td>
<td></td>
<td>users had more depressions, anger, mood disturbances only significant: users vs. control users vs. nonusers not significant</td>
<td></td>
</tr>
</tbody>
</table>
Frequency of not wearing a passenger seat belt, sexual behaviour, and its consequences.

High-risk behaviour:

During study exclusion of 2 only 5 people.

Participants showed slower performance, higher aggression, and higher feelings of anxiety and hostility.

Other changes included significant changes in self-confidence and self-esteem.

During the on-street periods, verbal aggression and physical aggression towards others were high.

Several athletes reported significantly higher feelings about hostility / aggression:

Using substances than when not using them.

(Users reported significantly more violence, theft, and truant behavior than non-users.)

Only self-reported violence or last 6 months.

Several athletes interviewed about 4 months (non-users).

Observations

Population

Author(s)

Year
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<tr>
<td><strong>Björkqvist et al. 1994</strong></td>
<td>27 males (40 mg Testosterone/day, 1 week placebo control)</td>
<td>self-evaluation and clinical examination: <strong>placebo group showed signif. higher effect</strong></td>
<td>but: short time</td>
</tr>
<tr>
<td><strong>Pope et al. 1997</strong></td>
<td>88 users, 68 nonusers (agents not stated, no doses given)</td>
<td>steroid users: mood disturbances incl. psychiatric disorders increased by 23%; but no aggressiveness more depression</td>
<td>self evaluation by psychologic interview forms</td>
</tr>
<tr>
<td><strong>Tricker et al. 1996</strong></td>
<td>double-blind placebo-controlled study (43 eugonodal men 19–40 y) (no competitive athletes) I: placebo, no exercise II: T, no exercise III: placebo, exercise IV: exercise</td>
<td>multi-dimensional anger inventory (MAI), mood inventory (MI), observer mood inv. (OMI) (spouse, partner, parent) before, during, after the 10 week intervention</td>
<td>no significant change at all, no difference in any of the 5 MAI domaines</td>
</tr>
</tbody>
</table>

**No correlations steroid use/behavioural changes**

Exercise consisted of thrice weekly strength training sessions. The Multi-Dimensional Anger Inventory (MAI), which includes 5 different dimensions of anger (inward anger, outward anger, anger arousal,
preexisting psychopathology. These data do not exclude the possibility that still higher doses increase angry behavior.

Administration to normal men in a controlled setting, do not administered: hyperphysiological doses of testosterone, when the treatment period in any group.

Overall there were no significant changes in ML or OM during the treatment and between placebo and the treated subjects.

No differences were observed between exercising and non-exercising and between placebo and the treated subjects.

The subjects' significant other (spouse, live-in partner, or a Mood Inventory (MI).

and after 10 week intervention.

Hostile outlook, and anger eliciting situations, and

only reconfirmed of observation.

80 Anthis, G. et al. 

Causistic

Conclusions: Anabolic, dosage

Observations Year

Population Comments, Comments
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<tr>
<td>Allnutt et al., 94</td>
<td>1 withdrawal depression for 2 y (bodybuilder)</td>
<td>after T-preparations for 2 y (bodybuilder)</td>
<td>unemployed</td>
</tr>
<tr>
<td>Cowan 94</td>
<td>1 severe depression after 2 y (bodybuilder)</td>
<td>various anabolic steroid preparations</td>
<td>social environment (unemployed, father) with psychiatric disorder</td>
</tr>
<tr>
<td>Stanley et al., 94</td>
<td>1 bodybuilder</td>
<td>substances not mentioned</td>
<td>psychic symptoms, violent outburst, “unusual physical sign”</td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrigan B., 96</td>
<td>2 murderers (high doses)</td>
<td>stanozolol + T nandrolone</td>
<td>murder under the influence? one case + alcohol; incidental?</td>
</tr>
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</table>

**Surveys**

<table>
<thead>
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<th>Observations, comments</th>
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</thead>
<tbody>
<tr>
<td>Archer, 91</td>
<td>neonates, adults (T and human aggression)</td>
<td>metaanalysis, (T and human aggression)</td>
<td>inconclusive, probably no neonatal organizing effect of androgens on human aggression, higher T-levels in groups of higher aggressiveness outcome of aggressions or competitive encounters can alter T levels, even mental state influences T</td>
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<tr>
<td>Bahrke et al. 96</td>
<td>estimation of 1 Mio users in USA</td>
<td>metaanalysis, several substances</td>
<td>extremely small percentage develop mental disturbances severe enough to require clinical treatment</td>
</tr>
<tr>
<td>Dabbs 96</td>
<td>summarises studies with extraordinary design</td>
<td>T-levels, (testosterone, aggression and delinquency)</td>
<td>T and family integration, dissocial behaviour of Vietnam veterans, face-expression on photographs, winners and loosers of competitions</td>
</tr>
</tbody>
</table>
References


Bronson, FH; Nguyen, KQ; De La Rosa, J (1996): Effects of anabolic steroids on behavior and physiological characteristics of female mice. Physiol Behav 59, 49- 55.


Kouri, EM; Lukas, SE; Poppe, HG; Oliva, PS (1995): Increased aggressive
responding in male volunteers following the administration of gradually increasing doses of testosterone cypionate. Drug Alcohol Depen 40, 73- 79.


Lumia, AR; Thorner, KM; McGinnis,MY (1994): Effects of chronically high doses of the anabolic androgenic steroid, testosterone, on intermale aggression and sexual behavior in male rats. Physiol Behav 55, 331- 335.


Tricker, R; Casaburi, R; Storer, TW; Clevenger, B; Beman, N; Shirazi, A; Bhasin, S (1996): The effects of supraphysiological doses of testosterone on angry behavior in healthy eugonadal men- A clinical research center study. J Clin Endocr Metab 81, 3754- 3758.