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RECENT ADVANCES
IN DOPING ANALYSIS
(7)

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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 focussed 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 wellknown 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 poenetary 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 changes 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

Author(s),	Year	Population	Anabolics, dosage	Observations	Conclusions, comments
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Endogenous anabolics

Ehrenkranz et al.	74	36 male prisoners 12 chronic aggressive 12 social dominant 12 control		correlation of testosterone to dominance	
Bergman et al.	94	18 imprisoned wife-beaters		psychological characterisation; T-level correlates only marginal; alcohol and drugs dominante the asocial behaviour	reflects necessarily preselection
Brooks et al.	96	194 male offenders 15 – 17 y	serum testosterone	violent offenders (n = 75) had higher T levels than sexual (n = 17) or nonviolent offenders (n = 102)	ethnic differences, strange criteria

Studies with positive correlation of anabolics use / psychic effects

Burnett et al.	94	24 adolescent athletes with reported use 24 nonusers 24 nonathletic adolescents	substances and dosages not known	users had more depressions, anger, mood disturbances only significant: users vs. control users vs. nonusers not significant	
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Author(s),	Year	Population	Anabolics, dosage	Observations	Conclusions, comments
Choi et al. (Violence towards women)	94	23 user strength athletes 14 nonuser	several steroids (stacking)	interviewed about 3 months (nonusers) or last cycle/ interval (users); Users reported significantly more fights, verbal aggression, violence towards their significant others when using anabolics than when not using them	only self-evaluation; partners not asked
Parrott et al.	94	21 male athletes	high doses during 6–14 week cycles	user questionnaire about hostility / aggression: subjects reported significantly higher feelings of aggression, aggression towards objects, verbal aggression, abd aggression during training (but nor physical aggression towards people) during the on-steroid periods. Other changes included signifivantly higher feelings of alertness, irritability, anxiety, suspiciousness, and negativism	not significant, only trends
Bond et al.	95	46 male strength athletes; 16 current users, 16 former users, 14 nonusers	several substances (stacking) cycles 8–11 weeks with 2-3 compounds athletes completed 3.4 cycles	“word conflict task”, current users rated themselves more negatively, showed slower performance, higher aggressiveness	
Kouri et al.	95	8 males contr. lab	T. cypionate, double blind randomized, increasing doses for 2 weeks (150 mg/300 mg/ 600 mg/week) or placebo	psychological tests (push-button accumulation of money or subtraction from fictious opponent)	only 8 people, exclusion of 2 during study
Middleman et al.	95	3054 high-school Students, 49 % male; mean age 16y	frequency scale 0...40 times use (lifetime)	high-risk behaviour: sexual behaviours, suicidal behaviours, frequency of not wearing a passenger seat belt;	

Author(s)	Year	Population	Anabolics, dosage	Conclusions, Comments
		Observations		
				riding a motorcycle, not wearing a helmet while riding a motorcycle, driving after drinking alcohol, riding with a driver who had been drinking alcohol, fighting, and carrying a weapon: steroid use is part of "risk behaviour syndrome"

No correlations steroid use/behavioural changes

Björkqvist et al.	94	27 males	40 mg Testosterone/d 1 week placebo control	self-evaluation and clinical examination: <i>placebo group showed signif. higher effect</i> but: short time
Pope et al.	94	athletes (88 users, 68 nonusers)	agents not stated, no doses given	steroid users: mood disturbances incl. psychiatric disorders increased by 23 % but no aggressiveness more depression
Tricker et al.	96	double-blind placebo-controlled 43 eugonadal men 19...40 y (no competitive athletes) I: placebo, no exercise II: T, no exercise III: placebo, exercise IV: exercise	600 mg T. enanthate/week (for 10 weeks)	no significant change at all, no difference in any of the 5 MAI domains

Author(s), Year **Population** **Anabolics, dosage**
Observations **Conclusions, Comments**

Hostile outlook, and anger eliciting situations), and

a Mood Inventory (MI),
were administered to subjects before, during,
and after 10 week intervention.

The subject's significant other (spouse, live-in partner, or
parent) also answered the same questions about the subject's
mood and behaviour (Observer Mood Inventory, OMI).

No differences were observed between exercising and
nonexercising and between placebo and TE treated subjects
for any of the 5 subdomains of MAI.

Overall there were no significant changes in MI or OMI during
the treatment period in any group.

Conclusion: Supraphysiological doses of testosterone, when
administered to normal men in a controlled setting, do not
increase angry behaviour.

These data do not exclude the possibility that still higher doses
of multiple steroids might provoke angry behaviour in men with
preexisting psychopathology.

Casusitics

Annitto 80 1 schizophrenic substances not mentioned
et al.

no causality postulated,
only recommend of observation

Author(s),	Year	Population Conclusions,	Anabolics, dosage	of this side-effectation comments	Observations comments
Allnutt et al.	94	1 withdrawal depression	after T-preparations for 2 y (bodybuilder)		unemployed
Cowan	94	1 severe depression after 2 y (bodybuilder)	various anabolic steroid preparations		social environment (unemployed, father) with psychiatric disorder
Stanley et al.	94	1 bodybuilder	substances not mentioned	psychic symptoms, violent outburst, "unusual physical sign"	
Corrigan B.	96	2 murderers (high doses)	stanozolol + T nandrolone	murder under the influence?	one case + alcohol; incidental?
<u>Surveys</u>					
Archer	91	neonates, adults	metaanalysis, (T and human aggression)	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

Author(s),	Year	Population	Anabolics, dosage	Observations	Conclusions
Bahrke et al.	96	estimation of 1 Mio users in USA	metaanalysis, several substances	extremely small percentage develop mental disturbances severe enough to require clinical treatment	in "positives" unclear influences of psychiatric history, genetic susceptibility, environmental and peer influences, expectation
Dabbs	96	summarises studies with extraordinary design	T-levels, (testosterone, aggression and delinquency)	T and family integration dissocial behaviour of Vietnam veterans face-expression on photographs winners and losers of competitions	several positive correlations

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