Research Report

European Addiction Research

Eur Addict Res 2010;16:213–219
DOI: 10.1159/000320286

Published online: August 26, 2010

Is There an Association between the Use of Anabolic-Androgenic Steroids and Criminality?

Kurt Skårberg[a, b] Fred Nyberg[c] Ingemar Engström[a]

[a]School of Health and Medical Sciences, Psychiatric Research Centre, Örebro University, and [b]Addiction Centre, Örebro County Council, Örebro; [c]Department of Pharmaceutical Bioscience, Uppsala University, Uppsala, Sweden

Key Words
Hormones · Anabolic-androgenic steroids · Steroids · Drugs of abuse · Crime · Violence · Sweden

Abstract
Aims: The aim of this study was to improve our understanding of the proposed association between anabolic-androgenic steroids (AAS) and criminality. ***Methods:*** The study was based on interviews and criminality data involving 32 users of AAS who had sought treatment for AAS-related problems at a psychiatric addiction clinic in Sweden. A score derived from the number of crimes, their level of severity and the relevant time periods was computed to allow comparisons between subgroups sorted according to type and timing of drug use. ***Results:*** The criminal activity level increased for 69% of the individuals after having started to use drugs. This was particularly obvious in the group who had started its involvement with drugs by using AAS. Crimes of violence and weapon offences showed a great increase in incidence after drug use had been initiated. The study also showed a significant decrease in criminality after treatment, particularly among individuals who had started their drug use with AAS. ***Conclusion:*** The results suggest that there is an association between the use of AAS and criminality, especially with regard to crimes of violence and weapon offences, and that this criminality may be enhanced when AAS are combined with other drugs of abuse.

Introduction

Anabolic-androgenic steroids (AAS) are synthetic derivatives of the male endogenous sex hormone testosterone [1]. These steroids were originally used by athletes but are now used by a far wider range of groups outside of sport and athletics [2, 3]. The majority of users are male [4, 5]. It has been shown that the use of AAS is often combined with the use of alcohol [6–8] and other drugs of abuse [9–11]. This finding was substantiated by a recent study in which we noted that the combination of AAS with alcohol, other drugs of abuse and pharmaceuticals was very common in a group of AAS users who sought treatment at an addiction clinic (AC) [12].

Several studies have suggested the possibility of an association between the use of AAS and aggressive or criminal behaviour. Animal studies have found AAS-related neurochemical changes in areas associated with stress, behavioural and reward responses and have also noted a

KARGER

Fax +41 61 306 12 34
E-Mail karger@karger.ch
www.karger.com

1022–6877/10/0164–0213$26.00/0

Accessible online at:
www.karger.com/ear

Ingemar Engström, MD, PhD
Psychiatric Research Centre
PO Box 1613
SE–701 16 Örebro (Sweden)
Tel. +46 19 602 58 88, Fax +46 19 602 58 86, E-Mail ingemar.engstrom@orebroll.se

greater incidence of biting behaviour associated with AAS administration [13]. AAS-treated animals have also demonstrated increased aggression and decreased time and provocation to bite [14].

In humans, AAS are used in supraphysiological doses to enhance the effects of physical training [15, 16]. A correlation has been found between the dose of AAS and the severity of psychiatric side effects, especially aggression, which may contribute to an increase in violent crimes [17]. Psychiatric side effects associated with AAS misuse, possibly leading to violence including homicide, have also been described, e.g. depression, mania, psychosis, suicide and marked aggression [18] or irritability, mood swings and decreased impulse control [19]. There are also reports of AAS users being more likely to show high-risk behaviour such as carrying weapons or fighting [20] or dangerous behaviour [21] than is usually seen in non-users.

Testosterone has long been suspected of increasing aggression and violence in man. High testosterone levels were found as early as the 1980s to be significantly connected with violent crimes [22]. More recently, it was found that subjects with higher serum testosterone levels were significantly more violent than those with lower serum testosterone levels [23]. In addition, an association was found between AAS use and heightened levels of violent behaviour after the effects of key demographic variables, previous violent behaviour, and polydrug use had been controlled for [24]. More violence towards women has also been reported when their significant others were using AAS [25].

Swedish studies have added to the data suggesting an association between increased aggression and illicit use of AAS. One study described 5 young men who got heavily involved in criminal activities such as assault, illegal threat and drug-related crimes after having started use of AAS [26]. In another study, it was noted that 1 subject who used AAS in a cyclic 'on-off' pattern was in an 'off' phase at the time of the crime [27]. In a retrospective cohort study, a higher risk of being convicted for weapon offence or fraud was found among AAS users than among non-users [28]. A study by the same research group investigated 55 deceased individuals who were AAS positive at the time of the postmortem medico-legal examination [29]. It was found that use of AAS, especially when combined with other illegal drugs, can be associated with a higher rate of violent crimes [29, 30].

Other authors have also found a connection between AAS and violent death. Pope Jr. and Katz [31] described 3 men who impulsively committed violent crimes, including murder, while taking AAS. Another study reported interviews with males associated with cases of criminal behaviour caused by AAS misuse, one of which involved firing a gun after injection of AAS [32]. In an investigation of the causes of death among 34 males who misused AAS, 9 were found to have died by homicide [10]. In another mortality study, AAS was found to be an indicator for increased risk of premature death [33].

The substantial evidence in the studies cited indicates an association between use of AAS and violent or otherwise criminal behaviour. Yet there are few systematic studies based on clinical samples that have studied this association in detail. As far as we are aware, no study has described the association between the development of drug use and the development of criminal behaviour, or has attempted to disentangle the association between these two factors over time.

The aim of this study was to investigate an eventual association between criminality and use of AAS with or without the use of other drugs of abuse. The research questions were as follows: (a) is there a relationship between AAS and criminality; (b) is this connection influenced by the use of other drugs, and (c) is criminality influenced by treatment of AAS users?

Methods

The study is based on 36 users of AAS (34 men and 2 women) who were consecutively included from a psychiatric AC in Örebro county, central Sweden, a county of 275,000 inhabitants. All subjects were attending the AC to seek help for what they believed to be AAS-related side effects. The mean age of the AAS users was 27.0 years (range: 19.0–43.0 years).

The participants had: (a) to be over 16 years of age, (b) to be fluent in Swedish, (c) to have been using non-prescribed AAS, alone or in combination with other illicit agents, within the last 4 months, (d) to have been using AAS for at least 4 consecutive months and (e) to be under the care of the AC, where a decision to commence treatment for their AAS use was agreed upon based on the initial clinical assessment. The lower limit of 4 months was chosen to include more than one AAS cycle, thus indicating regular use. None of the approached individuals declined to participate in the study.

In the interview described below, 35 of the 36 individuals recounted that they had committed any crime and 34 stated that they had been convicted of a crime. We compared these figures with data from the Swedish National Council for Crime Prevention (Brottsförebyggande rådet, BRÅ) by running the subjects' social security numbers through the database of BRÅ on all legal proceedings against individuals. BRÅ is a centre for research and development work within the justice system and all persons sentenced for any crime in Sweden have been included in this database since 1974 [34]. Thirty-two of the 36 subjects were found in

the database, indicating that they had been convicted of at least one crime. Thus, all persons found in the database admitted having carried out crimes, but an additional 3 persons claimed crime sentences that could not be found in the official database. This study is based on the 32 individuals found in the database.

Interviews

Prior to an interview, each participant was asked to write down a narrative of how their drug use had developed over the years, including the names of the drugs they had used and when they began using them. A semiopen face-to-face interview [35] was then conducted and carried out as a conversation in which the individuals were given considerable freedom in how to tell their stories. The interview comprised two main parts: firstly, a description of the temporal development of their use of drugs, and secondly, a description of their history of criminal activities. This questionnaire was partly derived from published studies [2, 36] but was also based upon our experience with clinical interviews of some 100 AAS users. The interviews took between 1 and 3 h per participant. The subjects were then given the opportunity to read and comment on these texts and to assess whether they seemed reasonable and whether they wished to remove any parts.

Definition of Crimes

The database used in the study includes all types of crime; the crimes were grouped by us according to previous research concerning drugs and criminality [28, 37–39], but also with reference to the Swedish law. The groupings were as follows:

- Crimes of violence: gross battery, battery, unlawful encroachment, unlawful restraint, unlawful detention, assault, trespass, robbery, negligence constituting a public danger, court assault, violence or threat against civil servant, violent resistance and promotion of escape.
- Weapon offences: possession of firearms, possession of knives and possession of explosives.
- Crimes against property: theft, pilfering, theft of a vehicle, unlawful dispossession, receiving stolen goods and smuggling.
- Fraud: fraud, unlawful use, gross forgery, forgery and false charge.
- Drug-related offences: possession of AAS, possession of narcotics, crimes against the alcohol laws, possession of goods dangerous to health and possession of syringes.
- Traffic crimes: dangerous (reckless) driving, using a vehicle without lawful authority, drunken driving and hit-and-run.
- Other offences: offences against damage laws, against law and order, against compulsory military service and against various vehicle laws.

Code System for Scoring Perpetrated Crimes

In order to assess total criminality over time, we developed a code system based on the maximum sentence for each crime according to Swedish law. Crimes that do not lead to deprivation of liberty were given 1 point. Crimes with a maximum sentence of 0.5 years received 2 points, followed by: maximum 1 year = 3 points; maximum 2 years = 4 points; maximum 3 years = 5 points; maximum 4 years = 6 points; maximum 6 years = 7 points, and maximum 10 years = 8 points. The code system thus divided the crimes into 8 groups depending on the severity of the crime according to the law.

The score for each individual was then divided by the relevant time period in order to yield a weighted value which expressed (a) the total number of crimes, (b) the level of severity of the crimes, and (c) the intensity of criminal acts based on time.

Periods

The computed crime scores were compared within 4 periods for each individual: period A comprised the time from start of criminality to start of drug use, period B from start of drug use to first treatment contact with an AC, period C from the start of treatment at the AC to the point when treatment was terminated, and period D the time from termination of treatment to the endpoint of the study (December 31, 2007).

Groups of Users

One of the aims of the study was to disentangle the association between different drug use patterns and criminality. The population sample was therefore divided into two groups depending on how the pattern of drug use had developed over time according to the interview. In group 1, AAS were the debut drug (n = 22); in group 2, other drugs of abuse were the debut drug (n = 10).

The mean ages of the participants in these subgroups were: group 1 = 26 years, and group 2 = 30 years. The mean time from when the treatment at the AC was terminated to the cutoff date of the study was 5.0 years (range: 2.1–7.0 years) for the whole population. For the subgroups, these values were: group 1 = 5.2 years (range: 4.0–7.0 years), and group 2 = 4.4 years (range: 3.0–6.1 years).

Statistical Analysis

The rates of criminality in the different periods were compared using the non-parametric Friedman test since normal distribution could not be assumed for the data. Dunnett's post hoc test was used to clarify the difference between the different periods among the groups and in total.

Ethical Approval

The study protocol was approved by the ethics committee of the Örebro County Council (No. 538/99) and the Regional Ethics Vetting Board in Uppsala (No. 2004 M-316) in accordance with the Swedish law concerning approval of medical research. The participants all gave their informed consent.

Results

The sample who had been convicted of various crimes consisted of 32 persons, as verified in the BRÅ database. Table 1 shows that 62% of these 32 persons had been convicted of crimes before the debut of drug use (period A). During period B, another 32% were convicted after the debut of drug use but before commencement of treatment. The proportion of persons convicted for each type of crime group at any time during the study period is reported in table 1.

In general, crimes of violence, weapon offences and drug-related crimes were among those groups that

Table 1. Proportion of individuals convicted for various types of crime during the different study periods A–D in both groups (n = 32), group 1 (n = 22) and group 2 (n = 10) (%)

	Group	Total	Period			
			A	B	C	D
Total		100	62	94	50	50
Crimes of violence	both groups	62	19	47	19	6
	group 1	54	14	41	23	0
	group 2	80	30	60	10	20
Weapon offences	both groups	56	6	37	6	9
	group 1	50	0	32	4	14
	group 2	70	20	50	10	0
Crimes against property	both groups	81	37	66	19	12
	group 1	77	36	59	14	9
	group 2	90	40	80	30	20
Fraud	both groups	28	3	22	0	9
	group 1	18	4	9	0	4
	group 2	50	0	50	0	20
Drug-related crimes	both groups	69	0	50	31	34
	group 1	73	0	45	27	36
	group 2	60	0	60	40	30
Traffic crimes	both groups	66	28	41	12	31
	group 1	68	32	32	14	32
	group 2	60	20	60	10	30
Other offences	both groups	34	3	22	9	3
	group 1	23	4	9	4	4
	group 2	60	0	50	20	0

showed the sharpest increase after the debut of drug use. During period B, almost half of the individuals were sentenced for crimes of violence (table 1). These crimes were more frequent when AAS and other drugs of abuse were combined. There was also an increase in the incidence of weapon offences during period B. Six percent were convicted of weapon crimes before drug use and 37% were convicted in period B, after the debut of drug use. In the total sample, two thirds of the individuals were convicted of weapon offences at one point or another during period B.

The changes in criminality between periods A–B–D were significant according to Friedman's test in the total sample ($p = 0.013$) and in group 1 ($p = 0.008$), but not in group 2 ($p = 0.666$). The level of criminality increased in 69% of the population after the debut of drug use of any kind (table 2).

For periods A–B, the post hoc test showed that the increase in criminality after drug debut was especially obvious in group 1, who started with AAS use ($p = 0.001$), where criminality increased in 77% of the subjects. In group 2, who started with other drugs of abuse, the level of criminality increased in 50% of the cases, whereas it actually decreased in the rest of the groups ($p = 0.999$).

After termination of treatment at the AC (periods B–D), the level of criminality significantly decreased in 75% of the population ($p = 0.001$) (table 2). The decrease was significant for group 1 ($p = 0.001$), but not for group 2 ($p = 0.456$).

The criminality scores in absolute figures are shown in figure 1. The level of criminality before the debut of drug use was quite low in group 1, whereas it was considerably higher in group 2. There was a considerable increase in criminality after the debut of drug use in the sample studied. Clear differences between the subgroups can be seen as group 1 showed a radical increase in criminality after starting drugs. Group 2 was already fairly deeply involved in criminality before the debut of drug use. Their criminality level had in fact decreased slightly after starting drugs.

The decrease in criminal behaviour during and after treatment is also shown in figure 1, which shows that criminality almost disappeared in group 1. The decrease in criminality began during treatment but reached its lowest level after termination of treatment and during the follow-up period (mean: 5 years). There was a decrease in all kinds of criminality except for drug-related crimes and traffic crimes.

The weighted values shown in table 3 indicate that drug-related crimes, crimes of violence and weapon offences increased the most among the patients when comparing periods A and B. Although crimes of violence showed a high number already in period A, this type of crimes increased further from period A to B. After treatment (comparing periods B and D), the decrease in crimes was most obvious with regard to crimes against property and crimes of violence.

In the population as a whole there was a clear increase in criminality after the debut of drug use and a clear decrease after treatment (fig. 1; table 3).

Discussion

This study was carried out in AAS users who sought treatment at a psychiatric AC. The results show an increase in criminality after the debut of drug use in the

Table 2. Change in criminality between periods A and B, and B and D for both groups (n = 32), group 1 (n = 22) and group 2 (n = 10)

	First drug of use	Change in criminality						Friedman's test	Post hoc test	
		increased periods		decreased periods		unchanged periods				
		A–B	B–D	A–B	B–D	A–B	B–D	A–B–D	A–B	B–D
Both groups	any[1]	69%	22%	28%	75%	3%	3%	0.013	0.10	0.001
Group 1	AAS	77%	23%	18%	77%	5%	0%	0.008	0.001	0.001
Group 2	other	50%	20%	50%	70%	0%	10%	0.666	0.999	0.456

[1] Either AAS or other drugs of abuse.

majority of persons. More specifically, a significant increase was found in crimes of violence, weapon offences and drug-related crimes. The crimes of violence included battery, assault, unlawful detention and threats of violence. The increase was found in the subgroup of patients who started their drug use with AAS. The subgroup that started with other drugs of abuse (group 2) was already involved in criminal activities before the debut of drug use. Because the increase in criminal activity occurred after the debut of AAS use in both groups, we suggest that it is probable that there is an association between the use of AAS and criminal behaviour.

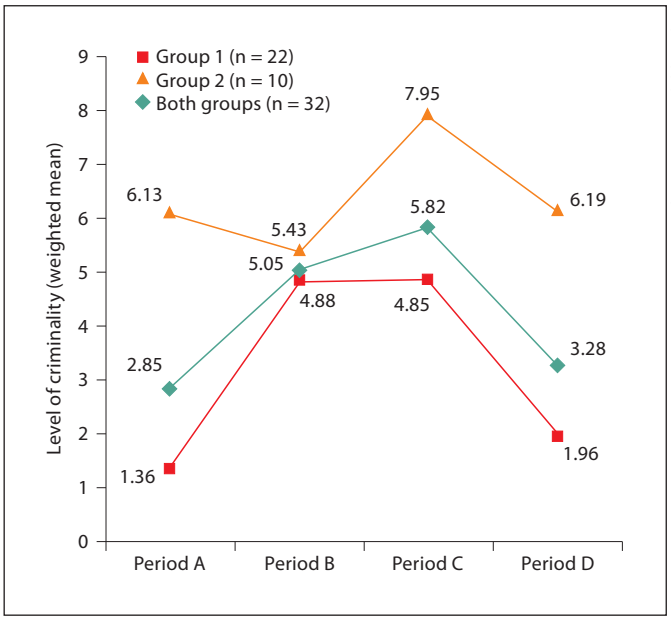
An exception from the general pattern was observed concerning crimes against property, for which almost half of the individuals had been sentenced already before their drug debut. The type of drug initially used did not seem to be relevant for crimes against property but was important for crimes of violence and weapon offences.

The increase in criminal activities was initiated by the debut of drug use, irrespective of the type of drug. The addition of another drug type only seemed to cause a further increase in criminality. We therefore find it probable that the association between AAS and criminality is at least as strong as that between drugs of abuse in general and criminality.

No person in our study was sentenced for drug-related crimes before their debut of using drugs. Most individuals were, however, sentenced for drug-related crimes during the period when they were active users of drugs. In group 1, none were sentenced for drug-related crimes while they were only using AAS, but most of the individuals in this group were sentenced for these crimes, usually for possession of narcotic drugs, when other drugs of abuse were added.

Special attention should be given to crimes of violence since earlier studies have pointed out a specific association between AAS and such crimes. In this study, AAS was found to be clearly associated with crimes of violence, both with regard to the number of convictions and the degree of severity, compared with other drugs of abuse. Our results therefore support those of earlier studies indicating a possible association between AAS and crimes of violence [17, 26, 29, 40].

The risk of being convicted of weapon offences has been shown to be high in AAS users [28]. These findings were corroborated in our study, where the number of persons convicted of weapon offences increased after the debut of drug use. We propose that the use of AAS



Color version available online

Fig. 1. Levels of criminality (weighted mean scores) in periods A–D for groups 1 and 2 and for the total study population.

Table 3. Total weighted criminality scores in the total population in periods A–D (n = 32)

	Period A	Period B	Difference	Period C	Period D	Difference
Total	91.29	161.65	+70.36	186.25	104.98	–56.67
Crimes of violence	19.00	36.91	+17.91	26.67	1.75	–35.16
Weapon offences	5.33	10.78	+5.45	4.00	4.53	–6.25
Crimes against property	55.99	41.66	–14.33	15.33	7.13	–34.53
Fraud	2.00	5.56	+3.56	0.00	6.50	+0.94
Drug-related crimes	0.00	54.88	+54.88	119.75	64.11	+9.23
Traffic crimes	8.47	9.74	+1.27	14.50	20.46	+10.72
Other offences	0.50	2.12	+1.62	6.00	0.50	–1.62

Values denote total weighted criminality scores based on the total number of crimes, the severity of the crimes, and the intensity of criminal acts based on time.

is associated with weapon offences, and that this association is stronger when other drugs of abuse are also being used. Based on our clinical experience, we believe that the widespread use of weapons in connection with AAS is related to the drug-related mistrust and suspicion shown towards other people, leading to the feeling of a necessity to protect oneself with the help of weapons.

The criminal activities were significantly reduced during and after treatment at the AC. This was especially obvious in the subgroup of individuals who started their drug use with using only AAS, where all individuals showed a reduced rate of criminality after treatment. The greatest effect was seen concerning crimes of violence and crimes against property. The smallest effect was seen in relation to drug-related crimes and traffic crimes. Initially, possession of narcotics was the most common cause of conviction for drug-related crimes, but later we also found that crimes such as possession of AAS, possession of goods dangerous to the health, and possession of syringes were involved. We believe this to be a consequence of the fact that the police initially were not especially knowledgeable about AAS. The level of awareness has now improved, resulting in more sentences.

One possible explanation for the finding that traffic crimes were not substantially reduced with treatment could be that 15 subjects in this sample began to use alcohol in a hazardous or harmful manner, as previously described [12]. Earlier research [7] has proposed that AAS use 'is a part of a risk behavior syndrome', one of the components of which is an increased tendency to drive drunk.

Conclusion

This study indicates an association between the use of AAS and criminality, especially crimes of violence and weapon offences. These findings support the conclusion by Pope Jr. et al. [32] that 'steroid use is a significant factor in criminal behavior'. It is, however, important to remember that, while this appears to be the case on an aggregated level, there remain considerable individual differences among patients. The association between AAS and criminality also seems to be enhanced when other drugs of abuse are added.

The study also indicates that treatment may have an effect on criminality. This relationship could be worth exploring in a larger sample. This is usually not a primary goal of treatment but could maybe be used as a proxy for treatment outcome. It should be emphasized, however, that there is a considerable risk that the use of AAS is transferred to use of other drugs and/or alcohol after treatment. Thus, while AAS can be viewed as a problem in itself, it can also be a gateway to the use of other drugs.

This study was based on a small group of individuals, but this is often the case in studies in this research area because of considerable difficulties in getting consent from affected individuals for research. We are well aware of the fact that this sample is a highly selected sample since all of the participants were recruited from an AC. This means that the results should be extrapolated to other AAS users only with great caution. Nevertheless, we believe that the results may be of great interest in a clinical setting.

References

1 Kuhn CM: Anabolic steroids. Recent Prog Horm Res 2002;57:411–434.
2 Evans NA: Gym and tonic: a profile of 100 male steroid users. Br J Sports Med 1997;31:54–58.
3 Nilsson S, Baigi A, Marklund B, Fridlund B: The prevalence of the use of androgenic anabolic steroids by adolescents in a county of Sweden. Eur J Public Health 2001;11:195–197.
4 Miller KE, Hoffman JH, Barnes GM, Sabo D, Melnick MJ, Farell MP: Adolescent anabolic steroid use, gender, physical activity, and other problem behaviors. Subst Use Misuse 2005;40:1637–1657.
5 Gruber AJ, Pope HG Jr: Psychiatric and medical effects of anabolic-androgenic steroid use in women. Psychother Psychosom 2000;69:19–26.
6 Ambrose PJ: Drug use in sports: a veritable arena for pharmacists. J Am Pharm Assoc 2004;44:501–514.
7 Middleman AB, Faulkner AH, Woods ER, Emans SJ, DuRant RH: High-risk behaviors among high school students in Massachusetts who use anabolic steroids. Pediatrics 1995;96:268–272.
8 Eklöf AC, Thurelius AM, Garle M, Rane A, Sjöqvist F: The anti-doping hot-line, a means to capture the abuse of doping agents in the Swedish society and a new service function in clinical pharmacology. Eur J Clin Pharmacol 2003;59:571–577.
9 Sjöqvist F, Garle M, Rane A: Use of doping agents, particularly anabolic steroids, in sports and society. Lancet 2008;371:1872–1882.
10 Thiblin I, Lindquist O, Rajs J: Cause and manner of death among users of anabolic androgenic steroids. J Forensic Sci 2000;45:16–23.
11 Brower KJ, Blow FC, Beresford TP, Fuelling C: Anabolic-androgenic steroid dependence. J Clin Psychiatry 1989;50:31–33.
12 Skårberg K, Nyberg F, Engström I: Multisubstance use as a feature of addiction to anabolic-androgenic steroids. Eur Addict Res 2009;15:99–106.
13 Johansson-Steensland P, Nyberg F, Chahl L: The anabolic-androgenic steroid, nandrolone decanoate, increases the density of Fos-like immunoreactive neurons in limbic regions of guinea-pig brain. Eur J Neurosci 2002;15:539–544.
14 Harrison RJ, Connor DF, Nowak C, Nash K, Melloni RH Jr: Chronic anabolic-androgenic steroid treatment during adolescence increases anterior hypothalamic vasopressin and aggression in intact hamsters. Psychoneuroendocrinology 2000;25:317–338.
15 Hall RC: Abuse of supraphysiologic doses of anabolic steroids. South Med J 2005;98:550–555.
16 Pagonis TA, Angelopoulos NV, Koukoulis GN, Hadjichristodoulou CS: Psychiatric side effects induced by supraphysiological doses of combinations of anabolic steroids correlate to the severity of abuse. Eur Psychiatry 2006;21:551–562.
17 Pagonis TA, Angelopoulos NV, Koukoulis GN, Hadjichristodoulou CS, Toli PN: Psychiatric and hostility factors related to use of anabolic steroids in monozygotic twins. Eur Psychiatry 2006;21:563–569.
18 Brower KJ: Anabolic steroid abuse and dependence. Curr Psychiatry Rep 2002;4:377–387.
19 Casavant MJ, Blake K, Griffith J, Yates A, Copley LM: Consequences of use of anabolic-androgenic steroids. Pediatr Clin North Am 2007;54:677–690.
20 Middleman AB, DuRant RH: Anabolic steroid use and associated health risk behaviours. Sports Med 1996;21:251–255.
21 Hall RC, Hall RC, Chapman MJ: Psychiatric complications of anabolic steroid abuse. Psychosomatics 2005;46:285–290.
22 Dabbs JM Jr, Frady RL, Carr TS, Besch NF: Saliva testosterone and criminal violence in young adult prison inmates. Psychosom Med 1987;49:174–182.
23 Brooks JH, Reddon JR: Serum testosterone in violent and nonviolent young offenders. J Clin Psychol 1996;52:475–483.
24 Beaver KM, Vaughn MG, Delisi M, Wright JP: Anabolic-androgenic steroid use and involvement in violent behavior in a nationally representative sample of young adult males in the United States. Am J Public Health 2008;98:2185–2187.
25 Choi PY, Pope HG Jr: Violence toward women and illicit androgenic-anabolic steroid use. Ann Clin Psychiatry 1994;6:21–25.
26 Thiblin I, Parlklo T: Anabolic androgenic steroids and violence. Acta Psychiatr Scand Suppl 2002;412:125–128.
27 Isacsson G, Garle M, Ljung EB, Asgård U, Bergman U: Anabolic steroids and violent crime: an epidemiological study at a jail in Stockholm, Sweden. Compr Psychiatry 1998;39:203–205.
28 Klötz F, Garle M, Granath F, Thiblin I: Criminality among individuals testing positive for the presence of anabolic-androgenic steroids. Arch Gen Psychiatry 2006;63:1274–1279.
29 Klötz F, Petersson A, Isacson D, Thiblin I: Violent crime and substance abuse: a medico-legal comparison between deceased users of anabolic-androgenic steroids and abusers of illicit drugs. Forensic Sci Int 2007;173:57–63.
30 Klötz F, Petersson A, Hoffman O, Thiblin I: The significance of anabolic androgenic steroids in a Swedish prison population. Compr Psychiatry 2010;51:312–318.
31 Pope HG Jr, Katz DL: Homicide and near-homicide by anabolic steroid users. J Clin Psychiatry 1990;51:28–31.
32 Pope HG Jr, Kouri EM, Powell KF, Campbell C, Katz DL: Anabolic-androgenic steroid use among 133 prisoners. Compr Psychiatry 1996;37:322–327.
33 Petersson A, Garle M, Granath F, Thiblin I: Morbidity and mortality in patients testing positively for the presence of anabolic-androgenic steroids in connection with receiving medical care: a controlled retrospective cohort study. Drug Alcohol Depend 2006;81:215–220.
34 Andersson J: The Swedish National Council for Crime Prevention: a short presentation. J Scand Stud Criminol Crime Prev 2005;6:74–88.
35 Rubin H, Rubin I: Qualitative Interviewing. The Art of Hearing Data. Thousand Oaks, Sage, 2004.
36 Malone DA Jr, Dimeff RJ, Lombardo JA, Sample RH: Psychiatric effects and psychoactive substance use in anabolic-androgenic steroid users. Clin J Sport Med 1995;5:25–31.
37 Warren JI, South SC, Burnette ML, Rogers A, Friend R, Bale R, van Patten I: Understanding the risk factors for violence and criminality in women: the concurrent validity of the PCL-R and HCR-20. Int J Law Psychiatry 2005;28:269–289.
38 Degenhardt L, Day C, Hall W, Conroy E, Gilmour S: Was an increase in cocaine use among injecting drug users in New South Wales, Australia, accompanied by an increase in violent crime? BMC Public Health 2005;5:40.
39 Messer LC, Kaufman JS, Dole N, Herring A, Laraia BA: Violent crime exposure classification and adverse birth outcomes: a geographically defined cohort study. Int J Health Geogr 2006;5:22.
40 Thiblin I, Kristiansson M, Rajs J: Anabolic-androgenic steroids and behavioural patterns among violent offenders. J Forensic Psychiatry 1997;8:299–310.