

A retrospective 30-year follow-up study of former Swedish-elite male athletes in power sports with a past anabolic androgenic steroids use: a focus on mental health

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ABSTRACT

Background The knowledge concerning the long-term effect of former anabolic androgenic steroids (AAS)-use on mental health is sparse.

Aim This study aims to investigate whether previous AAS-use affects mental health, present sociodemographic data, sport activity and substance abuse in a retrospective 30-year follow-up study of former elite athletes.

Methods Swedish male-elite power sport athletes (n=683) on the top 10 national ranking lists during any of the years 1960–1979 in wrestling, Olympic lifting, powerlifting and the throwing events in track and field answered a questionnaire.

Results At least 20% of the former athletes admitted previous AAS-use. They had more often sought professional expertise for mental problems and had used illicit drugs compared to those not having used AAS. The AAS-users also differed in former sport activity pattern compared to non AAS-users.

Conclusions It is clear that a relationship exists between use of AAS and mental-health problems. Further studies need to be done in order to clarify this relationship.

Anabolic androgenic steroids (AAS) are widely used drugs today. They are not only confined to professional athletes, sporting elites or even recreational athletes, but are also common among youths without association to organised sports. The acute effects of AAS-use on mental health are well described in the literature, for example, increased aggression and irritability,¹ anxiety and depressive symptoms,^{2–3} cognitive impairment,⁴ suicidal behaviours,³ hypomanic symptoms,⁵ enthusiasm⁶ and increased self-confidence.⁷

Though the acute psychiatric effects are well described, less is known whether former AAS-abuse also induces sustainable long-term effects on mental health. There are studies showing minor or no alterations in aggressive behaviours in past AAS-abusers who had been abstinent for a year^{8–9} or longer.¹⁰ On the other hand, one study found that past (abstinent period not defined) AAS-abusers had significantly more psychiatric diagnoses, as diagnosed by DSM-IV, than current abusers.⁸ A Finnish study,¹¹ concerning a 12-year follow-up study of 62 male-elite Finnish powerlifters, where there was a high suspicion of AAS-use, reported a 4.6 times higher death rate compared with the general population. The main causes

of death were myocardial infarctions and suicides.¹¹

The high occurrence of suicide in populations with a strong suspicion of previous AAS-use is in line with preliminary results from our own study group, showing that death risk from suicide was increased by 2–4 times. According to the conclusions made by Kanayama *et al.*,¹² the possible long-term effects of AAS are a growing problem, since conservative figures from the 1991 National Health Service report predicted that about half a million American men with a lifetime history of AAS-use would have passed the age of 45 by the year 2010.

The present study aimed to investigate whether former AAS-users compared with non-AAS-users in a population of former-elite athletes in four power sports differed in sociodemographic data, mental health, sport activity and abuse of other substances, 30 years after the end of their career.

METHODS

Subjects

The subjects included in this study were Swedish-male elite power sport athletes, on the top 10 national ranking lists, in any of the years 1960–1979 in four power sports; wrestling, Olympic lifting, powerlifting and the throwing events in track and field (hammer, discus, javelin and shot put; n=1199). The athletes' present contact data were identified through the Swedish Tax Agency by using the athletes' Swedish National Registration Number. Of the 1199 former-elite athletes, 66 were missing from Swedish records; either due to emigration (n=20) or not being traceable via formal Swedish authority registers or having a 'hidden identity' (n=46). In total, 137 former athletes were dead in 2003. Thus, 996 athletes were traceable and alive.

Questionnaire

During 2004, a questionnaire including structured questions concerning sociodemographic variables, previous and past sport activity, lifetime prevalence of seeking professional help for mental-health problems and previous and past substance use was sent to these 996 athletes. A reminder to fill in the questionnaire was sent to those athletes who had not answered, and finally 683 (68.6%) subjects had answered the questionnaire including the specific questions in the questionnaire concerning whether they had ever used AAS, and if so, when in relation to their sport career. Thus, 683 former-elite athletes represent the subjects in this study (figure 1).

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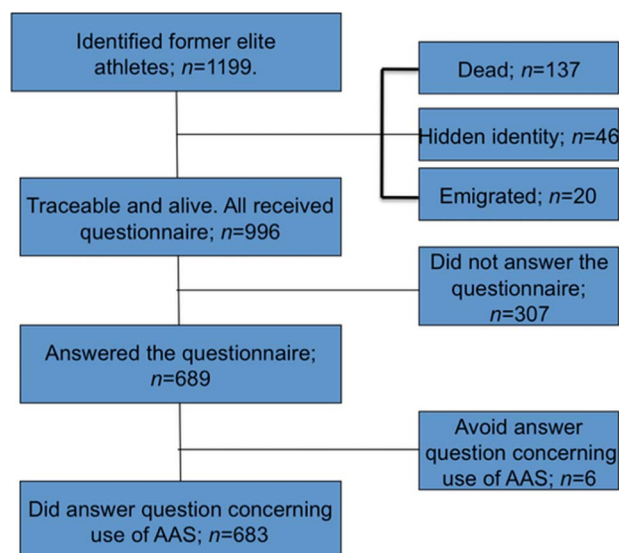


Figure 1 Description of the participants in this study (n=683). Access the article online to view this figure in colour.

Statistics

The data are presented as mean $\pm$ SE of the mean or as frequencies (per cent). Differences in scores among pairs of groups were assessed using independent Student *t* tests and differences in frequencies with a χ^2 test. The α level was 0.01 due to multiple comparisons, and two-tailed levels of significance were used in all statistical analyses.

The study was approved by the Ethics Committee of the University of Gothenburg, Sweden and was in compliance with the Helsinki Declaration of 1975.

RESULTS

Sociodemographics

Out of the 683 former Swedish-male elite athletes, the lifetime prevalence of AAS-use was 21% (n=143), while 79% (n=540) did not admit having ever used AAS.

The mean age of the participants was 57 $\pm$ 10 years (39–82 years) as measured in the year 2003. There was a significant

difference between the mean age of the former AAS-users and non-AAS-users (53 $\pm$ 6 and 58 $\pm$ 10 years, respectively; $t=6.55$; $p<0.001$).

Concerning the present occupational activity, the former AAS-users, compared with the non-AAS-users, were more often in the present occupation (63% vs 43%; $\chi^2=15.40$; $p<0.001$) and were less often old-age pensioners (3% vs 20%; $\chi^2=24.75$; $p<0.001$; table 1). However, the observed difference concerning 'present occupation' disappeared if all old-age pensioners, that is, above 65 years of age, were excluded from the analysis. A trend was still observable showing that former AAS-users were more often in the present occupation compared with non-AAS-users (58% and 47%, respectively).

The former AAS-users, compared with non-AAS-users, had children less often (81% vs 91%; $\chi^2=10.20$; $p<0.01$); however, no differences were noted in the number of children out of those who had children.

Present and past sport activity

Data for present and past sport activity are shown in table 1. Regarding their past sport activity, the former AAS-users were significantly older when they started training in the sport discipline within which they reached their highest ranking (15.7 $\pm$ 3.9 vs 14.1 $\pm$ 4.8; $t=3.7$; $p<0.001$) and they spent more hours per week training during their sport active years (12.4 $\pm$ 4.4 vs 9.8 $\pm$ 4.5; $t=6.2$; $p<0.001$) compared with non-AAS-users. There was no difference in mean age between the groups when they discontinued elite power sports. The reason for their discontinuation was more or less the same for the two groups except for one exception: former AAS-users reported significantly more often 'injuries/health problems' as the reason for discontinuation compared with non-AAS users (49% vs 24%; $\chi^2=28.78$; $p<0.001$). The former AAS-users and non-AAS-users did not differ in the present sport activities or amount of training per week.

Mental-health problems

Compared with non-AAS-users, former AAS-users had significantly more often sought professional help for depression (13% vs 5%; $\chi^2=10.31$; $p<0.001$), anxiety (13% vs 6%; $\chi^2=7.68$;

Table 1 Comparisons between former AAS-users (n=143) versus non-AAS-users (n=540) concerning present sociodemographic variables and present and past sport activity

	Former AAS-users (n=143)	Non-AAS-users (n=540)	p Value	p Value or χ^2 value
Sociodemographic data				
Age (years)	53 $\pm$ 6	58 $\pm$ 10	<0.001	6.55
Having a relationship (% yes)	82	86	ns	1.69
Having children (% yes)	81	91	<0.01	10.20
Number of children	2.5 $\pm$ 1	2.4 $\pm$ 1	ns	1.01
University degree (% yes)	8	22	ns	4.03
Present employment (% yes)	63	43	<0.001	15.40
Present old-age pensioner (% yes)	3	20	<0.001	24.75
Pensioner due to illness/sick-listed for a longer time (% yes)	13	8	ns	4.57
Present and past sport activity				
Age of sport debut (years)	15.7 $\pm$ 3.9	14.1 $\pm$ 4.8	<0.001	3.71
Training during the active career (h/week)	12.4 $\pm$ 4.4	9.8 $\pm$ 4.5	<0.001	6.22
Age of stop competing (years)	31.3 $\pm$ 7.3	31.0 $\pm$ 7.3	ns	1.23
Presently sport active (% yes)	85	81	ns	0.98
Present amount of training (h/week)	5.4 $\pm$ 2.9	5.1 $\pm$ 3.2	ns	1.02

Data are presented as mean $\pm$ SD or percentage (%).

AAS, anabolic androgenic steroids; ns, non-significant.

Table 2 Comparisons between AAS-users (n=143) versus non-AAS-users (n=540) in regard to lifetime prevalence (%) concerning seeking professional expertise for mental-health problems

	Former AAS-users (n=143) (%)	Non-AAS-users (n=540) (%)	p Value	χ^2 Value
Mental problems				
Depression	13	5	<0.001	10.31
Anxiety	13	6	<0.01	7.68
Melancholy	13	4	<0.001	20.27
Irritation and anger	3	1	ns	4.06
Concentration deficit	4	1	<0.01	7.62
Sleeping dysfunctions	13	7	ns	4.25
Suicidal thoughts	3	1	ns	5.11
Worry for mental health	8	3	<0.01	6.77
Panic attacks	4	2	ns	2.11
Mania	0	0	ns	0.79
Psychosis	1	0	ns	3.78
Obsessive compulsive Disorder	0	0	ns	3.77
Substance abuse	3	4	ns	0.62
Fatigue	10	7	ns	1.56
Decreased sexual desire	3	3	ns	0.09
Infertility	0	1	ns	0.19
Headache	4	5	ns	0.08
Abdominal pain	19	15	ns	1.52

Data are presented as percentage (%).

AAS, Anabolic Androgenic Steroids; ns, non-significant.

$p < 0.01$), melancholy (13% vs 4%; $\chi^2 = 20.27$; $p < 0.001$), concentration deficit (4% vs 1%; $\chi^2 = 7.62$; $p < 0.01$) and worry for mental health (8% vs 3%; $\chi^2 = 6.77$; $p < 0.01$; table 2).

Present and past substance use

The two groups did not differ regarding frequency of present alcohol consumption. Concerning tobacco use, the former AAS-users were less often present tobacco users compared with the non-AAS-users (2% vs 11%; $\chi^2 = 10.47$; $p < 0.001$). Regarding previous tobacco use, the two groups did not differ.

The former AAS-users showed higher lifetime prevalence of illicit drug use compared with the non-AAS-users (18% vs 4%; $\chi^2 = 35.20$; $p < 0.001$). The AAS-users had more often been offered AAS compared with the non-AAS-users (87% vs 20%; $\chi^2 = 223.1$; $p < 0.001$; see table 3 for substance use).

Former AAS-users

All the former AAS-users (n=143) reported having used AAS during their active sports career. The percentage of AAS-users in specific sport disciplines were: powerlifting (57%), Olympic lifting (47%), track and field (28%) and wrestling (6%). Forty-two per cent (n=60) had administrated AAS by tablets, 3% (n=5), by injections and 55% (n=78) by both tablets and injections. The main reasons for using AAS were: to achieve better sport results (81%), to train harder (56%), a suspicion that their competitors used AAS (45%) and faster recovery (43%).

Comparisons were also made between 'Former high AAS-users' (several cycles of AAS during a minimum of 2 years; n=53) and 'Former low AAS-users' (AAS-cycles less than 2 years; n=89) regarding present sociodemographic variables, past and present sport activities, past and present substance use

Table 3 Comparisons between former AAS-users (n=143) versus non-AAS-users (n=540) regarding present and previous substance use

Substance	Former AAS-users (n=143)	Non-AAS-users (n=540)	p Value	χ^2 Value
Tobacco				
Present tobacco use (% yes)	2	11	<0.001	10.47
Previous tobacco use (% yes)	27	27	ns	0.00
None tobacco user (% yes)	71	62	ns	3.48
Present alcohol consumption				
≥3 times drinking/week (% yes)	14	11	ns	0.97
1–2 times drinking/week (% yes)	42	46	ns	0.53
≤1 time drinking/month (% yes)	38	37	ns	0.09
Never drinking (% yes)	6	7	ns	0.17
Illicit drugs				
Lifetime prevalence of illicit drugs (% yes)	18	4	<0.001	35.20
AAS				
Ever been offered AAS (% yes)	87	20	<0.001	223.10

Data are presented as percentage (%).

AAS, Anabolic Androgenic Steroids; ns, non-significant.

Table 4 Comparisons between AAS-users who used several cycles of AAS during a minimum of 2 years (high AAS-users: n=53) versus AAS-users who used AAS for less than 2 years (low AAS-users: n=89) in regard to past and present substance use and lifetime prevalence for seeking professional expertise for mental-health problems

	High AAS-users (n=53) (%)	Low AAS-users (n=89) (%)	p Value	χ^2 Value
Substance use				
Combined AAS and use of illicit drugs	23	6	<0.001	9.13
Combined AAS and alcohol use	70	23	<0.01	29.36
Side effects of AAS	49	26	<0.01	7.50
Mental problems				
Anxiety	24	7	<0.01	9.06
Irritation and anger	7	0	<0.01	6.91

Data are presented as mean±SD or percentage.
AAS, anabolic androgenic steroids.

and lifetime prevalence (%) concerning seeking professional expertise for mental-health problems. Out of all variables that were tested between former high and low AAS-users (presented in tables 1–3), only the significant variables are presented in table 4.

There were no significant differences between former high and low AAS-users concerning sociodemographic variables and present and past sport activity. Furthermore, there were no differences in past and present substance use (tobacco, alcohol and illicit drugs). However, the former high AAS-users significantly more often combined AAS with the use of illicit drugs ($p<0.01$) and with the use of alcohol ($p<0.001$) compared with the former low AAS-users. Regarding lifetime prevalence concerning seeking professional expertise for mental-health problems, the former high AAS-users, compared with the former low AAS-users, had significantly more often sought professional help for anxiety ($p<0.01$) and for irritation and anger ($p<0.01$). Finally, the former high AAS-users significantly more often experienced side effects of AAS compared with the former low AAS-users ($p<0.01$).

DISCUSSION

The results from this study of former male-elite athletes in sport disciplines, where increased muscle strength has a marked influence on performance, showed that at least 20% admitted AAS-use during their active sport career. The study indicates that the former AAS-users had a higher frequency of lifetime prevalence of seeking professional expertise for several mental problems. Furthermore, former AAS-users more often had used illicit drugs. Former AAS-users were significantly older when they started training in their sport discipline in which they had been most successful and they also spent more hours per week training. Furthermore, if the former AAS-using athletes used AAS for a longer time than 2 years, they had more often sought professional expertise for anxiety, irritation and anger and they had also more often a combined use of alcohol and illicit drugs together with AAS. These high-consumers of AAS reported having experienced more side effects of AAS, compared with those athletes having used AAS no longer than 2 years. A former use of AAS does not seem to have a negative long-term effect on either present substance abuse and present sport activity or on whether they presently lived in a relationship or not.

The present results can be compared with previous results regarding lifetime prevalence of AAS-use among elite athletes active in the 60s and 70s. For example, in 1972, it was estimated that one-third of the Swedish-elite track and field athletes

used AAS.¹³ The present study is, however, based on a larger number of athletes and in four power sports. In the same year's Olympic Games, 68% of the participants in the track and field events reported prior steroid abuse.¹⁰ Shortly thereafter, in 1975, the International Olympic Committee (IOC) added AAS compounds to their list of prohibited substances.¹⁴ Nevertheless, in the Winter Games of 1992, a query reported that about 40% of the respondents estimated that more than 10% of the participants abused AAS in their respective sport discipline.¹⁵ Statistics published by the IOC show that the percentage of athletes testing positive for AAS has decreased since the mid-1980s.¹⁶ After the introduction of drug control in sport, the frequency of doping tests worldwide has exceeded 200 000 annually, with approximately 1–2% being reported positive by IOC accredited laboratories. The majority of the positive tests have shown the presence of AAS, although AAS comprise only 15% of all drugs banned by the IOC.¹⁷

The former elite athletes admitting AAS-use were significantly younger compared with the non-users. This age difference might explain why the former AAS-users are, to a higher degree, in their present employment. However, this difference disappeared when the old-age pensioners, that is, above 65 years of age, were excluded from the analysis.

Former AAS-users were significantly older when they started training in their specific sport discipline and they also spent more hours per week training. There is no obvious explanation to this later training start. The observed time spent on training among the AAS-users is reasonably explained by the known effect of AAS to make its users better tolerate hard training, 'train throw pain' and getting a quicker recovery, giving in summary a quantitatively higher training volume, in turn explaining the improvement in results often achieved by AAS-use. The reasons for AAS-use are those usually encountered among athletes taking AAS, which is to achieve improved results, tolerate harder training and get a quicker recovery, as aforementioned. However, interestingly, a major reason for AAS-use is the suspicion that the opponents use AAS to a high degree.¹⁸ It is also important to note that the former AAS-users more often had been offered AAS compared with the non-users indicating their near connection to groups of athletes with a generally more positive attitude to AAS-use.

The results from the present study show that former AAS-users, compared with those not having used AAS, had a significantly higher lifetime prevalence concerning seeking professional expertise for mental-health problems like depression, anxiety, melancholy, concentration deficit and worry for mental

health. One major drawback with the present study is that the relation in time between seeking professional help for mental problems and the use of AAS is not known, that is, if the effect is an acute or long-term effect of an AAS-use. However, many studies today do show a reliable correlation between the observed mental problems and use of AAS.¹ If one would assume that there is a relationship, it is still difficult to know whether AAS-abuse induces psychiatric symptoms or is a consequence of psychiatric symptoms or even personality disorders. Results from some clinical studies suggest that AAS-abuse may be a function of personality disorders,^{9, 19} while other studies suggest that AAS-abuse rather paves the way for different types of psychiatric symptoms.^{4, 20–26} Preliminary results from our own study group indicate that AAS might accentuate an already existing personality structure. Another possibility is that the abuses of AAS and psychiatric symptoms, by turns, reinforce each other in a negative manner. Though it is hard to know whether the observed effect is an acute or long-term effect of AAS, the fact remains that the former elite athletes significantly more often had sought professional expertise for mental problems compared with former elite athletes who had never used AAS. In all other aspects, the two groups did not differ in any significant way that could explain the observed effect. Another limitation associated with this work is that the data are solely based on men. Thus, the results are not necessarily applicable to women. Furthermore, the fact that the questionnaire asked for behaviours and psychiatric conditions that the athletes might have experienced a long time ago may affect the reliability of the observed results.

The present results showed no difference between the former AAS-users and non-users when comparing previous and present alcohol consumption and previous tobacco consumption. However, the former AAS-users had more often used illicit drugs, and the non-AAS-users were presently more addicted to tobacco. The results also indicate that the former AAS-users, who used AAS for longer than 2 years, more often combined AAS with alcohol and illicit drugs compared with those who used AAS for no longer than 2 years. It is proven today that the use of AAS often correlates with the use of other substances.^{27, 28} Whether AAS-use induces abuse of other substances or if drug abuse triggers the use of AAS is not yet clarified, although there are studies indicating that AAS-use can act as a gateway for misuse of other drugs.⁸ However, other studies do suggest that the concurrent use of AAS and illicit drugs is related to a general abuse liability.²⁹

In conclusion, at least 20% of male-elite athletes in four power sports active during 1960–1979 admitted former AAS-abuse. It is difficult to conclude from the present results whether the former use of AAS has long-term effects. The present results might instead mirror that the former AAS-users composed, for example, a certain personality structure prior to their AAS-use, which would be one of the causes behind the observed differences between former AAS-users and non-AAS-users. Other causes could include substance use and abuse as well as the influence of sociodemographic variables. Either way, it is feasible to suspect that AAS and psychiatric symptoms reinforce each other in a negative manner. Additionally, it is important to note that the former AAS-users more often had been offered AAS compared with non-users. This indicates that preventing efforts against AAS are of vital importance, both inside and outside the sporting world.

What are the new findings?

- ▶ A relationship is observed between the former use of anabolic androgenic steroids (AAS) and mental-health problems in former elite athletes.
- ▶ The former AAS-using athletes more often used illicit drugs compared with the former non-AAS-using athletes.
- ▶ At least 20% of Swedish male-elite power sport athletes on the top 10 national ranking lists during any of the years 1960–1979 in wrestling, Olympic lifting, powerlifting and the throwing events in track and field former athletes admitted previous AAS-use.

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