Use of anabolic-androgenic steroids in adolescence:

Winning, looking good or being bad?

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Abstract

Objective: To investigate the prevalence of anabolic-androgenic steroid (AAS) use among Norwegian adolescents and to contrast three perspectives on AAS-use: performance enhancement in sports competition; body image and eating concerns; and AAS-use belonging to a cluster of problem behavior. *Method*: A nationally representative sample of 8,877 Norwegian youths (15-22 years of age) were surveyed (response rate 78%). Sports participation included measures of participation in strength sports, participation in competitive sports, strength training, and perceived athletic competence. Body image and eating concerns included measures of disordered eating, perceived physical appearance, and satisfaction with body parts. Problem behavior was measured by three dimensions of conduct problems (overt destruction, overt non-destruction, and covert behavior), illicit drug use, and sexual involvement. *Results*: Lifetime AAS use was 0.8% (1.2 % male and .6% female), 12 month prevalence was 0.3%, and 5.1% had been offered AAS. AAS-use did not vary according to sports involvement and demographics. Logistic regression analyses showed that AAS use was associated with problem behavior (cannabis involvement and overt non-destruction, viz. aggressive, conduct problems) and to some extent involvement in power sports and disordered eating. AAS-users differed little from those who had been offered AAS, but who had refrained from using them, except that they were more often current cannabis users. *Conclusions*: Adolescent AAS-use seems primarily to be another type of problem-behavior and only secondary is it associated with strength sport participation and disordered eating.

Introduction

Use of anabolic-androgenic steroids (AAS) was first known to the public as a potential means to enhance performance in “power ” sports such as field events and weigh lifting. The main reason for use is the anabolic effect (Tanner et al., 1995). Although this has been somewhat hard to document experimentally in humans, the general trend is to accept its positive skeletal muscle-enhancing effect (Celotti and Negri-Cesi, 1992). AAS use has numerous adverse effects, among the most serious are increased risk of coronary heart disease, liver disease, testicular atrophy, prostate cancer, and breast enlargement in men and decrease in women (Bahrke et al., 1998). Possible psychological side effects include decreased libido, increased aggression including homicide and suicide, affective and psychotic disorders (Pope et al., 2000; Pope and Katz, 1988; Riem and Hursey, 1995). AAS is suggested to be addictive in some users (Brower et al., 1991). Moreover, AAS users often use other illicit drugs and there is the risk for spread of hepatitis and HIV to originally low risk populations through sharing needles in AAS injection (DuRant et al., 1993a). AAS use in adolescence may cause premature closure of the growth plates over the bones resulting in permanent short stature (Hallagan et al., 1989). The initiation has mostly been found to take place sometime during adolescence (Beel et al., 1998; Faigenbaum et al., 1998; Williamson, 1995; Yesalis et al., 1993). The prevention of AAS use should therefore be considered an important task not only within sports but also in the public at large. The search for risk and protective factors for AAS use in adolescence is therefore vital.

Rate of life-time use among USA high school students varies between 4% and 12% for males and 0.5% and 2% for females (Bahrke et al., 1998), whereas lower figures have been reported in other countries, e.g. between 1.2% and 3.2% for males and 0.2% and 2.0% for females in Australia (Beel et al., 1998). One report showed a fairly similar rate (12-month) in Canada (4.1% in males and 1.5% in females) (Canadian Centre for Drug-Free Sports, 1993). Prevalence of AAS use among Afrikaans-speaking sport participants has been reported to be in the same range (e.g. 2.5%), whereas much lower rates were found in the general adolescent student population in South Africa (Schwellnus et al., 1992). Studies from different regions in Sweden have provided varying lifetime estimates adolescents:

5.8% for males and 1.0% for females (Nilsson, 1995) vs. 2.1% and .2%, respectively (Kindlundh et al., 1999). Substantial regional difference has also been found in USA (DuRant et al., 1995) as well as in South Africa (Lambert et al., 1998). Apart from for Canada (e.g. Canadian Centre for Drug-Free Sports, 1993) and for USA (e.g. Yesalis et al., 1993) national data are lacking. The current knowledge about AAS use therefore needs to be supplemented by large scale and nationally representative samples from sites outside North America.

A policy of unannounced out-of-competition testing with continuous escort coverage from the moment of notification until delivery of the sample, as opposed to the 48-hour unescorted warning periods given by some countries, is employed by the Norwegian Confederation of Sports (NCS) among participants in all types of sports (Bahr and Tjørnhom, 1998). Almost all athletes in Norway, even at the high school and college levels, are associated with NCS. In comparison, only 16% of USA colleges and universities reported that they had tested for specific performance-enhancing drugs (Fields et al., 1994). It would therefore be of interest to contrast prevalence rates, particularly among sports participators, in Norway with prevalence rates in countries with a less strict testing regimen. The first aim of this research was therefore to estimate the prevalence of AAS use in Norway according to sports involvement, geographical region, and other demographics.

The vast amount of AAS research has been descriptive in nature. There have been some attempts at more theoretically driven research, but differing theoretical perspectives have rarely been contrasted. Theories of AAS use have had at least three different viewpoints. Firstly, many studies have taken sports as the vantagepoint, and these studies have noted such motives as winning and performing well in athletics (Scarpino et al., 1990). Accordingly the prevalence of AAS use among top athletes has been reported to be high in such sports as football, field, weight lifting, body building and possibly also self-defense sports and martial arts (VanHelder et al., 1991). High rates of use have also been found at sub-elite levels and among college and high school athletes (Bahrke et al., 1998; Beel et al., 1998).

Secondly, muscles do not only make you win; they simply fit the present-day body ideal. For men this body ideal implies upper torso strength and a mesomorph body type. For women this means slimness, particularly from the waist and down, coupled with large breasts (Cohn and Adler, 1992; Wichstrøm, 1999). To look good or to be big are the prime motives for AAS use among gym-based weight trainers (Gridley and Hanrahan, 1994) and among the top-two motives in the general adolescent population (Buckley et al., 1988; Whitehead et al., 1992). Eating problems and concerns have been found in male body-builders and AAS-users (Blouin and Goldfield, 1994; Komoroski and Rickert, 1992; Wroblewska, 1997). Possibly "reverse anorexia" (Pope et al., 1993) and hence AAS-use have partly the same etiology as eating disorders, including poor self-concept and poor body satisfaction. However, among normal adolescents one of the prime motives for looking good is to enhance ones chances with the opposite sex and one could therefore hypothesize that perceived "romantic appeal" is associated with AAS-use.

Thirdly, although the motive for use of AAS may be to win in sports or to enhance appearance, only a minority of young people actually employs AAS as a means for this common goal. AAS are substances who in many respects share the same characteristics as other substances: In many societies they are illegal or socially condemned. Thus, models of adolescent drug use could be extended to AAS-use. According to one such prominent model, Problem Behavior Theory (PBT), substance use during adolescence is part of a larger syndrome of problem behavior (Jessor and Jessor, 1977). PBT argues that delinquent-type behavior, underage drinking, problem drinking, marijuana use, use of other illicit drugs, and precocious sexual behavior are all part of the same pattern and constitute a broad class or syndrome of problem behavior. Young people who are heavily involved in one area of problem behavior tend to be heavily involved in other areas of problem behavior as well. The motive for the majority of adolescents being involved in such problem behavior has been suggested to gain adult status, which their body is prepared for, but which society denies them (Moffitt, 1993). AAS use may be part of such a problem behavior syndrome by virtue of being substances which are strongly condemned by society at large, but also by virtue of having the potency

of actually making the young person look more adult-like. Several pieces of research lend support to viewing AAS use as part of the PBT spectrum. Substance use has repeatedly been found to be prevalent among AAS-users (e.g. DuRant et al., 1993a; Kindlundh et al., 1999; Whitehead et al., 1992). Other aspects of problem behavior such as sexual involvement and conduct problems have not been analyzed systematically, but several case studies have noted violent acts and even homicide among AAS-users (Choi and Pope, 1994; Pope and Katz, 1994). Such violence has mostly been interpreted as an effect of the AAS-use itself. However, there is also a definite possibility that increased antisocial behavior among AAS-users is partly due to selection effects. Moreover, high school students who have used AAS played truant more often than non-users (Kindlundh et al., 1999).

Researchers addressing the nature of conduct problems and conduct disorder disagree whether this should be treated as a single syndrome or as different dimensions or sub-groups (Loeber and Stouthamer-Loeber, 1998). Based on a meta-analysis of dimensional analyses of conduct problems and crime, Loeber and Schmaling (1985) suggested that such behavior could be divided into four different types based on two dimensions: overt-covert (aggressive vs. non-aggressive) and destructive vs. non-destructive (property vs. persons). Because aggression has traditionally been singled out as the important dimension in previous AAS-research, we ask whether interpersonal aggression (covert aggression) is predictive of AAS-use or if other types of conduct problems also play a role.

Narratives from AAS-users often reveal that they were introduced to or offered the drug by training partners or trainers in gyms (Beel et al., 1998). However, although most of these offers may be turned down, those who are offered the drug are at particular risk for experimenting with it. For preventive purposes it is important to know the characteristics of those offered AAS and what predicts use as opposed to turning down the offered AAS.

In summary, the present study had three aims: 1) to estimate the prevalence of AAS use among adolescents in Norway according to sports involvement and demographic factors, 2) to test which of three perspectives, sports involvement, appearance and eating concerns, and problem

behavior theory predict AAS-use, 3) to identify predictors of AAS use as opposed to being offered AAS but refraining.

Methods

Participants

Students from 67 schools in grades 7 - 12 (ages 12 - 20) participated in the first round of data collection (t1) of the Young in Norway study during the spring and fall of 1992. Data for the present research are from the second round of data collection (t2) that took place in 1994. Details about participants and the procedures at t1 have been given elsewhere (Wichstrøm, 1995a; 1999), so only a brief outline will be presented here. Participants at t1 were representative of the Norwegian high school population, which implies almost complete representativeness for grades 7 to 10. The response rate was 97,0%. Due to dropout and courses that take less than 3 years to complete, about 80% of the 18-year olds were still attending high school. The overall response rate at t2 was 80.1%. The net sample was n = 8,512, mean age was 17.33 years (S.D. = 2.18, range 14 - 25), and there were slightly more girls than boys (53.8%). The main activity of the respondents was as follows: junior high school (31.5%), senior high school (50.4%), in education after senior high school graduation (4.3%), full-time employment (4.3%), part-time employment (6.3%), unemployment (1.8%), housewife (0.4%), military service (2.1%), unknown activity (2.2%). Among those who were still at their original school, 91.8% responded whereas the figure was 67.9% for those who received a postal questionnaire. Apart from this, the attrition was selective according to a large number of variables. Logistic regression analysis identified the following predictors of t2 attrition: gender (boy); vocational training; poor grades; conduct problems; low parental SES; few hours spent on homework; low parental monitoring; and urbanity. In all, by entering these variables, 65% of the attrition group was classified correctly.

Procedure

Every student gave his/her consent in writing based both on an oral and written description of the project formulated according to the standards prescribed by the Norwegian Data Inspectorate. According to these standards, a written informed consent was also obtained from parents of students

below the age of 15. The students were instructed to place the completed questionnaires in an envelope and to seal it themselves. A teacher trained by the liaison officer monitored the students in the class during completion. To avoid students influencing each other's responses, all eligible students at each school completed the questionnaire at the same time. Students who had consented to participate but who were not present in class during school that day completed the questionnaire together on a later occasion. At t2 participants who had left their original school received the questionnaire by mail (51.5%). Those not responding within 4 weeks were mailed another questionnaire with a reminder letter. The students still at their original school filled out the questionnaire at school according to the same procedure as in 1992.

Instruments

AAS involvement. The participants were asked whether they had ever used Anabolic Steroids (doping) (Yes/No), whether they had used them during the preceding 12 months (6-point scale), and whether they had ever been offered AAS (Yes/No). Follow-up questions were used to find out whether they had used or been offered types of doping other than AAS (Yes/No).

Involvement in power sports. The adolescents were posed an open-ended question about whether they had competed in or were currently competing in any sports and to state the type of sport. They were also asked whether they had been involved in sports they did not compete in. Those indicating weight lifting, bodybuilding, boxing, gymnastics, wrestling, or martial arts were grouped as power sports participators. Subject who currently or previously had competed in sports indicated their highest level of competition (community level, county level, national level or international level). In addition hours per week spent on training in private gyms was recorded. Perceived Athletic Competence was measured using a revised version of the Self Perception Profile for Adolescents (SPPA-R) (Harter, 1988; Wichstrøm, 1995b) ($\alpha = 0.82$).

Appearance and eating problems. Eating problems were measured using a 12-item version of EAT-26 (Garner et al., 1982) developed by Lavik et al. (1991). Several studies suggest favorable reliability and validity for boys and girls (Engelsen, 1999; Engelsen & Hagtvet, 1999a,b). Moreover, cross-sectional correlates (Wichstrøm, 1995a) as well as prospective predictors (Wichstrøm, 2000) of EAT-12 do not differ

between genders. A 7/8 cut-off point was used. Body mass index (BMI) (kg/cm^2) was based on self-report. Desired weight change was calculated by subtracting self-reported weight from desired weight (provided the same height). Two measures of physical appearance were included. The Body Areas Satisfaction Scale (BASS) (Brown et al., 1989) asks for ratings of satisfaction with specific body parts: face, lower torso, mid torso, upper torso, muscle tone, weight and height (α=0.81). Perceptions of Global Physical Appearance were measured using the Physical Appearance sub-scale in SPPA-R (α= 0.82), and Romantic Appeal was measured using another sub-scale in SPPA-R (α = 0.75).

Problem behavior. Three different dimensions of conduct problems were included based on previous analyses of the Young in Norway project (Pedersen and Wichstrøm, 1995). Frequency of conduct problems during the preceding 12 months was measured on a 6-point scale ranging from ”0 times” to ”More than 50 times”. In order to obtain an approximation of DSM-III-R symptoms of Conduct Disorder, only participation with intensity at hypothetical clinically meaningful levels was included (Wichstrøm et al., 1996). These dimensions included Overt Destruction: stolen from someone in the family (6 + times, 4.9%); stolen goods of value between 100 NOK and 500 NOK (2+ times, 3.9%); stolen goods of value between 500 NOK and 1000 NOK (1+ time, 2.1%); minor vandalism (destroyed bus seats, postboxes, telephone booths etc.) (6+ times, 1.9%); stolen a car or a motorcycle (1+ time, 1.6%); stolen goods of value more than 1000 NOK (1+ time, 2.3%); broken in to steal (1+ time, 2.7%); Overt Non-destruction: fought with a weapon (1+ time, 2.1%); fought without a weapon (6+ times, 2.8%); threatened someone to obtain money or goods (1+ time, 2.6%); Bullied or intimidated others (10+ times, 2.7%); forced someone to have sex (1+ time, 1.1%); robbed someone (1+ time, .8%); Covert Non-destruction: refrained from paying on buses, at the cinema etc. (10 + times, 5.6%); played hookey (50+ times, 1.6%); stayed out a whole night without parental permission (10+ times, only for those aged 17 or younger, 1.1%). Sexual involvement was measured by asking the adolescents if they ever had sexual intercourse. Drug use: Lifetime use of Cannabis (Yes/No) and having been offered Cannabis (Yes/No) were recorded. Period prevalence (12 months) of alcohol

intoxication, cannabis use, solvent use, and use of hard drugs, were measured on a 6-point scale ranging from ”0 times” to ”More than 50 times”.

Background information included degree of urbanization according to 5 categories: the capital of Oslo (approximately 500,000 inhabitants); large town (100,000 to 200,000 inhabitants); small town (fewer than 75,000 inhabitants and official status as a town); suburban area (less than 25 km from Oslo or large town); and rural area (not fulfilling any of the previous criteria). Parental socioeconomic status (SES) was measured by classification of mother and father’s occupation according to ISCO-88 (International Labour Office, 1988). The country was divided into five regions (East, South, West, Middle, and North). Because reports of AAS may be confounded with response style, a brief version of the Marlowe-Crown Social Desirability Scale (Crowne and Marlowe, 1964) developed by Schuessler (1982) on a youth sample was included.

Analysis

For bi-variate analyses AAS-involvement was grouped into those who had used AAS, those who had been offered AAS but not used them, and those who had never used or been offered AAS. Finally two logistic regression analyses were conducted. The dependent variables were to be offered AAS and use of AAS, with no offer and no use, respectively, as reference categories. Because no specific theoretical models were introduced, a stepwise procedure with backward elimination according to Δ L.R. was employed. Differences in regression coefficients between the two equations were tested with a t-test (Paternoster et al., 1998).

Results

In all 72 persons (0.8%, CI 95%: 0.7% - 1.0%) reported that they had ever used AAS and 430 persons (5.1%, CI: 4.6% - 5.5%) reported that they had been offered AAS. Only 8 AAS-users (11.1%) stated that they had not been offered the drugs. Correcting for attrition by weighting with the results from the logistic regression analysis predicting attrition, only 5 additional cases of AAS-use were estimated. AAS-use did not vary according to whether the subjects completed the questionnaire at school or at home, degree of urbanization, geographical region, parental SES, previous or current

sport competition, but those competing at high levels were slightly more prone to use AAS: community level 0.5%; county level 0.9%; national level 1.3%; international level 2.5%, χ^2 = 11.0, 3 df, p < .001. Those offered AAS more often lived in urban areas: capital area 7.6%; town 6.2%; small town 5.6%; suburban area 3.9%; and rural area 3.7%, χ^2 = 31.13, 4 df, p< .001. Current (5.9%) and past (6.9%) sports competitors had been offered AAS more often than those without sports involvement (3.4%) χ^2 = 28.52, 2 df, p < .001. Those competing at a high level had received offers of AAS the most: community level 4.8%; county level 5.8%; national level 9.9%; international level 14.3%, χ^2 = 44.14, 3 df, p < .001. AAS use was not associated with a socially desirable response style, whereas those who had been offered AAS scored slightly higher on this measure, t = -3.04, 1/8536 df, p < .01.

Almost half (N = 31) of the AAS-users had used the drug during the preceding 12 months (0.34%, CI: 0.25% - 0.50%). Those who had used the drug during the preceding 12 months differed from the past users in several ways by being more often males (80,6% vs. 48,8%), χ^2 = 7.65, 1 df, p<.01, participating more in power sports (56,7% vs. 13,3%), χ^2 = 12.38, 1 df, p<.001, being involved in Overt Destruction (53,6% vs. 23,7%), χ^2 = 6.22, 1 df, p<.05 and Overt Non-Destruction (50,0% vs. 17,9%), χ^2 = 7.78, 1 df, p<.01 more often, using illicit drugs the preceding 12 months more often: cannabis 58,1% vs. 19,5%, χ^2 = 11.37, 1 df, p<.001; solvents 32,3% vs. 9,8%, χ^2 = 5.71, 1 df, p<.05; having better self-perceived Romantic Appeal (score 3.17 vs. 2.85), t = 2.36, 1/70 df, p<.05, and training currently more often in private gyms (2.17 vs. .80 hours pr. week), t = 2.79, 1/68 df, p< .01). Entering these significant variables into a logistic regression predicting use within the previous 12 months vs. past use showed that only engagement in power sports aO.R. = 14.09 (3.16 - 62.89) and current use of cannabis aO.R. = 9.11 (2.22 - 37.31) were multivariately significant.

/Table 1 near here/

The AAS-users and those who had been offered AAS but had never used them shared many of the same characteristics, and differed from those who were not involved in AAS (Table 1): they were predominantly male, about 1/3 were involved in power sports, they more often trained in private

gyms, and they perceived their athletic competence to be better than those not involved in AAS did. Moreover they were less inclined to want to loose weight, they perceived their Romantic Appeal to be higher, and they were more often involved in all types of problem behavior, in particular aggressive behavior and drug use. The AAS-users as opposed to those offered AAS were less often males, they had used illegal substances more often: hard drugs (12 months) 19% vs. 5%, Cannabis lifetime 58% vs. 24% and 12 months 36% vs. 20%.

/Table 2 near here/

Logistic regression analysis showed that to have been offered AAS was predicted by gender (boy), sexual intercourse, offered cannabis, conduct problems of both overt destructive type and overt non-destructive type, disordered eating, and involvement in power sports (Table 2). Use of AAS was predicted by gender, offered cannabis and used cannabis, conduct problems of overt non-destructive type, disordered eating, and involvement in power sports. Thus, AAS involvement was mostly associated with variables within the problem behavior spectrum, but representatives from sports involvement (power sport) and appearance (disordered eating) were also included in the final model. Neither demographic variables nor social desirability were multivariately predictive. Significant interaction effects between the covariates and the variable resulting from the logistic regression analysis predicting attrition would indicate that the results were influenced by selective attrition. However, there was no such interaction. The variables included in the logistic regression model of those offered AAS and the model of those who used AAS differed little. The only exceptions were cannabis involvement which was significantly more predictive of AAS use as opposed to having been offered AAS ($p < .001$) and sexual intercourse which was less predictive of AAS use as compared to being offered AAS ($p < .05$).

Discussion

The prevalence and correlates of AAS use among Norwegian adolescents were investigated in a large, representative sample. The “life-time” prevalence of AAS use was 0.8% and 12 months prevalence was 0.3%. Prevalence did not differ according to age, degree of urbanization, geographical

region or SES. Three different types of explanation of AAS use were contrasted: body image and eating problems, involvement in power sports, and problem behavior. Multivariate analyses showed that AAS use was first and foremost associated with different types of problem behavior: that is drug (cannabis) involvement and aggressive-type conduct problems. In addition, involvement in power sports and disordered eating were multivariately associated with lifetime use. Recent AAS users were more often current cannabis users than previous AAS users. A substantial proportion of Norwegian adolescents (5.1%) had been offered AAS, and they differed little from those who had actually used the substances, except that the AAS users more often used other illegal substances (viz. cannabis).

The prevalence of AAS use among Norwegian adolescents was substantially lower than in most studies of adolescents from Western societies, which is typically in the range of 2.5% to 7% in the US and 2% to 3.5% in Australia, Canada, Sweden and South Africa. However, the present figure of 0.8% is close to the following estimates: 1.3% from a national study of visitors to registered gyms (Okstad et al., 1995a), 1.9% prevalence among visitors to gyms in a Norwegian county (Tangen and Bergsgard, 1994) and 1.4% prevalence among military personal mostly consisting of drafted young males in the age range 17-29 (military service is mandatory for Norwegian males) (Okstad et al., 1995b). There are therefore reasons to believe that AAS are less of a problem in the general Norwegian adolescent population than in many other Western countries and in the USA in particular. Among adolescent athletes AAS are more prevalent among participators in strength events such as wrestling, track events and football, which are popular among males in the USA. In Norway, the top three events are soccer, team handball and cross-country skiing, in that order. Thus, the lesser need for explosive strength among young Norwegian athletes compared to American athletes may explain some of the difference in AAS prevalence. This fact may also explain why there was no difference in AAS use among sports competitors and non-competitors, as often (see Bahrke et al., 1998 for review) but certainly not always (DuRant et al., 1995; Tanner at al., 1995; Whitehead et al., 1992) found among North American samples. Moreover, sports competition is the norm for adolescents in Norway (69.9% were present or past competitors in the present sample). Although AAS-use, but not AAS-

dealing, was legal when this study was conducted (1994), doping control has been a topic of considerable public interest. The overwhelming majority of Norwegian athletes is associated with the NCS and therefore risks unannounced doping tests. The number of tests performed in Norway has increased during the 1990's whereas the percentage of positive tests has declined compared to earlier periods (Bahr and Tjørnhom, 1998). The strong position against AAS taken by agencies associated with sports in Norway may thus have led to a strong opinion against the use of doping in sports. Indeed only 5% of Norwegian adolescents report that they agree to the statement "I would in fact like to try anabolic steroids (doping)" (Wichstrøm, 1995c), whereas in Australia, where the prevalence is lower than in the USA, 10% considered future use (McGufficke et al., 1990). Moreover, sport competitors had been offered AAS more frequently than non-competitors, but they were no more likely to use AAS. This finding along with the low prevalence rate might suggest that AAS have been fought fairly successfully in Norwegian sports.

To understand individual differences in AAS use, researchers have taken at least three different views: physical attractiveness and eating problems, participation in power sports, and drug use. The present study indicates that although all three perspectives add to the understanding of who use AAS, it is the illegal substance aspect that explains most of the variance in AAS-use. This association has been identified in several studies. However, drug use is correlated with other potential characteristics of AAS-users such as disordered eating (Jonas et al., 1987; Zweben, 1987) and living in urban areas (Wichstrøm et al., 1996). The present research adds to the understanding of AAS-use by demonstrating an association with drug use when such alternate explanations and potential confounders are controlled for. Moreover, drug use fits into a wider syndrome of problem behavior, but the effect of drug use is still strong when other aspects of problem behavior such as sexual involvement and conduct problems are controlled for.

Those offered AAS are at risk of experimenting with the substances. Moreover, previous research has identified weight trainers in gyms to be particularly at risk, with life time prevalence rates of AAS-use ranging from 7.7% (Korkia and Stimson, 1993) in the UK to 90% (Taylor and

Black, 1987) in the USA. Although most AAS-users in the present study had been offered the substances, only 15% of those offered them had ever used AAS. It has been suggested that personality disorders within cluster A and B may be more prevalent among body builders who had used AAS than in body builders who had not used them (Porcerelli and Sandler, 1995), and sub-clinical or clinically manifest personality disorders may increase the risk of accepting an offer to use AAS. However, others have not found these two groups of bodybuilders to differ in these respects (Moss et al., 1992; Perry et al., 1990; Yates et al., 1990). Researchers report that eating concerns and a desire for weight gain differentiate AAS body builders who are AAS-users from non-users (Blouin and Goldfield, 1995) and predict AAS-use among high school students (Komoroski and Rickert, 1992). They suggest that this might play an etiological role. However, these findings were not replicated in a sample of high-school graduates (Drewnowski et al., 1995) and in a study comparing body builders who use or do not use AAS (Schwerin et al., 1997). The present study suggests that although disordered eating multivariately associated with AAS-use, such problems might be considered a selection effect due to the fact that those offered AAS had equally distorted eating patterns.

Previous studies have indicated that alcohol use is correlated with AAS-use (Bahrke et al., 1998). More restrictions are placed on alcohol use in Norway than in most Western countries: an age limit of 18 apply for purchase, wine and liquor are only sold in a limited number of governmentally owned outlets, and alcohol is heavily taxed. Although this policy have kept the average consumption at a comparably low level, the explosive drinking culture of Nordic countries prevails: Drinking to intoxication is more common among Norwegian adolescents than in many Mid or Southern European countries (Wichstrøm, 1998). Hence, alcohol intoxication may be seen as socially acceptable in adolescence, whereas illicit drug use, e.g. cannabis use, is less prevalent than in many other countries and may be a more marginalized phenomenon. This may offer some explanation to why alcohol was not multivariately predictive once illicit drug use was controlled. This finding is also in keeping with results from Sweden (Kindlundh et al., 1999) as well the state of Georgia (DuRant et al., 1993a). It may thus be the illicit aspect of drug use that is important with respect to AAS. A substantial

proportion of AAS users obtains the drugs on the black market (Beel et al., 1998). There is a definite possibility that their AAS supplier also deals with other drugs, thereby increasing the risk for AAS users experimenting with other illegal substances or using them regularly. The previously identified association between AAS and other drugs might therefore merely represent a selection into an AAS using milieu or getting offers to use or buy AAS. The present study takes this research forward by demonstrating that AAS users more often use illegal substances than those who have been offered AAS but refrained from using them do. Cannabis possibly functions as a gateway drug for AAS in the Norwegian context, making the choice of experimenting with yet another illegal substance easier.

Limitations

The present study is cross-sectional and causal conclusions are therefore precluded. Numerous physiological, emotional and behavioral effects of AAS use have been suggested, among them irritability, aggression, depression, euphoria, variable libido, and aggressive behavior (Riem and Hursey, 1995). Most associations have not been substantiated in studies with adequate control for selection and expectancy biases, but recent studies indicate that AAS supplementation may increase mania and possibly also aggression in some men (Pope, Kuori & Hudson, 2000). It is therefore possible or even likely that some of the observed differences between non-users and users are the result of the intake of the drug or correlated events such as weight training, AAS expectancies and being in an AAS milieu. The fact that lifetime AAS use was recorded, whereas correlates were measured in a more narrow and recent time frame adds to the possibility that the present findings represent drug effects. However, the findings also showed that potential effects of AAS intake such as aggressive behavior and eating problems were not multivariately predictive of recent use, neither did they differentiate between AAS users and those who had been offered AAS. This may indicate that the present results were not solely due to the drug.

There has been considerable concern about under-reporting in self-report studies of AAS, and a minority of users of doping agents may also be misinformed about which substances they have actually used (Thompson et al., 1993). One study found sensitivity and specificity to be 74% and 82%

respectively in male weightlifters (Ferenchick, 1996) when self-reports were compared to urine samples. Based on the same method, DuRant et al (1993b) found acceptable positive and negative predictive values of anabolic steroid metabolites in self-reports, and also acceptable test-rest reliability over a four-month span. In general adolescents tend to give valid and reliable information about their drug use in anonymous surveys (see e.g. Rutter et al., 1998), and it is questionable whether self-reports about AAS use are less reliable and valid than for example self-reported cocaine or heroin use. Several aspects of the present study may have minimized potential underreporting. The general aim of the survey was concerned with the development and living conditions of adolescents, and question about AAS occupied only a small part, thus possibly making AAS users less reluctant to complete the survey than otherwise. Moreover, the sample was drawn from an almost complete register of all adolescents in Norway, the participators were assured anonymity by placing the questionnaire in an unmarked envelope which they sealed themselves, and the response rate was favorable and allowed for correction for attrition. Such correction had minimal impact on the findings as had data collection method (school-based vs. postal questionnaire). Moreover, to ensure that the subjects did not report other doping agents, a follow-up question asked about doping agents other than AAS. It should be noted that other alleged anabolic agents sold over the counter in the U.S. such as Creatine Monohydrate and AAS precursors (e.g. Andronostenedione and Norandrostenediol) had very limited availability at the Norwegian market as shown by other Norwegian studies (Okstad et al. 1995a; Bergsgard and Tangen 1995). However, some subjects could have classified hGH as AAS.

A cautionary note on generalizing the present findings to other cultures is warranted. Because the use of AAS as well as other drugs, in particular cannabis, is less frequent than in other countries, such as the USA, such use may be a more marginalized phenomenon in Norway. Cannabis use may thus be more strongly associated with other forms of deviance among Norwegian adolescents than among adolescents in countries with a higher prevalence of cannabis use. Indeed, hard drugs, such as cocaine and injected drugs, have been associated with AAS use in the USA (DuRant et al, 1993a). However, although the types of behavior associated with AAS may be different in other countries, the

conclusion may still hold that AAS use in the general adolescent population is first and foremost another type of problem behavior and secondly related to power sports and appearance.

References

Bahr, R. and Tjørnhom, M. Prevalence of doping in sports: Doping control in Norway, 1977-1995. Clin J Sport Med **8**: 32-37, 1998.

Bahrke, M. S., Yesalis, C. E. and Brower, K. J. Anabolic-androgenic steroid abuse and performance-enhancing drugs among adolescents. Child and Adolescent Psychiatric Clinics of North America **7**: 821-838, 1998.

Beel, A., Maycock, B. and McLean, N. Current perspectives on anabolic steroids. Drug Alcohol Rev **17**: 87-103, 1998.

Bergsgard, N. A. and Tangen, J. O. To dope or not to dope. Rapport 1 - En kartlegging av dopingbruk i et idrettsmiljø (Report No. 80). Bø, Norway: Telemarksforskning-Bø, 1994.

Blouin, A. G. and Goldfield, G. S. Body image and steroid use in male bodybuilders. Int J Eat Disord **18**: 159-165, 1995.

Brower, K. J., Blow, F. C., Young, J. P., and Hill, E. M. Symptoms and correlates of anabolic-androgenic steroid dependence. Br J Addict **86**: 759-768, 1991.

Brown, T. A., Cash, T. F. and Lewis, R. J. Body-image disturbances in adolescent female binge-purgers: A brief report of the results of a national survey in U.S.A. J Child Psychol Psychiatry **30**: 605-613, 1989.

Buckley, W. E., Yesalis, C. E., Friedl, K. E., Anderson, W. A., Streit, A. L., and Wright, J. E. Estimated prevalence of anabolic steroid use among male high school seniors. JAMA **260**: 3441-3445, 1988.

Canadian Centre for Drug-Free Sports. National School Survey on Drugs and Sport: final report, Gloucester, Ontario, 1993.

Celotti F. and Negri-Cesi, P. Anabolic steroids: a review of their effects on the muscles, of their possible mechanisms of action and of their use in athletics. J Steroid Biochem Mol Biol **43**: 469-77, 1992.

Choi, P. Y. L. and Pope, H. G. Jr. Violence toward women and illicit androgenic-anabolic steroid use. Ann Clin Psychiatry **6**: 21-25, 1994.

Cohn, L. D. and Adler, N. E. Female and male perceptions of ideal body shapes: Distorted views among Caucasian college students. Psychology of Women Quarterly **16**: 69-79, 1992.

Crowne, D. P. and Marlowe, D. The Approval Motive. Studies in Evaluative Dependence. New York: John Wiley and Sons, Inc, 1964.

Drewnowski, A., Kurth, C. L., and Krahn, D. D. Effects of body image on dieting, exercise, and anabolic steroid use in adolescent males. Int J Eat Disord **17**: 381-386, 1995.

DuRant, R. H., Rickert, V. I., Ashworth, C. S., Newman, C., and Slavens, G. Use of multiple drugs among adolescents who use anabolic steroids. N Engl J Med **328**: 922-926, 1993a.

DuRant, R., Rickert, V. and Ashworth, C. Validity of adolescents' self-report of anabolic steroid use. N Engl J Med **329**: 889, 1993b.

DuRant, R. H., Escobedo, L. G. and Heath, G. W. Anabolic-steroid use, strength training, and multiple drug use among adolescents in the United States. Pediatrics **96**: 23-28, 1995.

Englesen, B. K. Multidimensionality in adolescent eating problems. A two-phase measurement study. Eating Weight Disord **4**: 63-75, 1999.

Englesen, B. K. and Hagtvet, K.A. A generalizability study of the Eating Attitudes test (EAT-12) in non-clinical adolescents. Eating Weight Disord **4**: 179-186, 1999a.

Englesen, B. K. and Hagtvet, K.A. The dimensionality of the 12-item version of the Eating Attitudes Test. Confirmatory factor analyses. Sand J Psychol **40**: 293-300, 1999b.

Faigenbaum, A. D., Zaichkowsky, L. D., Gardner, D. E. and Micheli, L. J. Anabolic steroid use by male and female middle school students. Pediatrics **101**: E61-E66, 1998.

Ferenchick, G. S. Valdity of self-report in identifying anabolic steroid use among weightlifters. J Gen Intern Med **9**: 554-556, 1996.

Fields, L., Lange, W. R., Kreiter, N. A. and Fudala, P. J. A national survey of drug testing policies for college athletes. Med Sci Sports Exerc **26**: 682-686, 1994.

Garner, D. M., Olmsted, M. P., Bohr, Y. and Garfinkle, P. E. The Eating Attitudes test: psychometric features and clinical correlates. Psychol Med **12**: 871-878, 1982.

Gridley, D. W and Hanrahan, S. J. Anabolic-androgenic steroid use among male gymnasium participants: dependence, knowledge and motives. Sport Health **12**: 11-14, 1994.

Hallagan, J. B., Hallagan, L. F. and Snyder, M. B. Anabolic-androgenic steroid use by athletes. N Engl J Med **321**: 1042-1045, 1989.

Harter, S. Manual for the Self-Perception Profile for Adolescents. Denver, CO: University of Denver, 1988.

International Labour Office . ISCO-88 - International Standard Classification of Occupations. Geneve: Author, 1990.

Jessor, R. and Jessor, S. L. Problem behavior and psychosocial development. A longitudinal study of youth. New York: Academic Press, 1977.

Jonas, J. M., Gold, M. S., Sweeney, D. and Pottash, A. L. C. Eating disorders and cocaine abuse: A survey of 259 cocaine abusers. Journal of Clinical Psychiatry **48**: 47-50, 1987.

Kindlundh, A. M. S., Isacson, D. G. L., Berglund, L., and Nyberg, F. Factors associated with adolescent use of doping agents: anabolic-androgenic steroids. Addiction **94**: 543-553, 1999.

Komoroski, E. M. and Rickert, V. I. Adolescent body image and attitudes to anabolic steroid use. American Journal of Diseases of Children **146**: 823-828, 1992.

Korkia, P. and Stimson, G. V. Anabolic Steroid use in Great Britain. London: Centre for Research on Drugs and Health Behaviour, 1993.

Lambert, M. I., Titlestad, S. D. and Schwellnus, M. P. Prevalence of androgenic-anabolic steroid use in adolescents in two regions of South Africa. S Afr Med J **88**: 876-880, 1998.

Lavik, N. J., Clausen, S. E. and Pedersen, W. Eating behaviour, drug use, psychopathology and parental bonding in adolescents in Norway. Acta Psychiatr Scand **84**: 387-390, 1991.

Loeber, R., and Schmaling, K. B. Empirical evidence for overt and covert patterns of antisocial conduct problems: A meta-analysis. J Abnorm Child Psychol **13**: 337–353, 1985.

Loeber, R. and Stouthamer-Loeber, M. Development of juvenile aggression and violence. Some common misconceptions and controversies. Am Psychol **53**: 242-259, 1998.

McGufficke, A., Rowling, L. and Bailey, M. Drug use by adolescent athletes. Youth Studies **9**: 47-50, 1990.

Moffitt, T. E. Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. Psychol Rev **100**: 674-701, 1993.

Moss, H. B., Panzak, G. L. and Tarter, R. E. Personality, mood, and psychiatric symptoms among anabolic steroid users. The American Journal on Addictions **1**: 315-324, 1992.

Nilsson, S. Androgenic anabolic steroid use among male adolescents in Falkenberg. Eur J Clin Pharmacol **48**: 9-11, 1995.

Okstad, A., Solli, E., Kongsvik, T. and Storvoll, E. Dopingbruk i registrerte helsestudio. En undersøkelse av omfang og variasjoner. (Report No. 13, 1995). Nord-Trøndelag, Norway: Nord-Trøndelagsforskning, 1995a.

Okstad, A., Solli, E., Kongsvik, T. and Storvoll, E. Dopingbruk i Forsvaret. En undersøkelse av omfang og variasjoner. (Report No. 14, 1995). Nord-Trøndelag, Norway: Nord-Trøndelagsforskning, 1995b.

Paternoster, R., Brame, R., Mazerolle, P. and Piquero, A. Using the correct statistical test for the equality of regression coefficients. Criminology 36: 859-867, 1998.

Pedersen, W. and Wichstrøm, L. Patterns of delinquency in Norwegian adolescents. British Journal of Criminology **35**: 543-562, 1995.

Perry, P. J., Yates, W. R. and Andersen, K. H. Psychiatric symptoms associated with anabolic steroids: a controlled, retrospective study. Ann Clin Psychiatry **2**: 11-17, 1990.

Pope, H. G. and Katz, D. L. Affective and psychotic symptoms associated with anabolic steroid use. Am J Psychiatry **145**: 487-490, 1988.

Pope, H. G. and Katz, D. L. Psychiatric and medical effects of anabolic-androgenic steroid use: A controlled study of 160 athletes. Arch Gen Psychiatry **51**: 375-382, 1994.

Pope, H. G., Katz, D. L. and Hudson, J. I. Anorexia nervosa and "reverse anorexia" among 108 male bodybuilders. Compr Psychiatry **34**: 406-409, 1993.

Pope, H. G., Kuori, E.M. and Hudson, J. I**.** Effects of supraphysiologic doses of testosterone on mood and aggression in normal men: a randomized controlled trial. Arch Gen Psychiatry **57**: 133-140, 2000.

Porcerelli, J. H. and Sandler, B. A. Narcissm and empathy in steroid users. Am J Psychiatry **152**, 1672-1674, 1995.

Riem, K. E. and Hursey, K. G. Using anabolic-androgenic steroids to enhance physique and performance: effects on moods and behavior. Clinical Psychology Review **15**: 235-256, 1995.

Scarpino, V., Arrigo, A., Benzi, G., Garattini, S., La Vecchia, C., Bernardi, L. R., Silvestrini, G. and Tuccimei, G. Evaluation of prevalence of "doping" among Italian Athletes. Lancet **336**: 1048-1050, 1990.

Schuessler, K. F. Measuring social life feelings. San Francisco, CA: Jossey Bass, 1982.

Schwellnus, M. P., Lambert, M. I., Todd, M. P. and Juritz, J. M. Androgenic anabolic steroid use in matric pupils. A survey of prevalence of use in the western Cape. S Afr Med J **82**: 154-158, 1992.

Schwerin, M. J., Corcoran, K. J., LaFleur, B. J., Fisher, L., Patterson, D. and Olrich, T. Psychological predictors of anabolic steroid use: an explorative study. Journal of Child and Adolescent Substance Abuse **6**: 57-68, 1997.

Sylvester, J. Anabolic steroids at the 1972 Olympics. Scholastic Coach, pp. 90-92, 1973.

Tanner, S. M., Miller, D. W. and Alongi, C. Anabolic steroid use by adolescents: Prevalence, motives, and knowledge of risks. Clin J Sport Med **5**: 108-115, 1995.

Taylor, W. N. and Black, A. B. Pervasive anabolic steroid use among health club athletes. Annals of Sports Medicine **3**: 155-159, 1987.

Thompson, P.D., Zmuda, J.M. and Catlin, D.H. Use of anabolic steroids among adolescents. N Engl J Med **329**: 888-889, 1993.

VanHelder, W.P., Kofman, E. and Tremblay, M.S. Anabolic steroids in sport. Canadian Journal of Sport Sciences **16**: 248-257, 1991.

Whitehead, R., Chillag, S. and Elliot, D. Anabolic steroid use among adolescents in a rural state. J Fam Pract **35**: 401-405, 1992.

Wichstrøm, L. Social, psychological and physical correlates of eating problems. A study of the general adolescent population in Norway. Psychol Med **25**: 567-579, 1995a.

Wichstrøm, L. Harter's Self-Perception Profile for Adolescents: reliability, validity and evaluation of the question format. J Pers Assess **65**: 100-116, 1995b.

Wichstrøm, L. Hvem? Hva? Hvor? - Om ungdom og idrett. En landsdekkende surveyundersøkelse. (Statens trykksakekspedisjon: V-0837B). Oslo, Norway: Kulturdepartementet, 1995c.

Wichstrøm, L. Alcohol intoxication and school drop out. A nationally representative longitudinal study of Norwegian adolescents. Drug Alcohol Rev: **17**: 413-421, 1998.

Wichstrøm, L. The emergence of gender difference in depressed mood during adolescence: The role of intensified gender socialization. Develop Psychol **35**: 232–245, 1999.

Wichstrøm, L. Psychological and behavioral factors unpredictive of disordered eating. A prospective study of the general adolescent population in Norway. Int J Eating Disord **28**: 33-42, 2000.

Wichstrøm, L., Skogen, K. and Øia, T. The increased rate of conduct problems in urban areas: what is the mechanism? J Am Acad Child Adolesc Psychiatry **35**: 471-479, 1996.

Wroblewska, A. Androgenic-anabolic steroids and body dysmorhia in young men. J Psychosom Res **42**: 225-234, 1997.

Yates, W. R., Perry, P. J. and Andersen, K. H. Illicit anabolic steroid use: a controlled personality study. Acta Psychiatr Scand **81**: 548-550, 1990.

Yesalis, C.E., Kennedy, N. J., Kopstein, A. N. and Bahrke, M. S. Anabolic-androgenic steroid use in the United States. JAMA **270**: 1217-21, 1993.

Zweben, J. E. Eating disorders and substance abuse. J Psychoactive Drugs **19**: 181-192, 1987.

Table 1

Characteristics of adolescents who have used AAS, been offered AAS, and not involved in AAS

	Adolescent groups: Mean scores (s.d.) or percentages			χ^2 or F-value
	No AAS involvement N = 8,072	Offered AAS N = 364	Used AAS N = 72	
Gender (% boys) [b)]	44.2	78.7	62.5	172.37***
Age	17.53 (2.60)	17.50 (2.55)	17.50 (2.56)	.03
Sports-related characteristics:				
Power sports or martial arts (%)	11.0	32.7	35.0	166.98***
Training in private gyms, hours pr. week	.53 (2.82)	1.15 (1.95)	1.43 (2.07)	11.37***
Perceived athletic competence	2.48 (.67)	2.66 (.68)	2.54 (.72)	11.70***
Appearance-related characteristics:				
BMI	21.54 (4.62)	22.13 (2.93)	22.92 (5.06)	5.84*
Desired weight change (kg.)	-2.04 (7.61)	-.40 (10.55)	-.40 (17.84)	8.27***
Satisfaction with body parts	3.47 (.65)	3.60 (.69)	3.44 (.82)	7.56**
Physical appearance	2.65 (.69)	2.74 (.73)	2.70 (.67)	3.06
Romantic appeal	2.69 (.57)	2.94 (.54)	3.00 (.56)	38.46***
Eating problems (%)	4.0	4.8	10.0	6.68
Problem behavior:				
Overt Destructive (%)	10.3	33.1	36.4	213.43***
Covert Non-Destructive (%)	6.9	22.5	30.0	160.83***

Overt Non-Destructive (%)	6.5	29.7	31.3	307.29***
Offered cannabis (%)	27.7	78.9	81.9	520.52***
Used cannabis (%) [c)]	8.9	24.2	58.3	278.40***
Sexual intercourse (%)	45.9	77.3	72.5	151.10***
Intoxicated 50+ times previous 12 month (%)	3.5	9.8	18.3	75.16***
Used cannabis previous 12 months (%) [b)]	6.6	19.8	36.1	173.63***
Used solvents previous 12 months (%)	2.5	11.0	19.4	152.93***
Used hard drugs previous 12 months (%) [c)]	1.3	5.3	18.8	176.46***

Note: * p <.01, ** p<.001, *** p< .0001. Significance level of pairwise difference between Offered AAS and Used AAS [a)] p <. 05, [b)] p <. 01, [c)] p <. 001, Bonferroni correction.

Table 2

Adjusted odds ratios for AAS-use and AAS-offer. No AAS-use/no AAS offer as contrast.

Predictors	Offered AAS		Used AAS	
	aO.R.	CI 95%	aO.R.	CI 95%
Gender (boy)	3.65	2.68 - 4.79	1.98	1.02 - 3.83
Sexual intercourse*	2.47	1.80 - 3.37	1.12	.57 - 2.22
Offered Cannabis	6.06	4.40 - 8.32	6.10	2.54 - 14.61
Used Cannabis***	.73	.52 - 1.02	3.24	1.68 - 6.22
Disordered eating	2.10	1.15 - 3.85	4.07	1.53 - 10.75
Conduct problems: Overt Destructive	1.67	1.22 - 2.29	1.59	.80 - 3.16
Conduct problems: Overt Non-Destructive	2.57	1.85 - 3.56	2.29	1.12 - 4.68
Involvement in power sports	2.23	1.66 - 2.97	2.90	1.56 - 5.35

Note:

Regression coefficient significantly different * $p < .05$, *** $p < .001$.