[1] Department of Immunology, Medical University of Gdańsk, Poland
[2] Department of Histology, Medical University of Gdańsk, Poland
[3] Department of Hypertension and Diabetology, Medical University of Gdańsk, Poland

Prevalence and risk factors of anabolic-androgenic steroids (AAS) abuse among adolescents and young adults in Poland

Submitted: 10 February 2006
Accepted: 20 July 2006

Summary

Objective: To estimate the prevalence of anabolic-androgenic steroids (AAS) abuse among adolescent and young adults in Poland.
Method: 3687 men (48.2%) and women (51.8%), median age 23 (interquartile range 19–30 years) participated in a survey via a "pop-up window" which appeared on two popular Polish internet portals during one month. Questions concerning their body image, exercise behaviour, education level and use of anabolic-androgenic steroids were asked.
Results: The prevalence of anabolic-androgenic steroids use was 6.2% among males and 2.9% among females. Male AAS users, compared to non-users, were more often concerned about their physical appearance, were less educated and often engaged in some sport activity. Among female AAS users, no significant differences concerning self-body image satisfaction or participation in sports were found. However, compared to non-users, female AAS users were less educated.
Conclusion: The abuse of AAS is a reality in Poland and may become a serious health concern among adolescents and young adults.

Keywords: Anabolic agents – Androgens – Drug abuse – Adolescents – Poland – Internet.

Anabolic-androgenic steroids (AAS) have been used as doping agents by professional football players, weightlifters, powerlifters, bodybuilders and throwers in track and field events since the 1960s (Yesalis & Bahrke 1995). Today the abuse of AAS in no longer limited to elite athletes. The body ideal increasingly featured in the media, characterized by large muscles, well defined abdominals, and extremely low body fat, is an extreme goal that is achievable neither by most men nor women (Kouri et al. 1995; Labre 2002). In the quest for physical perfection and athletic performance, adolescents and young adults nowadays abuse AAS. The first big study of AAS abuse among high school students was conducted in the United States in 1987. It showed that 6.6% of male high school seniors reported having used these drugs and 38% of them had initiated abuse before 16 years of age. Moreover, one-third of the AAS users did not plan to participate in interscholastic sports (Buckley et al. 1988). Now, over twenty US local, state and national level studies have confirmed these findings and showed that 3% to 12% of high school males and 1% to 2% females admit to using AAS at some time in their life (Yesalis & Bahrke 1995; Yesalis et al. 1997). Other studies about the abuse of AAS were conducted in Canada (Melia et al. 1996), Sweden (Eklof et al. 2003; Kindlundh et al. 1999; Nilsson 1995; Nilsson et al. 2004), Great Britain (Williamson 1993), Australia (Handelsman & Gupta 1997) and South Africa (Lambert et al. 1998; Schwellnus et al. 1992). They all have reported the overall prevalence rates for high school-aged students to range between 1% and 3%. Although these rates are slightly lower than in the United States, they still are a cause for concern, especially when considering the adverse effects of AAS abuse. The prevalence of AAS abuse in Poland is still unknown but anecdotal evidence suggests that it is widespread. Thus, the aim of our study was to estimate the prevalence of AAS abuse among adolescents and young adults in Poland.

Methods

Participants and data collection

From the 5th of March until the 5th of April 2003, a "pop-up" window, with the invitation to participate in our survey en-

Soz Praventiv Med. 51 (2006) 392–398
0303-8408/06/060391–07
DOI 10.1007/s00038-006-6018-1

titled "Do you take care of your physical appearance?", appeared on two popular Polish internet portals: hoga.pl and www.opinie.pl. The respondents who agreed to participate were asked four closed questions (yes/no) concerning their physique anxiety and satisfaction with their body image, athletic participation ("exercise behaviour") and educational level. Respondents were also asked to mark their year of birth and gender. At the end of the survey, a question about using AAS was asked. All respondents who admitted using these agents, were additionally asked to select from a list of 8 types of AAS and accessory drugs they were usually using. The names of the substances were given in an international form but also the name under which they are commercially available was provided (brand name).

Statistical analysis

The tabular analysis of the results involved simple frequency counts and percentages. The χ^2 statistic was used to test for significant differences between AAS users and nonusers. All analyses were carried out using STATISTICA 6.0 software for Windows. $P < 0.01$ was considered statistically significant.

Results

Sample

The number of participants in our survey was 3 687. The sample consisted of young adults, median age 23 years (interquartile range 19–30 years), where 48.2 % of them were females and 51.8 % were males.

Prevalence of AAS abuse

More than 87 % (n = 3 233) of the 3 687 respondents answered the question concerning the abuse of AAS and indicated their gender. Among male respondents, 6.2 % admitted to using AAS in order to improve their physical appearance (n = 105). The prevalence of AAS abuse among females was 2.9 % (n = 45) (Table 1). These results clearly show that the likelihood of using AAS is increased by being male ($p < 0.01$).

About 50 % of male and female AAS users were between 18 and 27 years of age. 11.1 % of female and 14.3 % of male AAS users were less then 18 years. About 31 % of male and 32 % of female respondents were 28 years or older. Distribution of AAS abuse in different age groups is shown in Table 2.

Comparison of AAS users vs. non-users

All the respondents were also asked questions concerning their education level, physique anxiety and exercise behaviour. Almost eighty-four percent (83.8 %) of the male AAS users compared to non-users admitted that they were concerned about their physique and physical appearance ($p < 0.01$). Participation in sports activities was significantly different ($p < 0.01$) between male AAS users and nonusers, with the users more likely to attend the gym or do regular physical training (72.4 %). There were no significant differences in body image satisfaction between the groups. The majority of male AAS users were poorly educated. Many of them had less then 10 years of education (38.8 %). Data comparison of male AAS users vs. non-users are presented in Table 3.

In female responders, there were no significant differences concerning the physique anxiety, body image satisfaction and participation in sports activities between the AAS users and non-users. The only statistically significant difference between these groups was in education level. Females who abused AAS in order to improve their physical appearance were poorly educated, 45.9 % of them had no high school education ($p < 0.01$). Data comparison of female AAS users vs. non-users are presented in Table 4.

Types of AAS used

All respondents who admitted to using AAS were also asked to select from a list of 8 types of AAS and accessory drugs they were usually taking. Among the male AAS users, metandienone was the drug most often abused. 42.9 % of the male responders admitted using this oral AAS. Testosterone and its esters were used by 32.4 % and 24.8 % of the male AAS users respectively. Seventeen percent of the male AAS users were also using stanazolol and 12.4 % oxandrolone and mesterolone. Nandrolone decanoate was used by 9.5 % of the male AAS users. Antiestrogenes (tamoxifen or clomiphen) and human

Table 1 Prevalence of AAS abuse in our sample

	Females	Males
	% of subjects (n)	
Non-users	97.1 (1 506)	93.8 (1 577)
AAS users	2.9 (45)	**6.2 (105) ***
	* $p < 0.01$	

Table 2 Distribution of AAS abuse in different age groups

Age range	% of females (n)	% of males (n)
13–17 yrs	11.1 (5)	14.3 (15)
18–22 yrs	**24.4 (11)**	**24.8 (26)**
23–27 yrs	**24.4 (11)**	**23.8 (25)**
28–32 yrs	11.1 (5)	9.5(10)
33–37 yrs	8.9 (4)	8.6 (9)
>38 yrs	11.1 (5)	14.3 (15)
No data	8.9 (4)	4.8 (5)

Table 3 Comparison of male AAS users vs. non-users

	Non-users (%) N = 1 577	AAS users (%) N = 105
Do you take care of your physical appearance? *		
Yes	63.35	**83.81**
No	36.65	16.19
Are you satisfied with your physical appearance?		
Yes	47.31	55.24
No	52.69	44.76
Are you engaged in any sport activities?*		
Yes	51.36	**72.38**
No	48.64	27.62
Education level *		
No high school (≤10 yrs)	15.93	**38.78**
High school diploma (12 yrs)	46.22	32.65
Master degree (>12 yrs)	37.84	28.57
* $p < 0.01$		

Table 4 Comparison of female AAS users vs. non-users

	Non-users (%) N = 1 506	AAS users (%) N = 45
Do you take care of your physical appearance?		
Yes	76.16	77.78
No	28.84	22.22
Are you satisfied with your physical appearance?		
Yes	38.98	24.44
No	61.02	75.56
Are you engaged in any sport activities?		
Yes	54.73	57.78
No	48.27	42.22
Education level*		
No high school (≤10 yrs)	22.99	45.95
High school diploma (12 yrs)	42.55	37.84
Master degree (>12 yrs)	34.46	16.22
* $p < 0.01$		

chorionic gonadotropin (hCG) were used by 8.6 % and 10.5 % of the male responders respectively.

Among female AAS users, testosterone was the drug most often abused. Almost twenty-nine percent of the female responders admitted using this hormone. Thirteen percent of female responders were also using metandienone and 8.9 % oxandrolone. Stanazolol and nandrolone were abused by 4.4 % of the female AAS users. Antiestrogens and hCG were used by female responders by 4.4 % and 11.1 % respectively. The data on the types of AAS and accessory drugs abused by the participants in our studied sample are presented in Table 5.

Table 5 Types of AAS and accessory drugs abused by the subjects in our study

Types of drugs	% of female AAS users	% of male AAS users
Metandienone	13.3	42.9
Testosterone	28.9	32.4
Testosterone blend	11.1	24.8
Nandrolone decanoate	4.4	9.5
Stanazolol	4.4	17.1
Oxandrolone	8.9	12.4
Tamoxifen/Clomiphen	4.4	8.6
Beta HCG	11.1	10.5

Discussion

Today the misuse of AAS is no longer limited to elite-athletes. Recent reports highlight the fact that a significant number of recreational athletes including adolescent males and females, abuse these drugs (Bahrke et al. 2000). The muscular male body physique along with a thin, "waif" version of the female ideal is now featured in television, movies and numerous advertisements targeting adolescents (Labre 2002). Therefore, in the quest for physical perfection and athletic performance young adults started abusing AAS. Other problems may include body dissatisfaction (dysmorphophobia), eating disorders, and use of untested dietary supplements (Abraham 2003; Kanayama et al. 2001; Mędraś & Szczęsny 2001). To our knowledge our study is the first national survey of AAS abuse among adolescent and young adults in Poland. Our findings show that the non-medical use of these substances is a reality not only in the USA ("National Household Survey on Drug Abuse. Available online at: http://www.icpsr.umich.edu/cgi-bin/SDA11/hsda3. [Accessed Sep 2004]") and northern Europe (Eklof et al. 2003; Nilsson et al. 2004; Williamson 1993) but also in Poland. Among our male respondents, 6.2 % admitted using AAS in order to improve their physical appearance. The prevalence of AAS abuse among females was 2.9 %. These rates are comparable with the reports from the United States where the abuse of AAS among young males is 4 % to 12 % and among females 2.8 % to 3.2 % (Bahrke et al. 2000). Also, at least 25 studies have reported that the likelihood of using AAS is increased by being male. The relative risk of AAS abuse is generally at least 2 to 3 times greater for young men (Bahrke et al. 2000).

In our study about 50 % of male and female users were between 18 and 27 years of age and 11.1 % of female and 14.3 % of male were less than 18 years respectively. Several state and national level studies indicate a relationship between adolescent AAS abuse and age: older adolescents have a significantly higher AAS abuse rates than younger adolescents (Bahrke et al. 2000). Risk factors associated with AAS abuse among

adolescents and young adults also include physique anxiety, athletic participation and education level. Therefore, in our survey we asked questions concerning the above mentioned variables. More than eighty-three percent (83.8%) of our male AAS users compared to 63.35% of non-users admitted that they were concerned about their physique and physical appearance ($p < 0.01$). These results are consistent with the data obtained from several other investigations which have found that AAS users show a greater physique anxiety compared to non-users and one of the main reasons for misusing these substances is to improve physical appearance (Bahrke et al. 1998; Buckley et al. 1988; Johnson et al. 1989; Kindlundh et al. 1999; Nilsson 1995; Nilsson et al. 2004). AAS users may also show signs of body image dissatisfaction (Melia et al. 1996; Williamson 1993). However, other studies have found that AAS users are more satisfied with their bodies (Komoroski & Rickert 1992) and rate their levels of strength (Buckley et al. 1988; Williamson 1993) and health (Buckley et al. 1988; Whitehead et al. 1992; Yesalis et al. 1989) above average. This may explain why we didn't find any differences concerning self body image dissatisfaction between the AAS users and non-users in our study.

The results from our survey also showed that participation in sport activities was more common among our male respondents who abused AAS. This data is also consistent with the results of other investigations which have reported that generally AAS users are more likely to participate in school sponsored athletics than non-users (Bahrke et al. 2000). Another finding in our study is that the AAS users compared to non-users were less educated. Other studies do not show a clear correlation, between the education level and the risk of using AAS. However, some studies have reported that adolescent AAS users have lower school grades and a higher rate of truancy (Bahrke et al. 2000). In our female AAS users we didn't find any significant differences concerning the physique anxiety, self body image satisfaction and participation in sport activities. However, compared to non-users, female AAS users in our sample were poorly educated.

All respondents who admitted to using AAS also gave data on the type of substance they were using. Among the male AAS users, metandienone – a 17α-methyltestosterone derivative, was the drug most often abused. More than 40% of the male AAS users admitted using this oral AAS. Testosterone and its esters were the second most popular preparations abused by male AAS users. Nandrolone decanoate, the most often abused steroid among athletes and bodybuilders, was used by 9.5% of our male AAS users. In female AAS users, testosterone was the drug most often abused and 28.9% of them admitted using this hormone. Other abused drugs also included metandienone (13.3%) and oxandrolone (8.9%). Other studies, evaluating the prevalence of AAS abuse, rarely give any data on the type of substances most often used. In one review, testosterone and a blend of its esters (Sustanon 250, Organon) is pointed out as the preparation most often abused by AAS users (Dawson 2001). Data from the anti-doping hotline, which was started in 1993 in Sweden aiming to capture the abuse of AAS in the general public, show that the most often abused AAS preparations among Swedish AAS users are: testosterone, nandrolone, methandienone and stanazolol (Eklof et al. 2003).

Limitations

There are however some limitations to this study that should be considered. For one, the method of data collection, an internet-based survey, poses some challenges. The internet access among the general population can be biased with regard to gender, education, income, and age (Couper 2000), which has limited their usefulness to certain groups, such as students at a university or employees at a company (Baer et al. 2002). Also, an internet based questionnaire is a good method of data collection where the internet access is high (Balter et al. 2005). Recent data show that only 23.9% of Polish individuals (age range 15–75 years) use internet (Polish NetTrack Study 2004). Nonetheless, 72% of the internet users report being between 15 and 19 years of age which is the population at which our investigation was aimed. Additionally, it should be noted, that the popularity of the two internet portals (hoga.pl, www.opinie.pl), where we had installed the pop-up to take part in our survey, is not the same in every part of our country and it is possible that respondents don't reflect the whole population of adolescent and young adults in Poland. Therefore, the prevalence rates of various features described for our sample may not be generalised to the young Polish population as a whole. Nevertheless, it has been shown that the validity and reliability of data obtained online are comparable to those with classic methods (Buchanan & Smith 1999a Buchanan & Smith 1999a 1999b) and has already been used by other investigators to evaluate steroid abuse among recreational athletes, weightlifters and bodybuilders (Parkinson & Evans 2006; Perry et al. 2005). Additionally, in terms of response rate, McCabe et al (2002) have found that internet-based surveys produce higher yields than mailed hard copy surveys. Also, internet based surveys have been shown to reduce turnaround time and enhance survey item completion rates without compromising the integrity of the data (McCabe et al. 2002; Miller et al. 2002; Schleyer & Forrest 2000).

The reliance on self-report data may also constitute a source of experimental bias. Nonetheless, we believe that not too many of our adult respondents claimed to have used AAS when in fact they never had done so. Contrariwise, AAS abuse is quite

a rare behaviour, and participants in our control group cannot have suffered very much contamination from denials of AAS abuse (Ensminger et al. 1997).

Despite these limitations, the results of this study are disturbing, especially when considering the adverse effects of AAS abuse in young adults. Apart from undesirable body changes such as masculinisation of the body in women and breast development in men (gynecomastia), the abuse of AAS poses several health risks, including premature skeletal maturation, suppression of normal neuroendocrine function, infertility and hepatotoxicity (Kutscher et al. 2002). Also, adverse psychiatric effects such as major mood and dependence syndromes (Brower 2002; Malone et al. 1995), violent behaviour (Pope & Katz 1994) and an increased risk of progressing to opioid abuse (Arvary & Pope 2000; Kanayama et al. 2003; McBride et al. 1996) have been reported in participants who abused AAS. Recent reports also clearly show that long-term AAS abuse may also have deleterious effects on the cardiovascular system. High doses of AAS have unfavourable effects on serum lipid levels (Parssinen & Seppala 2002), can increase the arterial blood pressure (Lenders et al. 1988) and can lead to left ventricular hypertrophy of the heart muscle with restricted diastolic function (De Piccoli et al. 1991; Urhausen et al. 2004). AAS users who share needles or use non-sterile techniques when they inject steroids are also at risk for contracting dangerous infections, such as HIV/AIDS, hepatitis B and C, and bacterial endocarditis (Rich et al. 1999).

Conclusions

The abuse of AAS is a reality in Poland and may become a serious health concern with regard to adolescents and young adults. Polish AAS users are significantly more likely to be young males who are concerned about their physical appearance, with low education level and who are engaged in some sport activities. Parents, physicians and teachers should be aware of these risk factors which can help them identify and deter AAS abuse by adolescents and young adults. Also, there is a strong need of forming major AAS abuse prevention programs in Poland and educate the public about the dangers of AAS misuse.

Acknowledgements

The authors would like to thank the two Polish internet portals: hoga.pl and www.opinie.pl, for helping gathering the data for this study.

Zusammenfassung

Prävalenz und Risikofaktoren des Abusus von anabol-androgenen Steroiden (AAS) bei Adoleszenten und jungen Erwachsenen in Polen

Studienziel: Die Einschätzung der Prävalenz des Abusus von anabol-androgenen Steroiden bei Adoleszenten und jungen Erwachsenen in Polen.

Methoden: 3687 Männer (48,2 %) und Frauen (51,8 %), medianes Alter 23, (interquartiler Bereich 19–30 Jahre) beteiligten sich an einer Umfrage via „pop-up window", die während eines Monats auf zwei populären polnischen Internetportalen aufgeschaltet war. Ihnen wurden Fragen zu physischen Aspekten, sportlicher Betätigung, Bildungsstand und zum Konsum von anabol-androgenen Steroiden gestellt.

Resultate: Die Prävalenz des Konsums von anabol-androgenen Steroiden lag bei 6,2 % bei den Männern und bei 2,9 % bei den Frauen. Männliche AAS-Konsumenten machten sich im Vergleich zu den Nicht-Konsumenten mehr Sorgen über Ihr körperliches Erscheinungsbild, waren weniger gebildet und trieben oft Sport. Bei den AAS-Konsumentinnen wurden keine signifikanten Unterschiede betreffend des eigenen Körperbildes oder der sportliche Betätigung gefunden. Im Vergleich zu Nicht-Konsumentinnen waren die AAS-Konsumentinnen jedoch weniger gebildet.

Schlussfolgerungen: Der Missbrauch von anabol-androgenen Steroiden ist in Polen eine Realität und könnte sich zu einem ernsthaften Gesundheitsproblem bei Adoleszenten und jungen Erwachsenen entwickeln.

Soz Praventiv Med. 51 (2006) 392–398

Résumé

Utilisation de stéroïdes androgènes anabolisants chez les adolescents et les jeunes adultes en Pologne : prévalence et facteurs de risque

Objectifs: Estimer la prévalence de l'utilisation de stéroïdes androgènes anabolisants chez les adolescents et les jeunes adultes en Pologne.

Méthode: 3687 hommes (48.2 %) et femmes (51.8 %), âge moyen 23 ans (espace interquartile 19–30 ans), ont participé à une enquête apparaissant sur deux sites internet populaires polonais durant un mois. Les questions posées concernaient l'aspect physique des répondants, leur comportement en matière d'activité physique, leur niveau de formation ainsi que leur utilisation éventuelle de stéroïdes androgènes anabolisants.

Résultats: La prévalence de l'utilisation de stéroïdes androgènes anabolisants était de 6.2 % chez les hommes et de 2.9 % chez les femmes. Comparés aux non utilisateurs, les hommes recourrant aux stéroïdes androgènes anabolisants s'inquiétaient plus souvent de leur aspect physique, avaient un niveau de formation moins élevé et participaient plus souvent à des activités sportives. Parmi les femmes recourrant aux stéroïdes androgènes anabolisants, aucune différence significative n'a pu être mise en évidence sur le plan de l'image corporelle ou de la participation à des activités sportives. Par contre, elles présentaient un niveau de formation moins élevé que les femmes qui n'utilisaient pas les stéroïdes androgènes anabolisants.

Conclusions: L'abus de stéroïdes androgènes anabolisants est une réalité en Pologne. Cela pourrait devenir un problème de santé sérieux parmi les adolescents et les jeunes adultes.

References

Abraham SF (2003). Dieting, body weight, body image and self-esteem in young women: doctors' dilemmas. Med J Aust *178*: 607–11.

Arvary D, Pope HG Jr (2000). Anabolic-androgenic steroids as a gateway to opioid dependence. N Engl J Med *342*: 1532.

Baer A, Saroiu S, Koutsky LA (2002). Obtaining sensitive data through the Web: an example of design and methods. Epidemiology *13*: 640–5.

Bahrke MS, Yesalis CE, Brower KJ (1998). Anabolic-androgenic steroid abuse and performance-enhancing drugs among adolescents. Child Adolesc Psychiatr Clin N Am *7*: 821–38.

Bahrke MS, Yesalis CE, Kopstein AN, Stephens JA (2000). Risk factors associated with anabolic-androgenic steroid use among adolescents. Sports Med *29*: 397–405.

Balter KA, Balter O, Fondell E, Lagerros YT (2005). Web-based and mailed questionnaires: a comparison of response rates and compliance. Epidemiology *16*: 577–9.

Brower KJ (2002). Anabolic steroid abuse and dependence. Curr Psychiatry Rep *4*: 377–87.

Buchanan T, Smith JL (1999a). Research on the Internet: validation of a World-Wide Web mediated personality scale. Behav Res Methods Instrum Comput *31*: 565–71.

Buchanan T, Smith JL (1999b). Using the Internet for psychological research: personality testing on the World Wide Web. Br J Psychol *90 (Pt 1)*: 125–44.

Buckley WE, Yesalis CE, 3rd, Friedl KE, Anderson WA, Streit AL, Wright JE (1988). Estimated prevalence of anabolic steroid use among male high school seniors. JAMA *260*: 3441–5.

Couper M (2000). Web surveys: a review of issues and approaches. Public Opin Q *64*: 464–94.

Dawson RT (2001). Drugs in sport – the role of the physician. J Endocrinol *170*: 55–61.

De Piccoli B, Giada F, Benettin A, Sartori F, Piccolo E (1991). Anabolic steroid use in body builders: an echocardiographic study of left ventricle morphology and function. Int J Sports Med *12*: 408–12.

Eklof AC, Thurelius AM, Garle M, Rane A, Sjoqvist F (2003). 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 *59*: 571–7.

Ensminger ME, Anthony JC, McCord J (1997). The inner city and drug use: initial findings from an epidemiological study. Drug Alcohol Depend *48*: 175–84.

Handelsman DJ, Gupta L (1997). Prevalence and risk factors for anabolic-androgenic steroid abuse in Australian high school students. Int J Androl *20*: 159–64.

Johnson MD, Jay MS, Shoup B, Rickert VI (1989). Anabolic steroid use by male adolescents. Pediatrics *83*: 921–4.

Kanayama G, Gruber AJ, Pope HG, Jr, Borowiecki JJ, Hudson JI (2001). Over-the-counter drug use in gymnasiums: an underrecognized substance abuse problem? Psychother Psychosom *70*: 137–40.

Kanayama G, Pope HG, Cohane G, Hudson JI (2003). Risk factors for anabolic-androgenic steroid use among weightlifters: a case-control study. Drug Alcohol Depend *71*: 77–86.

Kindlundh AM, Isacson DG, Berglund L, Nyberg F (1999). Factors associated with adolescent use of doping agents: anabolic-androgenic steroids. Addiction *94*: 543–53.

Komoroski EM, Rickert VI (1992). Adolescent body image and attitudes to anabolic steroid use. Am J Dis Child *146*: 823–8.

Kouri EM, Pope HG, Jr, Katz DL, Oliva P (1995). Fat-free mass index in users and nonusers of anabolic-androgenic steroids. Clin J Sport Med *5*: 223–8.

Kutscher EC, Lund BC, Perry PJ (2002). Anabolic steroids: a review for the clinician. Sports Med *32*: 285–96.

Labre MP (2002). Adolescent boys and the muscular male body ideal. J Adolesc Health *30*: 233–42.

Soz Praventiv Med. 51 (2006) 392–398

Lambert MI, Titlestad SD, Schwellnus MP (1998). Prevalence of androgenic-anabolic steroid use in adolescents in two regions of South Africa. S Afr Med J *88*: 876–80.

Lenders JW, Demacker PN, Vos JA, et al.. (1988). Deleterious effects of anabolic steroids on serum lipoproteins, blood pressure, and liver function in amateur body builders. Int J Sports Med *9*: 19–23.

Malone DA, Jr, Dimeff RJ, Lombardo JA, Sample RH (1995). Psychiatric effects and psychoactive substance use in anabolic-androgenic steroid users. Clin J Sport Med *5*: 25–31.

McBride AJ, Williamson K, Petersen T (1996). Three cases of nalbuphine hydrochloride dependence associated with anabolic steroid use. Br J Sports Med *30*: 69–70.

McCabe SE, Boyd CJ, Couper MP, Crawford S, D'Arcy H (2002). Mode effects for collecting alcohol and other drug use data: Web and U.S. mail. J Stud Alcohol *63*: 755–61.

Mędraś M, Szczęsny M (2001). [Muscle dysmorphia as a problem of sports medicine.]. Medicina Sportiva *5*: 17–22.

Melia P, Pipe A, Greenberg L (1996). The use of anabolic-androgenic steroids by Canadian students. Clin J Sport Med *6*: 9–14.

Miller ET, Neal DJ, Roberts LJ, et al.. (2002). Test-retest reliability of alcohol measures: is there a difference between internet-based assessment and traditional methods? Psychol Addict Behav *16*: 56–63.

National Household Survey on Drug Abuse. Available online at: http://www.icpsr.umich.edu/cgi-bin/SDA11/hsda3. [Accessed Sep 2004].

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

Nilsson S, Spak F, Marklund B, Baigi A, Allebeck P (2004). Attitudes and behaviors with regards to androgenic anabolic steroids among male adolescents in a county of Sweden. Subst Use Misuse *39*: 1183–97.

Parkinson AB, Evans NA (2006). Anabolic androgenic steroids: a survey of 500 users. Med Sci Sports Exerc *38*: 644–51.

Parssinen M, Seppala T (2002). Steroid use and long-term health risks in former athletes. Sports Med *32*: 83–94.

Perry PJ, Lund BC, Deninger MJ, Kutscher EC, Schneider J (2005). Anabolic steroid use in weightlifters and bodybuilders: an internet survey of drug utilization. Clin J Sport Med *15*: 326–30.

Pope HG, Jr, Katz DL (1994). Psychiatric and medical effects of anabolic-androgenic steroid use. A controlled study of 160 athletes. Arch Gen Psychiatry *51*: 375–82.

Rich JD, Dickinson BP, Feller A, Pugatch D, Mylonakis E (1999). The infectious complications of anabolic-androgenic steroid injection. Int J Sports Med *20*: 563–6.

Schleyer TK, Forrest JL (2000). Methods for the design and administration of web-based surveys. J Am Med Inform Assoc *7*: 416–25.

Schwellnus MP, Lambert MI, Todd MP, Juritz JM (1992). Androgenic anabolic steroid use in matric pupils. A survey of prevalence of use in the western Cape. S Afr Med J *82*: 154–8.

Urhausen A, Albers T, Kindermann W (2004). Are the cardiac effects of anabolic steroid abuse in strength athletes reversible? Heart *90*: 496–501.

Whitehead R, Chillag S, Elliott D (1992). Anabolic steroid use among adolescents in a rural state. J Fam Pract *35*: 401–5.

Williamson DJ (1993). Anabolic steroid use among students at a British college of technology. Br J Sports Med *27*: 200–1.

Yesalis CE, Bahrke MS (1995). Anabolic-androgenic steroids. Current issues. Sports Med *19*: 326–40.

Yesalis CE, Barsukiewicz CK, Kopstein AN, Bahrke MS (1997). Trends in anabolic-androgenic steroid use among adolescents. Arch Pediatr Adolesc Med *151*: 1197–206.

Yesalis CE, Streit AL, Vicary JR, Friedl KE, Brannon D, Buckley W (1989). Anabolic steroid use: indications of habituation among adolescents. J Drug Educ *19*: 103–16.

Address for correspondence

Dr. Dominik Rachoń MD
Department of Hypertension and Diabetology
Medical University of Gdańsk
ul. Dębinki 7, 80-211 Gdańsk, Poland
Tel.: +48 58 349 2530
Fax: +48 58 349 2503
e-mail: drachon@amg.gda.pl