

Cross-sectional Study of Female Students Reporting Anabolic Steroid Use

Diane L. Elliot, MD; JeeWon Cheong, PhD; Esther L. Moe, PhD, MPH; Linn Goldberg, MD

Objective: To determine the characteristics of female US high school students reporting anabolic steroid use.

Design: Cross-sectional assessment using the 2003 Centers for Disease Control and Prevention national school-based Youth Risk Behavior Survey database.

Setting: Nationally representative sample of US high schools.

Participants: Female students in grades 9 through 12 (n = 7544).

Main Outcome Measures: Participants' self-reported anabolic steroid use was compared with other health-related behaviors and with sports participation.

Results: Prior or ongoing anabolic steroid use was reported by 5.3% of female high school students. Those adolescent girls had a marked increase in other health-compromising behaviors, including past 30-day use of

alcohol (odds ratio [OR], 8.83; 95% confidence interval [CI], 5.49-14.20), cigarettes (OR, 5.14; 95% CI, 3.14-8.42), marijuana (OR, 7.91; 95% CI, 5.20-12.04), cocaine (OR, 10.78; 95% CI, 6.18-18.81), and diet pills (OR, 4.86; 95% CI, 2.98-7.93). They were more likely to carry a weapon (OR, 7.54; 95% CI, 4.83-11.76), have had sexual intercourse before age 13 years (OR, 2.90; 95% CI, 1.58-5.33), and have had feelings of sadness or hopelessness almost every day for at least 2 consecutive weeks (OR, 4.13; 95% CI, 2.57-7.22). They were less likely to play school-sponsored team sports (OR, 0.52; 95% CI 0.34-0.80). Steroid users participating in sports shared the same problem behaviors as steroid users not participating in team athletics.

Conclusion: Self-reported anabolic steroid use is not confined to adolescent girls in competitive athletics and is an indicator of adolescent girls with a marked increase in a cluster of other health-harming behaviors.

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DURING THE 1990S, 3 DIFFERENT national surveys of US adolescents documented a 2-fold to 4-fold increase in the prevalence of anabolic steroid use among adolescent girls.¹ Public awareness concerning escalating female anabolic steroid use further heightened in 2004 when the Centers for Disease Control and Prevention reported that more than 7% of ninth-grade girls indicated current or prior anabolic steroid use, a level exceeding that of some young male subgroups.^{2,3} National attention⁴ focused on steroid use in adolescent girls when it became a topic discussed during the 2005 congressional hearings on drug use in sports.⁵

Author Affiliations: Division of Health Promotion and Sports Medicine, Department of Medicine, Oregon Health & Sciences University, Portland (Drs Elliot, Moe, and Goldberg); and Department of Psychology, University of Pittsburgh, Pittsburgh, Pa (Dr Cheong).

Previous associations with female anabolic steroid use have been limited to older women,⁶⁻⁸ and most reports of mature women taking anabolic steroids have related the use to competitive athletics and

to bodybuilding.⁶⁻⁹ Using the nationally representative 2003 Youth Risk Behavior Surveillance System¹⁰ data set, we examined the characteristics of girls reporting anabolic steroid use. Because of the association between steroid use and sports participation among older women, we particularly explored that relationship among girls reporting prior or ongoing anabolic steroid use.

METHODS

INSTRUMENT AND PROCEDURES

We analyzed data from the 2003 Youth Risk Behavior Survey.¹⁰ The Youth Risk Behavior Survey is a 95-item survey administered biannually to US high school students assessing demographic variables and priority health-risk behaviors relating to subsequent social problems, morbidity, disability, and mortality. It uses a 3-stage cluster design to draw a sample representative of US students in grades

9 through 12, and details of its sampling strategy and methods have been reported.¹¹⁻¹³

Trained data collectors administered the survey in classrooms during regular school hours. Local parental permission procedures were followed before survey administration, respondent anonymity was maintained, and the questionnaire and its administration was reviewed and approved by the institutional review board of the Centers for Disease Control and Prevention, Atlanta, Ga.

Anabolic steroid use was assessed by an item within a series of questions pertaining to controlled and illicit drug use, immediately following an item about the use of ecstasy (3,4-methylenedioxymethamphetamine) and preceding a query concerning illegal injections. The question asked, "During your life, how many times have you taken steroid pills or shots without a doctor's prescription?" Response options were 0 times, 1 to 2 times, 3 to 9 times, 10 to 19 times, 20 to 39 times, and 40 times or more. Individuals also were asked about sports participation in the question "During the past 12 months, on how many sports teams did you play?" Students could answer 0, 1, 2, or 3 teams or more.

In schools administering the survey, the overall student response rate was 83%. Among all female respondents (n=7544), 1.3% (n=97) were missing a response to the question concerning anabolic steroid use (n=61) or the covariates (n=36) and were excluded from the analysis examining the relationships between steroid use and covariates. The distribution of responses to the question about prior anabolic steroid use is shown in the **Figure**. The pattern suggests a potential bimodal distribution of female self-reported users. However, when those with less frequent use were compared with those reporting 20 or more times' use (31.5% of all users), only 2 notable differences were observed. Those with less frequent use were less likely to report being threatened or injured on school property (odds ratio [OR], 0.12; 95% confidence interval [CI], 0.05-0.31) and were less likely to use diet pills (OR, 0.26; 95% CI, 0.11-0.61). Because no statistically significant differences were noted on all other dimensions, respondents were dichotomized into anabolic steroid users and nonusers.

STATISTICAL ANALYSIS

Analyses were performed on weighted data using SUDAAN software,¹⁴ which accounts for the complex sampling design of the Youth Risk Behavior Survey. For the comparisons with other health-related behaviors (drug use, violence, sexual behaviors, risky driving behaviors, weight loss practices, and mental health problems), we dichotomized variables into those engaged in and not engaged in those actions.

We conducted the analyses in 2 steps. In step 1, we examined the association between self-reported prior or ongoing anabolic steroid use and demographic variables and team sports participation as given in **Table 1**. Among demographic variables, geographic region and metropolitan status did not relate statistically significantly to steroid use. However, race/ethnicity, grade level, and team sports participation differed, and we included those variables as covariates in the subsequent logistic regression analyses investigating anabolic steroid use and various health-related variables. In those logistic models, anabolic steroid use and the covariates were the predictors, and the dichotomized health behavior was the outcome. Overall, among adolescent girls reporting prior or ongoing anabolic steroid use, 37.8% participated in team sports. In step 2, to determine whether female steroid users participating in sports differed from other self-reported users, the analysis was repeated using only those adolescent girls reporting anabolic steroid use. Rather than comparing steroid users and nonusers, team sports participation was the predictor for the

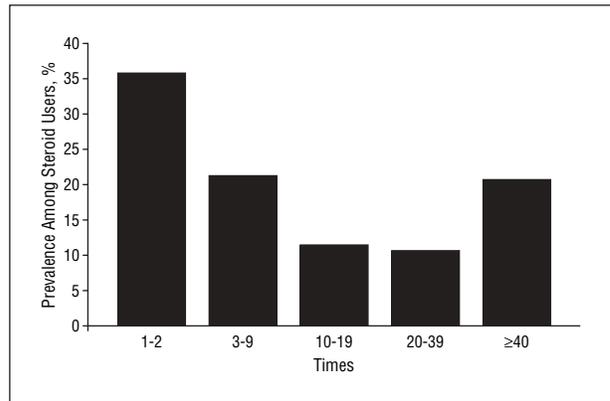


Figure. Distribution of responses among 313 (5.3% of the total) female US high school students not answering "0 times" to the survey question, "During your life, how many times have you taken steroid pills or shots without a doctor's prescription?" from the 2003 Youth Risk Behavior Survey.³

Table 1. Demographic Variables and Team Sports Participation for Female US High School Students Who Responded to the Item Assessing Prior or Ongoing Anabolic Steroid Use*

Variable	All Respondents (N = 7447)	Anabolic Steroid	
		Nonusers (n = 7134)	Users (n = 313)
Race/ethnicity			
White	61.1	60.9	65.1
African American	14.0	14.5	5.0
Hispanic	16.9	16.6	21.2
Other	8.0	8.0	8.8
Grade level			
9	28.9	28.3	40.7
10	26.5	26.5	26.0
11	23.4	23.6	19.7
12	21.2	21.6	13.6
Geographic region			
Northwest	21.2	20.9	26.4
Midwest	24.9	25.3	17.8
South	40.0	38.1	35.9
West	15.9	15.7	19.9
Metropolitan status			
Urban	27.1	26.9	31.2
Suburban	50.7	51.3	38.5
Rural	22.2	21.7	30.3
Team sports participation			
Yes	51.0	51.6	37.8
No	49.0	48.4	62.2

*From the 2003 Youth Risk Behavior Survey.³ Data are given as weighted percentages.

health behavior outcomes for this subset, again using the demographic variables as covariates.

RESULTS

Prior or ongoing anabolic steroid use was reported by 5.3% of female US high school students. Paradoxically, the prevalence of self-reported anabolic steroid use varied inversely with grade level (Table 1). Compared with stu-

Table 2. Prevalence Estimates of Health-Related Behaviors for Female US High School Students Who Responded to the Item Assessing Prior or Ongoing Anabolic Steroid Use and the Questions Concerning the Other Health Behaviors Listed*

Variable	Anabolic Steroid		Odds Ratio (95% Confidence Interval)†
	Nonusers	Users	
Alcohol and Other Drug Use			
Smoked cigarettes			
During past 30 d	21.2	55.8	5.14 (3.14-8.42)
On school property during past 30 d	6.7	28.4	5.78 (4.12-8.13)
Drank alcohol			
During past 30 d	44.8	87.2	8.83 (5.49-14.20)
On school property during past 30 d	3.4	21.4	7.91 (4.22-14.80)
Before age 13 y	22.4	45.2	2.97 (1.81-4.87)
Had >5 drinks in a row within a couple of hours during past 30 d	26.4	71.7	7.89 (4.85-12.85)
Used during past 30 d			
Marijuana	17.9	62.7	7.91 (5.20-12.04)
Cocaine	2.7	22.4	10.78 (6.18-18.81)
Sexual Behaviors			
Had sexual intercourse			
Yes	44.1	76.6	4.83 (3.07-7.59)
Before age 13 y	3.8	10.1	2.90 (1.58-5.33)
With >4 people during lifetime	10.4	30.5	4.12 (2.50-6.77)
When having sex, used condoms or birth control during past 3 mo	72.2	62.8	0.64 (0.46-1.01)
Been pregnant	4.5	11.1	2.77 (1.58-4.86)
Other Health-Related Behaviors			
During past 30 d			
Riding in a car driven by someone who had been drinking	29.8	69.1	5.40 (3.62-7.88)
Driving a car after drinking	8.2	33.2	6.06 (4.21-8.73)
Wearing seatbelts when riding in a car driven by someone else	89.5	71.6	0.28 (0.18-0.46)
Carrying a weapon during past 30 d			
Yes	5.6	30.2	7.54 (4.83-11.76)
On school property	2.4	16.8	8.42 (5.27-13.45)
On school property during past 12 mo			
Threatened or injured with a weapon	5.3	16.2	3.51 (2.14-5.76)
In a physical fight	6.8	28.7	5.99 (4.00-8.98)
Weight Loss Behaviors			
Tried to lose or gain weight	68.0	78.0	1.67 (1.01-2.78)
To lose weight during past 30 d			
Exercised	68.2	73.3	1.30 (0.82-2.04)
Not eaten for >24 h	17.1	37.5	2.92 (1.85-4.63)
Took diet pills, powders, or liquids	17.0	33.5	4.86 (2.98-7.93)
Vomited or took laxatives	6.7	26.0	4.96 (2.66-9.26)
Mental Health			
Felt sad or hopeless almost every day for ≥2 wk in a row	34.4	67.9	4.13 (2.57-7.22)
During past 12 mo			
Made a plan about how to attempt suicide	14.8	43.6	4.55 (2.84-7.29)
Attempted suicide	10.0	43.6	7.34 (5.22-10.31)

*From the 2003 Youth Risk Behavior Survey.³ Unless otherwise indicated, data are given as percentage prevalence (indicating the predicted proportion of individuals engaging in each behavior, adjusting for the other variables in the model).

†Anabolic steroid nonusers were used as a reference group in calculating the odds ratios. An odds ratio greater than 1 indicates that the users were more likely to engage in each outcome behavior.

dents in the 12th grade, those in the 9th grade (OR, 2.97; 95% CI, 1.72-5.13) and 10th grade (OR, 1.68; 95% CI, 1.01-2.79) were more likely to report prior or ongoing anabolic steroid use. Participating in team sports was negatively related to anabolic steroid use, such that those who were members of sports teams were less likely to self-report prior or ongoing anabolic steroid use (OR, 0.52; 95% CI, 0.34-0.80).

Table 2 gives the prevalence estimates, adjusted ORs, and 95% CIs comparing female anabolic steroid users with

the nonuser reference group, controlling for race/ethnicity, grade level, and sports participation. Odds ratios greater than 1 indicate that the self-reported anabolic steroid users have a higher likelihood of that behavior, and the opposite holds when the ratio is less than 1. Adolescent girls reporting anabolic steroid use had significantly more other health-harming behaviors. They were much more likely to use other unhealthy substances, including past 30-day use of cigarettes (OR, 5.14; 95% CI, 3.14-8.42), alcohol (OR, 8.83; 95% CI, 5.49-

14.20), marijuana (OR, 7.91; 95% CI, 5.20-12.04), and cocaine (OR, 10.78; 95% CI, 6.18-18.81). Young female steroid users indicated more sexual activity (OR, 4.83; 95% CI, 3.07-7.59), and they were more likely to report a history of being pregnant (OR, 2.77; 95% CI, 1.58-4.86). Steroid users also were more likely to report drinking and driving (OR, 6.06; 95% CI, 4.21-8.73) and having ridden with a drinking driver (OR, 5.40; 95% CI, 3.62-7.88), and they were less likely to wear seatbelts (OR, 0.28; 95% CI, 0.18-0.46). Young female users were more apt to have carried a weapon during the past 30 days (OR, 7.54; 95% CI, 4.83-11.76) and to have been involved in fights on school property during the past 12 months (OR, 5.99; 95% CI, 4.00-8.98).

More than two thirds of steroid users and nonusers reported trying to change their weight. However, those who reported anabolic steroid use were more likely to use extreme measures to lose weight, including greater 30-day use of vomiting and laxative use (OR, 4.96; 95% CI, 2.66-9.26) and diet pills, powders, or liquids taken for weight loss (OR, 4.86; 95% CI, 2.98-7.93) (Table 2). Last, psychological problems were prominent among these adolescents. Anabolic steroid users were more likely to indicate having had feelings of sadness or hopelessness for 2 consecutive weeks or more (OR, 4.13; 94% CI, 2.57-7.22) and were more likely to have attempted suicide (OR, 7.34; 95% CI, 5.22-10.31).

Overall, 51.6% of female students indicated participation on team sports. Team sports participants were less likely to be steroid users compared with team sports non-participants (OR, 0.52; 95% CI, 0.34-0.80). In addition, being in sports did not seem to identify a unique subgroup of steroid users. Self-reported anabolic steroid users in team sports differed in only 2 of the high-risk dimensions summarized in Table 2. Anabolic steroid users in team sports were more likely to use seatbelts (OR 3.11; 95% CI, 1.39-6.94) and condoms or birth control pills (OR, 5.24; 95% CI, 2.05-13.35), compared with anabolic steroid users who were not in team sports.

COMMENT

Adolescent female anabolic steroid users are characterized by polysubstance abuse and by a marked increase in other health-harming behaviors. Compared with non-users, odds are higher that they became sexually active at a younger age and have had more sexual partners; they are more likely to carry weapons and to have experience with violence. Along with greater controlled and illicit drug use, they are more likely to resort to harmful weight loss practices. These adolescent girls' mental health is more likely to be impaired, with more than two thirds having had feelings of depression and with almost half having planned or attempted suicide.

The co-occurrence of health-compromising behaviors among female adolescents has been observed in prior studies¹⁵⁻²⁶ using different means of assessment and among younger girls²⁷ and other nationalities.²⁸ However, this study represents the largest sample (to our knowledge) documenting that this cluster of health-harming actions among adolescent girls includes

anabolic steroid use. Our cross-sectional data set does not allow insight into temporal relationships or underlying mechanisms. Other investigators have related the clustering of harmful actions to overlapping psychosocial risk and protective factors, which are thought to result in a concurrent set of maladaptive and health-harming actions.^{29,30}

Anabolic steroid use can have marked performance-enhancing effects for girls,³¹ and lay publications^{4,32} have highlighted those consequences. Despite these facts, adolescent girls self-reporting prior or ongoing anabolic steroid use were less likely to participate in team-based athletics. Although this may seem contradictory, adolescent girls engaged in team sports have been reported to have a reduced prevalence of certain unhealthy actions.³³⁻³⁶ In addition, female adolescent steroid users in athletics did not seem unique, as they demonstrated the co-occurring unhealthy behaviors observed among steroid users not in athletics.

Anabolic steroids are body-shaping agents and cause a loss in body fat and an increase in lean tissue³¹; therefore, their association with unhealthy weight loss practices was not surprising. Despite lay perceptions that disordered eating is a problem of "good" girls,^{37,38} this national data set confirmed that the use of anabolic steroids, along with diet pill and laxative use, is associated with other health-harming actions.^{15,17-26}

The observed pattern of declining self-reported anabolic steroid use as adolescent girls matriculate through high school differs from that of other drugs, for which cumulative prior use increases with age.¹¹ However, unlike most drugs of abuse, anabolic steroid use requires sustained administration for a response and typically comprises cycles lasting several weeks. Perhaps younger girls experiment with a few days of steroid use, and as they mature, they become more sophisticated in their understanding of anabolic steroids and recalibrate to consider "use" as a cycle, rather than a few days' administration. In addition, steroid use may be more stigmatizing for older female adolescents, resulting in greater reluctance to self-report its use. That possibility is supported by findings from a recent online anonymous survey of steroid users, which reported a marked male predominance, far in excess of the predicted prevalence of female users.³⁹ Finally, steroid users may drop out at a rate that reduces the prevalence among remaining high school students, although it seems unlikely for steroid use to be the only drug to demonstrate that pattern.

The violence-promoting and mood-altering effects of anabolic steroid use are well-recognized adverse outcomes.^{40,41} Fighting and weapon-carrying were prevalent among adolescent girls who were anabolic steroid users, as were feelings of depression and suicide. Among older women, a subset seems to resort to anabolic steroid use for strength development and for self-defense,⁴² which was not something we could identify in this data set. In addition to direct drug effects, adolescent female steroid users may associate with adolescent male steroid users, which also may contribute to the findings. The marked increase in depression among the adolescent girls who were steroid users was striking. Drug use^{43,44} and disordered eating^{45,46} place adolescent

girls at greater risk for depression. In other groups, anabolic steroid use has been associated with suicide among athletes, as have eating disorders and access to firearms.⁴⁷

This evaluation has limitations. Data are cross-sectional, and causality and temporal sequences cannot be defined. In addition, associations were limited to items contained in the Youth Risk Behavior Survey instrument. We chose to use team participation as our measure of sports and exercise performance. Investigators have used other metrics, including shorter-term indexes of physical activity³⁵ and sport type and affiliation.⁴⁸ However, the team questionnaire item has been used by others,³⁴ and we were interested in examining its correlates because school sports teams may be an effective means to deter disordered eating and body-shaping drug use.⁴⁹

Despite these limitations, our findings provide concerning information about adolescent girls with self-reported prior or ongoing anabolic steroid use. Across all grades, these seem to be troubled adolescent girls with co-occurring health-compromising activities in the domains of substance use, sexual behavior, violence, and mental health. Adolescent boys with multiple problems have been the focus of research.⁵⁰ High-risk adolescent girls seem to have received less attention than adolescent boys, perhaps reflecting that their actions are less socially, albeit perhaps more personally, destructive. Anabolic steroid use is another marker for high-risk adolescent girls, and further study is needed to develop effective interventions for this population.

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Correspondence: Diane L. Elliot, MD, Division of Health Promotion and Sports Medicine, Department of Medicine, Oregon Health & Sciences University, CR110, 3181 SW Sam Jackson Park Rd, Portland, OR 97239 (elliott@ohsu.edu).

Author Contributions: Study concept and design: Elliot and Moe. Acquisition of data: Elliot. Analysis and interpretation of data: Elliot, Cheong, Moe, and Goldberg. Drafting of the manuscript: Elliot and Cheong. Critical revision of the manuscript for important intellectual content: Elliot, Cheong, Moe, and Goldberg. Statistical analysis: Cheong. Administrative, technical, and material support: Elliot, Moe, and Goldberg. Study supervision: Elliot.

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Announcement

Submissions. The Editors welcome contributions to Picture of the Month. Submissions should describe common problems presenting uncommonly, rather than total zebras. Cases should be of interest to practicing pediatricians, highlighting problems that they are likely to at least occasionally encounter in the office or hospital setting. High-quality clinical images (in either 35-mm slide or electronic format) along with parent or patient permission to use these images must accompany the submission. The entire discussion should comprise no more than 750 words. Articles and photographs accepted for publication will bear the contributor's name. There is no charge for reproduction and printing of color illustrations. For details regarding electronic submission, please see: <http://archpedi.ama-assn.org>.