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RISK FACTORS FOR ANABOLIC-ANDROGENIC STEROID USE IN MEN

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Summary—The illicit use of anabolic steroids to enhance athletic performance and physical appearance can cause numerous psychiatric and other adverse effects. In order to prevent steroid use and its negative consequences, knowledge of risk factors is needed. We conducted an anonymous survey of 404 male weight lifters from community gymnasiums who completed a 20-min, self-administered questionnaire. The sample for this study included all 35 men who were thinking about using steroids ("high-risk" nonusers), 50 randomly selected nonusers who were not thinking about using steroids ("low-risk" nonusers) and all 49 steroid users. The three groups differed in age, training characteristics, other performance-enhancers tried, body image, acquaintance with steroid users, and perception of negative consequences. When groups were compared along a continuum from low risk to high risk and from high risk to actual use, we found increasing amounts of competitive bodybuilding, performance-enhancers tried, and steroid-using acquaintances. Groups did not differ in their use of addictive substances. Nearly three-fourths of the high-risk group felt "not big enough," compared to 21% of the low-risk group and 38% of the steroid users ($p < .001$). These data suggest that steroids do work to increase satisfaction with body size, and that dissatisfaction with body size may contribute to the risk of using steroids.

Introduction

ANABOLIC-ANDROGENIC steroids, including testosterone and its synthetic derivatives, are used illicitly to enhance athletic performance and physical appearance. An estimated 1 million Americans have tried anabolic-androgenic steroids (Yesalis et al., 1993). As evidence of widespread use increases, particularly among adolescents and young adults (Yesalis, 1992), so do concerns about the potential of these drugs to cause adverse health consequences (Council on Scientific Affairs, 1990). Psychiatric effects have been associated with using steroids, including depression, suicides, mania, psychosis, marked aggression and homicidal violence (so-called "roid rage"), and addiction (Bahrke et al., 1990; Brower, 1992; Su et al., 1993). A particularly alarming trend in some adolescents has been the use of shared needles for injecting steroids (DuRant et al., 1993).

In order to prevent steroid use and its negative consequences, knowledge of risk factors

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is needed so that prevention programs can target the risk factors to reduce steroid use. Cross-sectional studies that compare users and nonusers of steroids represent one approach to delineating risk factors for use. Studies of high school and college students have found that males are more likely to use steroids than females and athletes are more likely to use steroids than nonathletes (Buckley et al., 1988; DuRant et al., 1993; Yesalis, 1992). Buckley et al. (1988), in their survey of male high school seniors, found that steroid users were more likely to participate in school sports, to be slightly older, to have a racial minority status, to be from larger schools, and to have parents who had not completed high school. In a national survey of the general population, males were significantly more likely than females to have tried steroids, but significant racial differences in steroid use were not observed (Yesalis et al., 1993). Taken together, these studies point to the importance of socio-demographic factors as contributors to the risk of using steroids.

Training characteristics may also be important determinants of steroid use. Pope et al. (1988) found that collegiate steroid users spent more time training with weights than nonusers. The role of other drug use as a predictor of steroid-taking is poorly studied. Whereas alcohol, tobacco, and marijuana may be "gateway drugs" for steroid use as they are for other illicit drugs, it is equally possible that steroids are themselves gateway drugs: i.e. once an exercise-oriented person has crossed the threshold for illicit steroid use, then other illicit drugs might more likely be used. Krowchuk et al. (1989) reported that illicit drug-using high school athletes were more likely to be aware of steroids and to regard them as efficacious, but were no more likely to be considering their use. Pope et al. (1988) found that college-age steroid users were more likely than nonusers to use cigarettes, alcohol, and illicit drugs, although the small number of users in their study precluded statistical tests of significance. DuRant et al. (1993) found that the use of anabolic steroids was significantly correlated with the frequency of use of cocaine, marijuana, and smokeless tobacco in adolescents. Finally, Yesalis et al. (1993), in the national survey of steroid use across age groups, found significant associations between steroid use and both the use of other illicit drugs and the use of alcohol. However, the association between cigarette use and steroid use was significant only for the 12-17 year old group.

Some individuals may initiate steroid use because they are either competing with their peers (as with athletes) or trying to increase their social desirability and attractiveness among their peers. Prior to using steroids, they may feel that they do not "measure up" or that they are not big enough. Thus, body image is a potential factor to study (Komoroski & Rickert, 1992). Having steroid-using acquaintances may also influence steroid use. Finally, perceived risks of drug-taking may influence the tendency to use steroids, as it apparently does for cocaine (Bachman et al., 1990).

The following study was conducted to determine if a community sample of steroid-using and nonusing weight lifters differed in terms of demographics, training characteristics, other substance use, body image, steroid-using acquaintances, and negative perceptions of steroids. We assumed that nonusers who were thinking about using steroids in the future had a higher risk of future steroid use (high-risk group) than nonusers who were not thinking about using steroids (low-risk group). Therefore, we compared high-risk nonusers to both low-risk nonusers and steroid users to identify possible differences and risk factors.

Methods

Subjects

Subjects were member weight lifters of four community gymnasiums who agreed to complete a self-administered questionnaire. Written informed consent was previously obtained from the gym owners or managers to distribute the questionnaire on-site. Owners/managers were assured that the name of their gym and other identifying information would be kept confidential and would not be linked to results or publications. Four gymnasiums were selected because of their convenience, and none refused participation. The study was conducted after obtaining approval from the appropriate Institutional Review Board of the University of Michigan.

Over a 7-month period ending in November 1989, 449 questionnaires were collected from weight lifters, including 45 females (10%). Because there were only two female steroid users and just one woman who indicated that she might try steroids in the future, we excluded women from the analyses. Of the 404 surveys from men, 49 (12%) admitted to using steroids and four men (1%) could not be classified because of incomplete responses. Of the 351 non-using men, 319 answered the following question: "Do you think you would ever try anabolic steroids in the future?" (Of the 32 nonusers who did not answer the question for defining risk, 29 completed an earlier version of the questionnaire without this question and 3 did not respond.) If they answered "yes," they were defined as *high-risk nonusers*. If they answered "no," they were defined as *low-risk nonusers*. On this basis, 35 (11%) men were high-risk nonusers and 284 (89%) men were low-risk nonusers. Of the 284 low-risk nonusers, 50 were randomly chosen by computer to form a similarly sized comparison group for statistical analyses. Similarly sized groups were important to fulfill the assumption of equal variances for the analyses of variance.

In sum, we divided the sample of men into three comparison groups. All 49 steroid users constituted the first group. Addictive patterns of steroid use in these 49 males were analyzed in a previous report, but comparisons with nonusers were not studied (Brower et al., 1991). All 35 high-risk nonusers (those who indicated that they might try steroids in the future) constituted the second group, and 50 low-risk nonusers (those who were not thinking about trying steroids) constituted the third group.

The questionnaire

The questionnaire, entitled "The University of Michigan Weight Lifter's Survey", was designed to be self-administered in 15-20 min. The questionnaire obtained information about demographic variables, patterns of weight lifting, body image, and patterns of steroid and other drug use. The length of the questionnaire was balanced for users and nonusers by a branch point which directed nonusers to answer a unique set of questions including their perceptions of and access to steroids, and which directed users to answer specific questions about their steroid use. Thus, some data presented below were available for the nonusers only. Subjects were asked by research assistants to complete the questionnaire either before or after their workouts. The front page contained instructions that explained the purpose of the questionnaire and gave assurance about anonymity. Subjects were instructed not to put their names on the questionnaire and to return the questionnaire

inside a sealed envelope. The envelopes were returned from the gym by the research assistants and opened at a later date. Those opening the questionnaires did not know from which gymnasium they came or who filled them out. Subjects' willingness to return the questionnaire constituted their consent to participate in the study.

The clarity of the questionnaire was tested in a pilot sample by face-to-face interviews in five subjects. Urine testing was performed in one pilot subject. In all tested instances, the subjects' responses were confirmed. In addition, reliability coefficients for two repeated questions for the 134 subjects were high (Pearson $r = 0.99$, $p < .001$ and Pearson $r = 0.85$, $p < .001$).

Data analysis

We based our analytic strategy on the assumption that the three groups – from low-risk to high-risk and from high-risk to user status – represented a continuum of increasing risk to use steroids. Thus, overall differences among the three groups were first tested by chi-square tests and analyses of variance for categorical and continuous variables, respectively. When overall differences were significant, we looked for significant contrasts between the low-risk and high-risk groups, and between the high-risk and steroid user groups. All tests were two-tailed. The Fisher's exact test was used instead of a chi square test when cell sizes were too small. Using these analytic tools, we identified a number of variables that distinguished the high-risk group from the other two groups. We then employed stepwise, multiple regression techniques to determine the best predictor variables that distinguished high-risk nonusers from each of the other two groups.

Results

Group comparisons

Demographically, the sample was composed of young, single white men who had completed two years of college (Table 1). The high-risk group was significantly younger than both the low-risk group and the users. The three groups did not differ in race or education, but the high-risk group contained more students, had less employment and lower incomes, and all had never married. After adjusting for age, these demographic differences were not significant, except for unemployed student status.

In terms of training characteristics (Table 2), the high-risk group had been lifting weights for a significantly shorter duration ($\bar{X} = 3.4$ years) than the steroid users ($\bar{X} = 7.3$ years), an effect that persisted even after adjusting for age. The high-risk group ($\bar{X} = 9.9$ h) spent significantly more time than the low-risk group ($\bar{X} = 7.6$ h), and as much time as the steroid users ($\bar{X} = 10.6$ h), lifting weights each week. The likelihood of training for a bodybuilding competition increased progressively when comparing groups in order from low-risk (4%) and high-risk (24%) to steroid-using (44%) status ($X^2 = 21.04$, $df = 2$, $p < .001$). However, the contrast between the latter two groups only approached significance ($X^2 = 3.42$, $df = 1$, $p = .064$). All three groups (63%) equivalently responded that they were training to improve

Table 1
Demographic Characteristics

Variable ^a	Low-risk nonusers (n = 50) ^b	High-risk nonusers (n = 35) ^b	Steroid users (n = 49) ^b	Low- vs high-risk groups (p value) ^c	High-risk group vs users (p value) ^c
Age (years)	23.4 ± 6.0	20.4 ± 2.9	24.4 ± 5.7	.009	< .001
Race (% white)	84.8	94.1	91.5	n.s.	n.s.
% Never married	87.5	100	76.6	.037 ^d	.002 ^d
Education (years)	14.8 ± 2.7	14.0 ± 2.6	14.5 ± 2.2	n.s.	n.s.
% Employed	56.0	37.1	77.6	n.s.	< .001
% Students	43.8	51.4	14.9	n.s.	< .001
Income (\$)	17,661 ± 21,056	8,814 ± 7,582	19,461 ± 14,782	.035 ^d	.011 ^d

^a Mean ± SD is presented for continuous variables.

^b Sample size is smaller for some variables due to missing responses.

^c The *p* values are for contrasts between two groups and were determined if the overall χ^2 test or ANOVA was significant at the *p* < .05 level. The overall test was not significant when both columns are marked "n.s." Fisher's exact test was used when cell sizes were too small.

^d Not significant after adjusting for age.

their performance in other sports, and almost all respondents (96%) affirmed that they lifted weights to improve physical appearance.

Weight lifters were asked to check "yes" for each of 15 non-steroidal substances that they had used for training: protein supplements, amino acids, vitamins, diet pills, caffeine, cocaine, amphetamines, growth hormone, growth hormone releasers, human chorionic gonadotropin, natural testosterone releasers, diuretics, tamoxifen, Mexican sarsaparilla, and "other". The number of these substances used progressively and significantly increased when comparing the low-risk nonusers (\bar{X} = 2.3) to the high-risk nonusers (\bar{X} = 3.9) and the steroid users (\bar{X} = 5.7) (Table 2). The three groups did not differ in their use of cocaine or amphetamines, tobacco, or alcohol; and about three-fourths of the nonusers had tried marijuana (a question not asked of the steroid users). The four CAGE questions, which are used to screen for alcoholism (Ewing, 1984), detected substantial but equivalent rates of alcohol problems among the three groups (Table 2). All three groups had considerable but equivalent alcohol intakes (8–9 drinks) when asked for the most drinks they consumed in one day in the past 30 days.

Body image significantly distinguished the high-risk group from the other two groups (Table 3). When asked, "Do you ever feel like you are not big enough?" subjects could respond on a 5-point scale; and we grouped together the responses of "all of the time" and "most of the time" in our analysis of "feels not big enough". Using this method, 71% of the high-risk group felt like they were "not big enough", compared to 38% of the steroid users and 21% of the low-risk group (χ^2 = 21.64, *df* = 2, *p* < .001). When asked, "How satisfied are you with your body and physical appearance?" subjects could respond on a 4-point scale ranging from "extremely satisfied" to "not so satisfied". We grouped the responses of "extremely satisfied" and "very satisfied" together, and found that fewer high-

Table 2
Training Characteristics and Substance Use

Variable ^a	Low-risk nonusers (<i>n</i> = 50) ^b	High-risk nonusers (<i>n</i> = 35) ^b	Steroid users (<i>n</i> = 49) ^b	Low- vs High-risk groups (<i>p</i> value)	High-risk group vs users (<i>p</i> value)
<i>Training characteristics</i>					
Years lifting weights	4.2 ± 3.2	3.4 ± 2.0	7.3 ± 4.4	n.s.	< .001
Hours week of lifting	7.6 ± 3.1	9.9 ± 3.8	10.6 ± 3.9	.005	n.s.
<i>Reason for training</i>					
● Bodybuilding competition (%)	4.0	23.5	43.5	.013	(.064)
● Other sports (%)	68.0	65.7	57.1	n.s.	n.s.
● Physical appearance (%)	98.0	94.3	95.9	n.s.	n.s.
<i>Substance use</i>					
Nonsteroidal substances used for training (#)	2.3 ± 2.3	3.9 ± 2.1	5.7 ± 2.3	.003	< .001
Cigarette smoker (%)	2.1	5.7	4.3	n.s.	n.s.
Chews tobacco (%)	8.5	9.1	13.3	n.s.	n.s.
CAGE score ≥ 2 (%)	27.7	34.3	30.4	n.s.	n.s.
Maximum drinks day	8.0 ± 8.0	8.5 ± 6.6	9.2 ± 7.9	n.s.	n.s.
Tried marijuana (%)	71.4	77.1	not asked	n.s.	n.s.
Cocaine or amphetamine used for training (%)	2.0	2.9	8.2	n.s.	n.s.

^a Mean ± *SD* is presented for continuous variables.

^b Sample size is smaller for some variables due to missing responses.

^c The *p* values are for contrasts between two groups and were determined if the overall X^2 test or ANOVA was significant at the *p* < .05 level. The overall test was not significant when both columns are marked "n.s." Fisher's exact test was used when cell sizes were too small. Parentheses mark *p* values that approached significance (*p* < .07), as these variables were entered into the regression analyses.

risk nonusers (26%) than steroid users (55%) were satisfied with their bodies and physical appearance ($X^2 = 6.63$, *df* = 1, *p* = .010). The contrast between the high-risk group (26%) and the low-risk group (46%) for satisfaction with body and physical appearance approached significance ($X^2 = 3.50$, *df* = 1, *p* = .061). Of interest, the high-risk group was significantly shorter than the low-risk group (albeit by only 1.5 inches); and although they weighed about the same as the low-risk group, they weighed significantly (23 lb) less than the steroid users (Table 3).

Knowing another steroid user increased progressively and significantly from 58% in the low-risk group to 83% in the high-risk group and 98% in the steroid users (Table 3). Nearly two-thirds of the nonusers reported that they could obtain steroids either very or somewhat easily, which did not differ between the two groups. Finally, the nonusers were asked if they thought steroids could cause each of 19 negative consequences: liver disease, heart attacks, hardening of the arteries, high blood pressure, acne, breasts to grow in men, death, episodes of rage, hallucinations, depression, psychotic reactions, mania, problems with sex drive, impotence, suicidal thinking, hair loss, testicles to shrink, confused thinking, and addiction. The number of perceived negative consequences was high for both groups (12 to 14) and did not differ between them (Table 3). However, the high-risk group endorsed two of the consequences (problems with sex drive and testicular atrophy) significantly

Table 3
Body Assessments and Other Factors

Variable ^a	Low-risk nonusers (n = 50) ^b	High-risk nonusers (n = 35) ^b	Steroid users (n = 49) ^b	Low- vs high-risk groups (p value) ^c	High-risk groups vs users (p value) ^c
<i>Body assessments</i>					
Feels not big enough (%)	20.8	71.4	38.1	<.001	.004
Satisfied with body and physical appearance (%)	45.8	25.7	54.8	(.061)	.010
Weight (lb)	182.6 ± 24.6	179.1 ± 22.2	202.1 ± 31.2	n.s.	<.001
Height (inches)	71.3 ± 2.7	69.8 ± 3.0	70.8 ± 3.4	.032	n.s.
<i>Other factors</i>					
Knows steroid user (%)	58.0	82.9	98.0	.015	.019
Easy to obtain (% yes)	65.3	65.7	not asked	n.s.	---
No. of perceived negative consequences (0-19)	12.7 ± 6.1	13.7 ± 5.6	not asked	n.s.	---
<i>Steroids cause:</i>					
• acne (% yes)	71.4	88.2	not asked	(.068)	---
• problems with sex drive (% yes)	65.3	87.9	not asked	.022	---
• hair loss (% yes)	59.2	79.4	not asked	(.053)	---
• testicles to shrink (% yes)	65.3	88.2	not asked	.018	---
• death (% yes)	81.6	88.2	not asked	n.s.	---

^a Mean ± SD is presented for continuous variables.

^b Sample size is smaller for some variables due to missing responses.

^c The *p* values are for contrasts between two groups and were determined if the overall X^2 test or ANOVA was significant at the *p* < .05 level. The overall test was not significant when both columns are marked "n.s." Fisher's exact test was used when cell sizes were too small. Parentheses mark *p* values that approached significance (*p* < .07), as these variables were entered into the regression analyses.

more often than the low-risk group, whereas the low-risk group endorsed none of the consequences significantly more often (Table 3).

Regression analyses

We employed stepwise, multiple regression techniques to select traits that best predicted how the high-risk group differed from the other two groups. Because the high-risk group was significantly (3–4 years) younger than the other two groups, we insured that age remained in the regression model. We entered other variables into the regression procedures that either differed significantly between groups or approached significance (*p* < .070). We excluded some demographic variables for entry (marital status and income), because they neither differed significantly between groups nor approached significance after adjusting for age.

The following 12 variables were entered to predict status as a low- or high-risk nonuser: age, weekly hours spent training, training for a bodybuilding competition, number of nonsteroidal substances used for training, satisfaction with body and physical appearance, feeling not big enough, height, knowing a steroid user, and thinking that steroids cause problems with sex drive, testicular atrophy, hair loss, and acne. The best predictors when

Table 4
Models for Predicting Risk Group

Variable	Parameter	SE	Wald X^2	<i>p</i> value
<i>Low-risk vs high-risk groups</i>				
Intercept	-19.95	8.14	6.00	.014
Age	-0.15	0.09	2.72	.100
Feels not big enough	1.06	0.33	10.40	.001
Height	-0.26	0.10	6.49	.011
Knows steroid user	-1.73	0.68	6.46	.011
<i>High-risk vs. user groups</i>				
Intercept	14.33	4.64	9.53	.002
Age	-0.27	0.11	6.36	.017
Student status	2.33	0.84	7.65	.006
Nonsteroidal substances used for training (#)	-0.78	0.23	11.08	.001
Feels not big enough	0.96	0.47	4.25	.039
Weight	-0.05	0.016	8.93	.003

age was included were feeling not big enough, height, and knowing a steroid user (Table 4). The predictors correctly classified 77% of subjects (goodness of fit $X^2 = 38.14$, $df = 4$, $p < .001$). The following 10 variables were entered to predict status as a high-risk nonuser or steroid user: age, employment, student status, duration of weight lifting activity, training for a bodybuilding competition, number of nonsteroidal substances used for training, satisfaction with body and physical appearance, feeling not big enough, weight, and knowing a steroid user. The best predictors when age was included were student status, number of nonsteroidal substances used for training, feeling not big enough, and weight (Table 4). The predictors correctly classified 82% of subjects (goodness of fit $X^2 = 59.19$, $df = 5$, $p < .001$).

Discussion

Weight lifters who were thinking about using steroids (high-risk group) could be distinguished from other nonusers by (a) younger age, (b) more hours each week spent lifting weights, (c) greater likelihood of training for a bodybuilding competition, (d) more nonsteroidal substances used for training, (e) feeling not big enough, (f) smaller height, (g) greater acquaintance with steroid users, and (h) greater awareness of certain side effects of steroid use. When these factors were entered into a regression analysis that controlled for age, the best predictors of high-risk status were feeling not big enough, knowing a steroid user, and shorter height.

Weight lifters who were thinking about using steroids (high-risk group) could be distinguished from steroid users by (a) younger age, (b) student status, (c) less employment, (d) shorter duration of weight lifting activity, (e) less nonsteroidal substances used for training, (f) feeling not big enough, (g) less satisfaction with body and physical appearance, (h) lower body weight, and (i) lesser acquaintance with steroid users. When these factors were entered into a regression analysis that controlled for age, the best predictors of high-risk status were student status, number of nonsteroidal substances used for training, feeling not big enough, and weight.

Overall, feeling not big enough was a consistent predictor of high-risk status. To some extent the high-risk group really was smaller in actual height and weight, but the subjective experience of feeling not big enough persisted as a predictor even after entering height and weight into the respective regression analyses. Anabolic-androgenic steroids probably appeal to individuals who do not feel big enough, because they can produce significant increases in lean body mass (Forbes et al., 1992). Komoroski and Rickert (1992) reported that steroid users were significantly more satisfied with their body image than nonusers. We previously reported that body image dissatisfaction predicted intensified patterns of steroid use among the 49 steroid users included in the present study (Brower et al., 1991). An intriguing interpretation of these data, then, is that steroids do work to increase satisfaction with body size, and that dissatisfaction with body size may contribute significantly first to the risk of using steroids and then to the risk of using steroids intensively.

The values of some variables (training for a bodybuilding competition, number of nonsteroidal substances used for training, and knowing a steroid user) progressively increased when comparing the low-risk group to the high-risk group and the high-risk group to the steroid users. Although the group comparisons are cross-sectional, the gradients observed in these three variables give the appearance of movement from low-risk status to actual steroid use as weight lifters become more involved in bodybuilding, trying substances, and knowing other users. Nevertheless, only a longitudinal study of weight lifters can properly track the antecedents of steroid use and the movement suggested by our data.

We did not find group differences in the use of addictive substances (tobacco, alcohol, marijuana, stimulants). Alcohol consumption and problems were substantial across groups. The lifetime prevalence of marijuana use was higher in the nonusers (74%) than in a national sample of college students studied in 1989 (51%) (Johnston et al., 1992), although the two groups are not necessarily comparable. Our sample used tobacco infrequently, but the trend to chew rather than smoke tobacco has been described in other athlete populations (DuRant et al., 1993). Overall, we found substantial use of alcohol and marijuana in our sample, but did not find support for the notion that alcohol, marijuana, or tobacco served as gateway drugs to use steroids. If anything, nonsteroidal performance aids appeared to function as gateway drugs, probably because they establish a mind-set for chemical enhancement without providing very effective results.

Nearly two-thirds of the nonusers agreed that they could easily obtain steroids, and availability did not distinguish the risk groups. Both risk groups were also fairly well-informed about the health risks of using steroids, and they could recognize more than 12 negative consequences. In fact, the high-risk group appeared somewhat more informed than the low-risk group. It is possible that the high-risk group, which was thinking about using steroids, deliberately sought information about steroids before deciding to use. However, the knowledge of the high-risk group regarding adverse consequences did not prevent them from thinking about using. Indeed, 88% of the high-risk group thought steroids could cause death. Other studies also have found that determined individuals will either use steroids or consider their use despite actual and perceived negative consequences (Brower et al., 1991; Yesalis et al., 1990). Moreover, prevention studies have shown that providing information only about negative consequences provides no benefit and may

paradoxically increase interest in trying steroids (Bosworth et al., 1988; Goldberg et al., 1991). Nevertheless, while certain subgroups are not readily deterred by negative consequences, trends in large, national samples suggest that perceived risks lead to reduced use of drugs like cocaine (Bachman et al., 1990). Similarly, the University of Michigan Monitoring the Future study found a statistically significant decline in the annual prevalence of steroid use among high school seniors from 1.9% in 1989 to 1.1% in 1992, while the perceived risk of harm significantly increased from 64% to 71% over the same time period (Johnston et al., 1993).

Several limitations of the study are emphasized. First, considerable selection bias was possible, because a small number of gymnasiums were selected by convenience and systematic sampling of subjects in those gymnasiums did not occur. We have no information on the characteristics of gym users who did not participate in the study, so we do not know how representative the sample was of this or other populations. Clearly, non-whites were poorly represented in the sample, which is important because national data indicate that minority groups are equally or more likely to use steroids than whites in this country (Buckley et al., 1988; Yesalis et al., 1993). It is also possible that steroid users were undersampled because the illicit nature of the activity may have deterred study participation. Furthermore, we studied a community sample of weight-lifting men, and other factors may better explain the risk to use steroids in women, students, and elite athletes. Thus, our results cannot be generalized without caution, and they serve mainly to generate hypotheses about risk factors. Second, there are a number of possible risk factors for steroid use that we made no attempt to assess, such as the details of athletic competition, family history of substance abuse, psychopathology, and other risk-taking behaviors. Other studies will need to examine these potential factors. Third, we relied on self-report without corroboration by collateral informants, physical measurements, or urine testing. Against these measures, the validity of responses to the questionnaire is unknown. We did obtain evidence of reliable responding as measured by repeated questions, and the guarantee of anonymity may have facilitated truthful responses. In addition, pilot testing of the questionnaire indicated that subjects understood the questions clearly and responded accordingly. Nevertheless, pilot testing occurred on a very small number of subjects, and study subjects may have minimized their actual or potential use of illicit drugs. Thus, future studies should employ methods to corroborate self-report data. Fourth, cross-sectional research does not provide information about the temporality of antecedent factors, and the differences we found at best represent correlates of risk and not causative factors for steroid use. Finally, body image disturbance, perhaps the most robust finding in our study, was measured in only a limited fashion. The phrase, "feeling not big enough", can refer to height, weight, strength, body image, self-esteem, or a feeling of personal power. Furthermore, the influence of a workout on body image is unknown, yet subjects completed the survey either before or after their workouts which may have introduced additional variability. Future studies should employ standardized, carefully timed, and more in-depth assessments of body image in steroid users and other weight lifters (Thompson, 1990).

In conclusion, we found that weight-lifting men who were thinking about using steroids (high-risk nonusers) differed from other male weight lifters predominantly in terms of body image. High-risk nonusers were most likely to feel not big enough when compared to both

steroid users and other nonusers. When groups were compared along a continuum from low risk to high risk and from high risk to actual use, increasing amounts of competitive bodybuilding, nonsteroidal performance-enhancers tried, and steroid-using acquaintances were reported. In regression analyses, body image distinguished high-risk nonusers from each of the other two groups, steroid-using acquaintances distinguished high-risk from low-risk nonusers, and use of nonsteroidal performance-enhancers distinguished high-risk nonusers from users. Taken together, these findings suggest that body image, peer group influences, and the use of nonsteroidal performance-enhancers may be particularly important risk factors for steroid use among male weight lifters in community gymnasiums. If confirmed by further research, then prevention efforts should focus on enhancing body image, resisting peer group influences, and alternatives to "gateway" performance-enhancers.

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