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Exposure to the mass media, body shape concerns, and use of supplements to improve weight and shape among male and female adolescents

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Exposure to the Mass Media, Body Shape Concerns, and Use of Supplements to Improve Weight and Shape Among Male and Female Adolescents

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ABSTRACT. *Objective.* To assess the prevalence and correlates of products used to improve weight and shape among male and female adolescents.

Methods. A cross-sectional study was conducted of 6212 girls and 4237 boys who were 12 to 18 years of age and enrolled in the ongoing Growing Up Today Study. The outcome measure was at least weekly use of any of the following products to improve appearance, muscle mass, or strength: protein powder or shakes, creatine, amino acids/hydroxy methylbutyrate (HMB), dehydroepiandrosterone, growth hormone, or anabolic/injectable steroids.

Results. Approximately 4.7% of the boys and 1.6% of the girls used protein powder or shakes, creatine, amino acids/HMB, dehydroepiandrosterone, growth hormone, or anabolic/injectable steroids at least weekly to improve appearance or strength. In multivariate models, boys and girls who thought a lot about wanting more defined muscles (boys: odds ratio [OR]: 1.6; 95% confidence interval [CI]: 1.1–2.2; girls: OR: 2.3; 95% CI: 1.2–3.2) or were trying to gain weight (boys: OR: 3.0; 95% CI: 2.0–4.6; girls: OR: 4.3; 95% CI: 1.6–11.4) were more likely than their peers to use these products. In addition, boys who read men's, fashion, or health/fitness magazines (OR: 2.3; 95% CI: 1.1–4.9) and girls who were trying to look like women in the media (OR: 2.9; 95% CI: 1.4–4.0) were significantly more likely than their peers to use products to improve appearance or strength, but hours per week watching television, watching sports on television, and participation in team sports were not independently associated with using products to improve appearance or muscle mass.

Conclusions. Girls and boys who frequently thought about wanting toned or well-defined muscles were at increased risk for using potentially unhealthy products to enhance their physique. These results suggest that just

as girls may resort to unhealthy means to achieve a low body weight, girls and boys may also resort to unhealthy means to achieve other desired physiques. *Pediatrics* 2005;116:e214–e220. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2004-2022; adolescents, creatine, steroids, body image, male and female.

ABBREVIATIONS. DHEA, dehydroepiandrosterone; GUTS, Growing Up Today Study; MRFS, McKnight Risk Factor Survey; OR, odds ratio; CI, confidence interval.

Although weight concerns are less common among male than female individuals, recent data suggest that these concerns are becoming more prevalent.¹ Among female individuals, weight dissatisfaction increases with relative weight, but among male individuals, the relationship is more complicated.^{2,3} For both male and female individuals, it is undesirable to be overweight, but for male individuals, it is also undesirable to be too lean or not sufficiently muscular.^{2,4} Most of the research on body dissatisfaction has focused on a desire to be thin and the unhealthy methods that people, mainly female individuals, use to achieve that goal.^{5,6} The prevalence of a desire to be more muscular and the prevalence of using unhealthy methods to increase muscle mass or definition are less well studied.⁷ Most^{8–12} but not all studies¹³ have found that use of anabolic steroids, a substance known to aid in increasing muscle mass, is more common among male than female individuals. For example, in a large cross-sectional study, Irving et al.⁹ observed that 5% of the boys and 3% of the girls had used steroids in the past year. They also found among the boys that steroid use was associated with participation in sports that emphasize weight or shape but was unrelated to BMI. Steroid use was slightly less common in a cross-sectional study of 9118 7th-, 9th-, and 11th-grade students in Connecticut public schools, among whom ~2% of the boys had used steroids and the leanest boys were the most likely to report steroid use.⁸

Some studies have observed an association between steroid use and participation in sports,^{9,12} but others have not.¹⁴ However, the studies are difficult to compare because some have included only athletes in their sample, thus precluding comparisons between athletes and nonathletes,¹⁵ and some stud-

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ies have not provided estimates of the association with sports participation.¹³ The prevalence of using supplements or products other than anabolic steroids to increase muscle mass, strength, or definition is not well known. In 1 study of 16 119 Canadian students, 27% reported using "extra protein," which was 9 times greater than the prevalence (2.8%) of using anabolic steroids.¹¹ The prevalence of creatine use has been studied in several cross-sectional studies of athletes,^{16–18} but data are lacking on the prevalence and correlates of creatine use among a general sample of children and adolescents.

Although anabolic steroids have performance-enhancing capabilities, they increase aggression and can adversely affect the liver, lipids, and reproductive system.¹⁹ Much less is known about the effectiveness and health consequences of using creatine, growth hormone, or dehydroepiandrosterone (DHEA). The studies on the effectiveness of creatine and DHEA are equivocal, but both types of substance may have adverse effects on health.¹⁹ Data on long-term use are lacking, but the data do suggest that these substances are not effective and may cause harm; thus, their use should be discouraged among young people. Unfortunately, there is widespread availability of these products advertised on the Internet.

The association of the use of products to improve appearance or increase muscle mass or strength with weight dissatisfaction, media influences, and participation in sports is not well understood. To assess these associations, we conducted a cross-sectional analysis using data collected in 1999 from >10 000 preadolescent and adolescent girls and boys in the Growing Up Today Study (GUTS), a prospective cohort study of youths throughout the United States.

METHODS

The GUTS was established in 1996 by recruiting children, who were 9 to 14 years of age, of women who were participating in the Nurses' Health Study II. Using the Nurses' Health Study II data, we identified mothers who had children who were aged 9 to 14. We wrote to the mothers a detailed letter explaining that the purpose of GUTS was to study the predictors of weight change during adolescence and sought parental consent to enroll their children. Additional details have been reported previously.³ Approximately 68% of the girls ($N = 9039$) and 58% of the boys ($N = 7843$) returned completed questionnaires, thereby assenting to participate in the cohort. The study was approved by the Institutional Review Board at Brigham and Women's Hospital.

Measures

Physical activity, inactivity, weight concerns, body dissatisfaction, weight change efforts, weight, and height were assessed annually from 1996 through 1999. Height and weight were self-reported. We calculated BMI using self-reported weight and height information (weight [kg]/height [m]²) and calculated z scores on the basis of the Centers for Disease Control and Prevention growth charts,²⁰ which are age and gender specific. Children who had a BMI ≥ 85 th percentile for age and gender were classified as being at risk for overweight or being overweight. Children who were <15th percentile were classified as being lean. Children who reported a BMI <12.5 kg/m² or were >3 SD above the mean were considered to be data errors and therefore set to missing and not used in the analysis ($n = 84$ girls and $n = 55$ boys).

Physical Activity

Physical activity was assessed with 18 questions on hours per week within each of the 4 seasons that a participant engaged in a

specific activity (eg, volleyball, soccer). A summary score of average hours per week of physical activity was computed. Reports of an average of >40 hours per week were considered implausible and therefore set to missing and not used in the analysis ($n = 97$ girls and $n = 165$ boys).

Body Dissatisfaction and Weight and Shape Concerns

Questions on weight concerns, body dissatisfaction, and efforts made to look like same-gender figures in the media were adapted from the junior high and high school version of the McKnight Risk Factor Survey (MRFS).²¹ The MRFS was designed for and evaluated with preadolescent and adolescent girls. It uses 5 response categories: never/not at all, a little, sometimes/pretty much, a lot, and always/totally. Like female individuals, male individuals may desire to have low body fat, but unlike female individuals, thinness may not be considered desirable. Thus, to make the MRFS appropriate for use with boys, we added the following question: "In the past year, how often have you thought about wanting to have toned or defined muscles?" For the analysis, the MRFS questions were dichotomized. Girls and boys were classified as thinking a lot about wanting toned or defined muscles when they responded "a lot" or "always" to the question on thinking about wanting to have toned or defined muscles. Participants were classified as making a lot of effort to look like same-gender figures in the media when they responded "a lot" or "totally" to the question, "In the past year, how much effort have you made to look like the girls or women (boys or men) you see on television, in movies, or in magazines?"

Media Exposure

Several types of media exposure were assessed. Participants were asked how many hours per week they watched television. Reports of an average of >80 hours per week were considered implausible and therefore set to missing and not used in the analysis ($n = 21$ girls and $n = 66$ boys). In addition, they were asked how many sports events they had seen on television during the past month and to specify which sports they watched (eg, gymnastics, football). The information was used to compute a summary estimate of all sports events watched.

Participants were asked the type of magazines most often read and frequency of reading magazines. Participants were asked to indicate which of the following categories of magazines they read most often: music (Rolling Stone, SPIN), fashion (Vogue, Elle), men's (GQ, Men's Health), humor (Mad, comics), sports (Sports Illustrated, Tennis), cars/trucks (Hot Rod, Car and Driver), gossip/celebrities (People, National Enquirer), news/variety (Life, Newsweek, Ebony), teen (Seventeen, YM), health/fitness (Self, Muscle & Fitness), TV/movies (Soap Opera Digest, TV Guide), women's (Glamour, Cosmopolitan), science (Popular Science, Omni), computer/video games (MacWorld, PC Games), or other (Travel, Food, etc). There was an additional response of "don't regularly read magazines." This group served as the reference group in the analysis. The magazines were grouped into 4 categories for the purpose of analysis. Music, TV/movies, or gossip were 1 category. Sports magazines were a separate category because the magazine genre was so popular among the boys. Among the girls, women's, teen, fashion, and health/fitness were grouped into 1 category, whereas among the boys, the group included men's magazines but not women's. All other magazines were grouped into an "other" category. In addition, participants were asked, "How often do you read this type of magazine?" The response options were "less than once a month," "1 to 3 times a month," or "at least once a week."

Use of Products to Improve Physical Appearance, Muscle Mass, or Strength

For assessing the use of products to improve physical appearance or muscle mass, participants were asked, "During the past year, how often did you use any of the following products because you thought they would improve physical appearance or help you gain weight, strength, or muscle mass?" They then were asked how often (never, less than monthly, monthly, weekly, or daily) they used each of the 7 products: protein powder or shakes, creatine, weight loss shakes/drinks, amino acids/hydroxy methylbutyrate (HMB), DHEA, growth hormone, and anabolic/injectable steroids. The information on weight loss shakes/drinks was not used

in the analysis because the focus was on products that could potentially lead to increasing muscle mass and body size. The information from these questions was used to create 3 outcome variables: any use of the products in the past year; at least weekly use of any of these products; and at least weekly use of creatine, amino acids/HMB, DHEA, growth hormone, or anabolic/injectable steroids.

Outcome Measures

The primary outcome measure was at least weekly use in the past year of protein powder or shakes, creatine, amino acids/HMB, DHEA, growth hormone, or anabolic/injectable steroids. The secondary outcome excluded the use of protein powder or shakes (ie, at least weekly use in the past year of creatine, amino acids/HMB, DHEA, growth hormone, or anabolic/injectable steroids).

Sample

In 1999, 7121 girls and 5293 boys completed the annual GUTS survey. Participants who were <9 or >14 years of age at baseline (108 girls and 50 boys) or who completed the abbreviated form of the 1999 GUTS survey (739 girls and 832 boys) that was sent only after participants failed to respond to 2 mailings of the full questionnaire were excluded from the analysis. In addition, children

who did not report on the 1999 questionnaire whether they used any products to improve their weight or physique (30 girls and 30 boys) or were missing information on type of magazine mostly frequently read (32 girls and 101 boys) were excluded; thus, 6212 girls and 4237 boys remained for analysis.

Analysis

All analyses were stratified by gender and conducted with SAS software (SAS version 8.2, Cary, NC). To account for the correlation between siblings, generalized estimating equations, using the logit link, were used for all multivariate analyses (SAS Proc Genmod). The child's age and age- and gender-specific z score of BMI were controlled for in all generalized estimating equations analyses. All *P* values are 2 sided, with *P* < .05 considered statistically significant.

RESULTS

As can be seen in Table 1, more boys were at risk for overweight or were overweight (23% vs 15%, respectively), but more boys than girls reported being satisfied with their body (47% vs 36%; Fig 1). However, the prevalence of thinking frequently

TABLE 1. Distribution of Age, Exposure to the Media, and Use of Products to Bulk Up in 1999

	Girls (<i>n</i> = 6212)	Boys (<i>n</i> = 4237)
Mean age (SD)	15.0 (1.5)	15.0 (1.6)
Weight status, <i>n</i> (%)		
<15th percentile of BMI for age and gender (lean)	583 (9.7)	396 (9.6)
≥ 85th percentile of BMI for age and gender (at risk for or overweight)	907 (15.1)	940 (22.8)
Types of magazines read, <i>n</i> (%)		
None	560 (9.0)	709 (16.9)
Music, TV/movies, or gossip	271 (4.4)	321 (7.6)
Men's/women's, teen, fashion, or health/fitness	4775 (76.9)	120 (2.9)
Sports	128 (2.1)	1200 (28.6)
Other (including computer)	478 (7.7)	1853 (44.1)
Frequency of reading magazines, <i>n</i> (%)		
<1 time per month	1518 (26.2)	1215 (30.7)
1–3 times per month	3477 (60.1)	1782 (45.1)
≥ weekly	791 (13.7)	957 (24.2)
Mean hours per week of watching television (SD)	9.5 (7.7)	12.3 (9.4)
Mean hours per week of moderate or vigorous physical activity (SD)	9.7 (7.1)	12.2 (8.4)
No. of sporting events watched on television in the past month	3.3 (3.1)	5.5 (3.7)
Participated in strength training during the past year, <i>n</i> (%)	2757 (44.4)	2623 (61.9)
Average times per week participating in team sports, <i>n</i> (%)		
0 times	1702 (27.6)	1017 (24.2)
1–3 times per week	1677 (27.2)	1168 (27.8)
4 or more times per week	2779 (45.1)	2012 (47.9)
Protein powder or shakes, <i>n</i> (%)		
Ever use in past year	497 (8.0)	431 (10.2)
At least weekly use	87 (1.4)	144 (3.4)
Creatine, <i>n</i> (%)		
Ever use in past year	27 (0.4)	181 (4.3)
At least weekly use	8 (0.1)	75 (1.8)
Amino acids, <i>n</i> (%)		
Ever use in past year	22 (0.4)	53 (1.3)
At least weekly use	8 (0.1)	18 (0.4)
DHEA, growth hormone, or steroids, <i>n</i> (%)		
Ever use in past year	15 (0.2)	30 (0.7)
At least weekly use	4 (0.1)	8 (0.2)
Creatine, amino acids, DHEA, growth hormone, or steroids, <i>n</i> (%)		
Ever use in past year	56 (0.9)	221 (5.2)
At least weekly use	19 (0.3)	91 (2.2)
Any product to build muscles or improve shape, <i>n</i> (%)		
Ever use in past year	523 (8.4)	520 (12.3)
At least weekly use	102 (1.6)	199 (4.7)

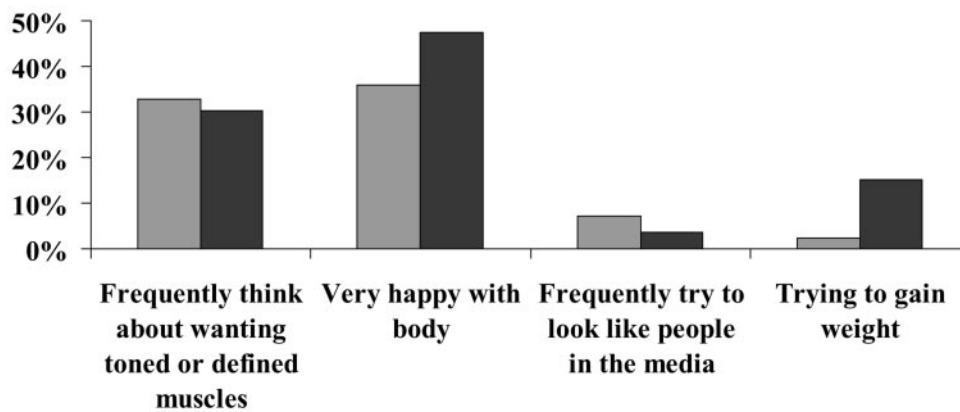


Fig 1. Body satisfaction among adolescents in GUTS. □, girls; ■, boys.

about wanting more toned or defined muscles was similar among girls (33%) and boys (30%; Fig 1). In contrast, boys were more likely than girls to be trying to gain weight, and girls were more likely than boys to be trying to lose weight (Fig 1).

Reading magazines was more common among the girls (91%) than the boys (83%), and there was a large difference in types of magazines read. Among the girls, women's, teen, fashion, and health/fitness magazines were the most popular types of magazine read (77%), whereas among the boys, sports magazines (29%) were popular, but men's, teen, and health/fitness were read by only 3% of the sample. Nevertheless, 4% of the boys reported making a lot of effort to look like male individuals in movies, in magazines, or on television (Fig 1).

Boys engaged in more hours per week of physical activity than girls (Table 1), but strength training was common in both genders (44% of girls and 62% of boys). Participation in team sports was common, and the gender difference in participation was minimal (Table 1). However, boys watched more hours per week of television (12.3 vs 9.5 hours) and watched more sporting events on television in the past month (5.5 vs 3.3) than did girls.

Protein powder or shakes were the products used most often to improve appearance, muscle mass, or strength. Approximately 8% of girls and 10% of boys had used protein powder or shakes in the past year, but <4% in either gender had used the product frequently (Table 1). Creatine was used by 4% of the boys during the past year, but it was used by only 0.4% of the girls. At least weekly use of any products to improve appearance or muscles was almost 3 times more common among boys (5%) than girls (2%). The gender difference was even larger when protein powder or shakes were not included as 1 of the products to improve appearance of muscles (2% of boys and 0.3% of girls).

Age was positively associated with at least weekly use of any products to build muscle to improve shape among both girls and boys (Table 2). Independent of age and age- and gender-specific z score of BMI, girls (odds ratio [OR]: 4.0; 95% confidence interval [CI]: 1.6–9.8) and boys (OR: 6.4; 95% CI: 4.4–9.3) who were trying to gain weight were significantly more likely than their peers who were not

trying to do anything about their weight to use products to improve appearance, muscle mass, or strength. Among the girls but not the boys, those who were trying to lose weight were also more likely to use these products (Table 2). The associations were attenuated but remained significant after adjusting for other correlates and confounders.

In addition, girls and boys who reported thinking frequently about wanting more defined muscles and those who were making a lot of effort to look like same-gender figures in the media were >3 times more likely than their peers to use products to build muscle or improve appearance. Type of magazine read was also associated with at least weekly use of products. Girls who read sports magazines (OR: 3.6; 95% CI: 1.0–13.8) and boys who read men's magazines (OR: 4.4; 95% CI: 2.3–8.3) were significantly more likely than their peers who did not read magazines to use products at least weekly. After adjusting for other correlates and confounders, the associations were attenuated and remained significant only for the boys (OR: 2.3; 95% CI: 1.1–4.9).

Hours per week of lifting weights was associated with at least weekly use of products among the girls (OR: 1.3; 95% CI: 1.2–1.4) and the boys (OR: 1.4; 95% CI: 1.3–1.5). Football was not assessed among the girls because few girls participate in the sport; however, among the boys, independent of hours per week of lifting weights, hours per week of playing football was positively associated with using products to increase muscle mass or improve appearance (Table 2). When adjusted only for age and BMI, times per week participating in team sports seemed to be related to using products to enhance muscles and appearance. However, the results were confounded by hours per week of playing football and/or weight lifting. In the fully adjusted results, participation in team sports was not related to use of products (data not shown). In addition, hours per week of watching television, the number of sports watched on television during the past month, and the type of sports watched were unrelated to at least weekly use of products to increase muscle mass or appearance (data not shown).

In secondary analyses in which the outcome was defined as at least weekly use of creatine, DHEA, growth hormone, or steroids, the results were similar

TABLE 2. Correlates of at Least Weekly Use of Any Product to Increase Muscle Mass or Definition Among Girls and Boys in GUTS

	Girls, OR (95% CI)		Boys, OR (95% CI)	
	Basic Model*	Full Model†	Basic Model*	Full Model†
Age	1.2 (1.1–1.4)‡	1.0 (0.9–1.2)	1.5 (1.4–1.7)	1.3 (1.2–1.5)
BMI z score	0.8 (0.6–1.0)§	0.7 (0.5–1.0)	1.1 (0.9–1.3)	1.0 (0.8–1.2)
Type of magazine read				
Do not read magazines regularly	1.0 (referent)		1.0 (referent)	1.0 (referent)
Music, TV/movies, or gossip	2.0 (0.6–7.1)		1.7 (0.9–3.1)	1.6 (0.8–3.1)
Women's/men's, teen, fashion, or health/fitness	1.9 (0.8–4.7)		4.4 (2.3–8.3)	2.3 (1.1–4.9)
Sports	3.6 (1.0–13.8)		1.6 (1.0–2.7)	1.2 (0.7–2.0)
Other (including computer)	1.2 (0.3–4.1)		1.0 (0.6–1.6)	1.1 (0.7–1.9)
Trying to look like female/male individuals in the media	3.8 (2.3–6.2)	2.4 (1.4–4.1)	3.8 (2.4–5.9)	1.8 (1.0–3.3)
Thinking a lot about wanting more defined muscles	3.3 (2.1–5.1)	2.0 (1.3–3.3)	3.0 (2.3–4.0)	1.6 (1.1–2.2)
Weight-change efforts				
Not trying to do anything	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)
Trying to maintain weight	1.2 (0.6–2.5)	1.1 (0.5–2.3)	1.3 (0.8–2.1)	1.1 (0.7–1.8)
Trying to lose weight	3.9 (1.8–6.1)	2.3 (1.2–4.5)	1.0 (0.6–1.6)	1.0 (0.6–1.7)
Trying to gain weight	4.0 (1.6–9.8)	4.2 (1.6–11.1)	6.4 (4.4–9.3)	3.0 (2.0–4.6)
Times per week participating in team sports				
0 times/wk	1.0 (referent)		1.0 (referent)	
1–3 times/wk	1.0 (0.5–1.7)		0.9 (0.5–1.5)	
4 or more times/wk	1.2 (0.7–1.9)		2.1 (1.4–3.0)	
Type of physical activity				
Weight lifting or strength training (h/wk)	1.3 (1.2–1.4)	1.2 (1.1–1.4)	1.4 (1.3–1.5)	1.3 (1.2–1.4)
Football (h/wk)	NA	NA	1.3 (1.2–1.4)	1.1 (1.0–1.2)

* Models include age and BMI z score, as well as the construct (eg, type of magazine read) of interest.

† Models include age, BMI z score, frequently thinking about wanting more toned muscles, trying to look like same-gender figures in the media (boys only), type of magazine read, weight-change efforts, hours per week of weight lifting, and (boys only) hours per week of football.

‡ Adjusted for BMI z score.

§ Adjusted for age.

to those from the primary analysis. The analysis was restricted to boys because there were too few girls using these products to conduct a meaningful analysis (Table 1). The associations with reading men's or fitness magazines (OR: 2.3 vs 2.8), thinking about wanting more defined muscles (OR: 1.6 vs 2.9), and trying to gain weight (OR: 3.0 vs 4.4) were somewhat stronger in the secondary analysis (Table 3).

DISCUSSION

In a sample of >10 000 adolescents who live throughout the United States, we observed that 8% of girls and 12% of boys reported using products to improve appearance, muscle mass, or strength. Girls and boys who reported thinking frequently about wanting more defined muscles and those who wanted to gain weight were the most likely to use these products. In addition, girls who wanted to lose weight were more likely than their peers to use these products.

Independent of whether a boy was making a lot of effort to look like male individuals in the media, boys who read men's, teen, fashion, or health and fitness magazines were 2 times more likely than their peers who did not read magazines to use products that were perceived to enhance appearance, muscle mass, or strength. Moreover, independent of efforts to change weight, girls who were making a lot of effort to look like female individuals in the media were significantly more likely than their peers to use products to enhance their physique. These findings suggest that just as concern with weight and media influences may lead girls to adopt unhealthy weight-control practices, such as purging, to lose

weight,²² concern with muscle definition and media images may lead young people to use unhealthy products to achieve a more desired physique.

Our finding that adolescents who lift weights or play football are at an increased risk for using creatine, amino acids, DHEA, growth hormone, or steroids is consistent with the findings from other cross-sectional studies.^{9,12} It is unknown whether the association is attributable to encouragement from peers or coaches, but the topic warrants more investigation. Because much of the research on prevalence and correlates of unhealthy approaches to increase muscle mass or strength has focused on steroids, little is known about the correlates of use of protein powder, protein shakes, creatine, amino acids, DHEA, and growth hormone. Because these products are used more commonly than steroids, the public health significance of any adverse effects of these products could be considerable.

We observed a lower prevalence of use of steroids than has been seen in other studies,^{9,10} which may partially reflect that the steroid use has been declining among 10th graders.²³ In addition, because the participants are children of nurses, it is possible that the children may be slightly more aware of the health consequences than other children in the general population and thus less likely to use steroids. We are unable to compare our prevalence rates of using products other than steroids to enhance appearance and physique because the prevalence of use of these products has not been assessed in other large studies.

There are some important limitations to the present study. First, the study was cross-sectional;

TABLE 3. Correlates of at Least Weekly Use of Creatine, Amino Acids, DHEA, Growth Hormone, or Steroids Among Boys in GUTS

	Basic Model, OR (95% CI)*	Partially Adjusted Model 1, OR (95% CI)†	Partially Adjusted Model 2, OR (95% CI)‡	Fully Adjusted Model, OR (95% CI)§
Age	1.0 (0.9–1.2)	1.0 (0.9–1.2)	1.0 (0.9–1.2)	1.0 (0.9–1.2)
BMI z score	1.3 (1.1–1.6)¶	1.3 (1.1–1.6)	2.0 (1.5–2.7)	1.3 (1.0–1.8)
Type of magazine read				
Do not read magazines regularly	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)
Gossip	1.1 (0.4–2.9)	1.1 (0.4–2.8)	1.1 (0.4–2.8)	1.0 (0.4–2.7)
Men's, health/fitness	5.5 (2.5–12.5)	4.6 (2.0–10.7)	4.6 (2.0–20.7)	2.8 (1.1–7.2)
Sports	1.2 (0.6–2.3)	1.0 (0.5–2.1)	1.0 (0.5–2.0)	0.7 (0.3–1.6)
Other	0.9 (0.5–1.8)	0.9 (0.5–1.7)	1.1 (0.6–2.2)	1.0 (0.5–2.1)
Trying to look like male individuals in the media	3.3 (1.7–6.5)	1.3 (0.6–2.6)	1.7 (0.8–3.5)	
Thinking a lot about wanting more defined muscles	5.6 (3.5–8.9)	5.6 (3.5–8.9)	3.5 (2.2–5.6)	2.9 (1.7–4.9)
Weight-change efforts				
Not trying to do anything	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)
Trying to maintain weight	1.3 (0.6–2.8)	1.1 (0.5–2.4)	1.1 (0.5–2.4)	1.1 (0.5–2.5)
Trying to lose weight	0.9 (0.4–1.9)	0.7 (0.3–1.5)	0.7 (0.3–1.5)	0.8 (0.4–1.9)
Trying to gain weight	13.4 (7.2–24.7)	7.8 (4.2–14.3)	7.8 (4.2–14.3)	4.4 (2.3–8.5)
Times per week participating in team sports				
0 times/wk	1.0 (ref)	1.0 (ref)	1.0 (ref)	
1–3 times/wk	0.4 (0.2–0.9)	0.4 (0.2–0.9)	0.4 (0.2–1.0)	
4 or more times/wk	1.7 (1.0–3.0)	1.4 (0.8–2.4)	1.2 (0.7–2.1)	
Type of physical activity				
Weight lifting or strength training (h/wk)	1.5 (1.3–1.6)	1.3 (1.3–1.4)	1.3 (1.2–1.4)	1.3 (1.2–1.4)
Football (h/wk)	1.4 (1.3–1.5)	1.2 (1.0–1.3)	1.1 (1.0–1.2)	1.2 (1.0–1.3)

* Models include age and BMI z score, as well as the construct (eg, type of magazine read) of interest.

† Models include age, BMI z score, and frequently thinking about wanting more toned muscles, as well as the construct (eg, type of magazine read) of interest.

‡ Models include age, BMI z score, frequently thinking about wanting more toned muscles, and weight-change efforts, as well as the construct (eg, type of magazine read) of interest.

§ Models include age, BMI z score, frequently thinking about wanting more toned muscles, type of magazine read, weight-change efforts, hours per week of weight lifting, and hours per week of football.

|| Adjusted for BMI z score.

¶ Adjusted for age.

thus, no inference can be made on the temporal order of associations. It is possible that children become concerned with their muscularity and/or learn about supplements by reading magazines and looking at advertisements in magazines. However, it is also possible that children who are concerned with their muscularity seek out magazines that are focused on physique because of their concern with their own body. Only prospective studies are able to tease apart the direction of the observed associations. Second, because of the low prevalence of use of products to enhance appearance and physique, we had only moderate statistical power. Third, the sample is predominately white, and children of low socioeconomic status are underrepresented; thus, it is not clear whether the results are generalizable to children of color or children from low socioeconomic status backgrounds. In addition, our media assessment included print, television, and movies, but not Internet media; thus, there may be some misclassification of media exposures, although in 1999, the use of Internet may have been slightly lower than it is currently. Despite these limitations, there are important strengths to the present study. First, this is the largest population-based study to assess correlates of using a range of potentially unhealthful products to enhance physique. Second, the sample includes a combination of athletes and nonathletes from across the United States. Third, the analysis included a range of possible correlates, including influences on body images, sports participation, BMI, and weight change efforts.

In conclusion, our results suggest that use of potentially unhealthful products that are perceived to improve appearance, muscle mass, or strength is relatively rare and more common among male than female individuals. Use of these products is associated with many of the factors, such as body image concerns and media influences, which are associated with unhealthful weight-control methods among young women.^{22,24,25} Our observation that ~30% of the girls and boys reported thinking frequently about wanting more defined muscles suggests that concern with muscle definition is a common but often overlooked source of body image concern, and unlike the more common weight-related concerns, it is equally prevalent in both genders. Moreover, this type of body dissatisfaction is associated with use of potentially unhealthful products to improve physique and therefore should be considered in any efforts to prevent or identify unhealthy concerns with body shape.

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