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## **Predictors of Muscularity Oriented Disordered Eating Behaviors in U.S. Young Adults: A Prospective Cohort Study**

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**Abstract**

**Objective:** To determine adolescent predictors of muscularity-oriented disordered eating behaviors in young men and women using a nationally representative longitudinal sample in the US, and to examine differences by sex.

**Methods:** We used nationally representative longitudinal cohort data collected from baseline (11-18 years old, 1994-1995) and seven-year follow-up (18-24 years old, 2001-2002) of the National Longitudinal Study of Adolescent to Adult Health (Add Health). We examined adolescent demographic, behavioral, and mental health predictors of young adult muscularity-oriented disordered eating behaviors defined as eating more or differently to gain weight or bulk up, supplements to gain weight or bulk up, or androgenic anabolic steroid use at seven-year follow-up.

**Results:** Of the 14,891 included participants, 22% of males and 5% of females reported any muscularity-oriented disordered eating behavior at follow-up in young adulthood. Factors recorded at adolescence that were prospectively associated with higher odds of muscularity-oriented disordered eating in both sexes included Black race, exercising to gain weight, self-perception of being underweight, and lower body mass index z-score. In addition, participation in weightlifting; roller-blading, roller-skating, skate-boarding, or bicycling; and alcohol among males and depressive symptoms among females during adolescence were associated with lower odds of muscularity-oriented disordered eating in young adulthood.

**Conclusions:** Interventions to prevent muscularity-oriented disordered eating behaviors may target at-risk youth, particularly those of Black race or who engage in exercise to gain weight.

Future research should examine longitudinal health outcomes associated with muscularity-oriented disordered eating behaviors.

**Keywords:** Males; muscularity-oriented disordered eating; young adults; body image; weight control

## Introduction

The idealized male body image has become increasingly muscular, as reflected by popular media, advertising, and action figures (Pope, Olivardia, Gruber, & Borowiecki, 1999; Pope, Khalsa, & Bhasin, 2017). In concert, body dissatisfaction among adolescent boys has increased, and 9% of adolescent boys report high concerns with muscularity (Field et al., 2014). Furthermore, young women have also demonstrated muscularity concerns (Girard, Rodgers, & Chabrol, 2018; Holland & Tiggemann, 2017). Recent epidemiological surveillance in the United States suggests that 30% of adolescent boys versus 7% of adolescent girls are actively trying to gain weight (Nagata et al., 2019), which may be a proxy for desire to increase muscularity. Despite the centrality of muscularity concerns in body image, there is a paucity of longitudinal research examining predictors of muscularity-oriented, as opposed to thinness-oriented, eating behaviors.

The pursuit of muscularity may involve specific dietary alterations in attempting to influence muscularity which can include the overregulation of protein consumption, the elimination of non-protein-based foods, periodic engagement in cheat meals to boost metabolic rate, eating beyond the point of feeling full, and maintaining continual access to pre-planned foods (Murray et al., 2017; Pila, Mond, Griffiths, Mitchison, & Murray, 2017). Alongside specific dietary alterations, the pursuit of muscularity may include broader potentially deleterious behaviors, including illicit appearance enhancing substance use such as androgenic anabolic steroids (AAS) (Pope et al., 2014). Adolescent boys report higher rates than adolescent girls of

using protein powders or shakes (35% vs 21%), AAS (6% vs 4%), and other muscle-enhancing substances (11% vs 6%) (Eisenberg, Wall, & Neumark-Sztainer, 2012).

This constellation of muscularity seeking behaviors may, in some instances, portend deleterious sequelae. For instance, muscularity-oriented disordered eating may be a risk factor for development of a clinical eating disorder associated with medical instability and the urgent need for hospitalization (Murray, Accurso, Griffiths, & Nagata, 2018). A distressing preoccupation with muscularity may result in the development of muscle dysmorphia, a mental disorder characterized by pathological pursuit of muscularity (Murray, Rieger, Touyz, & De la Garza Garcia Lic, 2010).

Cross-sectional studies have shown that muscularity concerns and disordered eating are associated with athletic participation given sport-related pressures for weight and performance (Petrie, Greenleaf, Reel, & Carter, 2008; Thompson & Sherman, 2014), binge drinking and drug use (Calzo et al., 2016), and depression (Grossbard, Atkins, Geisner, & Larimer, 2013; Olivardia, Pope Jr., Borowiecki III, & Cohane, 2004). Adolescent boys and young men with concerns about muscularity had higher odds of prospectively developing depressive symptoms, binge drinking, dieting, and use of muscle-building products (Eik-Nes, Austin, Blashill, Murray, & Calzo, 2018; Field et al., 2014). Adolescent predictors of thinness-oriented disordered eating behaviors in young adulthood include depression, physical abuse, poor body image, and family, school, or community disconnectedness (Nagata, Garber, Tabler, Murray, & Bibbins-Domingo,

2018). However, adolescent predictors of muscularity-oriented disordered eating behaviors in young adulthood using longitudinal data remain largely unknown.

The objective of this research was to identify adolescent predictors of muscularity oriented disordered eating behaviors in young adult men and women using a nationally representative longitudinal sample in the US. We hypothesized that adolescent sports participation, substance use (alcohol and smoking), mental health (depression and poor self-esteem), and self-perception of being underweight or low body mass index would predict young adult muscularity-oriented disordered eating behaviors.

## **Methods**

### **Study design and sample**

We used data from the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally representative cohort of youth in the US that has been followed from adolescence through adulthood (Harris et al., 2017). The baseline adolescent sample used systematic sampling methods and implicit stratification to ensure that the high schools ( $n=80$ ) and middle schools ( $n=52$ ) selected were representative of US schools with respect to region of country, urbanicity, size, type, and ethnicity. For this particular study, we used the restricted-use baseline sample (Wave I, 11-18 years, 1994-1995) and seven-year follow-up data (Wave III, 18-26 years, 2001-2002). We included male and female participants in the nationally representative weighted sample who had data at both baseline and seven-year follow-up. Of the 20,743 adolescent males and females in the nationally representative weighted baseline sample, 14,891

(71.8%) had complete seven-year follow-up data and were included (supplemental Appendix A). Further details about the Add Health study design, coordinated by the Carolina Population Center, can be found elsewhere (Harris et al., 2017). The University of North Carolina Institutional Review Board approved all Add Health study procedures.

## **Procedures**

At baseline and seven-year follow-up, an interviewer traveled to the participant's home or another suitable location. Written consent was obtained from the parent if the participant was under age 18, or from the participant if 18 or older. Interviews lasted approximately 90 minutes and were conducted in as private an area as possible. Audio computer-assisted self-interview (baseline) and computer-assisted self-interview (follow-up) were used by participants to answer potentially sensitive questions (e.g., alcohol, smoking).

## **Measures**

### ***Adolescent baseline measures***

Demographic characteristics, self-reported physical activity and exercise, substance use (tobacco, alcohol), mental health (self-esteem, depression), and weight perception were collected during the in-home interview. Self-esteem was based on the Rosenberg Self-Esteem Scale (Rosenberg, 1965). Depression score was a modified version of the Center for Disease Epidemiology Depression Scale (CESD-20) (Radloff, 1977). Self-reported weight (pounds) and height (inches) were converted to kilograms and meters to calculate body mass index (BMI)

using the standard formula weight (kilograms) divided by height (meters) squared ( $BMI = \text{weight}/\text{height}^2$ ). BMI was then converted into sex- and age-specific Z-scores (Centers for Disease Control, 2012). Household income was based on parents' self-report of household income in the previous calendar year. Gaussian normal regression imputation method was used to impute income for the 1,638 parents who either refused to answer the income question or stated they did not know, similar to the method used in previous studies (Gooding, Walls, & Richmond, 2012). A full list of measures is listed in supplemental Appendix B.

*Young adult (seven-year follow-up) measures*

**Weight gain attempts:** Participants were asked at baseline and follow-up, "What are you currently doing about your weight?" Response choices included: "trying to lose weight," "trying to gain weight or bulk up," "trying to stay the same weight," or "not trying to do anything about your weight." "Trying to gain weight or bulk up" was coded as a weight gain or muscle-building attempt.

**Muscularity-oriented disordered eating behaviors:** Participants who reported weight gain attempts were then asked, "During the past seven days, which of the following things did you do in order to gain weight or build muscle?" Response choices included: 1) ate different foods than usual, 2) ate more, or 3) took food supplements. These questions were adapted from validated eating behavior measures used in the Adolescent Health Survey and similar to those used in Project Eating Among Teens (Neumark-Sztainer, Story, Resnick, & Blum, 1998; Neumark-Sztainer, 2010). In addition, participants were asked, "In the past year, have you used anabolic

steroids or other illegal performance enhancing substances for athletes?” Response choices included yes or no. Those who had affirmative responses to any of 1-3 or to AAS use were coded as engaging in muscularity-oriented disordered eating behaviors.

### **Statistical analysis**

Data analysis was performed in 2019 using STATA 15.0. Add Health’s pre-constructed sample weights were applied to provide a nationally representative sample (Chen, 2014; Harris, 2013). Comparisons between males and females in descriptive characteristics were calculated using Pearson’s chi-square tests for categorical variables and independent samples *t*-tests for continuous variables. Effect size estimates were calculated using Number Needed to Treat (NNT) for categorical variables and Cohen’s *d* for continuous variables. Although NNT was initially developed to address comparisons of treatment efficacy (Kraemer & Kupfer, 2006), in this context NNT is the answer to the question, “How many males do you have to see to find one more ‘failure’ (i.e. one more male who uses any muscularity-oriented disordered eating behavior) than if you had sampled females?” (Striegel-Moore et al., 2009). A NNT <4 is considered a “strong” effect, a NNT between 4 and 9 is considered a “moderate” effect, and a NNT >9 is considered a “weak” effect (Kraemer & Kupfer, 2006). A Cohen’s *d* of .2 is considered a “small” effect, .5 is considered a “medium” effect, and .8 is considered a “large” effect (Cohen, 1988). Multiple logistic regressions were used to assess baseline (adolescent) predictors including demographics, behaviors, mental health, and weight factors of seven-year follow-up (young adult) weight gain attempts and any muscularity-oriented disordered eating

behavior. All models included the baseline variables age, race/ethnicity, and household income (Haines, Kleinman, Rifas-Shiman, Field, & Austin, 2010; Neumark-Sztainer et al., 2007; Tabler & Utz, 2015). Analyses were stratified by sex given the different rates of weight gain attempts (Nagata et al., 2019) and muscularity-oriented disordered eating behaviors (Eisenberg et al., 2012) in males and females. The Bonferroni correction was used to adjust for multiple statistical tests (VanderWeele & Mathur, 2019).

## Results

Baseline adolescent demographic, behavioral, mental health, and weight characteristics of the sample ( $N=14,891$ ) are reported in Table 1. Mean baseline age was 15.5 and the sample was racially and ethnically diverse. Although the question was not included in the baseline adolescent assessment, approximately 94% of men and 86% of women in the sample identified as heterosexual in young adulthood.

Outcomes in young adulthood (ages 18-26 at seven-year follow-up) are also listed in Table 1. The prevalence of all reported muscularity-oriented disordered eating behaviors was higher in young men than in young women, with moderate to weak effect size differences (NNT 4 to 42). Overall, 27.5% of young men and 4.9% of young women reported trying to gain weight or build muscle. The prevalence of muscularity-oriented disordered eating behaviors among young men and women, respectively included: any muscularity-oriented disordered eating behavior (21.9% vs 4.5%), eating more or different foods to gain weight or bulk up (17.4% vs

3.9%), taking food supplements to gain weight or bulk up (6.9% vs 0.7%), and using AAS (2.8% vs 0.4%). Correlations among the three muscularity-oriented disordered eating behaviors and weightlifting and exercise to gain weight or bulk up are shown in supplemental Appendix C. There were weak associations between each of the specific behaviors except between exercise and weightlifting to gain weight or bulk up which demonstrated a moderate association; all associations were statistically significant.

Tables 2 (males) and 3 (females) report adjusted odds ratios of adolescent behavioral, mental health, and weight-related predictors of young adult outcomes, including 1) weight gain attempts and 2) any muscularity-oriented disordered eating behavior (an affirmative response to any of: ate more or different foods, supplements to gain weight or bulk up, or AAS). All models include age, race/ethnicity, and household income as covariates.

#### *Weight gain attempts*

Among males, Black/African American race, weightlifting to gain weight or bulk up, exercise to gain weight or bulk up, self-perceived underweight, and lower BMI Z-score in adolescence were associated with higher odds of weight gain attempts in young adulthood (Table 2). Higher adolescent self-esteem and self-perceived overweight were associated with lower odds of weight gain attempts in young adulthood.

Among females, Black/African American race/ethnicity, Asian/Pacific Islander race/ethnicity, engaging in exercise to gain weight, depressive symptoms, self-perceived underweight, and lower BMI z-score were associated with higher odds of weight gain attempts in

young adulthood. Self-perceived overweight was associated with lower odds of weight gain attempts.

#### *Any muscularity-oriented disordered eating behavior*

Among males, Black/African American race; roller-blading, roller-skating, skateboarding, or bicycling; weightlifting to gain weight or bulk up; exercise to gain weight or bulk up; alcohol; smoking; self-perceived underweight; and lower BMI Z-score in adolescence were associated with higher odds of engagement in any muscularity-oriented disordered eating behavior in young adulthood (Table 2). Self-perceived overweight was associated with lower odds of any muscularity-oriented disordered eating behavior in young adulthood.

Among females, Black/African American race/ethnicity, engaging in exercise to gain weight, depressive symptoms, self-perceived underweight, and lower BMI z-score were associated with higher odds of any muscularity-oriented disordered eating behaviors. Self-perceived overweight was associated with lower odds of any muscularity-oriented disordered eating behavior in young adulthood.

#### **Discussion**

In this nationally representative longitudinal sample of young adults in the US, we found that 22% of young men versus 5% of young women engage in muscularity-oriented disordered eating behaviors, such as eating more or different foods to gain weight or bulk up, using

supplements to gain weight or bulk up, or AAS use. We identified adolescent predictors of young adult muscularity-oriented disordered eating behaviors in young adulthood. Engagement in weightlifting or exercise to gain weight, self-perceived underweight, and Black/African American or other race were associated with the highest odds of muscularity-oriented disordered eating behaviors in males. Engagement in exercise to gain weight, self-perceived underweight, and Black/African American race/ethnicity were associated with the highest odds of muscularity oriented-disordered eating behaviors in females.

Participation in roller-blading, roller-skating, skate-boarding, or bicycling as well as weightlifting and exercise to build muscle in adolescence was associated with young adult muscularity-oriented disordered eating. Participation in sports teams has previously been found to be associated with muscle-building behaviors in adolescence (Eisenberg et al., 2012). In particular, weight-related sports, or sports in which it is important to stay a certain weight, such as wrestling, rowing, or gymnastics, have been shown to be associated with greater odds of AAS use (Vertalino, Eisenberg, Story, & Neumark-Sztainer, 2007). Sports team participation and greater frequency of exercise has been shown to be associated with greater medical instability (as measured by bradycardia) among adolescents with anorexia nervosa or bulimia nervosa (Nagata et al., 2017).

We found that Black race was associated with increased odds of muscularity-oriented disordered eating behaviors. This is consistent with findings among adolescent boys in the US

that black race was associated with weight-gain attempts (Nagata et al., 2019), which may be a proxy for a desire to increase muscularity.

We did not find an association between sexual identity and any muscularity-oriented disordered eating behavior. One previous study found that bisexual, but not gay, adolescent boys were less likely to report weight gain attempts (Nagata et al., 2019). In contrast, sexual minority adolescent boys have been found to have increased odds of AAS use compared to their heterosexual counterparts (Blashill & Safren, 2014). Substance use, depressive symptoms, and victimization were found to partially explain this association (Blashill & Safren, 2014).

Our longitudinal findings confirm previous literature finding associations between muscularity-oriented disordered eating and substance use (Calzo et al., 2016) and depression (Grossbard et al., 2013; Olivardia et al., 2004). Overall, poor adolescent mental health and wellbeing as well as substance use may predict future engagement in muscularity-oriented disordered eating behaviors in young adulthood. Lower adolescent BMI predicted any muscularity-oriented disordered eating behavior in young adulthood.

The findings of this research may have relevance to health care providers, public health programs, and community-based programs to identify youth at risk for future muscularity-oriented disordered eating behaviors, including AAS use. Individuals who engage in weightlifting or exercise to gain weight or bulk up in adolescence may benefit from targeted interventions regarding body image and health risks of muscularity-oriented disordered eating behaviors.

Limitations of this study include the use of self-reported data at baseline and follow-up, a method that may be subject to reporting bias. The Add Health questionnaire did not ask about specific types of supplement use to gain weight or build muscle. The prevalence of muscularity-oriented disordered eating behaviors may be underreported. Due to the skip logic from the Add Health survey, participants who did not report trying to gain weight or bulk up were not asked the specific muscularity-oriented disordered eating questions. The stigma associated with AAS use and the fact that AAS use for muscle-enhancing purposes is illegal in the US may contribute to underreporting (Griffiths, Murray, & Mond, 2016; Pope et al., 2014). Furthermore, the AAS question was combined with other illegal performance enhancing substances. Though we created a combined muscularity-oriented disordered eating behavior variable, the specific behaviors may have varying levels of being “disordered” and severity of health consequences (Pope et al., 2014). Although the specific muscularity-oriented behaviors were significantly correlated with one another, the magnitude of the associations (for instance between exercise to gain weight or bulk up and weightlifting to gain weight or bulk up) were not as strong as might be expected. Levels of the outcome at baseline were not controlled for as AAS use and muscularity-oriented disordered eating behaviors were not assessed at baseline. Trends in body image concerns may have changed since the outcome data were collected in 2001; however, the prevalence of weight gain attempts in males in this sample are similar to rates from a similar nationally representative survey collected in 2015 (Nagata et al., 2019). There was the possibility for selection bias since we excluded participants with missing seven-year follow-up data and a higher proportion of

White participants compared to Black/African American or Hispanic/Latino participants as well as male participants who self-perceived “overweight” compared to “about the right weight” were retained (Appendix A). Strengths include the use of nationally-representative longitudinal data with seven-year follow-up in a large community sample size of adolescents followed into young adulthood.

### **Conclusion**

In this nationally representative longitudinal sample of young adults in the US, we found that over a fifth of young men and 5% of young women engage in muscularity-oriented disordered eating behaviors. Engagement in exercise to gain weight, Black/African American race, self-perceived underweight, and low BMI in adolescence were associated with higher odds of muscularity-oriented disordered eating behaviors in young adulthood. Future research should examine longitudinal health outcomes associated with muscularity-oriented disordered eating behaviors.

## References

- Blashill, A. J., & Safren, S. A. (2014). Sexual orientation and anabolic-androgenic steroids in U.S. adolescent boys. *Pediatrics*, *133*(3), 469-475. doi:10.1542/peds.2013-2768 [doi]
- Calzo, J. P., Horton, N. J., Sonnevile, K. R., Swanson, S. A., Crosby, R. D., Micali, N., . . . Field, A. E. (2016). Male eating disorder symptom patterns and health correlates from 13 to 26 years of age. *Journal of the American Academy of Child and Adolescent Psychiatry*, *55*(8), 700.e2. doi:10.1016/j.jaac.2016.05.011 [doi]
- Centers for Disease Control (2012). *Defining adult overweight and obesity*. Retrieved from <http://www.cdc.gov/obesity/adult/defining.html>
- Chen, P. (2014). *Appropriate analysis in Add Health: Correcting for design effects & selecting weights*. Retrieved from Carolina Population Center, University of North Carolina at Chapel Hill Website: <http://www.cpc.unc.edu/projects/addhealth/events/2014-add-health-users-conference-appropriate-analysis-ping-chen>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Eik-Nes, T. T., Austin, S. B., Blashill, A. J., Murray, S. B., & Calzo, J. P. (2018). Prospective health associations of drive for muscularity in young adult males. *The International Journal of Eating Disorders*, *51*(10), 1185-1193. doi:10.1002/eat.22943
- Eisenberg, M. E., Wall, M., & Neumark-Sztainer, D. (2012). Muscle-enhancing behaviors among adolescent girls and boys. *Pediatrics*, *130*(6), 1019-1026. doi:10.1542/peds.2012-0095
- Field, A. E., Sonnevile, K. R., Crosby, R. D., Swanson, S. A., Eddy, K. T., Camargo, C. A., . . . Micali, N. (2014). Prospective associations of concerns about physique and the development of obesity, binge drinking, and drug use among adolescent boys and young adult men. *JAMA Pediatrics*, *168*(1), 34-39. doi:10.1001/jamapediatrics.2013.2915
- Girard, M., Rodgers, R. F., & Chabrol, H. (2018). Prospective predictors of body dissatisfaction, drive for thinness, and muscularity concerns among young women in france: A sociocultural model. *Body Image*, *26*, 103-110. doi:10.1016/j.bodyim.2018.07.001

- Gooding, H. C., Walls, C. E., & Richmond, T. K. (2012). Food insecurity and increased BMI in young adult women. *Obesity (Silver Spring, Md.)*, *20*(9), 1896-1901. doi:10.1038/oby.2011.233
- Griffiths, S., Murray, S. B., & Mond, J. M. (2016). The stigma of anabolic steroid use. *Journal of Drug Issues*, *46*(4), 446-456. doi:10.1177/0022042616661837
- Grossbard, J. R., Atkins, D. C., Geisner, I. M., & Larimer, M. E. (2013). Does depressed mood moderate the influence of drive for thinness and muscularity on eating disorder symptoms among college men? *Psychology of Men & Masculinity*, *14*(3), 281-287. doi:10.1037/a0028913
- Haines, J., Kleinman, K. P., Rifas-Shiman, S. L., Field, A. E., & Austin, S. B. (2010). Examination of shared risk and protective factors for overweight and disordered eating among adolescents. *Archives of Pediatrics & Adolescent Medicine*, *164*(4), 336-343. doi:10.1001/archpediatrics.2010.19
- Harris, K. M. (2013). *The Add Health study: Design and accomplishments*. Retrieved from Carolina Population Center, University of North Carolina at Chapel Hill Website: <http://www.cpc.unc.edu/projects/addhealth/documentation/guides/DesignPaperWIIIV.pdf>
- Harris, K. M., Halpern, C. T., Whitsel, E., Hussey, J., Tabor, J., Entzel, P. & Udry, J. R. (2017). The National Longitudinal Study of Adolescent to Adult Health: Research design. Retrieved from Carolina Population Center, University of North Carolina at Chapel Hill Website: [https://www.cpc.unc.edu/projects/addhealth/design/researchdesign\\_3618\\_regular.pdf](https://www.cpc.unc.edu/projects/addhealth/design/researchdesign_3618_regular.pdf)
- Holland, G., & Tiggemann, M. (2017). "Strong beats skinny every time": Disordered eating and compulsive exercise in women who post fitspiration on instagram. *The International Journal of Eating Disorders*, *50*(1), 76-79. doi:10.1002/eat.22559
- Iannaccone, M., D'Olimpio, F., Cella, S., & Cotrufo, P. (2016). Self-esteem, body shame and eating disorder risk in obese and normal weight adolescents: A mediation model. *Eating Behaviors*, *21*, 80-83. doi:10.1016/j.eatbeh.2015.12.010
- Kraemer, H. C., & Kupfer, D. J. (2006). Size of treatment effects and their importance to clinical research and practice. *Biological Psychiatry*, *59*(11), 990-996. doi:10.1016/j.biopsych.2005.09.014
- Murray, S. B., Accurso, E. C., Griffiths, S., & Nagata, J. M. (2018). Boys, biceps, and bradycardia: The hidden dangers of muscularity-oriented disordered eating. *The Journal of*

*Adolescent Health : Official Publication of the Society for Adolescent Medicine*, 62(3), 352-355. doi:S1054-139X(17)30492-5

- Murray, S. B., Nagata, J. M., Griffiths, S., Calzo, J. P., Brown, T. A., Mitchison, D., . . . Mond, J. M. (2017). The enigma of male eating disorders: A critical review and synthesis. *Clinical Psychology Review*, 57, 1-11. doi:S0272-7358(17)30137-X
- Murray, S. B., Rieger, E., Touyz, S. W., & De la Garza Garcia Lic, Y. (2010). Muscle dysmorphia and the DSM-V conundrum: Where does it belong? A review paper. *The International Journal of Eating Disorders*, 43(6), 483-491. doi:10.1002/eat.20828
- Nagata, J. M., Bibbins-Domingo, K., Garber, A. K., Griffiths, S., Vittinghoff, E., & Murray, S. B. (2019). Boys, bulk, and body ideals: Sex differences in weight gain attempts among adolescents in the United States. *J Adolesc Health*, 64(4), 450-453. doi:10.1016/j.jadohealth.2018.09.002
- Nagata, J. M., Carlson, J. L., Kao, J. M., Golden, N. H., Murray, S. B., & Peebles, R. (2017). Characterization and correlates of exercise among adolescents with anorexia nervosa and bulimia nervosa. *The International Journal of Eating Disorders*, 50(12), 1394-1403. doi:10.1002/eat.22796
- Nagata, J. M., Garber, A. K., Tabler, J., Murray, S. B., & Bibbins-Domingo, K. (2018). Differential risk factors for unhealthy weight control behaviors by sex and weight status among U.S. adolescents. *J Adolesc Health*, 63(3), 335-341. doi:10.1016/j.jadohealth.2018.03.022
- Neumark-Sztainer, D. (2010). Project EAT 2010 and F-EAT surveys - derived variables and scales. Retrieved from University of Minnesota Website:  
[http://docs.sph.umn.edu/epich/eat/EAT2010\\_FEAT\\_Psychometrics.pdf](http://docs.sph.umn.edu/epich/eat/EAT2010_FEAT_Psychometrics.pdf)
- Neumark-Sztainer, D., Story, M., Resnick, M. D., & Blum, R. W. (1998). Lessons learned about adolescent nutrition from the minnesota adolescent health survey. *Journal of the American Dietetic Association*, 98(12), 1449-1456. doi:S0002-8223(98)00329-0
- Neumark-Sztainer, D., Wall, M. M., Haines, J. I., Story, M. T., Sherwood, N. E., & van den Berg, P. A. (2007). Shared risk and protective factors for overweight and disordered eating in adolescents. *American Journal of Preventive Medicine*, 33(5), 359-369. doi:S0749-3797(07)00498-9

- Olivardia, R., Pope Jr., H. G., Borowiecki III, J. J., & Cohane, G. H. (2004). Biceps and body image: The relationship between muscularity and self-esteem, depression, and eating disorder symptoms. *Psychology of Men & Masculinity*, 5(2), 112-120. doi:10.1037/1524-9220.5.2.112
- Petrie, T. A., Greenleaf, C., Reel, J., & Carter, J. (2008). Prevalence of eating disorders and disordered eating behaviors among male collegiate athletes. *Psychology of Men & Masculinity*, 9(4), 267-277. doi:10.1037/a0013178
- Pila, E., Mond, J. M., Griffiths, S., Mitchison, D., & Murray, S. B. (2017). A thematic content analysis of #cheatmeal images on social media: Characterizing an emerging dietary trend. *The International Journal of Eating Disorders*, doi:10.1002/eat.22671
- Pope, H. G., Jr, Khalsa, J. H., & Bhasin, S. (2017). Body image disorders and abuse of anabolic-androgenic steroids among men. *Journal of the American Medical Association*, 317(1), 23-24. doi:10.1001/jama.2016.17441
- Pope, H. G., Jr, Olivardia, R., Gruber, A., & Borowiecki, J. (1999). Evolving ideals of male body image as seen through action toys. *The International Journal of Eating Disorders*, 26(1), 65-72. doi: 10.1002/(SICI)1098-108X(199907)26:1<65::AID-EAT8>3.0.CO;2-D
- Pope, H. G., Jr, Wood, R. I., Rogol, A., Nyberg, F., Bowers, L., & Bhasin, S. (2014). Adverse health consequences of performance-enhancing drugs: An endocrine society scientific statement. *Endocrine Reviews*, 35(3), 341-375. doi:10.1210/er.2013-1058
- Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1(3), 385-401. doi:10.1177/014662167700100306
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.
- Striegel-Moore, R. H., Rosselli, F., Perrin, N., DeBar, L., Wilson, G. T., May, A., & Kraemer, H. C. (2009). Gender difference in the prevalence of eating disorder symptoms. *The International Journal of Eating Disorders*, 42(5), 471-474. doi:10.1002/eat.20625
- Tabler, J., & Utz, R. L. (2015). The influence of adolescent eating disorders or disordered eating behaviors on socioeconomic achievement in early adulthood. *The International Journal of Eating Disorders*, 48(6), 622-632. doi:10.1002/eat.22395

- Thompson, R. A., & Sherman, R. (2014). Reflections on athletes and eating disorders. *Psychology of Sport and Exercise, 15*(6), 729-734. doi:10.1016/j.psychsport.2014.06.005
- VanderWeele, T. J., & Mathur, M. B. (2019). Some desirable properties of the bonferroni correction: Is the Bonferroni correction really so bad? *American Journal of Epidemiology, 188*(3), 617-618. doi:10.1093/aje/kwy250
- Vertalino, M., Eisenberg, M. E., Story, M., & Neumark-Sztainer, D. (2007). Participation in weight-related sports is associated with higher use of unhealthful weight-control behaviors and steroid use. *Journal of the American Dietetic Association, 107*(3), 434-440. doi:10.1016/j.jada.2006.12.010

Table 1. Descriptive characteristics of male sample from the National Longitudinal Study of Adolescent to Adult Health (N=14,891)

	Males (n=7,018)	Females (n=7,873)		
	Mean $\pm$ SE / % <sup>a</sup>	Mean $\pm$ SE / % <sup>a</sup>	p <sup>b</sup>	Effect size <sup>c</sup>
<b>Baseline (Adolescence)</b>				
<b>Demographic</b>				
Age	15.61 $\pm$ 0.12	15.46 $\pm$ 0.11	<0.001	0.12
Race/ethnicity			<0.001	
White	68.2%	68.8%		167
Black/African American	14.4%	11.5%		34
Hispanic/Latino	12.3%	1.5%		9
Asian/Pacific Islander	3.7%	3.1%		167
American Indian/Native American	0.6%	0.5%		1000
Other race/ethnicity	0.9%	0.6%		333
Household income, thousands of US dollars	45.40 $\pm$ 1.54	46.34 $\pm$ 1.57	0.43	-0.02
<b>Physical activity and exercise</b>				
Roller-blading, roller-skating, skate-boarding, or bicycling	49.8%	36.6%	<0.001	8
Baseball, softball, basketball, soccer, swimming, or football	82.4%	66.4%	<0.001	6
Jogging, walking, karate, jumping rope, gymnastics or dancing	81.4%	86.9%	<0.001	18
Weightlifting to gain weight or build muscle	18.0%	0.6%	<0.001	6
Exercise to gain weight or build muscle	15.8%	2.5%	<0.001	8
<b>Substance use</b>				
Alcohol	44.0%	44.1%	0.52	1000
Smoking	57.0%	56.5%	0.47	200
<b>Mental health</b>				
Self-esteem	12.60 $\pm$ 0.09	14.17 $\pm$ 0.11	<0.001	-0.35

Depressive symptoms	10.11 ± 0.17	12.46 ± 0.21	<0.001	-0.30
<b>Body image and weight</b>				
Weight self-perception			<0.001	
Self-perceived "about the right weight"	54.4%	48.5%		17
Self-perceived underweight	22.4%	11.6%		9
Self-perceived overweight	23.2%	40.0%		6
Body mass index z-score	0.39 ± 0.03	0.30 ± 0.2	<0.001	0.09
<b>Seven-Year Follow-Up Measures (Young Adulthood)</b>				
<b>Sexual identity</b>			<0.001	
Heterosexual	94.2%	85.9%		12
Mostly heterosexual	3.4%	10.1%		15
Bisexual or gay	2.4%	4.0%		63
<b>Young adult weight gain attempts or muscularity-oriented disordered eating behaviors</b>				
Trying to gain weight or bulk up, follow-up	27.5%	4.9%	<0.001	4
Any muscularity-oriented disordered eating behavior, follow-up	21.9%	4.5%	<0.001	6
Ate more or differently to gain weight or build muscle, follow-up	17.4%	3.9%	<0.001	7
Supplement use to gain weight or build muscle, follow-up	6.9%	0.7%	<0.001	16
Androgenic anabolic steroid use, follow-up	2.8%	0.4%	<0.001	42

<sup>a</sup>All means and percentages are calculated with weighted data to reflect the representative proportion in the target U.S. population

<sup>b</sup>Independent samples t-test for continuous variables, Pearson's chi-square test for categorical variables

<sup>c</sup>Cohen's D for continuous variables, Number Needed to Treat for categorical variables

Table 2. Associations between adolescent baseline predictors and young adult muscularity-oriented disordered eating behaviors in males

	Weight gain attempts		Any muscularity-oriented disordered eating behavior <sup>a</sup>	
	OR (95% CI) <sup>b</sup>	p	OR (95% CI) <sup>b</sup>	p
<b>Demographic</b>				
Race/ethnicity				
White (referent)	-	-	-	-
Black/African American	<b>2.03 (1.61 - 2.55)</b>	<b>&lt;0.001</b>	<b>1.66 (1.29 - 2.15)</b>	<b>&lt;0.001</b>
Hispanic/Latino	1.01 (0.78 - 1.30)	0.959	1.02 (0.75 - 1.41)	0.881
Asian/Pacific Islander	1.23 (0.79 - 1.91)	0.352	1.21 (0.77 - 1.88)	0.405
American Indian/Native American	0.64 (0.1 - 4.02)	0.629	1.22 (0.32 - 4.73)	0.771
Other race/ethnicity	2.40 (1.26 - 4.58)	0.008	2.95 (1.52 - 5.71)	0.002
Sexual identity				
Heterosexual (referent)	-	-	-	-
Mostly heterosexual	0.60 (0.35 - 1.02)	0.057	0.61 (0.34 - 1.10)	0.099
Bisexual or gay	0.59 (0.38 - 1.05)	0.072	0.7 (0.37 - 1.31)	0.264
Household income	1.00 (1.00-1.00)	0.228	1.00 (1.00-1.00)	0.931
<b>Physical activity and exercise</b>				
Roller-blading, roller-skating, skateboarding, or bicycling	1.27 (1.09 - 1.49)	0.002	<b>1.35 (1.13 - 1.60)</b>	<b>0.001</b>
Baseball, softball, basketball, soccer, swimming, or football	1.33 (1.04 - 1.70)	0.023	1.33 (1.01 - 1.76)	0.043
Jogging, walking, karate, jumping rope, gymnastics or dancing	1.39 (1.09 - 1.78)	0.008	1.42 (1.11 - 1.82)	0.006
Weightlifting to gain weight	<b>2.49 (2.06 - 3.02)</b>	<b>&lt;0.001</b>	<b>2.38 (1.93 - 2.94)</b>	<b>&lt;0.001</b>
Exercise to gain weight	<b>2.47 (1.98 - 3.07)</b>	<b>&lt;0.001</b>	<b>2.42 (1.94 - 3.02)</b>	<b>&lt;0.001</b>
<b>Substance use</b>				
Alcohol	1.21 (1.02 - 1.43)	0.032	<b>1.38 (1.15 - 1.65)</b>	<b>0.001</b>
Smoking	1.22 (0.99 - 1.49)	0.057	1.32 (1.10 - 1.59)	0.003
<b>Mental health</b>				
Self-esteem	<b>0.96 (0.94 - 0.98)</b>	<b>0.001</b>	0.97 (0.95 - 1.00)	0.045
Depressive symptoms	1.01 (1.00 - 1.02)	0.212	1.01 (1.00 - 1.03)	0.041
<b>Body image and weight</b>				
Weight self-perception				
Self-perceived "about the right weight" (referent)	-	-	-	-
Self-perceived underweight	<b>1.59 (1.32 - 1.91)</b>	<b>&lt;0.001</b>	<b>1.56 (1.26 - 1.93)</b>	<b>&lt;0.001</b>

Self-perceived overweight	<b>0.32 (0.24 - 0.43)</b>	<b>&lt;0.001</b>	<b>0.38 (0.28 - 0.51)</b>	<b>&lt;0.001</b>
Body mass index z-score	<b>0.59 (0.55 - 0.65)</b>	<b>&lt;0.001</b>	<b>0.63 (0.57 - 0.68)</b>	<b>&lt;0.001</b>

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**Bold** indicates statistical significance after Bonferroni adjustment ( $p < 0.00125$ )

<sup>a</sup> Any muscularity-oriented disordered eating behaviors included an affirmative response to ate more or different foods, supplements to gain weight or bulk up, or anabolic-androgenic steroid use.

<sup>b</sup> OR = odds ratio; all models include age, race/ethnicity, and household income

Table 3. Associations between adolescent baseline predictors and young adult muscularity-oriented disordered eating behaviors in females

	Weight gain attempts		Any muscularity-oriented disordered eating behavior <sup>a</sup>	
	OR (95% CI) <sup>b</sup>	p	OR (95% CI) <sup>b</sup>	p
<b>Demographic</b>				
Race/ethnicity				
White (referent)	-	-	-	-
Black/African American	<b>2.69 (1.87 - 3.86)</b>	<b>&lt;0.001</b>	<b>2.81 (1.92 - 4.12)</b>	<b>&lt;0.001</b>
Hispanic/Latino	1.62 (1.04 - 2.53)	0.034	1.68 (1.07 - 2.64)	0.024
Asian/Pacific Islander	<b>3.76 (2.21 - 6.41)</b>	<b>&lt;0.001</b>	2.61 (1.25 - 5.45)	0.011
American Indian/Native American	-	-	0.17 (0.02 - 1.38)	0.096
Other race/ethnicity	1.88 (0.25 - 14.39)	0.541	2.08 (0.27 - 16.04)	0.478
Sexual identity				
Heterosexual (referent)	-	-	-	-
Mostly heterosexual	1.82 (1.14 - 2.93)	0.013	1.76 (1.04 - 2.98)	0.036
Bisexual or gay	1.39 (0.67 - 2.89)	0.371	1.11 (0.48 - 2.60)	0.806
Household income	0.99 (0.99 - 0.99)	0.018	0.99 (0.98 - 1.00)	0.670
<b>Physical activity and exercise</b>				
Roller-blading, roller-skating, skate-boarding, or bicycling	1.21 (0.90 - 1.62)	0.201	1.28 (0.95 - 1.72)	0.108
Baseball, softball, basketball, soccer, swimming, or football	1.03 (0.75 - 1.43)	0.842	1.01 (0.73 - 1.40)	0.953
Jogging, walking, karate, jumping rope, gymnastics or dancing	0.95 (0.61 - 1.50)	0.835	0.94 (0.59 - 1.51)	0.800
Weightlifting to gain weight	0.89 (0.21 - 3.66)	0.868	0.78 (0.18 - 3.44)	0.737
Exercise to gain weight	<b>5.07 (2.88 - 8.92)</b>	<b>&lt;0.001</b>	<b>3.48 (1.95 - 6.21)</b>	<b>&lt;0.001</b>
<b>Substance use</b>				
Alcohol	1.10 (0.79 - 1.54)	0.573	1.06 (0.75 - 1.49)	0.742
Smoking	1.38 (1.00 - 1.90)	0.048	1.44 (1.06 - 1.97)	0.021
<b>Mental health</b>				
Self-esteem	1.01 (0.97 - 1.05)	0.745	1.00 (0.96 - 1.03)	0.904
Depressive symptoms	<b>1.03 (1.01 - 1.05)</b>	<b>0.001</b>	<b>1.02 (1.01 - 1.04)</b>	<b>0.001</b>
<b>Body image and weight</b>				
Weight self-perception				
Self-perceived "about the right weight" (referent)	-	-	-	-
Self-perceived underweight	<b>3.59 (2.47 - 5.21)</b>	<b>&lt;0.001</b>	<b>3.71 (2.50-5.50)</b>	<b>&lt;0.001</b>
Self-perceived overweight	<b>0.30 (0.19 - 0.47)</b>	<b>&lt;0.001</b>	<b>0.32 (0.20-0.50)</b>	<b>&lt;0.001</b>
Body mass index z-score	<b>0.36 (0.31 - 0.42)</b>	<b>&lt;0.001</b>	<b>0.36 (0.31 - 0.42)</b>	<b>&lt;0.001</b>

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**Bold** indicates statistical significance after Bonferroni adjustment ( $p < 0.00125$ )

<sup>a</sup> Any muscularity-oriented disordered eating behaviors included an affirmative response to ate more or different foods, supplements to gain weight or bulk up, or anabolic-androgenic steroid use.

<sup>b</sup> OR = odds ratio; all models include age, race/ethnicity, and household income

Table 1. Descriptive characteristics of male sample from the National Longitudinal Study of Adolescent to Adult Health (N=14,891)

	Males (n=7,018)	Females (n=7,873)		
	Mean $\pm$ SE / % <sup>a</sup>	Mean $\pm$ SE / % <sup>a</sup>	p <sup>b</sup>	Effect size <sup>c</sup>
<b>Baseline (Adolescence)</b>				
<b>Demographic</b>				
Age	15.61 $\pm$ 0.12	15.46 $\pm$ 0.11	<0.001	0.12
Race/ethnicity			<0.001	
White	68.2%	68.8%		167
Black/African American	14.4%	11.5%		34
Hispanic/Latino	12.3%	1.5%		9
Asian/Pacific Islander	3.7%	3.1%		167
American Indian/Native American	0.6%	0.5%		1000
Other race/ethnicity	0.9%	0.6%		333
Household income, thousands of US dollars	45.40 $\pm$ 1.54	46.34 $\pm$ 1.57	0.43	-0.02
<b>Physical activity and exercise</b>				
Roller-blading, roller-skating, skate-boarding, or bicycling	49.8%	36.6%	<0.001	8
Baseball, softball, basketball, soccer, swimming, or football	82.4%	66.4%	<0.001	6
Jogging, walking, karate, jumping rope, gymnastics or dancing	81.4%	86.9%	<0.001	18
Weightlifting to gain weight or build muscle	18.0%	0.6%	<0.001	6
Exercise to gain weight or build muscle	15.8%	2.5%	<0.001	8
<b>Substance use</b>				
Alcohol	44.0%	44.1%	0.52	1000
Smoking	57.0%	56.5%	0.47	200
<b>Mental health</b>				
Self-esteem	12.60 $\pm$ 0.09	14.17 $\pm$ 0.11	<0.001	-0.35
Depressive symptoms	10.11 $\pm$ 0.17	12.46 $\pm$ 0.21	<0.001	-0.30
<b>Body image and weight</b>				
Weight self-perception			<0.001	
Self-perceived "about the right weight"	54.4%	48.5%		17
Self-perceived underweight	22.4%	11.6%		9
Self-perceived overweight	23.2%	40.0%		6
Body mass index z-score	0.39 $\pm$ 0.03	0.30 $\pm$ 0.2	<0.001	0.09

**Seven-Year Follow-Up Measures (Young Adulthood)**

<b>Sexual identity</b>				
Heterosexual	94.2%	85.9%	<0.001	12
Mostly heterosexual	3.4%	10.1%		15
Bisexual or gay	2.4%	4.0%		63
<b>Young adult weight gain attempts or muscularity-oriented disordered eating behaviors</b>				
Trying to gain weight or bulk up, follow-up	27.5%	4.9%	<0.001	4
Any muscularity-oriented disordered eating behavior, follow-up	21.9%	4.5%	<0.001	6
Ate more or differently to gain weight or build muscle, follow-up	17.4%	3.9%	<0.001	7
Supplement use to gain weight or build muscle, follow-up	6.9%	0.7%	<0.001	16
Androgenic anabolic steroid use, follow-up	2.8%	0.4%	<0.001	42

<sup>a</sup>All means and percentages are calculated with weighted data to reflect the representative proportion in the target U.S. population

<sup>b</sup>Independent samples t-test for continuous variables, Pearson's chi-square test for categorical variables

<sup>c</sup>Cohen's D for continuous variables, Number Needed to Treat for categorical variables

Table 2. Associations between adolescent baseline predictors and young adult muscularity-oriented disordered eating behaviors in males

	Weight gain attempts		Any muscularity-oriented disordered eating behavior <sup>a</sup>	
	OR (95% CI) <sup>b</sup>	p	OR (95% CI) <sup>b</sup>	p
<b>Demographic</b>				
Race/ethnicity				
White (referent)	-	-	-	-
Black/African American	<b>2.03 (1.61 - 2.55)</b>	<b>&lt;0.001</b>	<b>1.66 (1.29 - 2.15)</b>	<b>&lt;0.001</b>
Hispanic/Latino	1.01 (0.78 - 1.30)	0.959	1.02 (0.75 - 1.41)	0.881
Asian/Pacific Islander	1.23 (0.79 - 1.91)	0.352	1.21 (0.77 - 1.88)	0.405
American Indian/Native American	0.64 (0.1 - 4.02)	0.629	1.22 (0.32 - 4.73)	0.771
Other race/ethnicity	2.40 (1.26 - 4.58)	0.008	2.95 (1.52 - 5.71)	0.002
Sexual identity				
Heterosexual (referent)	-	-	-	-
Mostly heterosexual	0.60 (0.35 - 1.02)	0.057	0.61 (0.34 - 1.10)	0.099
Bisexual or gay	0.59 (0.38 - 1.05)	0.072	0.7 (0.37 - 1.31)	0.264
Household income	1.00 (1.00-1.00)	0.228	1.00 (1.00-1.00)	0.931
<b>Physical activity and exercise</b>				
Roller-blading, roller-skating, skateboarding, or bicycling	1.27 (1.09 - 1.49)	0.002	<b>1.35 (1.13 - 1.60)</b>	<b>0.001</b>
Baseball, softball, basketball, soccer, swimming, or football	1.33 (1.04 - 1.70)	0.023	1.33 (1.01 - 1.76)	0.043
Jogging, walking, karate, jumping rope, gymnastics or dancing	1.39 (1.09 - 1.78)	0.008	1.42 (1.11 - 1.82)	0.006
Weightlifting to gain weight	<b>2.49 (2.06 - 3.02)</b>	<b>&lt;0.001</b>	<b>2.38 (1.93 - 2.94)</b>	<b>&lt;0.001</b>
Exercise to gain weight	<b>2.47 (1.98 - 3.07)</b>	<b>&lt;0.001</b>	<b>2.42 (1.94 - 3.02)</b>	<b>&lt;0.001</b>
<b>Substance use</b>				
Alcohol	1.21 (1.02 - 1.43)	0.032	<b>1.38 (1.15 - 1.65)</b>	<b>0.001</b>
Smoking	1.22 (0.99 - 1.49)	0.057	1.32 (1.10 - 1.59)	0.003
<b>Mental health</b>				
Self-esteem	<b>0.96 (0.94 - 0.98)</b>	<b>0.001</b>	0.97 (0.95 - 1.00)	0.045
Depressive symptoms	1.01 (1.00 - 1.02)	0.212	1.01 (1.00 - 1.03)	0.041
<b>Body image and weight</b>				
Weight self-perception				
Self-perceived "about the right weight" (referent)	-	-	-	-
Self-perceived underweight	<b>1.59 (1.32 - 1.91)</b>	<b>&lt;0.001</b>	<b>1.56 (1.26 - 1.93)</b>	<b>&lt;0.001</b>
Self-perceived overweight	<b>0.32 (0.24 - 0.43)</b>	<b>&lt;0.001</b>	<b>0.38 (0.28 - 0.51)</b>	<b>&lt;0.001</b>
Body mass index z-score	<b>0.59 (0.55 - 0.65)</b>	<b>&lt;0.001</b>	<b>0.63 (0.57 - 0.68)</b>	<b>&lt;0.001</b>

**Bold** indicates statistical significance after Bonferroni adjustment (p<0.00125)

<sup>a</sup> Any muscularity-oriented disordered eating behaviors included an affirmative response to ate more or different foods, supplements to gain weight or bulk up, or anabolic-androgenic steroid use.

<sup>b</sup> OR = odds ratio; all models include age, race/ethnicity, and household income

Table 3. Associations between adolescent baseline predictors and young adult muscularity-oriented disordered eating behaviors in females

	Weight gain attempts		Any muscularity-oriented disordered eating behavior <sup>a</sup>	
	OR (95% CI) <sup>b</sup>	p	OR (95% CI) <sup>b</sup>	p
<b>Demographic</b>				
Race/ethnicity				
White (referent)	-	-	-	-
Black/African American	<b>2.69 (1.87 - 3.86)</b>	<b>&lt;0.001</b>	<b>2.81 (1.92 - 4.12)</b>	<b>&lt;0.001</b>
Hispanic/Latino	1.62 (1.04 - 2.53)	0.034	1.68 (1.07 - 2.64)	0.024
Asian/Pacific Islander	<b>3.76 (2.21 - 6.41)</b>	<b>&lt;0.001</b>	2.61 (1.25 - 5.45)	0.011
American Indian/Native American	-	-	0.17 (0.02 - 1.38)	0.096
Other race/ethnicity	1.88 (0.25 - 14.39)	0.541	2.08 (0.27 - 16.04)	0.478
Sexual identity				
Heterosexual (referent)	-	-	-	-
Mostly heterosexual	1.82 (1.14 - 2.93)	0.013	1.76 (1.04 - 2.98)	0.036
Bisexual or gay	1.39 (0.67 - 2.89)	0.371	1.11 (0.48 - 2.60)	0.806
Household income	0.99 (0.99 - 0.99)	0.018	0.99 (0.98 - 1.00)	0.670
<b>Physical activity and exercise</b>				
Roller-blading, roller-skating, skate-boarding, or bicycling	1.21 (0.90 - 1.62)	0.201	1.28 (0.95 - 1.72)	0.108
Baseball, softball, basketball, soccer, swimming, or football	1.03 (0.75 - 1.43)	0.842	1.01 (0.73 - 1.40)	0.953
Jogging, walking, karate, jumping rope, gymnastics or dancing	0.95 (0.61 - 1.50)	0.835	0.94 (0.59 - 1.51)	0.800
Weightlifting to gain weight	0.89 (0.21 - 3.66)	0.868	0.78 (0.18 - 3.44)	0.737
Exercise to gain weight	<b>5.07 (2.88 - 8.92)</b>	<b>&lt;0.001</b>	<b>3.48 (1.95 - 6.21)</b>	<b>&lt;0.001</b>
<b>Substance use</b>				
Alcohol	1.10 (0.79 - 1.54)	0.573	1.06 (0.75 - 1.49)	0.742
Smoking	1.38 (1.00 - 1.90)	0.048	1.44 (1.06 - 1.97)	0.021
<b>Mental health</b>				
Self-esteem	1.01 (0.97 - 1.05)	0.745	1.00 (0.96 - 1.03)	0.904
Depressive symptoms	<b>1.03 (1.01 - 1.05)</b>	<b>0.001</b>	<b>1.02 (1.01 - 1.04)</b>	<b>0.001</b>
<b>Body image and weight</b>				
Weight self-perception				
Self-perceived "about the right weight" (referent)	-	-	-	-
Self-perceived underweight	<b>3.59 (2.47 - 5.21)</b>	<b>&lt;0.001</b>	<b>3.71 (2.50-5.50)</b>	<b>&lt;0.001</b>
Self-perceived overweight	<b>0.30 (0.19 - 0.47)</b>	<b>&lt;0.001</b>	<b>0.32 (0.20-0.50)</b>	<b>&lt;0.001</b>
Body mass index z-score	<b>0.36 (0.31 - 0.42)</b>	<b>&lt;0.001</b>	<b>0.36 (0.31 - 0.42)</b>	<b>&lt;0.001</b>

**Bold** indicates statistical significance after Bonferroni adjustment (p<0.00125)

<sup>a</sup> Any muscularity-oriented disordered eating behaviors included an affirmative response to ate more or different foods, supplements to gain weight or bulk up, or anabolic-androgenic steroid use.

<sup>b</sup> OR = odds ratio; all models include age, race/ethnicity, and household income