

University of Tasmania Open Access Repository

Cover sheet

Title

Anabolic steroid use and body image psychopathology in men: Delineating between appearance- versus performance-driven motivations

Author

Murray, SB, Griffiths, S, Jon Mond, Kean, J, Blashill, AJ

Bibliographic citation

Murray, SB; Griffiths, S; Mond, Jon; Kean, J; Blashill, AJ (2016). Anabolic steroid use and body image psychopathology in men: Delineating between appearance- versus performance-driven motivations. University Of Tasmania. Journal contribution.

https://figshare.utas.edu.au/articles/journal_contribution/Anabolic_steroid_use_and_body_image_psychopathology_versus_performance-driven_motivations/22953305

Is published in: [10.1016/j.drugalcdep.2016.06.008](https://doi.org/10.1016/j.drugalcdep.2016.06.008)

Copyright information

This version of work is made accessible in the repository with the permission of the copyright holder/s under the following,

Licence.

Rights statement: © 2016 Elsevier Ireland Ltd. All rights reserved.

If you believe that this work infringes copyright, please email details to: oa.repository@utas.edu.au

Downloaded from [University of Tasmania Open Access Repository](#)

Please do not remove this coversheet as it contains citation and copyright information.

University of Tasmania Open Access Repository

Library and Cultural Collections

University of Tasmania

Private Bag 3

Hobart, TAS 7005 Australia

E oa.repository@utas.edu.au

CRICOS Provider Code 00586B | ABN 30 764 374 782

utas.edu.au



Full length article

Anabolic steroid use and body image psychopathology in men: Delineating between appearance- versus performance-driven motivations

Stuart B. Murray^{a,*}, Scott Griffiths^b, Jonathan M. Mond^c, Joseph Kean^d, Aaron J. Blashill^{e,f}

^a Department of Psychiatry, University of California, San Francisco, San Francisco, CA, United States

^b Department of Psychology, University of Sydney, Sydney, NSW, Australia

^c Department of Psychology, Macquarie University, Sydney, NSW, Australia

^d Centre for Public Health, Liverpool John Moores University, Liverpool, UK

^e Department of Psychology, San Diego State University, San Diego, CA, United States

^f SDSU/UCSD Joint Doctoral Program in Clinical Psychology, San Diego, CA, United States

ARTICLE INFO

Article history:

Received 17 February 2016

Received in revised form 27 May 2016

Accepted 7 June 2016

Available online 16 June 2016

Keywords:

Anabolic androgenic steroids

Eating disorders

Muscle dysmorphia

Body image

ABSTRACT

Objective: Anabolic androgenic steroid (AAS) use has been robustly associated with negative body image, and eating- and muscularity-oriented psychopathology. However, with AAS being increasingly utilized for both appearance and athletic performance-related purposes, we investigated whether comorbid body image psychopathology varies as a function of motivation for usage.

Method: Self-reported motivation for current and initial AAS use was recorded amongst 122 AAS using males, alongside measures of current disordered eating and muscle dysmorphia psychopathology.

Results: Those reporting AAS for appearance purposes reported greater overall eating disorder psychopathology, $F(2, 118) = 7.45, p = 0.001, \eta_p^2 = 0.11$, and muscle dysmorphia psychopathology, $F(2, 118) = 7.22, p < 0.001, \eta_p^2 = 0.11$, than those using AAS primarily for performance purposes. Additionally, greater dietary restraint, $F(2, 116) = 3.61, p = 0.030, \eta_p^2 = 0.06$, functional impairment, $F(2, 118) = 3.26, p = 0.042, \eta_p^2 = 0.05$, and drive for size, $F(2, 118) = 10.76, p < 0.001, \eta_p^2 = 0.15$, was demonstrated in those using AAS for appearance purposes.

Discussion: Motivation for AAS use may be important in accounting for differential profiles of body image psychopathology amongst users. Men whose AAS use is driven primarily by appearance-related concerns may be a particularly dysfunctional subgroup.

© 2016 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Anabolic-androgenic steroids (AAS) are a group of drugs, including testosterone and synthetic derivatives, that increases the synthesis of protein and promote the development of secondary male sex characteristics. Chronic use of AAS is associated with cardiovascular, endocrine, metabolic, neurologic, psychiatric, infectious, hepatic, renal, and musculoskeletal disorders, as well as early mortality (Kanayama et al., 2009; Pope et al., 2014). There is now well-recognized evidence linking AAS use to long-term risk of dyslipidemia, cardiomyopathy, major mood disorders, aggression,

violence, and AAS dependence (e.g., Pope et al., 2014; Kanayama et al., 2008; Thiblin et al., 2015). Estimates indicate that between 2.9% and 4% of Americans have used AAS at some point in their lives, nearly double the rate of heroin use, and boys and men are much more likely to use AAS compared to girls and women (e.g., Pope et al., 2014). Dependence is also common, with 23% to 57% of individuals who used subsequently developing AAS dependence (Kanayama et al., 2008).

Motivations to use AAS, however, differ from motivations for use of other substances, as appearance and performance motivations, versus desires for intoxication, are the most common reasons for use (Cohen et al., 2007; Parkinson and Evans, 2006). For example, in a sample of 500 men who use AAS, increasing muscle mass, improving physical appearance, and increasing strength were rated as the top three motivations for AAS use (Ip et al., 2011). These results largely mirror those found in a sample of nearly 2000 men who

* Corresponding author at: Department of Psychiatry, University of California, San Francisco, 3333 California St., Suite 245, San Francisco, CA, 94118.
E-mail address: stuart.murray@ucsf.edu (S.B. Murray).

use AAS, who also identified increasing muscle mass, increasing strength, and looking good, as the top three motivations for use (Cohen et al., 2007). These findings suggest that most men who use AAS are likely doing so to enhance appearance (e.g., muscularity), performance (e.g., strength), or both.

Negative body image is a primary risk factor for AAS use (Field et al., 2014; Van den Berg et al., 2007; Cafri et al., 2006; Kanayama et al., 2006; Riciardelli and McCabe, 2004). For example, Cafri et al. (2006) found that a desire for increased muscularity was significantly associated with AAS use among young adult men. Recently, Jampel et al. (2016) found that perceiving oneself as either very underweight or very overweight was associated with AAS use, suggesting that males who use AAS may do so to gain muscularity and/or reduce body fat. Relatedly, among men who use AAS, many report decreasing fat to be an important motivation (Ip et al., 2011; Cohen et al., 2007). These findings are consistent with sociocultural theories, suggesting that internalization of largely unattainable body image ideals may drive AAS use among men (McCreary et al., 2007; Parent and Moradi, 2011). The internalization of this masculine, muscular ideal may lead to shame in one's own appearance, which may be manifested in pathological eating and exercise behaviors, including symptoms of eating disorders (EDs; such as anorexia and bulimia nervosa) and muscle dysmorphia (MD). Indeed, in a recent cross-sectional cohort study of male weightlifters, ED pathology (e.g., drive for thinness, symptoms of bulimia, body dissatisfaction), and elevated symptoms of MD were strongly predictive of AAS use (Pope et al., 2012).

To our knowledge, no study has examined ED pathology and symptoms of MD among men who use AAS as a function of AAS motivations. Given that changing appearance and improving performance appear to be the primary motivations for AAS use, it would be of interest to consider whether and to what extent associations with EDs and related psychopathology might differ as a function of which of these different motivations is predominant. The goal of the current study was to address this issue by examining associations between motivations for AAS use and the occurrence of EDs and related pathology in a sample of males reporting current or recent AAS use. We hypothesized that men who state their motivation for AAS use relates primarily to concerns about appearance would report greater ED and MD symptoms compared to men who primarily use AAS for performance reasons.

2. Methods

2.1. Participants

Participants were 122 males who self-reported current or recent AAS use. Recruitment occurred through specialist needle exchange centers in which clean needles were obtained for self-administered AAS injections ($n = 46$), and in bodybuilding gymnasiums ($n = 76$), in the north of England. Sensitivity analyses revealed no significant differences in MD or ED psychopathology (including all subscale and total/global scores), or in age or lifetime duration of anabolic steroid use, between participants recruited from specialist needle exchanges and participants recruited from bodybuilding gymnasiums (all p 's > 0.05), allowing the conflation of recruitment sites. All participants responded to study advertisements, which were placed in gymnasiums or needle exchange centers and referred to an anonymous study of body image and steroid use. Once informed consent was obtained, a series of self-report questionnaires were completed. Ethical approval for this study was granted by the University of California, San Francisco.

Participants' ages ranged from 17 to 48 years with a mean of 29.38 years ($SD = 7.11$). Most participants (83.6%) identified as being heterosexual, 3.3% identified as being gay/bisexual, while 13.1% did

not indicate their sexual orientation. Participants' total duration of AAS use ranged from less than 1 year to 36 years with a mean of 4.64 years ($SD = 6.19$) and a median of 2 years. Participants were also asked how long it had been since they had last used AAS, with recent AAS use operationalized as having used steroids within the past 365 days (1 year). This broad catchment area for defining recent use was intended to accommodate the discontinuous nature of ongoing AAS use, which is characterized by intermittent 'cycling on' and 'cycling off' in attempting to mitigate the medical risks of continuous AAS use (Casavant et al., 2007; Cohen et al., 2007). Two participants who reported that they had last used steroids more than 365 days ago were excluded on the basis that they were not recently using AAS. Subsequently, participants' responses ranged from less than 1 day ago (implying that had used AAS earlier that day) to 365 days ago with a mean of 30.55 days ($SD = 71.67$) and a median of 4 days.

2.2. Measures

2.2.1. Androgenic anabolic steroid use. Participants' motivation for AAS use was assessed via three forced-choice items in which participants were asked to indicate whether their current and initial AAS use was undertaken primarily for: (i) appearance purposes; (ii) athletic performance purposes; or (iii) both appearance and athletic performance purposes. Participants were also asked to indicate the duration of their AAS use, and their most recent dose.

2.2.2. Muscle Dysmorphia Disorder Inventory (MDDI). The MDDI (Hildebrandt et al., 2004) is a 13-item measure that indexes the core aspects of MD symptomatology, including the drive for size, appearance intolerance, and functional impairment. All items are designed to correspond to the proposed diagnostic criteria for MD, and the MDDI yields strong psychometric properties (Hildebrandt et al., 2004). In the present study, the MDDI demonstrated adequate internal consistency (Cronbach's α range across subscales = 0.84 to 0.90).

2.2.3. Eating Disorder Examination-Questionnaire (EDE-Q). The EDE-Q (Fairburn and Beglin, 1994) is a widely-used, 36-item, self-report measure designed to assess the occurrence and frequency of key attitudinal and behavioral components of ED psychopathology over the previous 28 days; namely dietary restraint, eating concern, weight concern and shape concern. A global score indicating overall levels of ED pathology is derived from the 22 items assessing core attitudinal features and this score has been found to have strong psychometric properties in both community and clinical samples of adolescent and young adult women (Mond et al., 2004). However, the EDE-Q, which was designed and validated in samples of female ED patients, may lack sensitivity in indexing ED psychopathology in males, particularly as applied to muscularity- rather than thinness-oriented concerns and associated behaviors (Murray et al., 2010, 2016). In the current study, this limitation was addressed by reversing the polarity of certain gender specific items of the EDE-Q, as has been outlined in previous research addressing male ED psychopathology (Murray et al., 2012). For example, the item "Have you had a definite fear that you might gain weight or become fat" was amended to read "Have you had a definite fear that you might lose weight or become not muscular enough" (Murray et al., 2012). In the present study, the modified EDE-Q demonstrated adequate internal consistency (Cronbach's α range across subscales = 0.74 to 0.88).

2.3. Statistical analyses

The normality of the data were established by calculating Z-scores for kurtosis and skewness statistics and checking them for

Table 1
Spearman rank-order correlation coefficients.

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age	–										
2. Lifetime duration of AAS use	0.33***	–									
3. MDDI, Total score	0.05	0.17	–								
4. MDDI, Drive for size	0.06	0.13	0.84***	–							
5. MDDI, Functional impairment	0.15	0.10	0.83***	0.61***	–						
6. MDDI, Appearance intolerance	–0.04	0.24**	0.73***	0.46***	0.41***	–					
7. EDE-Q, Global score	0.01	0.17	0.71***	0.65***	0.52***	0.57***	–				
8. EDE-Q, Dietary restraint	–0.17	0.09	0.41***	0.40***	0.21*	0.41***	0.74***	–			
9. EDE-Q, Eating concerns	0.05	–0.01	0.39***	0.26**	0.25**	0.40***	0.63***	0.32**	–		
10. EDE-Q, Weight concerns	0.11	0.21*	0.59***	0.59***	0.50***	0.39**	0.85***	0.44***	0.41***	–	
11. EDE-Q, Shape concerns	0.07	0.17	0.78***	0.68***	0.65***	0.56***	0.85***	0.39***	0.58***	0.79***	–

Note: AAS—anabolic androgenic steroid, MDDI—Muscle Dysmorphic Disorder Inventory, EDE-Q—Eating Disorder Examination-Questionnaire.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

statistical significance, and by visual inspection of frequency histograms and Q–Q plots. Normal data were analysed using Pearson product-moment correlations and univariate ANOVAs with current motivation for AAS use as the independent variable, which contained three levels: (i) appearance motivation, (ii) performance and appearance motivations, and (iii) performance motivation. Non-normal data were analysed using Spearman rank-order correlations and Kruskal–Wallis H-tests. Dependent variables included in the analyses included the total and subscale scores of the MDDI and the global and subscale scores of the modified EDE-Q. Significant main effects were followed-up with Tukey HSD pairwise comparisons. Effect sizes are given as partial eta-squared (η_p^2) (.01 = small, 0.09 = medium, 0.25 = large) (Cohen et al., 2003).

3. Results

3.1. Descriptive data

Participants reported that their initial motivation for AAS was to improve their appearance (50.4%), to improve their performance (30.6%), or to improve both performance and appearance (19.0%). A different pattern was observed regarding current motivation for AAS use; appearance (41.3%) was followed by performance and appearance (33.1%), which, in turn, was followed by performance (25.6%). The majority (76.9%) of participants reported the same motivation for their current use as for their initial use; 12.4% transitioned from an initial appearance motivation to a current performance and appearance motivation, 5.0% transitioned from performance motivation to appearance motivation, 2.5% transitioned from appearance motivation to performance motivation, 2.5% transitioned from performance motivation to performance and appearance motivation, and 0.8% transitioned from performance and appearance motivation to appearance motivation.

3.2. Bivariate associations

Lifetime duration of AAS use was positively correlated with age (Table 1). Neither duration of AAS use or age was associated with MD or ED symptoms, with the exception of appearance intolerance, which was weakly positively correlated with lifetime duration of AAS use. The total and subscale scores of the MD measure were broadly and strongly positively correlated with the global and subscale scores of the ED measure.

3.3. Primary results

Results of the ANOVAs are shown in Table 2. As can be seen, participants in the appearance group reported significantly greater MD symptomatology, as measured by the MDDI total score, than users in the performance group. Significant between-groups differences

were also observed for the Drive for Size and Functional Impairment subscales of the MDDI. Specifically, participants in the appearance motivation group had significantly greater Drive for Size than those in the appearance and performance motivations group, who in turn reported greater Drive for Size than participants in the performance motivation group. In addition, participants in the appearance group had significantly greater Functional Impairment, indicating greater appearance-related psychosocial burden than participants in the performance group. No significant between-groups differences were observed for the Appearance Intolerance subscale of the MDDI.

Significant between-group differences in overall levels of ED pathology, as measured by the EDE-Q Global score, were also observed. Participants in the appearance motivation group reported higher levels of ED pathology than participants in both the performance and appearance and performance groups. Significant between-groups differences were observed for the Dietary Restraint, Weight Concerns and Shape Concerns subscales. Users in the appearance group reported significantly more Dietary Restraint than users in the performance and appearance group. Users in the appearance group reported significantly more Weight Concerns and Shape Concerns than users in the performance and appearance group and users in the performance group. No significant between-groups differences were observed for the Eating Concerns subscale.

4. Discussion

AAS use is a burgeoning public health problem, and the current study is novel in investigating body image-related psychopathology amongst males reporting current AAS use, as a function of one's motivation for use. Participants who reported using AAS purely for appearance-related reasons were found to report elevated levels of ED and MD symptomatology, relative to men who used AAS for both appearance and performance reasons. Further still, men who reported using AAS primarily for performance reasons alone had comparatively lower levels of body image psychopathology. These findings, and the large effect sizes, suggest that, motivation for AAS use may be important in accounting for adverse body image-related sequelae associated with AAS use.

With current evidence suggesting an increasing prevalence of AAS use amongst boys and young men (e.g., Partnership for a Drug-Free America, 2013), and similar evidence suggesting an increase in the prevalence of ED behaviors in males (Mitchison et al., 2013), and muscularity-oriented behaviors in particular (Murray et al., 2016), a thorough explication of the relationship between AAS use and body image psychopathology may assist in interventional efforts. The present results are consistent with findings noting the greater prevalence of non-athletic as opposed to athletic-driven motivations for AAS use (Kanayama et al., 2001), although extend our

Table 2

Summary statistics for the ANOVAs examining clinical and demographic data as a function of current motivation for anabolic androgenic steroid use.

Variable	Current motivation for anabolic androgenic steroid use						Statistical comparisons			
	Performance (P)		Performance and Appearance (P&A)		Appearance (A)					
	Mean	SD	Mean	SD	Mean	SD	ANOVA $F(df)$ or Kruskal-Wallis $H(df)$	p	η_p^2	Pairwise comparisons
1. Age (years)	29.54	7.24	29.54	7.24	29.93	7.34	$H(2)=1.09$	0.579		
2. Lifetime duration of AAS use (years)	4.30	6.57	4.45	6.90	5.08	5.46	$H(2)=1.88$	0.391		
3. MDDI, Total score	2.29	0.84	2.65	0.71	2.98	0.84	$F(2, 118)=7.22$	0.001	0.11	A > P
4. MDDI, Drive for size	2.47	0.95	2.99	0.78	3.45	1.01	$F(2, 118)=10.76$	<0.001	0.15	A > P&A, P&A > P
5. MDDI, Functional impairment	2.04	1.15	2.52	0.98	2.63	1.01	$F(2, 118)=3.26$	0.042	0.05	A > P
6. MDDI, Appearance intolerance	2.31	1.05	2.35	0.97	2.72	1.03	$F(2, 118)=2.14$	0.122	0.04	
7. EDE-Q, Global score	1.68	0.98	1.68	0.90	2.45	1.25	$F(2, 116)=7.45$	0.001	0.11	A > P&A, A > P
8. EDE-Q, Dietary restraint	3.01	1.41	2.40	1.67	3.30	1.59	$F(2, 116)=3.61$	0.030	0.06	A > P&A
9. EDE-Q, Eating concerns	0.50	0.91	0.70	0.72	0.95	1.35	$H(2)=5.89$	0.053		
10. EDE-Q Weight concerns	1.68	1.54	1.86	1.21	2.85	1.55	$F(2, 116)=8.09$	0.001	0.12	A > P&A, A > P
11. EDE-Q Shape concerns	1.47	1.58	1.76	1.10	2.69	1.58	$F(2, 116)=9.01$	<0.001	0.13	A > P&A, A > P

Note: AAS—anabolic androgenic steroid, MDDI—Muscle Dysmorphic Disorder Inventory, EDE-Q—Eating Disorder Examination-Questionnaire.

understanding of the relationship between body image and AAS use by illustrating a greater array of body image psychopathology amongst appearance-driven AAS users. This is important when considering that body image concerns serve as a significant risk factor for further AAS use (Pope et al., 2012). Further, the ED- and MD-related symptom severity of noted for performance-based AAS use was largely comparable to that demonstrated by non-pathological gym using control men in our previous studies (Murray et al., 2012), which suggests that *not all* AAS use may be associated with clinically relevant body image psychopathology, which yields important implications for prevention efforts. For instance, males who use AAS for performance-based motives may be less likely to respond to appearance-based prevention models (Stice et al., 2006), and may require a modified preventative approach.

Previous findings have suggested that body image psychopathology in AAS users may be more apparent in long-term users, with brief, experimental users typically demonstrating little body image psychopathology (Kanayama et al., 2006). Interestingly, we noted no differences in the duration of AAS use as a function of motivation for use, suggesting that, when use is primarily for appearance-related reasons, both shorter-term and longer-term AAS users may be vulnerable to greater body image-related psychopathology. However, we did note a gradual reduction in the prevalence of performance-based AAS use from first usage to current usage. This finding suggests that, over time, those using AAS may become increasingly aware of the appearance-related effects and that this may in turn be associated with greater body image psychopathology. More broadly, however, the findings suggest that whilst one's motivation for AAS use may be important in accounting for the extent of comorbid body image psychopathology, differential pathways likely underpin the duration of one's AAS use.

The results from the current study may impart salient clinical implications. Firstly, use of the term 'appearance and performance enhancing drugs' (APED's) may be problematic, since it conflates largely distinct profiles of AAS use, with diverging risk profiles. Indeed, in screening for potential ED and body image psychopathology amongst AAS users, healthcare providers should first ascertain the motivation for the AAS use. The current findings suggest that appearance-driven use may warrant greater attention, from an early intervention point of view, among mental health professionals and health professionals more generally. Further, different types of interventions, for example, specifically targeting or not targeting appearance-related concerns and ED psychopathology, may be needed when considering presentations involving different pri-

mary motivations for AAS use. The current findings may also have implications for community-based health promotion programs, the need to draw greater public attention to the particular dangers, in terms of both physical and mental health impairment, likely to be associated with steroid use driven primarily by appearance-related concerns.

Important limitations of the current research should, however, be noted when considering these implications. First, the cross-sectional design of this precludes firm causal inferences. Second, this study focussed on male AAS use and body image psychopathology. In light of recent evidence reporting AAS use in females (Ip et al., 2011; Pope et al., 2014), and given the different way in which body image concerns are likely to manifest in females (Murray et al., 2016), research among female AAS users would be of interest. Recruitment of adequate sample sizes for such research may be problematic, however, given the low prevalence of AAS use among this population. Third, while the current study found no association between motivation for use and duration of use, other potential covariates were not assessed. For example, higher doses of AAS use may be associated with both greater adverse physical health sequelae and greater body-image disturbance and/or associated behaviors. Similarly, while we assessed the overall duration of AAS use, this may not fully account for variability of AAS cycles within the cumulative number of years of AAS use, and further research may seek to index the length of each cycle of AAS use in more clearly specifying the actual number of lifetime days of AAS use. Further, a dimensional measure of the reason for AAS would give an indication of the degree to which appearance- versus performance-driven motivation drive AAS use. Finally, we must also acknowledge the risk of response bias, in that participants in the current study self-selected to participate after viewing the study advertisement, and it is unclear whether these participants differed from AAS users who declined to participate. Notable strengths of the current research include its novelty and the recruitment of a relatively large and unique community sample of AAS users. To our knowledge, this is the first study to delineate motivations for AAS use and to consider the potential importance of appearance- versus performance-related motivations in terms of their differential associations with ED- and MD-related psychopathology.

In sum, the current research suggests that men whose AAS use is driven primarily by appearance-related concerns may be a particularly dysfunctional subgroup in terms of ED and related psychopathology whereas performance-driven use may be less problematic in terms of associations with psychopathology. The

findings have implications for health promotion and early intervention programs designed to reduce the adverse health impact of AAS use. Further, the findings indicate the need to assess and distinguish between appearance- and performance-related motivations for AAS use in future research.

Funding

Nothing declared.

Conflict of interest

No conflict declared.

Contributors

All authors listed have seen approved and contributed to the manuscript. SBM conceived of the study; SBM, SG and JK completed data analyses. SBM, SG and AJB wrote the manuscript, and JK and JMM provided interpretation and editorial comments.

Acknowledgement

None declared.

References

- Cafri, G., Van den Berg, P., Thompson, J.K., 2006. Pursuit of muscularity in adolescent boys: relations among biopsychosocial variables and clinical outcomes. *J. Clin. Child. Adolesc. Psychol.* 35, 283–291, <http://dx.doi.org/10.1207/s15374424jccp3502.12>.
- Casavant, M.J., Blake, K., Griffith, J., Yates, A., Copley, L.M., 2007. Consequences of use of anabolic steroids. *Pediatr. Clin. North Am.* 54, 677–690, <http://dx.doi.org/10.1016/j.pcl.2007.04.001>.
- Cohen, J., Cohen, P., West, S.G., Aiken, L.S., 2003. *Applied Multiple Regression/Correlation Analysis For The Behavioral Sciences*, third edition. Routledge, New York.
- Cohen, J., Collins, R., Darkes, J., Gwartney, D., 2007. A league of their own: demographics, motivations and patterns of use of 1,955 male adult non-medical anabolic steroid users in the United States. *J. Int. Soc. Sports Nutr.* 4, 12, <http://dx.doi.org/10.1186/1550-2783-4-12>.
- Fairburn, C.G., Beglin, S.J., 1994. Assessment of eating disorders: interview or self-report questionnaire? *Int. J. Eat. Disord.* 16, 363–370.
- Field, A.E., Sonnenville, K.R., Crosby, R.D., Swanson, S.A., Eddy, E.T., Carmand, C.A., Horton, N.J., 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, 34–39, <http://dx.doi.org/10.1001/jamapediatrics.2013.2915>.
- Hildebrandt, T., Langenbucher, J., Schlundt, D.G., 2004. Muscularity concerns among men. Development of attitudinal and perceptual measures. *Body Image* 1, 169–181, <http://dx.doi.org/10.1016/j.bodyim.2004.01.001>.
- Ip, E.J., Arnett, M.J., Tenerowicz, M.J., Perry, P.J., 2011. The anabolic 500 survey: characteristics of male users versus nonusers of anabolic-androgenic steroids for strength training. *Pharmacotherapy* 31, 757–766, <http://dx.doi.org/10.1592/phco.31.8.757>.
- Jampel, J.D., Murray, S.B., Griffiths, S., Blashill, A.J., 2016. Self-perceived weight and anabolic steroids misuse among US adolescent boys. *J. Adolesc. Health* 58, 397–402, <http://dx.doi.org/10.1016/j.jadohealth.2015.10.003>.
- Kanayama, G., Pope Jr., H.G., Hudson, J.I., 2001. 'Body image' drugs: a growing psychosomatic problem. *Psychother. Psychosom.* 70, 61–65, <http://dx.doi.org/10.1159/000056228>.
- Kanayama, G., Barry, S., Hudson, J.I., Pope Jr., H.G., 2006. Body image and attitudes towards male roles in anabolic- androgenic steroids users. *Am. J. Psychol.* 163, 697–703.
- Kanayama, G., Hudson, J.I., Pope Jr., H.G., 2008. Long-term psychiatric and medical consequences of anabolic-androgenic steroid abuse: a looming public health concern? *Drug Alcohol Depend.* 98, 1–12, <http://dx.doi.org/10.1016/j.drugalcdep.2008.05.004>.
- Kanayama, G., Brower, K.J., Wood, R.I., Hudson, J.I., Pope Jr., H.G., 2009. Anabolic androgenic steroid dependence: an emerging disorder. *Addiction* 104, 1966–1978, <http://dx.doi.org/10.1111/j.1360-0443.2009.02734.x>.
- McCreary, D.R., Hildebrandt, T.B., Heinberg, L.J., Boroughs, M., Thompson, J.K., 2007. A review of body image influences on men's fitness goals and supplement use. *Am. J. Mens Health* 1, 307–316, <http://dx.doi.org/10.1177/1557988306309408>.
- Mitchison, D., Mond, J.M., Slewa-Younan, S., Hay, P., 2013. The prevalence and impact of eating disorder behaviors in Australian men. *J. Eat. Disord.* 1, <http://dx.doi.org/10.1186/2050-2974-1-S1-023>.
- Mond, J.M., Hay, P.J., Rodgers, B., Owen, C., Beumont, P.J.V., 2004. Validity of the Eating Disorders Examination Questionnaire (EDE-Q) in screening for eating disorders in community samples. *Behav. Res. Ther.* 42, 551–567, [http://dx.doi.org/10.1016/s0005-7967\(03\)00161-X](http://dx.doi.org/10.1016/s0005-7967(03)00161-X).
- Murray, S.B., Rieger, E., Touyz, S.W., De la Garza García, Y., 2010. Muscle dysmorphia and the DSM-V conundrum: where does it belong? A review paper. *Int. J. Eat. Disord.* 43, 483–491, <http://dx.doi.org/10.1002/eat.20828>.
- Murray, S.B., Rieger, E., Hildebrandt, T., Karlov, L., Russell, J., et al., 2012. A comparison of eating, exercise, shape and weight related symptomatology in males with muscle dysmorphia and anorexia nervosa. *Body Image* 9, 193–200, <http://dx.doi.org/10.1016/j.bodyim.2012.01.008>.
- Murray, S.B., Griffiths, S., Mond, J.M., 2016. Evolving eating disorder psychopathology: conceptualising muscularity-oriented disordered eating. *Br. J. Psychiatry* 208, 1–2, <http://dx.doi.org/10.1192/bjp.bp.115.168427>.
- Parent, M.C., Moradi, B., 2011. His biceps become him: a test of objectification theory's application to drive for muscularity and propensity for steroid use in college men. *J. Couns. Psychol.* 58, 246–256, <http://dx.doi.org/10.1037/a0021398>.
- Parkinson, A.B., Evans, N.A., 2006. Anabolic androgenic steroids: a survey of 500 users. *Med. Sci. Sport Exer.* 38, 644–651.
- Partnership for a Drug-Free America, 2013. The Partnership Attitude Tracking Study. Partnership for a Drug-Free America, New York (accessed May 2015) Available at: <http://www.drugfree.org/wp-content/uploads/2014/07/PATS-2013-FULL-REPORT.pdf>.
- Pope Jr., H.G.H., Kanayama, G., Hudson, J.I., 2012. Risk factors for illicit anabolic-androgenic steroid use in male weightlifters: a cross-sectional cohort study. *Biol. Psychiatry* 71, 254–261, <http://dx.doi.org/10.1016/j.biopsych.2011.06.024>.
- Pope Jr., H.G., Kanayama, G., Athey, A., Ryan, E., Hudson, J.I., Baggish, A., 2014. The lifetime prevalence of anabolic-androgenic steroid use and dependence in Americans: current estimates. *Am. J. Addiction* 23, 371–373, <http://dx.doi.org/10.1111/j.1521-0391.2013.12118x>.
- Riciardelli, L.A., McCabe, M.P., 2004. A biopsychosocial model of disordered eating and the pursuit of muscularity in adolescent boys. *Psychol. Bull.* 130, 179–205.
- Stice, E., Shaw, H., Burton, E., Wade, E., 2006. Dissonance and healthy weight eating disorder prevention programs: a randomized efficacy trial. *J. Consult. Clin. Psychol.* 74, 263–275, <http://dx.doi.org/10.1037/0022-006X.74.2.263>.
- Thiblin, L., Garmo, H., Garle, M., Holmberg, L., Byberg, L., et al., 2015. Anabolic steroids and cardiovascular risk: a national population-based cohort study. *Drug Alcohol Depend.* 152, 87–92, <http://dx.doi.org/10.1016/j.drugalcdep.2015.04.013>.
- Van den Berg, P., Paxton, S.J., Keery, H., Wall, M., Nuemark-Sztainer, D., 2007. Body dissatisfaction and body comparison with media images in males and females. *Body Image* 4, 257–268, <http://dx.doi.org/10.1016/j.bodyim.2007.04.003>.