Overview

NAD

Nordic Studies on Alcohol and Drugs
2024, Vol. 41(2) 212–225

DOI: 10.1177/14550725231206011
journals.sagepub.com/home/nad

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The dichotomy between health and drug abuse in bodybuilding

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Abstract

Aim: The aim of the present study was to investigate the expansion and prevalence of anabolic steroid use by examining the divergent effects between health and drug abuse and to create more awareness around the harmful consequences of these drugs when administered at abusive levels. **Methods:** A focused and concise literature search was conducted, and 101 high-quality articles were included in the review. **Results:** The findings underscore the adverse health risks of steroid abuse, emphasizing the stark contrast between health and drug abuse. **Conclusions:** While steroids and other performance-enhancing drugs can yield muscle growth, strength and even fat loss, abusing these substances can lead to adverse health outcomes. Furthermore, within the fitness subculture, particularly in the realm of bodybuilding, steroid abuse fosters an atmosphere of cheating and deception, frequently downplaying or ignoring the negative and sometimes deadly consequences it brings.

Keywords

bodybuilding, contest prep, performance-enhancing drugs, steroid abuse, steroids

Hormonal doping has been part of the bodybuilding culture for years and continues to be an ongoing practice (Andreasson & Johansson, 2019). It can be postulated that individuals who misuse performance-enhancing drugs (PEDs), such as steroids, attain physical characteristics that cannot be achieved through endogenous means alone. Interestingly, the individuals who abuse these substances appear to be revered, idolized and admired as exemplars of muscularity. With the advent of social media, adolescents are highly prone to the influences of these acclaimed "role models" and their contribution to unrealistic physical standards (Murnen & Don, 2012).

Submitted May 15, 2023; accepted September 21, 2023

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Regardless, it is understandable why a muscular physique is admired, as it tends to signify the perception of power, strength, dominance, masculinity and leadership (Lennon & Johnson, 2021; Murnen & Don, 2012). However, introducing drug abuse into this equation should raise questions about the individual's influence on society and whether it is positive or negative. To some adolescents, bodybuilders may be perceived as role models for health within the fitness community, and their influence on society seems predominantly determined by their physique (Aguilar & Arbaiza, 2021).

As with most things today, bodybuilding's influence on society is primarily attributed to the Internet, specifically social media platforms (Aguilar & Arbaiza, 2021). Social media appears to be a source of body image issues and may be directly tied to its use (Fardouly & Vartanian, 2016). With the ease of access to information, images and videos, and the competitive nature social media perpetuates, society could be more prone to steroid abuse than ever. Research shows a connection between social media, body image dissatisfaction and increased steroid usage (Griffiths et al., 2018). Furthermore, there appears to be a link between muscularity and health, while the former is viewed as a causal factor. In addition to muscularity, lower adiposity levels are likely perceived as a representation of physical vigour and good health in society. To give credence to this idea, the literature does reveal that robust muscularity and health correspond with lower mortality rates (Srikanthan & Karlamangla, 2014). However, this evaluation becomes paradoxical when doping agents (e.g., steroids) are used to acquire such muscularity. That said, the influence of bodybuilders may play a crucial role in shaping societal perceptions regarding the accurate portrayal of what constitutes health. The sacrifice of health in pursuit of muscularity through steroid abuse negates health and well-being. Thus, there exists a dichotomy between health and steroid abuse in bodybuilding.

Methods

An overview was conducted to compare and contrast drug abuse in the sport of bodybuilding and its impact on health outcomes in society. Systematic searches were performed using multiple electronic Internet search engines and databases, including ResearchGate, Google Scholar, Science Direct, Google, Web of Science and PubMed. The search was conducted primarily using the following keywords: anabolic steroid abuse in bodybuilding ($n = 34$); athlete anabolic steroid use ($n = 279$); and social media steroid use ($n = 41$).

The initial search located a total of 354 articles. The inclusion criteria in article selection were as follows: (1) articles published in peer-reviewed journals; (2) articles focused on steroid abuse in bodybuilders and athletes; (3) articles written in English; and (4) articles dated 2001–2023, excluding one crucial paper. The excluded paper was Bhasin's famous 600-mg study conducted in 1996. The study showed notable statistical differences in muscle growth between men who took supraphysiological doses of testosterone and those who did not. It demonstrates the undeniable potency of steroid use. Articles that did not meet the inclusion criteria or were not concisely relevant to the subject were not selected.

The search concluded with 101 peer-reviewed articles. The reference section for each article found was also screened for additional articles that potentially met the inclusion criteria. The data cited from the research were primarily based on health outcomes associated with anabolic steroid abuse and the sociocultural roles steroids play in society. The findings also assessed doping rules and regulations in the context of bodybuilding and athletics and how it has shaped contemporary views on substance use for performance.

In conclusion, the aim of the present review was to provide a comprehensive overview of the critical impact anabolic steroid abuse has on health and the vast dichotomy between the two. The findings showcase the adverse health

risks of steroid abuse, emphasizing the stark contrast between health and well-being and drug abuse.

Health and testosterone

Testosterone was first isolated by Ernst Laqueur in 1935, and Adolf Butenandt and Leopold Ruzicka subsequently synthesized the hormone (Nieschlag & Nieschlag, 2019). In clinical settings, testosterone replacement therapy (TRT) can be a tool that aids in health restoration since low endogenous levels (<300 ng/dL) of this hormone might result in health complications (Jia et al., 2015; Shin & Park, 2019). Although, for replacement therapy to be administered, an individual must be diagnosed with hypogonadism, which appears primarily associated with age (Kaufman & Vermeulen, 2005; Lisco et al., 2020; Wu et al., 2008). The benefits of TRT, when natural production is low, will improve a myriad of health markers, such as bone density, sexual function, depression and muscle mass, and it may also help prevent cardiovascular disease and metabolic syndrome (Bassil et al., 2009; Bhasin, 2021). This hormonal therapy can even play a role in reducing body fat in subcutaneous and visceral fat deposition compartments (Caliber & Saad, 2020; Corona et al., 2016a; Woodhouse et al., 2004). Therefore, there is a strong connection between testosterone and health.

Correspondingly, there is a strong relationship between skeletal muscle mass and health, and evidence supports this, showing an enhanced quality of life and mortality extension (Abramowitz et al., 2018; Srikanthan et al., 2016; Wolfe, 2006). Thus, having high enough testosterone to build and support muscle growth could very well be argued that it affects health and well-being in a positive light. However, this positive effect on health, due to increased muscle mass, may very well be negated when an individual abuses testosterone or its derivatives. In any drug-abusing environment, there comes a point where too much becomes detrimental and possibly fatal. In toxicology, a principle is credited to the Swiss physician Paracelsus, who stated, "What is there that is not poison? All things are poison and nothing is without poison. Solely the dose determines that a thing is not a poison." (Grandjean, 2016). Since then, it has been well documented that the dosage of a substance is a crucial factor in determining the severity of poisoning (Tsatsakis et al., 2018).

In bodybuilding, steroid dosages typically far exceed what is considered safe; consequently, many health problems can manifest. Some health issues associated with anabolic-androgenic steroid (AAS) abuse are infertility, cardiovascular disease, acne vulgaris, impaired insulin sensitivity, liver and kidney toxicity, and possibly brain deterioration (Baggish et al., 2017; Bjørnebekk et al., 2021; Bond et al., 2022; de Ronde & Smit, 2020; Modlinski & Fields, 2006; Petrovic et al., 2022; Rasmussen et al., 2017; Thiblin et al., 2015; Walker & Adams, 2009). To get more specific between sexes, men may develop gynecomastia, alopecia, atrophy of the testes and azoospermia, and women may experience an enlarged clitoris, menstruation disruption, amenorrhea, masculinization in voice and excessive body hair (University of Naples Parthenope, Department of Science and Technology, Naples, Italy & Mazzeo, 2018).

From the current literature, it is clear that health complications occur when exogenous sources of anabolic steroids are being abused, usually at high levels. However, as mentioned previously, a deficiency in endogenous testosterone may also lead to health issues. Therefore, intervention measures with TRT may be a potential solution to mitigate these problems. Even so, the long-term safety of TRT is still unknown. The administration of TRT may exacerbate health issues in older men prone to comorbid conditions such as prostate cancer and cardiovascular disease (Rodrigues Dos Santos & Bhasin, 2021; Spitzer et al., 2013). In such scenarios, close oversight should be integral to this therapy. Regardless, it should be noted that therapeutic doses and doping doses cannot be equated.

Therapy is administered to treat a specific hormonal deficiency to improve health, while doping, as with anabolic steroids, is intended to achieve atypical muscularity, at least in bodybuilding (Andreasson & Johansson, 2019; Bhasin et al., 2001; Handelsman, 2021; Linhares et al., 2022; Shin & Park, 2019).

The rise of anabolic steroids

Since the inception of bodybuilding in the 19th century, practitioners have continuously explored various ways to increase muscle hypertrophy (and strength). Muscle hypertrophy represents the enlargement of skeletal muscle mass and cross-sectional area, which can occur by adding sarcomeres in series or parallel to each other (Haun et al., 2019; Schoenfeld, 2010). Pursuing physique goals can often elicit the behavior of "doing whatever it takes" to achieve the outcome, even if compromising health accompanies this goal. Coincidentally, anabolic steroids started gaining traction among bodybuilders and athletes in the 1950s (Kam & Yarrow, 2005; Kanayama & Pope, 2018).

Anabolic-androgenic steroids (AAS) are synthetic derivatives of testosterone that have potent effects on muscle protein synthesis and fat oxidation (Corona et al., 2016b; Nordström et al., 2012; University of Naples Parthenope, Department of Science and Technology, Naples, Italy & Mazzeo, 2018). Doping dosages of anabolic steroids are quantified at levels exceeding average physiological production, approximately 10–100 times greater than average endogenous output (Shahidi, 2001). In contrast, this is considerably higher when hedged against therapeutic levels administered, which are typically placed in the range of 400–700 ng/dL (Bhasin et al., 2010; Shoskes et al., 2016). Consequently, steroid doping in sports became the norm in the 1970s as it was highly advantageous in building muscle, strength and performance (Andreasson & Johansson, 2019).

Due to its extreme potency and abuse, the International Olympic Committee (IOC) added anabolic steroids to its banned substance list in 1975, and in 1976 steroid testing was first implemented at the Montreal Olympics (Fitch, 2012; Reardon & Creado, 2014). But despite the stringent regulations imposed on drug testing, the use of steroids persisted among athletes. However, it was thrust into the limelight in 1988 when Canadian sprinter Ben Johnson tested positive for the steroid Stanazolol and had his Olympic gold medal withdrawn (Baron et al., 2007; Ogunbanjo, 2012). Two years later, Congress passed the Anabolic Steroid Act in 1990, making AAS illegal, placing them as a Schedule III drug in the Controlled Substance Act (Kraska et al., 2010). Subsequently, in the 1990s, numerous athletic organizations started to prohibit anabolic steroids and forbade their use during competitions. However, the credibility of these policies was questionable since specific organizations, including the MLB, did not actually enforce drug testing for steroid use (Erickson, 2015).

To gain a better understanding of the efficacy of steroids, research on these hormonal compounds was pursued. In 1996, Bhasin et al. conducted a randomized controlled trial that explored the effectiveness of 600 mg of testosterone enanthate weekly on strength-trained men. One of the groups that were administered testosterone but did not exercise had an increase of 3.2 kg in fat-free mass, while in comparison, those in the placebo plus exercise group (who did not receive testosterone but were strength trained) had an increase of 1.9 kg fat-free mass (Bhasin et al., 1996). It should be noted that the group who strength trained and received supraphysiological testosterone doses saw more significant results than the other groups. However, this study illustrates the exceptional power behind the hormone testosterone, even when strength training is not implemented.

In 1999, the IOC organized a global conference on doping in sports. Subsequently, it established a sister entity named the World

Anti-Doping Agency (WADA) to aid in the fight against sports doping (Hughes, 2015). This conference resulted from authorities finding copious amounts of performance-enhancing drug (PEDs) and drug paraphernalia during the 1998 Tour de France (Baron et al., 2007). Even with rigorous drug-testing protocols established, it continued to be an ongoing issue in sports through the black market. Underground drug labs began to create ways to circumvent drug testing and started manufacturing "designer steroids", which are modified versions of existing steroids (Gheddar et al., 2019). The goal was to produce undetectable substances that evaded drug-testing methods. Consequently, the chemical structure of designer steroids was diverse enough that organizations like WADA and the IOC had difficulty detecting these drugs in the athlete's bloodstream (Geyer et al., 2014; Gheddar et al., 2019; Kazlauskas, 2010; Teale et al., 2012).

The first designer steroid, tetrahydrogestrinone (THG), was found in 2003 using liquid chromatography with tandem mass spectrometry (Malvey & Armsey, 2005). A whistleblower anonymously mailed a syringe containing THG, the designer steroid, to the United States Anti-Doping Agency (USADA) and, subsequently, the substance was tested (Catlin et al., 2004). The Bay Area Laboratory Cooperative (BALCO) was primarily responsible for designing and distributing undetectable steroids to athletes between the late 1990s and 2003, which became known as the BALCO Scandal (Athey & Bouchard, 2013). The discovery of THG began an intense investigation of several high-profile athletes. Allegedly, multiple athletes received THG from BALCO and some were stripped of their medals and even banned from competing again.

As a result of undetectable steroids becoming the norm, most major athletic organizations have established more thorough drug-testing protocols and enforced drug policies to ensure athletes do not have an unfair advantage over other competitors. However, in bodybuilding, some organizations, such as the International Fitness and Bodybuilding Federation (IFBB) and National Physique Committee (NPC), have been questioned on their drug-testing regulations and policies. The scrutiny comes from observations of the bodybuilders affiliated with these federations, being that they exhibit a greater degree of physical size, density and leanness when compared to their counterparts in drug-free established federations. Nonetheless, the IFBB has been a signatory to the WADA code since 2003, ensuring anti-doping rules are in accordance with WADA (Ntoumanis et al., 2015). But in 2022, some reports suggested that the IFBB failed to comply with the regulations about performance-enhancing substances and, as a result, may have lost its endorsement from the WADA and its corresponding privileges.

It is no mystery why bodybuilders began harnessing the potent properties of anabolic steroids since they efficaciously augment strength, recovery and muscle growth (Bhasin et al., 2001; van Marken Lichtenbelt et al., 2004). Even amid potential health complications and premature death, the risk outweighs the reward for many. In addition to the abundance of authentic anabolic steroids and their dangers, the black market is also rife with counterfeit and poorly controlled substances, which increases the user's health risk as well (Graham et al., 2009). A perfect foundation has been laid to sell fake drugs since acquiring PEDs online appears to be extremely easy (McBride et al., 2018). Typically, counterfeit drugs contain either a completely different active ingredient than listed, smaller amounts than listed or no active ingredient (ARUD Center for Addiction Medicine, Zürich, Switzerland et al., 2021; Coopman & Cordonnier, 2012; Hullstein et al., 2015; Krug et al., 2014). In this case, they will have adulterants, or what is known as cutting agents, that resemble the drug to increase bulk and maximize profit margins (Broséus et al., 2016; Cho et al., 2015; Cole et al., 2011). Counterfeit or contaminated steroids can also adversely affect health, depending on the adulterated

agent. Physical problems include pain, abscesses and infections, and mental anxiety about suffering the negative consequences of using counterfeit substances (Frude et al., 2020).

Social media influence

The Internet, particularly social media, might be a source of addiction for some individuals, which can cause psychological, neurological and social problems (Cash et al., 2012; Ji et al., 2023). Interactions via social media can release dopamine inside the brain as it stimulates reward pathways (Oprea et al., 2021). Dopamine is a chemical secreted in the brain that makes an individual feel pleasure, motivation and satisfaction (Volkow et al., 2017). With this in mind, body image dissatisfaction in recent years can be traced back to social media usage (Fardouly & Vartanian, 2016). Interestingly, it also appears that body image dissatisfaction and an increase in anabolic steroid usage are correlated to the advent of social media (Griffiths et al., 2018). As previously discussed, PEDs, such as steroids, have been an ongoing problem in bodybuilding and athletics, but now adolescents might be targets.

Social media, especially image-focused platforms such as Instagram, allow individuals to showcase their physique and fitness progression. Therefore, the desire to keep up, outperform or look better than others is a constant reality. These platforms can create a state of social comparison and are fertile ground for envy, and consequently, have even been linked to depression (Appel et al., 2016). Social media users are frequently exposed to images and videos daily. If the algorithm is catered to health and fitness, individuals may experience persistent exposure to content that showcases muscular, well-built physiques in conjunction with low adiposity. This social monitoring could potentially lead to heightened pressure to acquire a similar body and can result in dangerous practices, such as using anabolic steroids due to muscle dysmorphia (Cerea et al., 2018; Leone et al., 2005).

Moreover, social media rewards its users through likes, comments and follows based on user-generated content (Rosenthal-von der Pütten et al., 2019). This reward system may persuade physique goals; consequently, PEDs such as anabolic steroids could be abused. Enhanced muscularity can increase precedence and status, thus appearing more successful to themselves and others. Since social media is a very competitive space and garnering attention is difficult, a muscular physique may grant such esteem and status. Furthermore, on these social media platforms, fitness influencers sell their products or programs and often convey that their physical progress has been acquired naturally without doping. This veracity is uncertain; however, some have postulated that over half of the fitness influencers on social media use PEDs.

Social media and the unrealistic physique standards of fitness influencers may push recreational exercisers into using anabolic steroids to achieve comparable results. In addition, the ease of locating information is relatively simple today. Many can go online in groups and forums, remain anonymous and discuss the topic while amassing pertinent information (Tighe et al., 2017). Unfortunately, the information on anabolic steroids is typically found through non-medical or science backgrounds, but rather from misleading sources such as bodybuilders, athletes and drug dealers (ARUD Center for Addiction Medicine, Zürich, Switzerland et al., 2021).

Discussion

According to the literature, when testosterone deficiency occurs, testosterone replacement therapy (TRT) can improve health and daily life (Akerman et al., 2017; Rizk et al., 2017; Traish, 2018). This type of therapy appears safe when not abused and is used to help issues such as sexual function, depression, muscle mass and bone density (Bassil et al.,

2009; Bhasin, 2021; Rizk et al., 2017). However, when testosterone is abused, health complications and even death can occur. Testosterone is typically abused through anabolic steroids, which are testosterone derivatives (Kuhn, 2002). Anabolic steroids are potent hormonal drugs that increase muscle, strength and performance; otherwise, these drugs would not be considered viable (Andreasson & Johansson, 2019; Bhasin et al., 1996). In physical fitness, the primary objective of anabolic steroid abuse is to acquire appreciable muscle growth and strength. Moreover, and perhaps a significant consideration, a dose-response relationship exists between testosterone and strength/muscle growth (Bhasin et al., 2001; Storer et al., 2003). Essentially, the drug's potential to induce muscle growth and strength increases proportionally with the dosage administered, thus suggesting a solidified reason for its abuse.

The bodybuilders of the 1950s, 1960s and 1970s paved the way for many recreational bodybuilders today. After 1980, steroids segued into the general population and rapidly engulfed society (Kanayama & Pope, 2018). Since then, these compounds have become more abused, even by those not competing in bodybuilding or athletic sports (Cohen et al., 2007). Research has discovered that most steroid users are not professional bodybuilders or athletes, but instead recreational lifters focused on aesthetics (Bonnecaze et al., 2020). It is easy for individuals to acquire these drugs on the Internet since they are readily available and straightforward to purchase with no prescription (McBride et al., 2018). Interestingly, Internet purchases are the primary source of anabolic steroid acquisition (McBride et al., 2018). With such ease of acquisition, the widespread use of anabolic steroids has become a health concern in our society. The problem comes with abuse as it has been linked to various adverse health effects, including liver damage, infertility, cardiovascular disease and psychiatric disorders (Albano et al., 2021).

Even though steroids are heavily embedded inside the fitness world, it is commonly accepted that gym culture is a positive and healthy endeavor. The influence of fitness promotes health and helps fight the obesity epidemic that seems to be trending. Research shows we have a health crisis as obesity rates have tripled between 1975 and 2014 and evidently, things are getting worse with time (NCD Risk Factor Collaboration (NCD-RisC), 2016; Ward et al., 2019). Gym culture and its popularity can help fight this rise in obesity, but like anything, it can go too far, and obsession may very well segue into adverse behavior and consequences (Lichtenstein et al., 2017). That said, a double-edged sword exists inside health-promoting gym culture due to rampant drug abuse. Nonetheless, the infusion of hormonal drugs such as steroids can potentially undermine the health benefits of an exercise lifestyle. This, of course, negates the primary purpose of a healthy lifestyle and instead compromises health and well-being. Thus, the importance of safe practices must be addressed, and the abuse of hormonal drugs must be discouraged.

Furthermore, it must be noted that adolescents who enter the athletic and strength-training world are vulnerable to the influence of social norms (White & Noeun, 2017; Woolf et al., 2014). The aspiration to achieve a muscular physique can often be encouraged by images and videos on social media, and it appears that the use of anabolic steroids may correlate to this (Hilkens et al., 2021). During adolescence, research shows that the influence of social media could harm body image and mental health (Marengo et al., 2018). These social media influencers may highly influence younger adults who are simultaneously active on social media and in strength training. There seems to be pressure to emulate what they visually consume online, which could gateway them to using PEDs (Castillo & Comstock, 2007). In addition, adolescents may overlook the health problems associated with anabolic steroids or may not be aware of the dangers as they are more focused on the anabolic outcomes of the

drugs (Dodge & Jaccard, 2006; Nilsson et al., 2001).

Conclusion

The abuse of anabolic steroids poses a significant threat to the health of our society. It has been commonly accepted to parallel a robust physique with health and well-being. Rightfully so, as this can be a good indication. While steroids and other PEDs can promote muscle growth, strength and even fat loss, abusing these substances can lead to adverse health outcomes. In addition, inside gym culture, steroid abuse promotes cheating and deception, and dismisses the negative and sometimes deadly consequences it brings. The reliance on anabolic steroids to achieve extreme muscularity and lower body fat levels can create a disillusioned reality of what health represents. It may also instil guilt as it is acquired through illusive means where accomplishment is not earned but hacked. Moreover, adolescents who idolize those inside the fitness culture are vulnerable and more at risk of abusing these substances. Drug abuse is the antithesis of health, despite who the user is and what their intentions are. The health messaging conveyed by the fitness influencer and bodybuilding community should be questioned due to its deceptive promotion of unhealthy practices rooted in drug propaganda. Drugs have their place and are probably both the best and worst discovery of humanity, but their abuse does not come without serious risk. The dichotomy between health and steroid abuse in bodybuilding is clear: both cannot coexist.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article

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