Addiction to Anabolic-androgenic Steroids: A Review

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Author’s contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Presently, there is an emerging understanding the sociological, ethical and medical-scientific understandings of addiction. Simultaneously, there is a new understanding of synthetic hormones in relation to the users who are largely not athletes, and the nature of illicit hormonal supplementation, which has potential for user dependency. Given that what we knew about anabolic-androgenic steroid use needs an update, it is worthwhile examining the phenomenon of AAS addiction. Addiction to AAS is an understudied condition which has been shown to mimic the neurological elements of other drugs of addiction. With a realization of the potential for AAS users to have compromised volition in their drug abuse, it demands an opportunity to rethink received wisdom about AAS use and all users, both athlete and non-athlete.

Keywords: Doping; anabolic steroid; addiction.

1. INTRODUCTION

Anabolic-androgenic steroids (AAS) are synthetic derivatives of testosterone, which naturally occurs in males as a primary hormone synthesized in the testes, but also naturally occurs in women. AAS are manufactured with varying formulations to maximize anabolic effects while minimizing androgenic effects [1].
French physiologist Charles Édouard Brown-Séquard presented the first research findings about testosterone at a meeting of the Société de Biologie in Paris on June 1st, 1889. He had self-tested an injectable hormone treatment derived from the testicles of dogs and guinea pigs [2]. Aged 72 at that time, Brown-Séquard noted that the injections had reversed his aging process, and had rejuvenated him to a younger physiological state. Adaptations of Brown-Séquard’s process have appeared in the historical records of medical prescriptive practices since 1924, but more prominently since the 1940s, after synthetic testosterone emerged in 1935.

By the 1950s, AAS became widely associated with enhanced athletic performance when first-hand accounts of the performance-enhancement use of the drug by weightlifters from the Soviet Union emerged after the 1954 World Championships, causing a global race to develop more effective AAS varieties for establishing global sporting supremacy. AAS is one of the most commonly used performance-enhancing drug used in sport, and varieties of AAS are the drugs most commonly detected by the World Anti-Doping Agency’s doping control tests [3].

Despite the public preoccupation with non-prescription AAS use as being an issue in sports, the majority of AAS users in many populations are not competitive athletes, but take these drugs for a number of desired effects [4]. Given that AAS use amongst athletes comprises a large number of people worldwide, the vast majority of users being non-competitive athletes pushes the number much higher. For example, a review of epidemiological studies across six continents estimates the number of “regular illicit AAS users” worldwide at 6.4% of men and 1.6% of women globally [5]. Given this level of drug use on a worldwide scale, concerns about drug misuse and potential dependency need to be addressed.

Drug dependence is an omnipresent social phenomenon that is commonly the primary cause of morbidity in the world. In Canada, for one example, use of drugs leads to just over 20% of all deaths in people under 70 years of age [1]. At one point in the recent history of the United States, 25% of all Americans over the age of 15 were addicted to at least one substance [2].

Drug dependence is a compulsive, chronic and relapsing behaviour focused on drug seeking and use persists despite negative consequences [3]. This behaviour is constituted by certain elements that typify the experiences of addicts [4]:

1.) Compulsive engagement with the behavior, a preoccupation with it;
2.) Impaired control over the behavior;
3.) Persistence or relapse, despite evidence of harm and;
4.) Dissatisfaction, irritability or intense craving when the object – be it a drug, activity or other goal – is not immediately available

Anabolic Androgenic Steroid (AAS) dependence has been observed in the scientific literature since the latter 1980s. [5,6]. While AAS themselves have not been studied to the same degree as other drugs of abuse [7], there is sufficient research to suggest that AAS dependence is an authentic addiction embodying many of the requisite empirical elements.

2. COMPULSIVE ENGAGEMENT WITH THE BEHAVIOR, A PREOCCUPATION WITH IT

Brower et al. observed a pattern of AAS use which is also typical of addiction formations with other drugs [8]. AAS users initiate usage and over longer and longer periods of continuous use exhibit more and more traits of addiction. Progression to dependence could be driven by intense dissatisfaction with bodily appearance. Indeed, unhealthy bodily self-perceptions frequently motivate the initial use of AAS amongst young males [9-12]. At the most acute end of the spectrum is the condition of “muscle dysmorphia,” which acts as anorexia nervosa “in reverse”; in which the afflicted see themselves as undersized in spite of external, more objective measures to the contrary, in the same way as anorexics perceive themselves as obese in spite of the opposite being obvious [13-17].

AAS are compelling drugs for abuse. While typical consumption patterns are thought to be cyclical, whereby users suspend intake for considerable periods of time as part of a planned consumption, there is a very common pattern of continual and unceasing use. Through the period starting in the 1990s and into 2005, researchers in several English-speaking countries confirmed the authenticity of an AAS dependency diagnosis using then current definitions found in the Diagnostic and Statistical Manual(s) of Mental Disorders (DSM III & DSM-IV) [18]. One primary
limitation to the consideration of AAS as a drug of dependence is the issue of its “non-euphoric” nature. As such, AAS fail to compel researchers to widely examine or consider AAS as a drug with dependency features comparable to more common drugs of study, such as opiates. Pope et al note that across the studies conducted in the time period 1990-2005, 35% of users developed diagnosable AAS dependence according to the diagnostic criterion [18].

3. IMPAIRED CONTROL OVER THE BEHAVIOR

In discussions about impaired control, we are speaking about the impairment of volition on those who are taking AAS and not seeking to quit, since questions of relapse follow later.

Looking to sociological features of drug use in a sporting context, there are a host of economic and social reasons why usage would be desirable without reference to the personal preferences of the user. First, for many athletes the potential economic benefits are profoundly disparate from the economic profile of their home. Furthermore, many athletes may feel an obligation to achieve financial security for themselves as well as family and friends from more impoverished communities. Former Major League Baseball player and AAS user Jose Canseco noted this when he considered the example of a baseball player from any Caribbean nation. That young man’s success or failure is not merely athletic and personal, but total and shared by the larger community of family and possibly neighbours [19].

Secondly, AAS users may be self-medicating severe feelings of inadequacy or inefficacy. While much has been said, and justifiably so, about the social-structural progenitors of body-image complications in women, there has been some research in this same area for males. Media characterizations of masculinity have become increasingly muscular and lean, creating an ideal that is difficult or impossible to achieve without the aid of AAS or related compounds [20]. It comes as no surprise that these features are found in AAS users to an acute degree [21].

Thirdly, early research suggests that AAS appears to function on a neurological level as any other drug of addiction. A developing field of literature suggests that the same neurological mechanism of addiction – the mesolimbic dopamine system – also mediates testosterone use. [22] With AAS dependence, impaired self-control becomes evident as the concern for punishments (e.g. positive drug tests and subsequent banishment from sport) decreases. [23,24] The intensity of the AAS users’ craving for their drug has been estimated as equivalent to that experienced by addicts of nicotine and benzodiazepines [22].

One final issue associated with AAS dependence is the prevalence of polysubstance abuse in AAS users. [25,26] Polysubstance use and dependence occurs as users seek to moderate the unpleasant side-effects of an AAS regimen and further enhance the androgenic and anabolic properties of their AAS use. In the most detailed study of this kind, Skarberg, Nyberg & Engstrom determined that AAS addicts would often use alcohol, cannabinoids and benzodiazepines (mainly flunitrazepam) to induce sleep; drugs like Clomid to alleviate gynaecomastia and testicular atrophy; analgesics such as morphine, codeine and dextropropoxyphene to alleviate the pains of training; and other training aids such as hGH and IGF-1 for additional performance-enhancement. [26] This issue of polypharmacy creates greater problems for the volition of the addict, as combinations of drug addictions may compound the difficulties in abstinence [27].

4. PERSISTENCE OR RELAPSE, DESPITE EVIDENCE OF HARM

Typically, an addicted drug user will express deep and genuine desires to quit a drug long before he or she does – if that ever happens. Addicts distinguish themselves by their unique relationship to their drugs of addiction. Robinson and Berridge eloquently describe an addict’s “craving” of and compulsion for drugs this way: “that, as drugs come to be wanted more and more, they often come to be liked less and less.” [28] Much of this inefficacy at quitting a destructive habit comes from oppositional forces of positive and negative reinforcements against quitting. Midgely, Heather & Davies [29] point to this framework indicating the positive re-enforcers of AAS maintenance combined with the negative re-enforcers of AAS cessation:

a) Primary Positive Reinforcement due to brain reward,
b) Primary Negative Reinforcement due to avoidance of withdrawal symptoms,
c) Secondary Positive Reinforcement due to rewards associated with increased body size or better body image
d) Secondary Negative Reinforcement due to avoidance of loss of size or positive body image.

While mainstream studies of drug addiction have not taken up AAS addiction as quickly or broadly as other addictions, one of the stated reasons is that unlike opioids, AAS is not associated with intense and instantaneous euphoria. Without this kind of instantaneous euphoria, AAS fits less perfectly into the existing biological model of addiction as a brain disease. On the other hand, the literature on AAS addiction as well as the relatively limited ethnographic works on AAS use describes a very distinct sense of euphoria reported by AAS users [30]. Brower et al. found that 43% of AAS users reported feeling “high” and other descriptions of extreme pleasure from longer term AAS use. In this sense, while not instant, the feelings are very real and a positive reinforcement of continued use [8].

This persistence occurs in the face of significant secondary effects of supraphysiologic dosages of AAS, such as acne, hirsutism, virilization, and reproductive dysfunction [7,18,25,42] as well as the multinational illegality of possession and use of non-prescribed AAS and their legal consequences, all of which could serve as dysphoric to the user, but insufficiently so to impair the development of AAS dependency.

There is an identified withdrawal effect upon cessation of AAS use [31-33]. Former users experience a characteristic withdrawal syndrome with affective and hypogonadal symptoms which create cravings to resume use, and this precipitates the tendency to relapse which is so common amongst addicts. Withdrawal from AAS can create severe depression [34,35], self-perceptions of physical weakness and loss of muscle mass and increase in bodyfat which serve as negative reinforcements of cessation [35].

5. DISSATISFACTION, IRRITABILITY OR INTENSE CRAVING WHEN THE OBJECT – BE IT A DRUG, ACTIVITY OR OTHER GOAL – IS NOT IMMEDIATELY AVAILABLE

In the issue of AAS use, the evidence is clear; AAS use can commandeer a user’s physical development by virtue of offering him or her body improvements (muscle gain & fat loss) that would be otherwise unachievable, the usage patterns itself into addictive behaviour over time when recesses from drug use are neglected in favour of constant use and constant ‘gains’ and finally dissatisfaction at the gradual erosion of a user’s physical development and the possible reemergence of body image issues which likely precipitated AAS use initially [36-37].

The usage pattern of the continual AAS user creates the need for greater and more frequent exposures to assuage the user’s desires for the drug. With the discovery of the effect AAS has on the mesolimbic dopamine system (a typical neurological pathway for addiction), the same pattern of dependence exists. Addiction requires repeated exposure for development [38], and consistency of use is necessary for the re-patterning of the mesolimbic dopamine system that is the hallmark of addiction [39,40].

As a product of this, failure to procure AAS on the typical ingestion schedule for any user results in the intense desire or craving for the drug which is reminiscent of addictions to other drugs. Athletes typically have routines around procurement and intake of the drug, with the exceptional trait of many with placing consumption within a larger timeframe involving diet and exercise [41].

6. CONCLUSION

AAS demonstrate some preliminary similarities to other drugs of addiction, manifesting themselves in familiar patterns of addictive behaviours, and suggestive, but early, neurological evidence of similarities. AAS addiction certainly demands scientific attention as a possibly neglected drug of addiction, and clinical concern as a growing epidemiologic phenomenon [42].

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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