

Abstract The use of anabolic steroids by athletes is controversial. On the one hand, many athletes believe that steroids improve athletic performance and thus provide an advantage to those who use them.



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**Full article: The Uses of Anabolic Androgenic Steroids Among Athletes .**



Background and objectives: Anabolic-androgenic steroids (AASs) are a group of synthetic molecules derived from testosterone and its related precursors. AASs are widely used illicitly by adolescents and

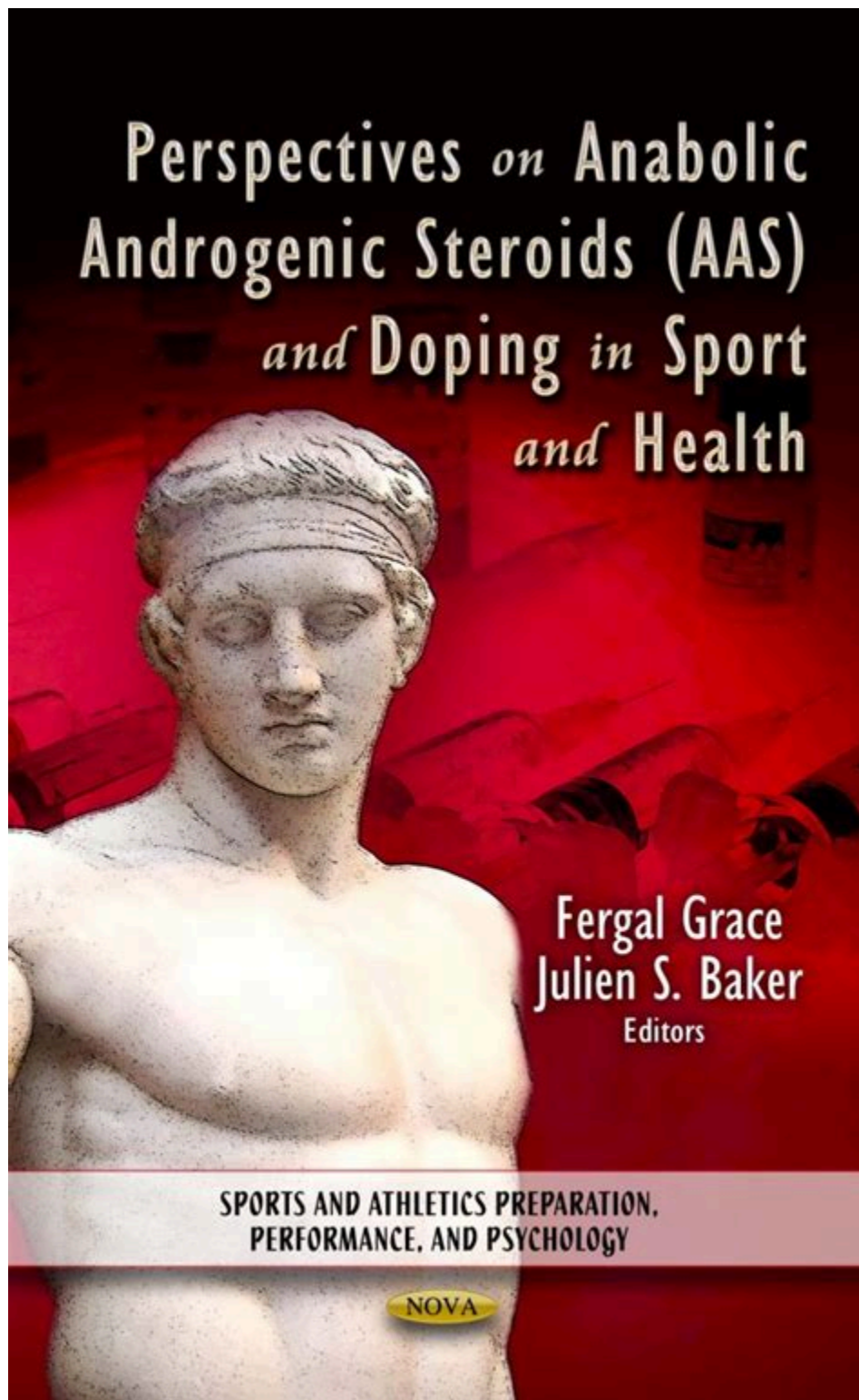
athletes, especially by bodybuilders, both for aesthetic uses and as performance enhancers to increase muscle growth and lean body mass.

## The uses of anabolic androgenic steroids among athletes | JMDH



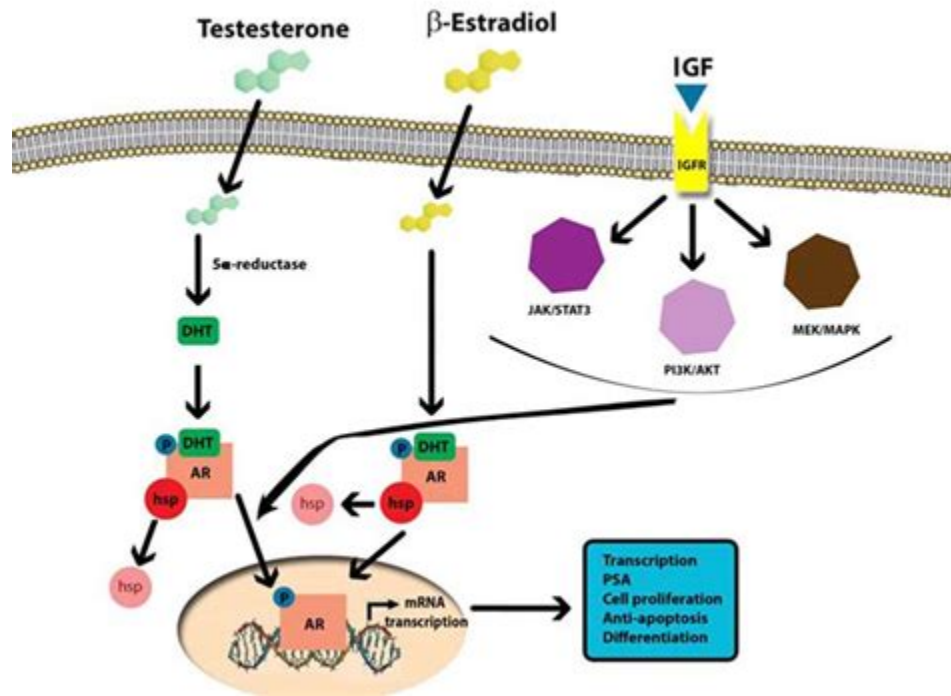
Anabolic-androgenic steroids ("steroids") are synthetic derivatives of the natural male hormone. Overall, our key informants, steroid users and literature review indicate that no single approach will solve the problem of adolescent steroid use. Rather, a solution lies within a strategy to

## Anabolic-Androgenic Steroid Use in Sports, Health, and Society



Anabolic-androgenic steroids (AASs), commonly known as anabolic steroids, are a large group of molecules including endogenously produced androgens, such as testosterone, as well as synthetically manufactured derivatives [ 1 ]. Testosterone, Nandrolone Decanoate (ND), methandienone, and methenolol, are the most commonly abused androgens [ 2 ].

## Anabolic androgenic steroids and carcinogenicity focusing on Leydig .



Anabolic-androgenic steroids (AASs) are a large group of molecules including endogenously produced androgens, such as testosterone, as well as synthetically manufactured derivatives. AAS use is widespread due to their ability to improve muscle growth for aesthetic purposes and athletes' performance, ...

# Anabolic steroids: a review of the literature - PubMed

LEADING ARTICLE

*Sports Med* 2002; 32 (3): 285-296  
0112-1642/02/0005-0285\$25.00/0  
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## Anabolic Steroids A Review for the Clinician

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### Abstract

The number of athletes self-administering ergogenic pharmacological agents to increase their competitive edge continues to be a problem. Most athletes using anabolic steroids (AS) have acquired a crude pharmacological database regarding these drugs. Their opinions regarding steroids have been derived from their subjective experiences and anecdotal information. For this reason, traditional warnings regarding the lack of efficacy and potential dangers of steroid misuse are disregarded. A common widely held opinion among bodybuilders is that the anabolic steroid experts are the athletic gurus who for years have utilised themselves as the experimental participants and then dispensed their empirical findings. This review will address the common anabolic steroid misconceptions held by many of today's athletes by providing an evaluation of the scientific literature related to AS in athletic performance.

As athletic competition continues to intensify, athletes strive for higher levels of performance to achieve success. Many of these athletes, as well as their coaches, believe that one must do whatever is required to win. If this formula requires the use of performance enhancing substances, such as anabolic steroids (AS), this is an acceptable gamble. Thus, the number of athletes administering performance enhancing pharmacological agents to achieve their goals is no longer limited to elite athletes, but to all categories of athletes.<sup>[1]</sup>

Being actively involved with the bodybuilding population, through various regional and national bodybuilding competitions as well as interviewing bodybuilders around the Midwest, the authors are aware of the use of various types of performance enhancing agents. These athletes have varying attitudes on the effects, mechanism of action, and adverse

effects that are related to the use of these substances. AS are the most prevalent agents being used among this population. AS are also the most studied of all the performance enhancing agents. Although there are many AS studies, there is no consensus among researchers regarding their effectiveness as ergogenic agents. In contrast, bodybuilders eagerly postulate numerous potential mechanisms of action and endorse AS efficacy because of their first-hand experience.<sup>[2]</sup>

The AS using athletes of today have a 'sophisticated' steroid pharmacological knowledge, based on both their subjective experiences and anecdotal information, which in their minds surpasses the majority of healthcare providers.<sup>[1,3]</sup> For this reason, traditional warnings from healthcare providers regarding the lack of efficacy and potential dangers of steroid misuse are largely disregarded.<sup>[1]</sup> Today,

The use of anabolic androgenic steroids (AAS) for strength training and muscle building is a widespread practice among athletes and young individuals. Athletes and bodybuilders are using these substances for various purposes, such as enhancing muscle mass, strengthening their bodies, and enhancing their performances.



## **Anabolic-androgenic steroid use in a young body-builder: A case report .**



Anabolic-androgenic steroid (AAS) use has become a major worldwide substance use disorder, affecting tens of millions of individuals. . We reviewed the published literature on AAS-induced behavioral effects and augmented this information with extensive observations from our clinical and forensic experience. Results.

### **[PDF] The Uses of Anabolic Androgenic Steroids Among Athletes; Its .**



A review of the molecular mechanisms, physiological processes, and clinical complications arising from the excessive use of AAS among athletes highlights the molecular mechanisms, physiological processes, and clinical complications arising from the excessive use of AAS. Abstract The use of anabolic androgenic steroids (AAS) for strength training and muscle building is a widespread practice .

# Adverse Effects of Anabolic-Androgenic Steroids: A Literature Review



Review

## Adverse Effects of Anabolic-Androgenic Steroids: A Literature Review

Giuseppe Davide Albano <sup>1,†</sup>, Francesco Amico <sup>1,†</sup>, Giuseppe Cocimano <sup>1</sup>, Aldo Liberto <sup>1</sup>, Francesca Maglietta <sup>2</sup>, Massimiliano Esposito <sup>1</sup>, Giuseppe Li Rosi <sup>3</sup>, Nunzio Di Nunno <sup>4</sup>, Monica Salerno <sup>1,‡</sup> and Angelo Montana <sup>1,\*,‡</sup>

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**Citation:** Albano, G.D.; Amico, F.; Cocimano, G.; Liberto, A.; Maglietta, F.; Esposito, M.; Rosi, G.L.; Di Nunno, N.; Salerno, M.; Montana, A. Adverse Effects of Anabolic-Androgenic Steroids: A Literature Review. *Healthcare* **2021**, *9*, 97. <https://doi.org/10.3390/healthcare9010097>

Received: 5 December 2020  
Accepted: 11 January 2021  
Published: 19 January 2021

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**Abstract:** Anabolic-androgenic steroids (AASs) are a large group of molecules including endogenously produced androgens, such as testosterone, as well as synthetically manufactured derivatives. AAS use is widespread due to their ability to improve muscle growth for aesthetic purposes and athletes' performance, minimizing androgenic effects. AAS use is very popular and 1–3% of US inhabitants have been estimated to be AAS users. However, AASs have side effects, involving all organs, tissues and body functions, especially long-term toxicity involving the cardiovascular system and the reproductive system, thereby, their abuse is considered a public health issue. The aim of the proposed review is to highlight the most recent evidence regarding the mechanisms of action of AASs and their unwanted effects on organs and lifestyle, as well as suggesting that AAS misuse and abuse lead to adverse effects in all body tissues and organs. Oxidative stress, apoptosis, and protein synthesis alteration are common mechanisms involved in AAS-related damage in the whole body. The cardiovascular system and the reproductive system are the most frequently involved apparatuses. Epidemiology as well as the molecular and pathological mechanisms involved in the neuropsychiatric side-effects of AAS abuse are still unclear, further research is needed in this field. In addition, diagnostically reliable tests for AAS abuse should be standardized. In this regard, to prevent the use of AASs, public health measures in all settings are crucial. These measures consist of improved knowledge among healthcare workers, proper doping screening tests, educational interventions, and updated legislation.

**Keywords:** AASs; anabolic androgenic steroids; organ damage; toxicity; injury; chronic administration

### 1. Introduction

Anabolic-androgenic steroids (AASs), commonly known as anabolic steroids, are a large group of molecules including endogenously produced androgens, such as testosterone, as well as synthetically manufactured derivatives [1]. Testosterone, Nandrolone Decanoate (ND), methandienone, and methenolol, are the most commonly abused androgens [2]. AAS use is widespread due to their ability to improve muscle growth for esthetic purposes and athletes' performance, minimizing androgenic effects [3]. Indeed, androgens are able to increase the size of muscle fibers as well as muscle strength, and

**Abstract:** The use of anabolic androgenic steroids (AAS) for strength training and muscle building is a widespread practice among athletes and young individuals. Athletes and bodybuilders are using these substances for various purposes, such as enhancing muscle mass, strengthening their bodies, and enhancing their performances.

# Review Article: Anabolic-Androgenic Steroids, Violence, and Crime: Two .



## Anabolic Steroid Abuse and Violence

Bruce Maycock<sup>1</sup> and Andrea Beel<sup>2</sup>

### INTRODUCTION

Violence is an issue of major public concern in Australia. Newspaper stories have implicated anabolic androgenic steroids in some physical assaults and fatalities. In the cases of Greg Wane and Steven De Souza, both found guilty of murder, the defendants used the defence of diminished responsibility due to anabolic androgenic steroid use (Belli 1995). The diminished responsibility defence due to 'roid rages' has been termed the 'dumbbell defence' or 'steroid defence' and has been used in legal cases in the United States (US) since 1965. 'Roid rage' is a term used by those in the weight training culture to refer to an anabolic androgenic steroid-related act of aggression.

This bulletin examines the relationship between anabolic androgenic steroid use and violence. There are four sections to the bulletin. The first two sections are concerned with the nature of anabolic androgenic steroids and their prevalence in Australia. The third section examines how anabolic androgenic steroids are obtained and used. In the final section, the physical and psychological harms associated with anabolic androgenic steroid abuse are discussed, with particular attention paid to evidence on the relationship between anabolic androgenic steroid use and increased aggression and violence.

For the purpose of this bulletin:

- the term 'anabolic' refers to the tissue-building effects (increasing muscle mass) of the steroid,
- the term 'androgenic' relates to the masculinising effect of the steroid,
- the term 'anabolic steroids' will be used instead of the proper name anabolic androgenic steroids, and

- 'anabolic steroid abuse' is defined as an illicit use of anabolic steroids and any use likely to cause damage or risk to the user or others.

### NATURE AND MEDICAL USE OF ANABOLIC STEROIDS

Anabolic steroids are synthetic derivatives of the testosterone hormone. Naturally occurring testosterone hormone is broken down rapidly by the liver when it is ingested or injected, giving little androgenic or anabolic benefit to the recipient. By artificially altering the structure of testosterone this problem has been overcome (Yesalis & Bahrke 1995). There are many variations of anabolic steroids, with some having greater androgenic effects and others greater anabolic effects. Anabolic steroids are primarily available in both oral and injectable form, however transdermal patches, buccal tablets (absorbed through the mouth) and nasal sprays have also been used as methods of anabolic steroid delivery (Yesalis & Bahrke 1995). The oral form of anabolic steroids is modified to slow down its use in the liver. The injectable form is generally fat-soluble, resulting in a slow release into circulation and therefore a prolonged action (Wilson 1988). Modifications of the testosterone structure can also enhance the potency of a given anabolic steroid or alter its metabolism, in addition to slowing the rate of inactivation in the liver (Hoberman & Yesalis 1995).

### MEDICAL USE OF ANABOLIC STEROIDS

Anabolic steroids are restricted substances in Australia. They can be

legally obtained from medical practitioners for a limited number of purposes, such as to treat muscle wasting. Historically, anabolic steroids have been used to treat medical conditions such as reproductive dysfunctions, anaemia, metastatic breast cancer and protein deficiency (Kochakian 1993). Anabolic steroids have also been used to treat depression, melancholia, and involuntal psychoses (Bahrke, Yesalis & Wright 1990).

Currently, anabolic steroids are being used to help treat trauma patients (burns, surgery, radiation therapy) and patients with chronic debilitating illnesses that result in muscle wasting such as HIV. Additionally, they are used to treat male and female hormonal dysfunctions, as well as being used in replacement therapy for men with hypogonadism, treatment of impotence and to stimulate growth and initiate puberty in boys. In the United Kingdom (UK), anabolic steroids are being used as hormone replacement therapy for men over 54 years. It is claimed that testosterone therapy for men can prevent physical ailments and depression, strengthen ageing bodies and restore a waning interest in sex (Hoberman & Yesalis 1995). The World Health Organisation has completed successful trials using anabolic steroids as a male contraceptive. It should be noted that in those trials, anabolic steroids proved to be an effective contraceptive for men, with minimal short-term side effects (WHO Task Force on Methods for the Regulation of Male Fertility 1990).

### ANABOLIC STEROIDS AND MUSCLE STRENGTH

There is general agreement that anabolic steroids do not enhance the

Anabolic-androgenic steroid (AAS) use has become a major worldwide substance use disorder, affecting tens of millions of individuals. Importantly, it is now increasingly recognized that some individuals develop uncharacteristically violent or criminal behaviors when using AAS. We sought to summarize available information on this topic. Methods:

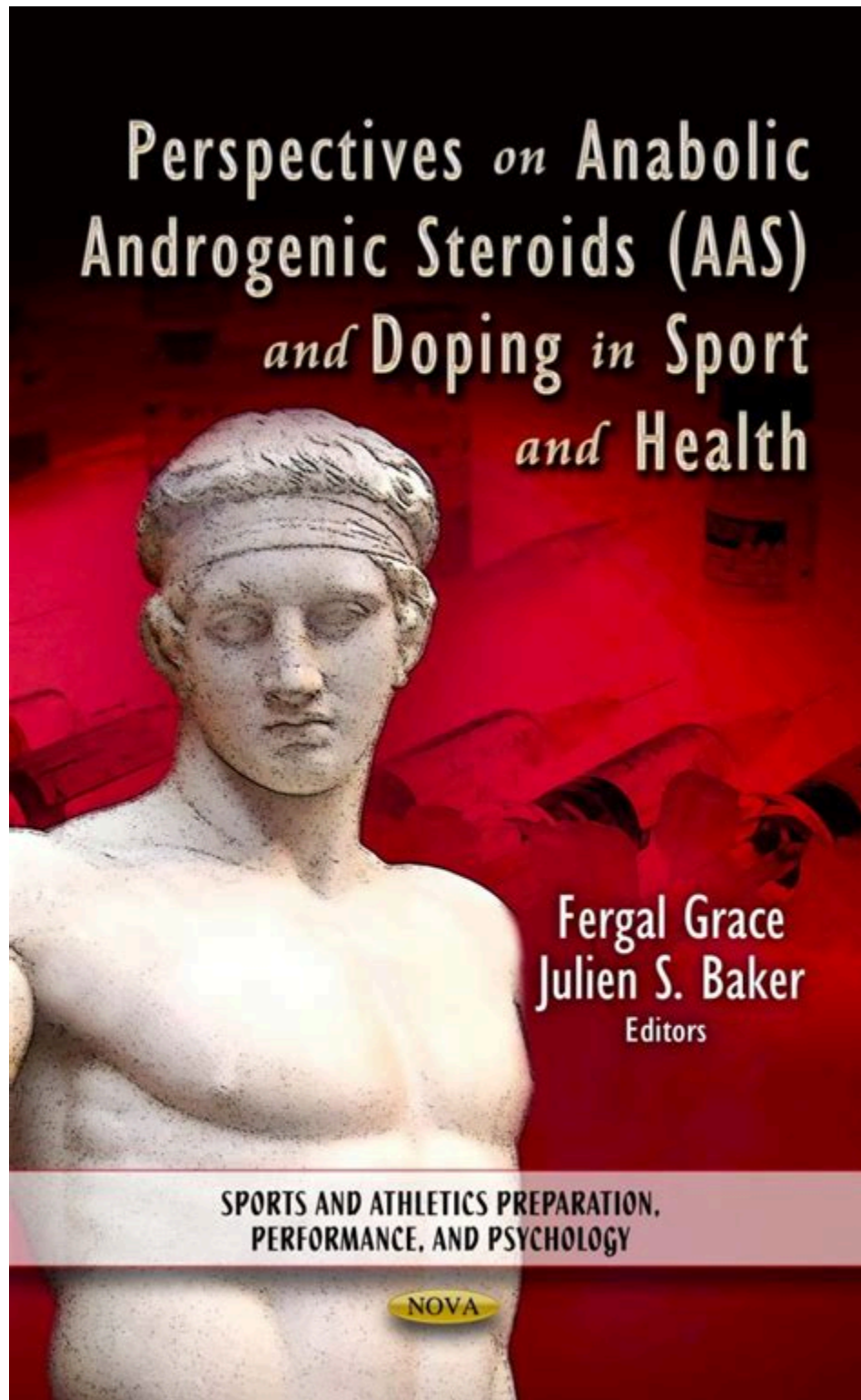


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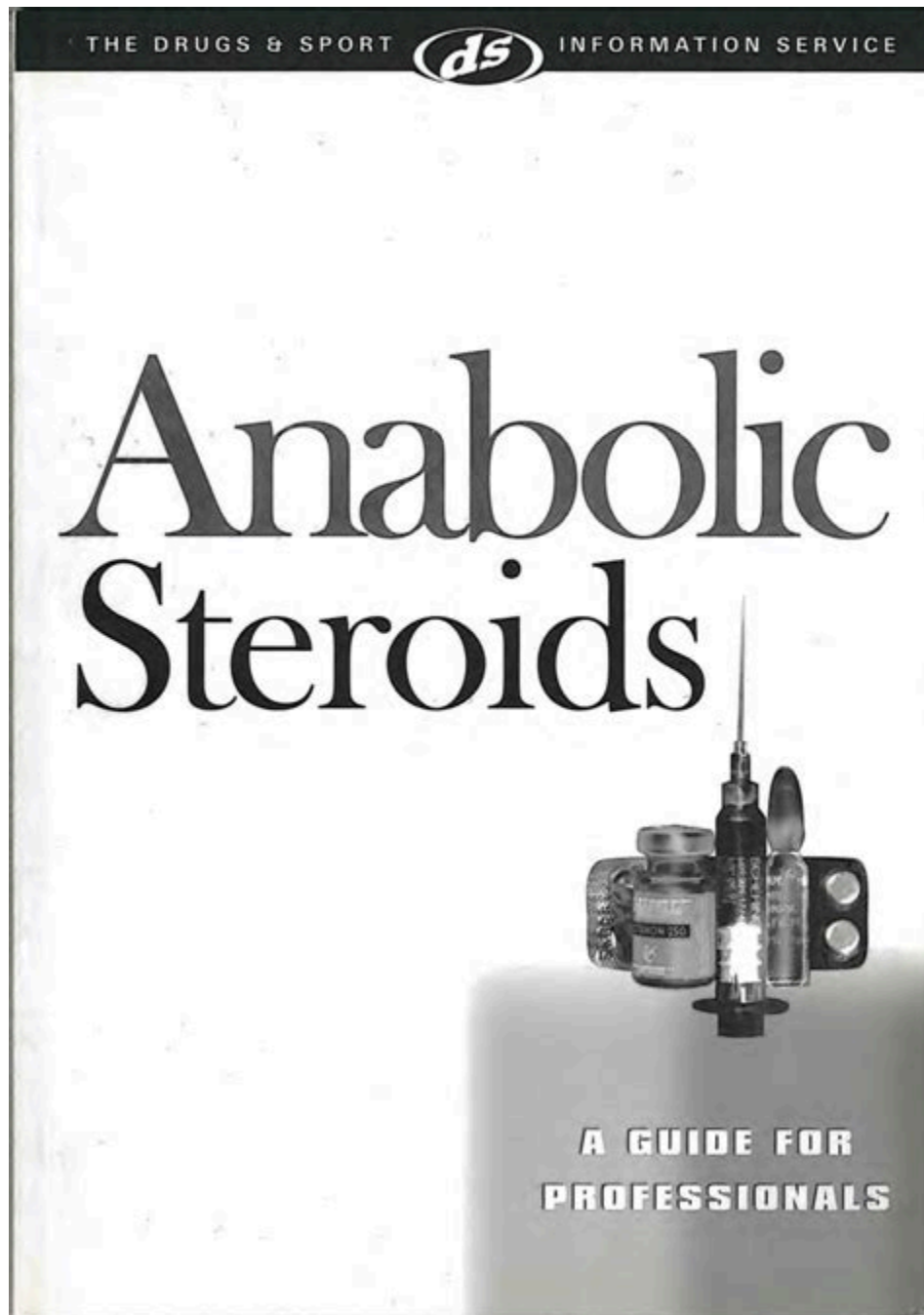


The Uses of Anabolic Androgenic Steroids Among Athletes; Its Positive and Negative Aspects- A Literature Review Zhang Wenbo & Zhang Yan Pages 4293-4305 | Received 08 Sep 2023, Accepted 13 Dec 2023, Published online: 28 Dec 2023 Cite this article doi/10. 2147/JMDH. S439384 In this article Full Article Figures & data References Citations

## Doping and sports endocrinology: anabolic-androgenic steroids



Abstract. The use of anabolic steroids affects not only professional athletes but also the general population (bodybuilders, gym clients, and adolescents). In the first case, its use is prohibited and sanctioned by the World Anti-Doping Agency and Olympic committees. For the other users, it is difficult to establish its prevalence since many .



Anabolic-Androgenic Steroid Use in Sports, Health, and Society BHASIN, SHALENDER; HATFIELD, DISA L. ; HOFFMAN, JAY R. ; KRAEMER, WILLIAM J. ; LABOTZ, MICHELE; PHILLIPS, STUART M. ; RATAMESS, NICHOLAS A. Author Information *Medicine & Science in Sports & Exercise* 53 (8):p 1778-1794, August 2021. | DOI: 10. 1249/MSS. 0000000000002670 Free SDC Abstract

# The Uses of Anabolic Androgenic Steroids Among Athletes; Its . - PubMed

REVIEW ARTICLE

Sports Med 2004; 34 (8): 513-554

01 12-1642-04-0008-0513-0000

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## Effects of Androgenic-Anabolic Steroids in Athletes

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Adverse Effects of Anabolic-Androgenic Steroids: A Literature Review by Giuseppe Davide Albano 1,†, Francesco Amico 1,†, Giuseppe Cocimano 1, Aldo Liberto 1, Francesca Maglietta 2, Massimiliano Esposito 1, Giuseppe Li Rosi 3, Nunzio Di Nunno 4, Monica Salerno 1,‡ and Angelo Montana 1,\* ,‡ 1



# Sudden Cardiac Death in Anabolic-Androgenic Steroid Users: A Literature .



Review

## Sudden Cardiac Death in Anabolic-Androgenic Steroid Users: A Literature Review

Marco Torrisi <sup>1</sup>, Giuliana Pennisi <sup>1</sup>, Ilenia Russo <sup>1</sup>, Francesco Amico <sup>1</sup>, Massimiliano Esposito <sup>1</sup>, Aldo Liberto <sup>1</sup>, Giuseppe Cocimano <sup>1</sup>, Monica Salerno <sup>1</sup>, Giuseppe Li Rosi <sup>2</sup>, Nunzio Di Nunno <sup>3</sup> and Angelo Montana <sup>1,\*</sup>

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Received: 30 September 2020; Accepted: 2 November 2020; Published: 4 November 2020



**Abstract:** *Background and objectives:* Anabolic-androgenic steroids (AAS) are a group of synthetic molecules derived from testosterone and its related precursors. AASs are widely used illicitly by adolescents and athletes, especially by bodybuilders, both for aesthetic uses and as performance enhancers to increase muscle growth and lean body mass. When used illicitly they can damage health and cause disorders affecting several functions. Sudden cardiac death (SCD) is the most common medical cause of death in athletes. SCD in athletes has also been associated with the use of performance-enhancing drugs. This review aimed to focus on deaths related to AAS abuse to investigate the cardiac pathophysiological mechanism that underlies this type of death, which still needs to be fully investigated. *Materials and Methods:* This review was conducted using PubMed Central and Google Scholar databases, until 21 July 2020, using the following key terms: “((Sudden cardiac death) OR (Sudden death)) AND ((androgenic anabolic steroid) OR (androgenic anabolic steroids) OR (anabolic-androgenic steroids) OR (anabolic-androgenic steroid))”. Thirteen articles met the inclusion and exclusion criteria, for a total of 33 reported cases. *Results:* Of the 33 cases, 31 (93.9%) were males while only 2 (6%) were females. Mean age was 29.79 and, among sportsmen, the most represented sports activity was bodybuilding. In all cases there was a history of AAS abuse or a physical phenotype suggesting AAS use; the total usage period was unspecified in most cases. In 24 cases the results of the toxicological analysis were reported. The most detected AASs were nandrolone, testosterone, and stanozolol. The most frequently reported macroscopic alterations were cardiomegaly and left ventricular hypertrophy, while the histological alterations were foci of fibrosis and necrosis of the myocardial tissue. *Conclusions:* Four principal mechanisms responsible for SCD have been proposed in AASabusers: the atherogenic model, the thrombosis model, the model of vasospasm induced by the release of nitric oxide, and the direct myocardial injury model. Hypertrophy, fibrosis, and necrosis represent a substrate for arrhythmias, especially when combined with exercise. Indeed, AAS use has been shown to change physiological cardiac remodeling of athletes to pathophysiological cardiac hypertrophy with an increased risk of life-threatening arrhythmias.

**Keywords:** AAS; anabolic androgenic steroids; SCD; sudden cardiac death; cardiac damage; adverse effects; cardiac toxicity

Anabolic-androgenic steroids (AAS) are synthetic drugs produced to imitate the male sex hormone testosterone [1]. They have anabolic effects more than androgenic effects as compared to testosterone. . After a thorough review of the literature, we found a spectrum of clinical manifestations with which an AAS abuser can present. Some patients .

Review

## Adverse Effects of Anabolic-Androgenic Steroids: A Literature Review

Giuseppe Davide Albano <sup>1,†</sup>, Francesco Amico <sup>1,†</sup>, Giuseppe Cocimano <sup>1</sup>, Aldo Liberto <sup>1</sup>, Francesca Maglietta <sup>2</sup>, Massimiliano Esposito <sup>1</sup>, Giuseppe Li Rosi <sup>3</sup>, Nunzio Di Nunno <sup>4</sup>, Monica Salerno <sup>1,‡</sup> and Angelo Montana <sup>1,\*,‡</sup>

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**Citation:** Albano, G.D.; Amico, F.; Cocimano, G.; Liberto, A.; Maglietta, F.; Esposito, M.; Rosi, G.L.; Di Nunno, N.; Salerno, M.; Montana, A. Adverse Effects of Anabolic-Androgenic Steroids. *A Literature Review*. *Healthcare* **2021**, *9*, 97. <https://doi.org/10.3390/healthcare9010097>

Received: 5 December 2020  
 Accepted: 11 January 2021  
 Published: 19 January 2021

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**Abstract:** Anabolic-androgenic steroids (AASs) are a large group of molecules including endogenously produced androgens, such as testosterone, as well as synthetically manufactured derivatives. AAS use is widespread due to their ability to improve muscle growth for aesthetic purposes and athletes' performance, minimizing androgenic effects. AAS use is very popular and 1–3% of US inhabitants have been estimated to be AAS users. However, AASs have side effects, involving all organs, tissues and body functions, especially long-term toxicity involving the cardiovascular system and the reproductive system, thereby, their abuse is considered a public health issue. The aim of the proposed review is to highlight the most recent evidence regarding the mechanisms of action of AASs and their unwanted effects on organs and lifestyle, as well as suggesting that AAS misuse and abuse lead to adverse effects in all body tissues and organs. Oxidative stress, apoptosis, and protein synthesis alteration are common mechanisms involved in AAS-related damage in the whole body. The cardiovascular system and the reproductive system are the most frequently involved apparatuses. Epidemiology as well as the molecular and pathological mechanisms involved in the neuropsychiatric side-effects of AAS abuse are still unclear, further research is needed in this field. In addition, diagnostically reliable tests for AAS abuse should be standardized. In this regard, to prevent the use of AASs, public health measures in all settings are crucial. These measures consist of improved knowledge among healthcare workers, proper doping screening tests, educational interventions, and updated legislation.

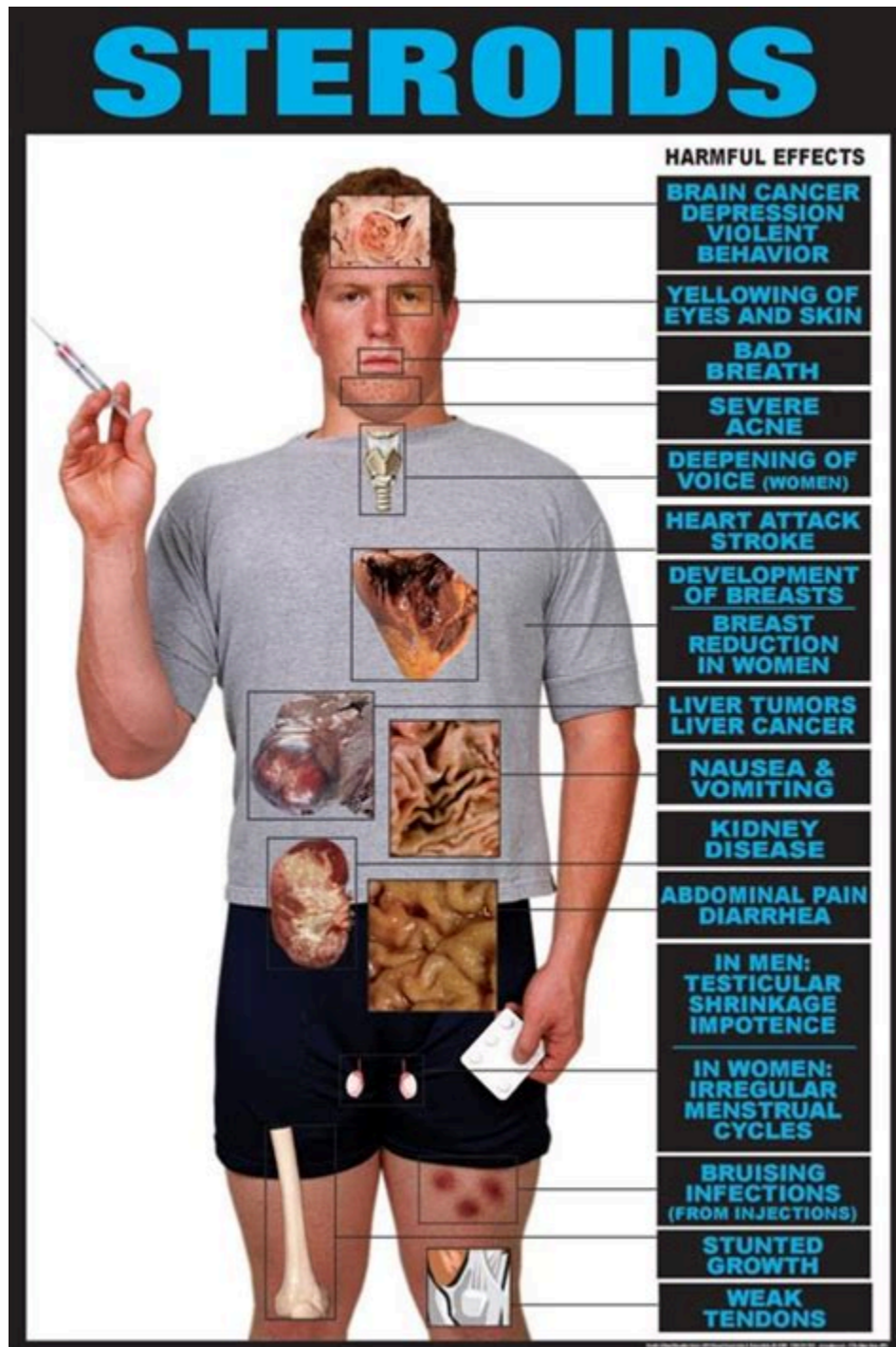
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### 1. Introduction

Anabolic-androgenic steroids (AASs), commonly known as anabolic steroids, are a large group of molecules including endogenously produced androgens, such as testosterone, as well as synthetically manufactured derivatives [1]. Testosterone, Nandrolone Decanoate (ND), methandienone, and methenolol, are the most commonly abused androgens [2]. AAS use is widespread due to their ability to improve muscle growth for esthetic purposes and athletes' performance, minimizing androgenic effects [3]. Indeed, androgens are able to increase the size of muscle fibers as well as muscle strength, and

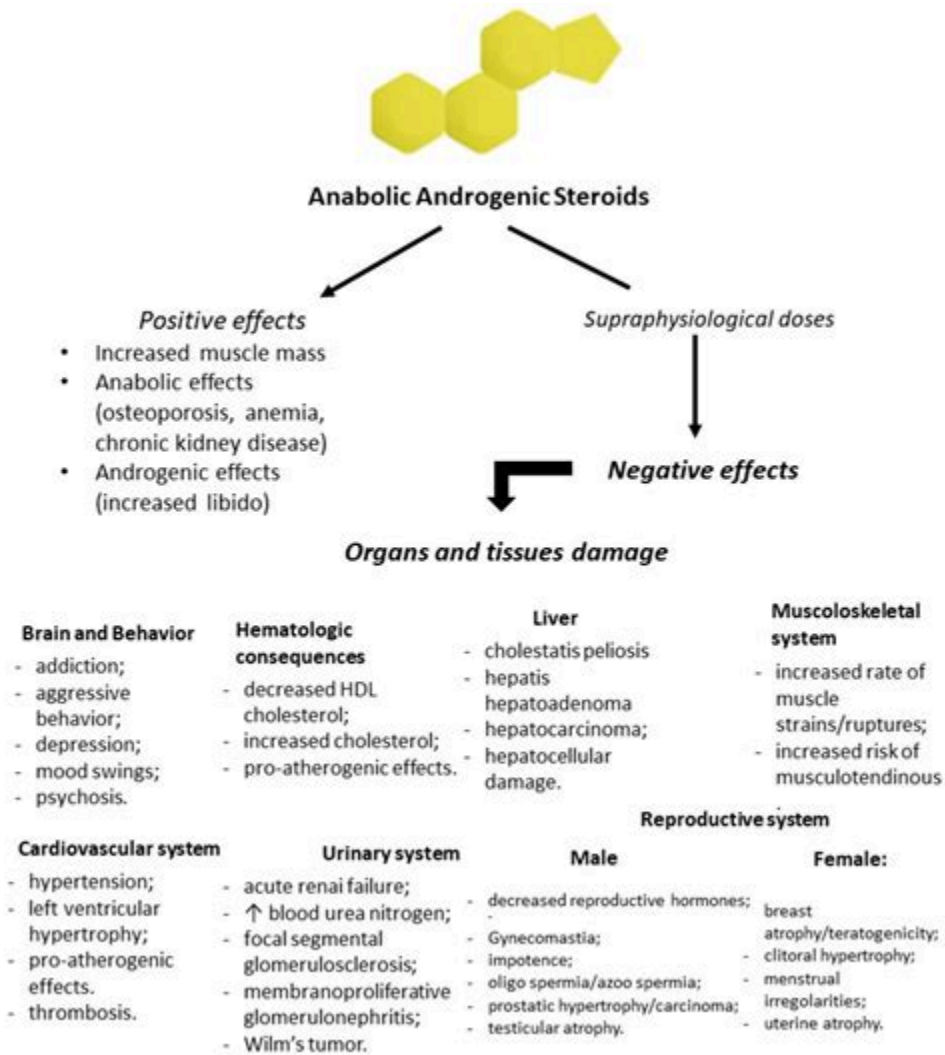
In this literature review, we analyzed the AAS-mediated carcinogenicity, focusing on Leydig cell tumor. AAS-induced carcinogenicity can affect DNA transcription through two pathways. It can act directly via the androgen receptor, by means of dihydrotestosterone (DHT) produced by the action of 5- $\alpha$ -reductase.

# Anabolic-Androgenic Steroids, Violence, and Crime: Two Cases and .



"purely" anabolic but all possess androgenic properties as well. The present review briefly recapitulates the historic literature about the androgenic/anabolic steroids and describes literature supporting the anabolic activity of these drugs in normal people, focusing on the use of suprapharmacologic doses by athletes and

# Adverse Effects of Anabolic-Androgenic Steroids: A Literature Review - MDPI



Anabolic-androgenic steroids (AASs), commonly known as anabolic steroids, are a large group of molecules including endogenously produced androgens, such as testosterone, as well as synthetically manufactured derivatives [1]. Testosterone, Nandrolone Decanoate (ND), methandienone, and methenolol, are the most commonly abused androgens [2].

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