Effects of Androgenic Anabolic Steroids on Cardiovascular Health in Athletes on a Global Scale

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ABSTRACT:

Background:

Athletes use androgenic anabolic steroids frequently to induce muscle strength and help with aesthetic appearance. Steroids affect many aspects of the cardiovascular system, from changes in the structure of the heart to the effect on hyperlipidemia and hypertension. The purpose of this paper is to provide an understanding of the effects of steroids on cardiovascular health in athletes as well as understand the impact of social determinants of health.

Methods:

This review paper synthesized results from three research studies that were conducted across the following countries: United States, Bosnia and Herzegovina, and Iran. PubMed and Google Scholar were searched with the key terms cardiovascular health, steroids, international studies, and athletes.

Results:

All subjects were male athletes. No females were detected. Each of the three studies reported cardiovascular abnormalities as an effect of steroids use: hyperlipidemia, hypertension, increased coronary plaque, and reduction in left ventricular functions.

Discussion:

This study discovered steroids in athletes cause damage to cardiovascular health with varying results globally. The results display that while physiological harms of steroids are common, misuse is mainly caused by social determinants of health. Addressing this will require standardized global research methods and consistent policy efforts globally to limit steroids access and display the importance of cardiovascular health in athletes.

INTRODUCTION:

Athletes often use androgenic anabolic steroids (AAS) to improve function. AAS induce muscle strength and size, have performance enhancing properties, and help with “aesthetic appearance” [1,2]. Despite the benefits of AAS, the short and long term effects on the athlete are not fully understood.

Although AAS affects many aspects of the human body, studies have specifically focused on the impact of AAS on the cardiovascular system. For example, studies have documented preclinical evidence of AAS causing cardiovascular issues including left ventricular (LV) hypertrophy, myocardial dysfunction, fibrosis, increasing coronary artery calcification, and plaque volume [3]. Furthermore, studies have used imaging such as tissue Doppler imaging (TDI) or speckle tracking echocardiography (STE) to detect early LV dysfunction in AAS using athletes [4,5]. In addition to the changes in the heart structure, AAS can have detrimental effects on hyperlipidemia and hypertension, both of which are risk factors for developing cardiovascular disease [6]. For example, Yeater et al. confirmed increasing systolic pressure (10-12 mmHg) in athletes using AAS during a one year period [6]. In addition, a study identifying the effects of AAS on cholesterol found lower HDL and higher LDL in athletes utilizing anabolic steroids [7].

Across the world, the prevalence of AAS differs in different regions. Alsaeed et al. reveal notable regional differences: eastern countries display smaller AAS ranges than countries like the United Kingdom and United States [8]. These different ranges can be due to several factors including lower education, cultural norms, social influence, and access through familiar or trusted sources. In conclusion, countries with more non-restrictive social environments or easier access are more prone to higher AAS use [8].

The primary purpose of this paper is to review literature and present an evidence-based paper on the current understanding of the effects of AAS on cardiovascular health in athletes. Specifically, this paper will look at social determinants of health (SDOH), identifying whether athletes from a certain country are more likely to experience the harms of AAS on cardiovascular health compared to athletes of a different country. This paper will provide a resource for coaches, athletes, and sports foundations to better understand the harmful effects of AAS and identify at-risk athletes.

METHODS:

This review was conducted by searching PubMed and Google Scholar using the key search terms “athletes, cardiovascular disease, cardiovascular health, steroids, AAS, Europe, Middle East, and America.” The inclusion criteria stated that studies must report on the relationship between athletes, cardiovascular health, and steroid use, should be solely published in English, and be limited to cohort studies. Studies which did not look at a population of athletes, did not consider exposure to AAS, and systematic reviews were excluded.

RESULTS:

Three articles met the inclusion criteria of this review and were further evaluated to summarize the overall impact of steroids on cardiovascular health in athletes as well as identify disparities between countries. All three studies looked at male athletes or recreational bodybuilders as no females using AAS were identified; however, in some studies, females acted as the control [4,9,10]. The motivation AAS use was consistent throughout the three studies: aesthetic and

improving performance. Mdani et al. stated that 43.5% used AAS for body aesthetics, 18.3% for strength, and 16.8% for competition [4,9,10]. All three studies also reported cardiovascular abnormalities, although specific abnormalities discussed varied between studies. Solakovic et al. reported 55.7% had hypertension and hyperlipidemia as well as some signs of vascular damage [4,9,10]. Baggish et al. reported a reduction in left ventricular functions (LVEF) and increased coronary plaque volume [4]. Mdani et al. reported 33.3% heart related issues but did not specify [9]. Lastly, looking at the dosage and duration, Baggish et al. reported that for every 10 years of AAS use, the sudden death (SD) rate increased by 0.60 [4]. The other two studies, Mdani et al. and Solakovic et al., did not mention the dosage duration [9,10].

Given that each study took place in a different country, it is important to further understand how geography plays a role in AAS use. For example, Alsaeed et al. discussed the different AAS rates in different countries across the world. He reported 1-6% use in western european countries, 22% amongst gym athletes in UAE, 13% of youth training body builders in Iran, and 20% of athletes in the United States [8]. In addition to rates of AAS globally, the study discussed the SDOH with statistical findings [8].

Table 1. Impact of SDOH on AAS

SDOH	**User percentage [8]**
Education	No significant difference
Social Influence	73.5% users knew another user
Perceptions/Beliefs	70.5% believed muscular body only achieved through AAS
Access Channels	Common source of AAS was gym coaches (62.1%), friends (32.7%), pharmacists/doctors (30.8%)

Table 2. Cardiovascular Related Findings Across Three Studies

Author	**Country**	**Subjects**	**Settings**	**CVD Complication Reported**
Solakovic et al. (2015)	Bosnia and Herzegovina	35 male athletes (under 35)	Observational clinic follow-up	55.7% hypertension and hyperlipidemia and signs of vascular damage
Baggish et al.	United States	86 male	Cross Sectional	Increased

(2017)		weightlifters		coronary plaque and volume as well as notable reductions in left ventricular functions
Mdani et al. (2017)	Iran	277 men	Self-report study	33.3% heart-related issues (did not specify which heart issues)

DISCUSSION:

The results show that AAS use among athletes causes negative effects on cardiovascular health, including hyperlipidemia, hypertension, increased coronary plaque, and reduction in left ventricular functions. The findings from this review emphasize the role geography plays in the use of AAS in athletes, specifically with regards to their cardiovascular health. Cultural norms, healthcare access, and legal rules affect how AAS is used. When looking at the reported results across all three countries, we gather that the US reveals long term internal damage through advanced medical technology [4]. Bosnia and Herzegovina reveals widespread unregulated use [9]. Iran reveals some heart issues however mainly focused on the social effects from AAS abuse [8].

In line with the hypothesis, these cardiovascular factors are likely caused by social factors such as intense training and dietary patterns that might further affect cardiovascular health. We also suggested the possibility that the differences between countries are due to social determinants such as peer influence, aesthetic appearance, coaches, and healthcare professionals.

The results from this review display that AAS misuse is not only a performance issue but also a public health issue. Although a standardized measurement is necessary to determine AAS effects across all countries, it may fail as varying factors of use in each region cannot be individually considered.

Limitations

The studies in this review–inlcuding those from Bosnia and Iran–highlight the differences in AAS usage rates, however there is a lack of standardized methodologies on how to determine AAS effects across all regions which makes it difficult to compare cardiovascular outcomes across all athlete populations. In addition, self-reported data like the study by Mdani et al. may not fully account for prevalence due to legal implications, which is also known as social desirability bias [9].

Future Considerations

Although detailed data was gathered on AAS and cardiovascular outcomes, it is important that future research gathers an international view that takes into account the regional differences in prevalence, cultural views, and SDOH. Future studies should consider regular monitoring of AAS distribution and incorporate regular cardiovascular screening for AAS users.

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