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ORIGINAL RESEARCH

Androgenic-anabolic steroids inhibited post-exercise hypotension: a case control study

Jefferson F.C.R. Junior[a], Alexandre S. Silva[b,c], Glêbia A. Cardoso[b,c], Valmir O. Silvino[a], Maria C.C. Martins[a], Marcos A.P. Santos[a,*]

[a] *Department of Biophysics and Physiology, Campus Universitário Ministro Petrônio Portella, Universidade Federal do Piauí (UFPI), Teresina, PI, Brazil*
[b] *Laboratory of Applied Studies in Physical Training to Performance and Health (LETFADS), Department of Physical Education, Universidade Federal da Paraíba (UFPB), João Pessoa, PB, Brazil*
[c] *Associate Graduate Program in Physical Education – UPE/UFPB, Department of Physical Education, Universidade Federal da Paraíba (UFPB), João Pessoa, PB, Brazil*

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Abstract
Background: There is evidence of hypertensive effects caused by anabolic androgenic steroids (AAS). A single exercise session promotes the acute reduction of blood pressure, but the effects of AAS on this phenomenon are unknown.
Objectives: To investigate the post-exercise blood pressure response in androgenic-anabolic steroid users.
Methods: Thirteen AAS users (23.9 ± 4.3 years old) and sixteen controls (22.1 ± 4.5 years old) performed a session of aerobic exercise. Heart rate and blood pressure were assessed before exercise and during a 60 min post-exercise resting period. Repeated ANOVA measures were used to determine differences between the groups.
Results: While the control group had a significant reduction in post-exercise systolic blood pressure of up to 13.9 ± 11.6 mmHg at 40 min, this phenomenon was limited among AAS users who reached a maximum of 6.2 ± 11.5 mmHg at 60 min. The between groups comparison revealed significant higher post-exercise hypotension (PEH) for the control group at 30 min (−12.9 ± 14.1 mmHg vs. −2.9 ± 7.6 mmHg), 40 min (−13.9 ± 11.6 mmHg vs. −2.5 ± 8.3 mmHg), 50 min (−13.9 ± 13.9 mmHg vs. −5.0 ± 7.9 mmHg) and 60 min (−12.5 ± 12.8 mmHg vs. −6.2 ± 11.5 mmHg). There was no significant diastolic PEH in any of the groups.
Conclusions: This study demonstrated impaired systolic post-exercise hypotension as a new adverse effect of AAS usage.

* Corresponding author at: Departamento de Biofísica e Fisiologia, Campus Universitário Ministro Petrônio Portella, CEP 64049-550, Universidade Federal do Piauí, Teresina, PI, Brazil.
E-mail: marcosedfisio@gmail.com (M.A. Santos).

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Introduction

A meta-regression of 187 studies to assess the overall prevalence of anabolic-androgenic steroids (AAS) concluded that non-medical AAS use is a serious, widespread public health problem that has a high prevalence in different populations. The prevalence rate was significantly greater among men (6.4%, $p < 0.001$), in people from the Middle East (21.7%), in recreational sportsmen (18.4%, $p < 0.001$) and in teenagers aged up to 19 years (2.5%).[1]

According to health organizations,[2] AAS have several side effects, including cardio-metabolic disorders.[3] Phenomena such as dyslipidemia, systemic inflammation, oxidative stress, vascular dysfunction, angiogenesis inhibition and increased autonomic sympathetic nervous activity[4–6] have been reported among AAS users. All these events contribute to the increase in arterial pressure.[7,8] Studies indicate that not only do AAS users present arterial pressure (AP) levels higher than those of the control group, but such values are also compatible with those diagnosed in patients with hypertension, despite being young and having no diseases.[9,10]

On the other hand, it is well established that physical training is an effective method of anti-hypertensive treatment.[11] A single exercise session can promote a decrease in blood pressure levels immediately after it is over, and this effect endures for many hours—a phenomenon called post-exercise hypotension (PEH).[12] The mechanisms involved are sympathetic reduction, nitric oxide production and reduction of volemia.[12–14] Coincidentally, such mechanisms may be affected in AAS uses.[3] Consequently, we raised the hypothesis that the PEH phenomena may occur differently in AAS users. Considering that there are no studies that answer this question, the present study was designed to investigate the effect of an aerobic exercise session in the post-exercise blood pressure response in AAS users.

Methods

Participants

This is a case–control study in which the case was bodybuilder practitioners, AAS users and the control was bodybuilder practitioners non-AAS users. We considered a previous study in which an aerobic exercise session promoted a decrease of 13 ± 1 mmHg in the systolic pressure in young normotensive adults,[14] which resulted in an effect size of 2.9. Adopting a statistical power of 0.90 and an α error of 0.05, a minimum sample size of only four participants was found to be required for the study. Thirteen AAS users and sixteen controls were recruited. They performed resistance exercises for bodybuilding competitions at the professional level. The individuals trained at least five times a week and had been practicing this sport for at least two years, along with aerobic exercises, but no more than once per week. The AAS group has been using AAS at a baseline of at least 1 year.

None of the participants of the study presented with any known heart diseases or hypertension and did not use anti-hypertension medicines or nutritional supplements (thermogenic). No smokers were included as volunteers for the study. Participants who had difficulties performing the aerobic exercise session were not included in the study.

This study was approved by the ethics committee of the Universidade Federal do Piauí (UFPI), Teresina, PI, Brazil under protocol 07726613.6.0000.5214. All participants signed the consent form according to resolution 196/96 of the National Health Council.

Procedures

After one week of familiarization consisting of two sessions of aerobic exercise, individuals were anthropometrically evaluated and instructed to refrain from exercises for 48 h before the experiment procedures and to avoid the intake of protein-rich foods, caffeine and alcohol during this period.

The experimental design is shown in Fig. 1. The participants performed an aerobic exercise session. Blood pressure measurements were taken before and during a post-exercise 60 min period of recovery, at intervals of 10 min between each measurement. The heart rate was recorded at the same time as the blood pressure and during the workout for the intensity control. All procedures were performed between 2 pm and 4 pm.

The blood pressure was evaluated according to the recommendations of the Brazilian Guidelines on Hypertension (2010),[15] using a BR A100 Plus oscillometric device (MICROLIFE BR3BTO-A/BR), previously validated by Cukson et al.[16] The measurements were performed by a trained and experienced evaluator. When the participants reached the laboratory for the experimental sessions, they were asked to remain seated for at least 20 min in a quiet environment with a temperature between 24 °C and 27 °C. Subsequently, the two arm measurements were made. If there was no difference between the results, the right arm was determined for the experimental measures. If there was more than a 5-mmHg difference, the arm with the highest result was used for the procedures. Afterward, three measurements determined the blood pressure data at rest, and the two closest values were considered. After the experimental exercise session, the volunteers were instructed to sit down immediately. Then, measures in triplicate were made every 10 min during a period of 60 min post-exercise.

The exercise protocol consisted of 60 min of running/walking with an intensity between 60% and 85% of the estimated maximum heart rate. First, the exercise began with a warm-up run on a treadmill (ProAction BH Fitness, made in Puerto del Carmen, Spain) with a duration of 3 min and spontaneous intensity, considered mild by the volunteers. Immediately after warm up, they started a gradual increase in speed every minute, during the first 5 min until the prescribed intensity was reached, and they remained in this intensity range until the end of the workout.

The heart rate was measured with a heart rate monitor V800 (Polar® Electro Oy, Kempele, Finland). For pre- and post-exercise measures, the volunteers remained seated. During the exercise, the measures were reported to the volunteers, and the speed of the treadmill was changed when the heart rate was not compatible with that previously established for each volunteer.

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