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ORIGINAL ARTICLE

Anabolic androgenic steroids: assessment of the knowledge of medical students

Esteroides androgênicos anabolizantes: avaliação do conhecimento de estudantes de medicina

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ABSTRACT

Introduction: Anabolic-androgenic steroids (AAS) are substances derived from testosterone, illicitly used on a large scale for aesthetic purposes, muscle gain, and sports performance. Numerous studies have demonstrated that AAS can induce various adverse reactions in users. **Objective:** To assess the beliefs and knowledge of medical students regarding AAS and potential complications associated with its misuse. **Methods:** Qualitative and descriptive cross-sectional observational study was conducted using an online questionnaire developed by the authors. **Results:** The study included a sample of 309 medical students from a single medical school. Among the participants, 89% disagreed that AAS use promotes rapid, efficient, and healthy muscle hypertrophy. Only 25% of the students reported awareness of the correct indications for AAS prescription. Additionally, 73% agreed with the resolution prohibiting the use of these substances for aesthetic and sporting purposes in Brazil; however, only 14% believed this measure would be effective. Regarding complications related to AAS, the sample identified the most significant risks as heart problems, hypertension, aggressiveness, hepatotoxicity and dysphonia, and hirsutism in women. **Conclusion:** The study identified a significant knowledge gap among medical students regarding the correct indications for AAS and the health risks associated with their administration. These topics are not adequately covered during medical education. The curriculum should address this subject given its high prevalence to equip future physicians with ethical medical practices, enable them to educate the public about the risks associated with AAS, and prepare them to manage the complexity of adverse effects linked to the improper use of these substances.

Keywords: Anabolic Androgenic Steroids; Medical Students; Adverse Event; Surveys and Questionnaires; Testosterone.

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RESUMO

Introdução: Esteroides androgênicos anabolizantes (EAA) são substâncias derivadas da testosterona, utilizadas em larga escala e ilicitamente com objetivo estético, ganho de massa muscular e performance esportiva. Diversos estudos comprovaram que EAA podem induzir inúmeras adversidades aos usuários. **Objetivo:** Identificar as crenças e o conhecimento de estudantes do curso de Medicina a respeito de EAA e possíveis complicações relacionadas a seu abuso. **Métodos:** Estudo observacional transversal qualitativo e descritivo, conduzido através de questionário *online* elaborado pelos autores. **Resultados:** O estudo incluiu amostra de 309 estudantes de Medicina de uma única faculdade. Dentre os participantes, 89% discordam que o uso de EAA promove hipertrofia muscular de modo rápido, eficiente e saudável. Apenas 25% estão cientes das indicações para prescrição de EAA. Ademais, 73% concordam com a resolução que proíbe o uso dessas substâncias com finalidades estéticas e de performance no Brasil; no entanto, apenas 14% acreditam que essa medida será eficiente. Em relação às complicações relacionadas aos EAA, a amostra identificou que os riscos mais significativos são problemas cardíacos, hipertensão, agressividade, hepatotoxicidade, disfonia e hirsutismo em mulheres. **Conclusão:** O estudo identificou o desconhecimento de estudantes de Medicina sobre as indicações de EAA e riscos relacionados à sua administração. Foi observado que esses tópicos não são adequadamente abordados na educação médica. O currículo deveria abordar esse tema por sua alta prevalência para capacitar os futuros profissionais com práticas éticas, habilitá-los a educar a população sobre os riscos relacionados a EAA, e prepará-los para manejar a complexidade de efeitos adversos relacionados ao uso inapropriado.

Palavras-chave: Esteroides Androgênicos Anabolizantes; Estudantes de Medicina; Eventos Adversos; Inquéritos e Questionários; Testosterona.

Introduction

Anabolic-androgenic steroids (AAS) are hormones derived from testosterone that exert biological effects related to increasing muscle mass and the induction or maintenance of male secondary sexual characteristics[1]. Common preparations include nandrolone, stanozolol, oxandrolone, methandrostenolone, and trenbolone[2]. Testosterone has specific clinical indications, such as the treatment of male hypogonadism and cross-sex hormone therapy for transgender individuals[3]. However, its application for other therapeutic purposes still lacks robust long-term efficacy evidence[3]. Nevertheless, the abuse of these substances for muscle gain, aesthetic enhancement, and athletic performance is widespread, leading to multiple adverse effects and an increased mortality risk among users.

AAS abuse involves practices such as illicit prescriptions, illegal trade, clandestine production, and smuggling, making it difficult to estimate precise prevalence rates[4]. It is estimated that the lifetime prevalence of AAS use is 6.4% among men and 1.6% among women, with initiation typically occurring in young adulthood[5,6].

Reports indicate that between 15% and 25% of men attending gyms use AAS, a concerning figure considering that many of these individuals escape anti-doping controls and rarely report their use to healthcare professionals[7,8]. Thus, many AAS users are at risk not only from the direct effects of the substances but also from the lack of medical monitoring and health education, which could otherwise be provided by qualified professionals.

The primary motivation for AAS use is physical appearance improvement rather than athletic performance[7]. This motivation is often linked to body image concerns and muscle dysmorphia — a subtype of body dysmorphic disorder characterized by dissatisfaction with body size and an obsession with muscular development[8].

Adverse effects of AAS use include hypertension, dyslipidemia, atherosclerotic disease, myocardial hypertrophy, reduced left ventricular ejection fraction, cardiomyopathy, cardiac conduction abnormalities,

clotting changes, polycythemia, focal segmental glomerulosclerosis, hepatotoxicity, acne, and alopecia[1,8-11]. In men, gynecomastia, testicular atrophy, and oligospermia/azoospermia are notable, whereas in women, effects include hirsutism, dysphonia, clitoral hypertrophy, and menstrual irregularities[1,8-10].

Studies have shown that AAS users have a threefold higher incidence of non-ischemic heart disease and a fivefold higher risk of thromboembolic disorders[12]. Mortality rates among users are significantly elevated, with a 2.81-fold increase compared to non-users[13].

Another concerning aspect is the frequent combination of AAS with other substances, such as growth hormone, thyroid hormones, glucocorticoids, insulin, diuretics, and beta-2 adrenergic agonists, to enhance results or mitigate unwanted adverse reactions[9,14]. Aromatase inhibitors and estrogen receptor antagonists, for instance, are used to prevent gynecomastia[9].

In addition to physical consequences, AAS are associated with neuropsychiatric effects, including mania or hypomania, depression, aggression, cognitive deficits, and dependence[7,9]. Dependence often follows a pattern where initial use motivated by aesthetic gains evolves into compulsive consumption due to withdrawal symptoms and the regression of desired muscle growth effects[15].

In Brazil, regulations establish that hormone replacement therapy should only be performed in cases of proven deficiency or where clinical benefit is scientifically substantiated[16]. The Brazilian Society of Endocrinology and Metabolism and other organizations oppose the use of AAS for aesthetic, athletic, or anti-aging purposes, citing the lack of scientific backing and the well-documented risks[3,17,18]. In 2023, the Federal Council of Medicine prohibited the use of AAS for such purposes through Resolution No. 2,333/2023.

Evidence-based medical education, starting from undergraduate training, plays a critical role in preventing inappropriate AAS prescriptions, reducing iatrogenesis, and equipping professionals to manage complications related to AAS abuse. Moreover, it is crucial for educating patients about the risks inherent to the misuse of these hormones.

This study aims to assess the knowledge and beliefs of medical students regarding anabolic steroids, focusing on the complications arising from their misuse for aesthetic, muscle gain, and sports performance purposes. It also evaluates how medical training may influence students' perceptions and practices related to AAS use.

Methods

Study Design

This was a qualitative, descriptive, cross-sectional observational study aimed at identifying the beliefs and knowledge of medical students regarding AAS. It was approved by the Research Ethics Committee (CAAE 69903223.7.0000.5134) and conducted in accordance with Resolution 466/12 of the National Health Council.

Sample

Participants were selected using a convenience sampling method, including medical students from a single private institution located in Belo Horizonte, Minas Gerais (n=309). The sample was divided into three groups according to the medical school cycle: Basic (n=108), Clinical (n=104), and Internship (n=97).

Instruments

A questionnaire developed by the authors via Google Forms consisting of multiple-choice questions about AAS use for aesthetic, muscle gain, and sports performance purposes, as well as associated adverse effects.

Procedures

Active search for participants was carried out by distributing the questionnaire link through WhatsApp social media groups. Data collection occurred between July 2023 and March 2024.

Statistical Analysis

The R language, version 4.4.1, was used to create routines and generate descriptive statistics for the dataset, in addition to performing the main statistical tests.

Results

The study analyzed responses from 309 medical students, predominantly female (63.4%) and aged between 18 and 25 years (92.6%). The distribution among medical school cycles was balanced: Basic (35%), Clinical (33.3%), and Internship (31.7%) – Table 1.

For the interpretation of the results, the data obtained from the questionnaire were divided into groups: items related to knowledge; items related to opinions; items related to adverse events; and items related to the use of AAS among medical students. No significant differences were observed between sexes in the responses.

Regarding knowledge about AAS (Table 2), 89% of participants disagreed with the statement that AAS use promotes healthy muscle gain (p=0.5), while 69% believed that users are unaware of associated risks (p=0.8). Only 25% reported knowing the correct clinical indications for AAS prescription, with significant differences between cycles (p=0.008). The percentage was 15% in the Basic cycle, 30% in the Clinical cycle, and 32% in the Internship cycle, indicating greater familiarity with therapeutic indications among students at more advanced stages of the course and with greater exposure to medical practice; however, the fact that only one-quarter of the sample recognized the correct indications reflects significant gaps in medical education.

In terms of opinions on regulation and clinical use (Table 3), 73% agreed with Federal Council of Medicine Resolution No. 2.333/2023 prohibiting AAS use for aesthetic and performance purposes, although only 14% believed it would be effective. Additionally, 46% reported knowing physicians who prescribed AAS for non-therapeutic

purposes. This proportion showed a significant difference across academic cycles (p=0.003), with 35% in the Basic cycle, 46% in the Clinical cycle, and 59% in the Internship cycle, indicating greater exposure to controversial practices during the more advanced stages of medical training. Additionally, 73% of participants reported having observed the influence of public figures on social media promoting the use of AAS for inappropriate purposes, highlighting the popularization of these substances and the easy access to information lacking scientific basis.

The data presented in Tables 1 and 2 highlight the side effects considered most important by the study participants regarding AAS use in both men and women. Among male users, the most frequently reported effects were cardiovascular problems (82%), increased blood pressure (65%), and hepatotoxicity (56%). Mood changes and aggressiveness were also widely reported (57%), followed by testicular atrophy (45%), increased LDL cholesterol (31%), oligospermia (30%), and gynecomastia (22%).

Regarding females, the most frequently mentioned effects were cardiovascular problems (77%), increased blood pressure (54%), and hepatotoxicity (52%). Other commonly cited effects included dysphonia (47%), hirsutism (43%), mood changes and aggressiveness (40%), increased LDL cholesterol (37%), and clitoromegaly (38%).

These findings reflect important differences in risk perception between sexes. While cardiovascular problems were the most prominent effects reported in both groups, participants often expressed greater concern about virilizing characteristics in women using AAS, such as dysphonia, hirsutism, and clitoromegaly. In men, concerns related to fertility issues, such as testicular atrophy and oligospermia, were also noted, although to a lesser extent.

Regarding AAS use among medical students, a large proportion of the sample demonstrated awareness of these substances, particularly Trenbolone (72%) and Oxandrolone (71%).

Despite being aware of the potential adverse effects, one participant (0.3%) reported current use, and eight (2.6%) reported past use of AAS for aesthetic purposes, lean mass gain, and sports performance, with only one female among them. Additionally, 72 participants (23.3%) reported having considered using AAS for the same purposes. Within this latter group, 53 were men, representing 47% of the

Table 1: Sample.

Characteristics	n (%)
Sex	
Female	196 (63.4%)
Male	113 (36.6%)
Age	
18 - 25	286 (92.6%)
26 - 36	21 (6.8%)
> 36	2 (0.6%)
Medical School Cycle	
Basic (1st - 4th semester)	108 (35%)
Clinical (5th - 8th semester)	103 (33.3%)
Internship (9th – 12th semester)	98 (31.7%)
Total	309

Source: Elaborated by the authors.

Table 2. Items related to knowledge.

	Medical School Cycle				
Characteristics	**Basic**	**Clinical**	**Internship**	**Total**	***p***
The use of AAS promotes mass gain quickly, efficiently and healthily					0.5
Agree	15 (14%)	9 (8.7%)	10 (10%)	34 (11%)	
Disagree	93 (86%)	95 (91%)	87 (90%)	275 (89%)	
Individuals who use AAS for aesthetic and sports purposes are aware of their harmful effects on health / possible side effects					0.8
Agree	36 (33%)	30 (29%)	30 (31%)	96 (31%)	
Disagree	72 (67%)	74 (71%)	67 (69%)	213 (69%)	
Do you know the correct indications for prescribing AAS according to current scientific literature and the Brazilian Society of Endocrinology and Metabolism?					**0.008**
Yes	16 (15%)	31 (30%)	31 (32%)	78 (25%)	
No	92 (85%)	73 (70%)	66 (68%)	231 (75%)	

Source: Elaborated by the authors.

Table 3. Items related to Opinion.

Characteristics	N = 309	*p*
Do you agree with the Resolution No. 2.333/23?		0.6
Yes	226 (73%)	
No	83 (27%)	
Do you believe that Resolution No. 2.333/23 will be effective?		> 0.9
Yes	42 (14%)	
No	267 (86%)	
Do you believe that the use and effects of AAS are insufficiently discussed during medical school?		0.2
Yes	274 (89%)	
No	35 (11%)	
Have you ever seen a physician recommending these drugs for aesthetic or performance purposes?		**0.003**
Yes	143 (46%)	
No	166 (54%)	
If you have a social media account, have you come across public figures promoting the use of AAS?		0.4
Yes	227 (73%)	
No	82 (27%)	

Source: Elaborated by the authors.

male sample—a figure that reinforces the existing literature indicating that men are the population with the highest prevalence and desire for AAS use compared to women.

Regarding sources of access to these substances, participants mentioned medical prescriptions (6 cases), sales in gyms (1 case), and other sources (4 cases). A discrepancy was observed in the data, as 11 individuals disclosed their source of access to AAS, whereas only 9 admitted to using these drugs, suggesting possible underreporting by the participants.

Discussion

The results obtained in this study highlight significant gaps in medical students' knowledge about anabolic-androgenic steroids (AAS). Although most participants acknowledge the risks associated with AAS use, only 25% demonstrated knowledge of the correct clinical indications for these substances, with modest improvement in the more advanced stages of medical education. This finding reflects a medical education that, while increasing familiarity with clinical practice throughout academic cycles, still lacks specific and in-depth approaches on the topic.

The data also revealed relevant ethical concerns: 46% of students reported knowing physicians who prescribed AAS for non-therapeutic purposes, a proportion that increased significantly among those in the internship phase. This indicates that exposure to clinical practice may not only expand technical knowledge but also lead students to encounter controversial practices that may influence their ethical development.

It is worth noting that Brazil's National Health Surveillance Agency classifies anabolic steroids as controlled substances under category C5, requiring a controlled prescription, identification of the prescriber with a national tax ID number, and the inclusion of a diagnostic code from the International Classification of Diseases to justify the prescription[7,20]. The Federal Council of Medicine Resolution No. 2.333/2023 prohibits the use of hormonal therapies for aesthetic and performance-enhancing purposes, and several scientific medical entities have taken a stand against the abuse of these drugs for such ends[3,17-19].

Regarding participants' opinions, although 73% support the prohibition of AAS use, only 14% believe this measure will be effective. This reflects a widespread perception that regulations alone are insufficient to mitigate the problem. This skepticism may be related to the ease of access to these substances through both legal and illegal means and the role of social media in promoting unrealistic aesthetic standards and spreading misinformation.

Furthermore, the charts show that students recognize the most severe adverse effects of AAS, such as cardiovascular issues, but also express concern about sex-specific effects, including virilizing characteristics in women and fertility-related issues in men. This risk awareness contrasts with the reports of actual or considered use of AAS among the sample, reinforcing the need for educational strategies that address not only the biological effects but also the ethical and social aspects of AAS use.

Considering that cardiovascular problems were the most frequently reported side effects by both male and

female participants, it is important to emphasize that AAS use is associated with a significant increase in mortality from cardiovascular diseases. Several studies point to a strong correlation between AAS use and a higher risk of myocardial infarction, venous thromboembolism, arrhythmia, cardiomyopathy, and heart failure. However, the epidemiology of cardiovascular diseases among AAS users remains relatively underexplored[21].

Current literature highlights that even physically active individuals—typically considered less susceptible to cardiovascular disease—may develop severe complications due to AAS abuse. These findings underscore the substantial negative impact of AAS on cardiovascular health, highlighting the need for continuous, long-term medical monitoring to fully understand the spectrum of associated risks. A recent study conducted in Denmark showed an all-cause mortality rate 2.81 times higher in AAS users compared to non-users (p<0.001)[21]. In light of this, future initiatives must prioritize raising awareness among healthcare professionals about the cardiovascular risks of AAS use, enabling the development of effective preventive measures and personalized treatment strategies for this specific population[21].

The lack of responses in the "none of the above" option in questions regarding the most important adverse effects of AAS use in men and women suggests that participants widely acknowledge the risks of AAS use, regardless of sex. This may indicate a significant level of awareness about the potential adverse effects of these substances, even though their use remains a public health concern.

Supporting the finding that 89% of the sample believes AAS use and effects are insufficiently addressed in medical education, the results point to the need to revise the medical curriculum. Medical schools play a crucial role in training professionals capable of combating the aesthetic use of anabolic steroids by promoting an education based on awareness and an in-depth understanding of the associated risks. Incorporating courses that cover pharmacology, endocrinology, and public health, along with discussions on the physical, psychological, and social impacts of steroid use, can equip future physicians with the knowledge necessary to educate patients and society about the dangers of these practices. Moreover, encouraging communication and empathy skills enables professionals to develop effective strategies to address this issue in clinical settings, promoting healthy alternatives for achieving aesthetic goals and strengthening ethical commitment to health and individual well-being.

Among the main limitations of this study is its cross-sectional nature, which prevents the identification of causal relationships between the variables analyzed. Additionally, the use of an online questionnaire may have limited the sample's representativeness, as participation was restricted to individuals with internet access and willingness to respond. Response bias should also be considered, given the sensitivity of questions regarding AAS use, which may have led some participants to underreport or overestimate behaviors and perceptions. Lastly, the sample consisted predominantly of young individuals from a single academic institution, limiting the generalizability of the findings to other populations.

Conclusion

The study revealed significant gaps in medical students' knowledge and ethical training regarding AAS, as well as beliefs and perceptions that may influence their future practices. Despite the widespread acknowledgment of the risks associated with AAS use, familiarity with therapeutic indications remains limited, especially in the early stages of medical training.

The presence of controversial practices, such as prescribing AAS for non-therapeutic purposes, and the spread of misinformation through social media reinforce the importance of a more integrated medical curriculum that addresses not only technical aspects but also the ethical and sociocultural dimensions of AAS use.

It is concluded that medical education must be revised to include a more systematic approach to AAS, promoting greater awareness of their risks and strengthening the ethical commitment of future physicians. In addition, it is essential to implement educational strategies and public policies aimed at reducing the normalization of AAS use and lowering its prevalence among both healthcare professionals and the general population. Finally, future studies are recommended to adopt randomized or stratified sampling methods to improve sample representativeness and external validity, as well as to evaluate the impact of educational interventions on knowledge and medical practice related to AAS use.

Author's contributions

We describe contributions to the papers using the taxanomy (CRediT) provide above: *Conceptualization, Investigation, Methodology, Visualization & Writing – review & editing*: HLF Santos; G de M Dayrell; FCP Maia. *Project administration, Supervision & Writing – original draft*: HLF Santos; G de M Dayrell; FCP Maia. *Validation & Software*: FCP Maia. *Resources & Funding acquisition*: HLF Santos; G de M Dayrell; FCP Maia. *Data curation & Formal Analysis*: FCP Maia.

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References

1. Bond P, Smit DL, de Ronde W. Anabolic-androgenic steroids: How do they work and what are the risks? Front Endocrinol (Lausanne). 2022;13:1059473. DOI: https://doi.org/10.3389/fendo.2022.1059473.

2. Liu JD, Wu YQ. Anabolic-androgenic steroids and cardiovascular risk. Chin Med J (Engl). 2019;132(18):2229-36. DOI: https://doi.org/10.1097/CM9.0000000000000407.

3. Sociedade Brasileira de Endocrinologia e Metabologia (SBEM). Posicionamento da Sociedade Brasileira de Endocrinologia e Metabologia sobre o uso de Esteroides Anabolizantes e similares para fins estéticos ou para ganho de desempenho esportivo [Internet]. 2022; [access in 2024 Mar 3]. Available from: https://www.endocrino.org.br/wp-content/uploads/2022/09/Posicionamento-da-SBEM-Anabolizantes.docx.pdf.

4. Macedo C, Fioretti AMB. O abuso de esteroides anabolizantes como um grande problema social e de saúde pública. Rev DERC. 2020; 26(1):30-3.

5. Sagoe D, Molde H, Andreassen CS, Torsheim T, Pallesen S. The global epidemiology of anabolic-androgenic steroid use: a meta-analysis and meta-regression analysis. Ann Epidemiol. 2014;24(5):383-98. DOI: https://doi.org/10.1016/j.annepidem.2014.01.009.

6. Ganson KT, Hallward L, Cunningham ML, Murray SB, Nagata JM. Anabolic-Androgenic Steroid Use: Patterns of Use among a National Sample of Canadian Adolescents and Young Adults. Perform Enhanc Health. 2023;11(1):100241. DOI: https://doi.org/10.1016/j.peh.2022.100241.

7. Hohl A, Ronsoni MF, Meirelles RMR. Guia prático em endocrinologia feminina, andrologia e transgeneridade. 1. ed. Clannad; 2022.

8. Goldman AL, Pope HG, Bhasin S. The Health Threat Posed by the Hidden Epidemic of Anabolic Steroid Use and Body Image Disorders Among Young Men. J Clin Endocrinol Metab. 2019;104(4):1069-74. DOI: https://doi.org/10.1210/jc.2018-01706.

9. Pope HG Jr, Wood RI, Rogol A, Nyberg F, Bowers L, Bhasin S. Adverse health consequences of performance-enhancing drugs: an Endocrine Society scientific statement. Endocr Rev. 2014;35(3):341-75. DOI: https://doi.org/10.1210/er.2013-1058.

10. Smit DL, Bond P, de Ronde W. Health effects of androgen abuse: a review of the HAARLEM study. Curr Opin Endocrinol Diabetes Obes. 2022;29(6):560-5. DOI: https://doi.org/10.1097/MED.0000000000000759.

11. Abdullah R, Bjørnebekk A, Hauger LE, Hullstein IR, Edvardsen T, Haugaa KH, et al. Severe biventricular cardiomyopathy in both current and former long-term users of anabolic-androgenic steroids. Eur J Prev Cardiol. 2024;31(5):599-608. DOI: https://doi.org/10.1093/eurjpc/zwad362.

12. Horwitz H, Andersen JT, Dalhoff KP. Health consequences of androgenic anabolic steroid use. J Intern Med. 2019;285(3):333-40. DOI: https://doi.org/10.1111/joim.12850.

13. Windfeld-Mathiasen J, Heerfordt IM, Dalhoff KP, Andersen JT, Horwitz H. Mortality Among Users of Anabolic Steroids. JAMA. 2024;331(14):1229-30. DOI: https://doi.org/10.1001/jama.2024.3180.

14. Irwig MS, Fleseriu M, Jonklaas J, Tritos NA, Yuen KCJ, Correa R, et al. Off-label use and misuse of testosterone, growth hormone, thyroid hormone, and adrenal supplements: risks and costs of a growing problem. Endocr Pract. 2020;26(3):340-53. DOI: https://doi.org/10.4158/PS-2019-0540.

15. Handelsman DJ. Androgen Misuse and Abuse. Endocr Rev. 2021;42(4):457-501. DOI: https://doi.org/10.1210/endrev/bnab001.

16. Conselho Federal de Medicina (CFM). Resolução CFM nº 1.999/2012 [Internet]. 2012; [access in 2024 Feb 25]. Available from: https://sistemas.cfm.org.br/normas/visualizar/resolucoes/BR/2012/1999.

17. Sociedade Brasileira de Endocrinologia e Metabologia (SBEM). Posicionamento da Sociedade Brasileira de Endocrinologia e Metabologia sobre o uso de Esteroides Anabolizantes e similares [Internet]. 2024; [access in 2024 Apr 15]. Available from: https://www.endocrino.org.br/wp-content/uploads/2024/04/Comunicado-sobre-Esteroides-Anabolizantes-e-Similares.pdf.

18. Conselho Federal de Medicina (CFM). Carta de Brasília Pela segurança do paciente e contra o uso indevido de esteroides anabolizantes no Brasil [Internet]. 2024; [access in 2024 Apr 5]. Available from: https://www.endocrino.org.br/wp-content/uploads/2024/04/cartadebrasilia_forumanabolizantes.pdf.

19. Conselho Federal de Medicina (CFM). Resolução CFM nº 2.333/2023 [Internet]. 2023; [access in 2024 Feb 25]. Available from: https://sistemas.cfm.org.br/normas/visualizar/resolucoes/BR/2023/2333.

20. Ministério da Saúde (BR). Secretaria de Vigilância Sanitária. Portaria nº 44, de 12 de maio de 1998 [internet]. 1998; [access in 2026 Apr 16]. Available from: https://bvsms.saude.gov.br/bvs/saudelegis/svs/1998/prt0344_12_05_1998_rep.html.

21. Windfeld-Mathiasen J, Heerfordt IM, Dalhoff KP, Andersen JT, Andersen MA, Johansson KS, et al. Cardiovascular disease in anabolic androgenic steroid users. Circulation. 2025;151(12):828-34. DOI: https://doi.org/10.1161/circulationaha.124.071117.