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USE OF PSYCHOSTIMULANTS AND THEIR SILENT EFFECTS ON CARDIOVASCULAR HEALTH AMONG BRAZILIAN YOUNG ADULTS AGED 18 TO 25 YEARS

Uso de Psicoestimulantes e seus Efeitos Silenciosos na Saúde Cardiovascular entre Jovens Brasileiros de 18 a 25 Anos de Idade

Uso de Psicoestimulantes y Sus Efectos Silenciosos en la Salud Cardiovascular entre Jóvenes Brasileños de 18 a 25 Años

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ABSTRACT

The use of psychostimulants among Brazilian youth has intensified in recent decades, particularly in academic and professional settings characterized by high competitiveness and sleep deprivation. Although these substances are widely associated with improved cognitive performance, their cardiovascular effects, especially in subclinical forms, remain underrecognized in this age group. To analyze, through the scientific literature, the silent effects of psychostimulants on the cardiovascular system of Brazilian young adults aged 18 to 25 years, with emphasis on pathophysiological mechanisms and the main hemodynamic and structural alterations described. This is a narrative literature review conducted through searches in the PubMed, SciELO, and NCBI Bookshelf databases, including publications from 2020 to 2024. Observational studies, reviews, and clinically based articles addressing the medical and non-medical use of psychostimulants and their cardiovascular repercussions in young populations were included. Studies focusing exclusively on pediatric or elderly populations or on contexts not related to the cardiovascular system were excluded. The analyzed studies indicate a consistent association between psychostimulant use and persistent activation of the sympathetic nervous system, evidenced by increased blood pressure, elevated heart rate, reduced heart rate variability, and subtle electrocardiographic changes, such as QT interval prolongation. Imaging findings also suggest early signs of cardiac remodeling, including mild ventricular hypertrophy and increased arterial stiffness, even in young and apparently healthy individuals. The indiscriminate use of psychostimulants represents an emerging risk factor for the early development of subclinical cardiovascular alterations in Brazilian youth. These findings highlight the need for health education strategies, cardiovascular monitoring, and the promotion of rational use of these substances, as well as the encouragement of healthy lifestyle habits as long-term preventive measures.

Keywords: *Central Nervous System Stimulants; Cardiovascular Risk; Self-Medication; Young Adults; Blood Pressure; Public Health.*

RESUMO

O uso de psicoestimulantes entre jovens brasileiros tem se intensificado nas últimas décadas, especialmente em contextos acadêmicos e profissionais marcados por elevada competitividade e privação de sono. Embora amplamente associados à melhora do desempenho cognitivo, os efeitos cardiovasculares dessas substâncias, sobretudo em sua forma subclínica, permanecem pouco reconhecidos nessa faixa etária. O objetivo foi analisar, por meio da literatura científica, os efeitos silenciosos dos psicoestimulantes sobre o sistema cardiovascular em jovens brasileiros entre 18 e 25 anos, com ênfase nos mecanismos fisiopatológicos e nas principais alterações hemodinâmicas e estruturais descritas. Trata-se de uma revisão de literatura de caráter narrativo, realizada a partir de buscas nas bases PubMed, SciELO e NCBI Bookshelf, contemplando publicações entre 2020 e 2024. Foram incluídos estudos observacionais, revisões e artigos de base clínica que abordassem o uso médico e não médico de psicoestimulantes e suas repercussões cardiovasculares em populações jovens. Excluíram-se trabalhos com foco exclusivo em populações pediátricas, idosos ou em contextos não relacionados ao sistema cardiovascular. Os estudos analisados indicam associação consistente entre o uso de psicoestimulantes e a ativação persistente do sistema nervoso simpático, evidenciada por

elevação da pressão arterial, aumento da frequência cardíaca, redução da variabilidade da frequência cardíaca e alterações eletrocardiográficas discretas, como prolongamento do intervalo QT. Achados de imagem também apontam para sinais iniciais de remodelamento cardíaco, incluindo hipertrofia ventricular leve e aumento da rigidez arterial, mesmo em indivíduos jovens e aparentemente saudáveis. O uso indiscriminado de psicoestimulantes configura um fator de risco emergente para o desenvolvimento precoce de alterações cardiovasculares subclínicas em jovens brasileiros. Esses achados reforçam a necessidade de estratégias de educação em saúde, monitoramento cardiovascular e estímulo ao uso racional dessas substâncias, bem como o incentivo a hábitos de vida saudáveis como medidas preventivas de longo prazo.

Palavras-chave: Estimulantes do Sistema Nervoso Central; Risco Cardiovascular; Automedicação; Juventude; Pressão Arterial; Saúde Pública.

RESUMEN

El uso de psicoestimulantes entre jóvenes brasileños se ha intensificado en las últimas décadas, especialmente en contextos académicos y profesionales caracterizados por alta competitividad y privación del sueño. Aunque estas sustancias se asocian ampliamente con la mejora del rendimiento cognitivo, sus efectos cardiovasculares, particularmente en su forma subclínica, siguen siendo poco reconocidos en este grupo etario. Analizar, a través de la literatura científica, los efectos silenciosos de los psicoestimulantes sobre el sistema cardiovascular en jóvenes brasileños de 18 a 25 años, con énfasis en los mecanismos fisiopatológicos y en las principales alteraciones hemodinámicas y estructurales descritas. Se trata de una revisión narrativa de la literatura realizada mediante búsquedas en las bases de datos PubMed, SciELO y NCBI Bookshelf, incluyendo publicaciones entre 2020 y 2024. Se incluyeron estudios observacionales, revisiones y artículos de base clínica que abordaran el uso médico y no médico de psicoestimulantes y sus repercusiones cardiovasculares en poblaciones jóvenes. Se excluyeron trabajos centrados exclusivamente en poblaciones pediátricas o ancianas, o en contextos no relacionados con el sistema cardiovascular. Los estudios analizados indican una asociación consistente entre el uso de psicoestimulantes y la activación persistente del sistema nervioso simpático, evidenciada por el aumento de la presión arterial, la elevación de la frecuencia cardíaca, la reducción de la variabilidad de la frecuencia cardíaca y cambios electrocardiográficos sutiles, como la prolongación del intervalo QT. Los hallazgos de imagen también sugieren signos iniciales de remodelación cardíaca, incluyendo hipertrofia ventricular leve y aumento de la rigidez arterial, incluso en individuos jóvenes y aparentemente sanos. ***Conclusión:*** *El uso indiscriminado de psicoestimulantes representa un factor de riesgo emergente para el desarrollo temprano de alteraciones cardiovasculares subclínicas en jóvenes brasileños. Estos hallazgos refuerzan la necesidad de estrategias de educación en salud, monitoreo cardiovascular y promoción del uso racional de estas sustancias, así como el fomento de hábitos de vida saludables como medidas preventivas a largo plazo.*

Palabras clave: *Estimulantes del Sistema Nervioso Central; Riesgo Cardiovascular; Automedicación; Jóvenes; Presión Arterial; Salud Pública.*

1. INTRODUCTION

Psychostimulants constitute a class of substances capable of modulating central nervous system activity through interference with dopaminergic and noradrenergic systems, promoting increased alertness, attention, and wakefulness, in addition to effects on mood and cognitive performance.

These properties have led to the widespread use of these compounds both in therapeutic contexts, such as the treatment of Attention-Deficit/Hyperactivity Disorder and narcolepsy, and in non-medical settings, particularly among young individuals seeking to artificially enhance academic and professional performance.

At the global level, a significant expansion in psychostimulant consumption among young populations has been observed, driven by environments characterized by high competitiveness, productivity demands, and chronic sleep deprivation. In Brazil, this phenomenon parallels sociocultural and educational transformations that intensify performance pressure related to university entrance examinations, competitive civil service exams, and labor market integration, thereby favoring self-medication practices and unsupervised use of these substances.

Concurrently, the country is undergoing a demographic transition marked by population aging and the consolidation of cardiovascular diseases as one of the leading causes of morbidity and mortality. In this context, early exposure to cardiovascular risk factors during youth assumes strategic relevance for public health, as it may anticipate the development of chronic pathologies throughout the life course and increase the future burden on the healthcare system.

Scientific literature describes that psychostimulants exert their cardiovascular effects primarily through persistent activation of the sympathetic nervous system. Drugs such as methylphenidate and amphetamines increase synaptic availability of catecholamines, while caffeine acts as an antagonist of adenosine receptors, indirectly promoting enhanced adrenergic activity. These mechanisms are associated with increased heart rate, elevated blood pressure, and heightened myocardial excitability.

Observational studies and recent reviews indicate that, even in young and apparently healthy individuals, continuous or high-dose use of psychostimulants may be associated with subtle hemodynamic alterations, such as persistent tachycardia, increased blood pressure variability, and mild electrocardiographic changes, including QT interval prolongation.

Beyond functional alterations, investigations employing imaging techniques and autonomic markers suggest the presence of early signs of cardiac and vascular remodeling in frequent psychostimulant users, such as mild ventricular hypertrophy and increased arterial stiffness. Although these changes may remain asymptomatic for prolonged periods, they are recognized as predisposing factors for the future development of heart failure, coronary artery disease, and cerebrovascular events.

In the Brazilian context, this issue is exacerbated by factors such as widespread social acceptance of self-medication, informal access to controlled medications, and the frequent combination of psychostimulants with other substances, including energy drinks, alcohol, and nicotine. These behaviors contribute to increased cardiovascular overload and hinder early recognition of potential adverse effects, particularly among young populations who tend to underestimate health-related risks.

Despite the growing body of evidence regarding the cardiovascular effects of psychostimulants, much of the literature still focuses on acute outcomes or populations with preexisting comorbidities, with less emphasis on subclinical and silent alterations in healthy young adults. This gap limits the understanding of the true magnitude of the impact of early psychostimulant use on cardiovascular trajectories across the lifespan.

Therefore, it is necessary to deepen the analysis of the pathophysiological mechanisms and early cardiovascular manifestations associated with both medical and non-medical use of psychostimulants in young populations, particularly within the national context, which is shaped by specific social, cultural, and educational factors influencing consumption patterns.

Accordingly, the present study aims to analyze, through a review of the scientific literature, the silent effects of psychostimulants on the cardiovascular system in Brazilian young adults aged 18 to 25 years, highlighting the main underlying mechanisms, the hemodynamic and structural alterations described, and the implications for prevention and health monitoring strategies.

2. METHODOLOGY

This narrative literature review was developed with the aim of synthesizing current scientific evidence regarding the use of psychostimulants and their silent cardiovascular effects in Brazilian young adults aged 18 to 25 years. A comprehensive search strategy was designed to capture interdisciplinary evidence from the fields of cardiology, pharmacology, public health, and behavioral sciences, with particular emphasis on both medical and non-medical patterns of psychostimulant use.

Electronic searches were conducted in widely recognized scientific databases, including PubMed/MEDLINE, SciELO, and the NCBI Bookshelf, focusing on publications addressing psychostimulant use, methylphenidate, amphetamines, caffeine, energy drinks, autonomic regulation, blood pressure, heart rate variability, electrocardiographic changes, and subclinical cardiovascular outcomes. Controlled descriptors and keywords were combined using Boolean operators to refine the search strategy and enhance the relevance of the retrieved studies.

Original research articles, clinical and observational studies, as well as relevant narrative and systematic reviews published between 2020 and 2024 in Portuguese, English, and Spanish were included. Studies focusing exclusively on pediatric or geriatric populations were excluded, as were those that did not address cardiovascular outcomes, except when mechanistic contributions could be reasonably extrapolated to young adult populations.

No geographic restrictions were applied. Priority was given to studies discussing hemodynamic alterations, autonomic modulation, electrocardiographic findings, markers of early cardiac and vascular remodeling, as well as behavioral and environmental factors associated with psychostimulant use in academic and occupational settings.

Data extraction focused on identifying reported cardiovascular effects, proposed pathophysiological mechanisms linking psychostimulant exposure to sympathetic activation and autonomic imbalance, and clinical or subclinical outcomes related to the maintenance of cardiovascular health. Findings were organized thematically, allowing for an integrated and critical discussion of consumption patterns, underlying biological pathways, and implications for prevention and monitoring strategies in young populations.

3. RESULTS AND DISCUSSION

The studies analyzed in this review indicate that psychostimulant use among Brazilian young adults aged 18 to 25 years is consistently associated with persistent activation of the sympathetic nervous system, primarily reflected by elevated blood pressure and increased heart rate, even in individuals without a prior diagnosis of cardiovascular disease. These findings were observed both in users of prescription-controlled medications, such as methylphenidate and amphetamines, and in frequent consumers of caffeine and energy drinks, suggesting a shared physiological pattern of adrenergic hyperstimulation.

The reviewed literature demonstrates that subtle hemodynamic alterations, including borderline hypertension and persistent tachycardia, tend to manifest subclinically and are often detected only through ambulatory blood pressure monitoring and complementary examinations. This silent nature contributes to risk underestimation by users, who commonly associate cardiovascular diseases with older age groups.

Regarding pathophysiological mechanisms, the data indicate that sustained elevation of catecholamine levels—resulting from impaired reuptake and increased release of dopamine and norepinephrine—promotes peripheral vasoconstriction and enhanced myocardial contractility. This hemodynamic overload increases cardiac workload and chronically elevates systemic vascular resistance, creating a favorable environment for the progressive development of structural changes.

Among the reported electrocardiographic findings, subtle rhythm disturbances and QT interval prolongation stand out in frequent psychostimulant users. Although these changes are not always associated with immediate clinical symptoms, their presence is recognized as a predisposing factor for arrhythmic events, particularly when combined with other stimulating substances such as high-dose caffeine or alcohol.

Imaging studies and autonomic analyses included in this review suggest early signs of cardiovascular remodeling in young populations continuously exposed to these substances. The presence of mild ventricular hypertrophy and increased arterial stiffness, even at incipient stages, indicates that the effects of psychostimulants may extend beyond functional alterations to structural modifications with potential long-term impact.

From a behavioral perspective, the results highlight that consumption patterns are strongly associated with academic and professional environments characterized by high competitiveness, chronic sleep deprivation, and psychological stress. Recurrent use during examination periods, extended work hours, and intense cognitive demands contributes to the consolidation of a pattern of psychological dependence, characterized by progressive tolerance and gradual dose escalation.

Self-medication emerges as a central factor in national studies, facilitated by informal access to controlled medications and unrestricted consumption of over-the-counter stimulants. This practice increases exposure to cardiovascular risks in the absence of appropriate clinical supervision, hindering early detection of subclinical changes and the implementation of effective preventive measures.

When compared with international data, Brazilian findings are consistent regarding the main

mechanisms of cardiovascular toxicity but differ in the sociocultural context sustaining consumption. The normalization of stimulant use as a tool for academic and professional performance reinforces a scenario of collective vulnerability, in which cardiovascular health is frequently relegated to a secondary concern amid productivity demands.

From a clinical standpoint, the results suggest that young psychostimulant users constitute an emerging risk group for the early development of autonomic and hemodynamic dysfunction. Persistent tachycardia, elevated blood pressure, and alterations in heart rate variability may represent initial stages of a pathological continuum that, over time, favors the development of systemic arterial hypertension, coronary artery disease, and heart failure.

Monitoring strategies described in the literature—such as ambulatory blood pressure monitoring, electrocardiography, and 24-hour Holter monitoring in selected populations—proved particularly relevant for detecting silent alterations. These methods allow early identification of abnormal patterns that may not be perceived during routine clinical assessments, expanding opportunities for preventive interventions.

From a public health perspective, the findings reinforce the need for policies focused on health education and the rational use of medications, especially in university settings and workplaces with high cognitive demand. Awareness programs addressing the cardiovascular risks associated with unsupervised psychostimulant use may contribute to reducing self-medication and promoting safer strategies for managing stress and fatigue.

Despite the consistency of the analyzed data, this review identified important limitations in the available literature. There is a scarcity of longitudinal studies following young users over extended periods, as well as heterogeneity in the cardiovascular assessment methods employed. This methodological variability hampers direct comparison of findings and the definition of standardized risk parameters.

Another relevant aspect is the predominance of observational studies and secondary analyses, which limits direct causal inference between psychostimulant use and the development of structural cardiovascular alterations. The lack of controlled trials and prospective cohorts represents a significant gap in consolidating more robust evidence in this field.

Nevertheless, the biological plausibility presented across studies, combined with the recurrence of hemodynamic and autonomic findings, supports the interpretation that early and

prolonged psychostimulant use plays a relevant role in modulating cardiovascular health in young adults. This convergence of pathophysiological mechanisms and clinical data reinforces the importance of considering these compounds as emerging risk factors in the context of cardiovascular prevention.

Finally, the integrated results and discussion highlight that the impact of psychostimulants should not be understood solely from the perspective of cognitive performance, but also as a phenomenon of clinical and social relevance. Incorporating this topic into educational strategies, screening programs, and health policies may contribute to reducing future cardiovascular outcomes and promoting a more conscious culture of care among young populations.

4. CONCLUSION

This study allows the conclusion that psychostimulant use among Brazilian young adults aged 18 to 25 years represents a relevant factor in the early modulation of cardiovascular health, as the sustained sympathetic activation associated with these substances is directly related to the emergence of subclinical hemodynamic and autonomic alterations. In addressing the proposed objective, the findings demonstrate that even in the absence of overt clinical manifestations, these compounds can significantly influence cardiovascular physiological balance in young populations, underscoring the need for greater attention to this age group within preventive health strategies.

From a clinical and scientific perspective, the synthesized findings contribute to expanding the understanding of the silent effects of psychostimulants, highlighting their relevance as an emerging risk factor in academic and occupational contexts marked by high cognitive demand and self-medication behaviors. Incorporating this knowledge may support more targeted monitoring strategies, as well as educational actions aimed at the rational use of these substances and the promotion of lifestyle habits that preserve cardiovascular function over time.

As a perspective for future investigations, the development of longitudinal studies following young users over extended periods is warranted, allowing assessment of the progression of identified subclinical alterations and their potential conversion into clinical cardiovascular outcomes. Furthermore, standardization of hemodynamic and autonomic assessment methods may contribute to consolidating comparable parameters across different contexts and populations, thereby strengthening the evidence base in this field.

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