Adderall: The 'Smart Drug' That Isn't All That Smart

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Introduction

The rise in the non-medical use of stimulants like Adderall can be attributed to the increase in substance abuse by college students [1]. When taken in controlled doses, Adderall is safe for medical use. However, when taken in large doses by non-ADHD students, the effects may vary [2]. College students abuse this drug from the pressures of the academic environment under the assumption that this stimulant will promote attentiveness and improve cognition [3].

Background Information

Adderall is a stimulant primarily prescribed for ADHD. It improves focus, attention, and impulse control by increasing the number of monoamine neurotransmitters travelling between neurons, specifically dopamine, norepinephrine, and serotonin [4]. Adderall contains a mix of 75% dextroamphetamine and 25% levoamphetamine, chemicals that are mirror images of each other that work together to enhance Adderall's effects. Its polar structure, characterized by its amine group and benzene ring, shown in Figure 1, allows it to interact effectively with neurons [5]. Adderall increases the amount of monoamines between neurons in three ways. Firstly, Adderall inhibits a protein called vesicular monoamine transporter 2, disrupting neurotransmitter storage and promoting their release [7]. Secondly, Adderall blocks a protein called monoamine oxidase, preventing neurotransmitter breakdown [6]. Thirdly, Adderall stimulates a receptor inside the neuron to reverse the direction of monoamine transporters to make them push out monoamines instead of taking them back up. Overall, Adderall is an indirect agonist of monoamine release. Through inhibiting proteins and reversing transporter direction, Adderall increases the amount of dopamine, norepinephrine, and serotonin flowing between neurons. Although effective for medical use, chronic misuse can disrupt natural dopamine production, leading to dependency and withdrawal symptoms [4].

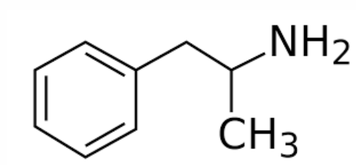

Figure 1: Chemical structure of amphetamine (Adderall).

Research Question

How does the non-medical use of Adderall (amphetamine) affect cognitive performance in healthy college students, and do these effects outweigh the negative consequences?

Methods

A literature review was conducted on the effects of the non-medical use of Adderall on college students. A systematic search on PubMed was done using search terms: ((Adderall) OR (amphetamine) OR (dextroamphetamine)) AND (ADHD) AND ((misuse) OR (illicit use) OR (non-prescription use) OR (non-medical use) OR (diversion)) AND (students). We narrowed this search to articles published in the past ten years, and 17 articles resulted. From these 17, we filtered down to seven journal articles based on if they discuss the target audience, post-secondary students, and mentioned side effects of Adderall side usage.

Results

Common symptoms observed in five research studies regarding the non-medical use of Adderall include weight loss, loss of appetite, insomnia, and heart complications, such as increased heart rate (shown in Figure 2) and blood pressure [1][8]. Additionally, there were mixed results on cognitive advancements; the three cases determined there was overall no enhanced cognitive performance [1][3][9]. However, two studies showed slight to moderate improvements in memory, attention, and recall [10][11]. While two other studies showed a decline in these areas after administration [2][8]. Decrease in working memory is exemplified in Figure 3. It is important to note that articles with improvement stated it could have been due to a placebo effect [3]. Participants believed their cognitive function would improve, and so it did.

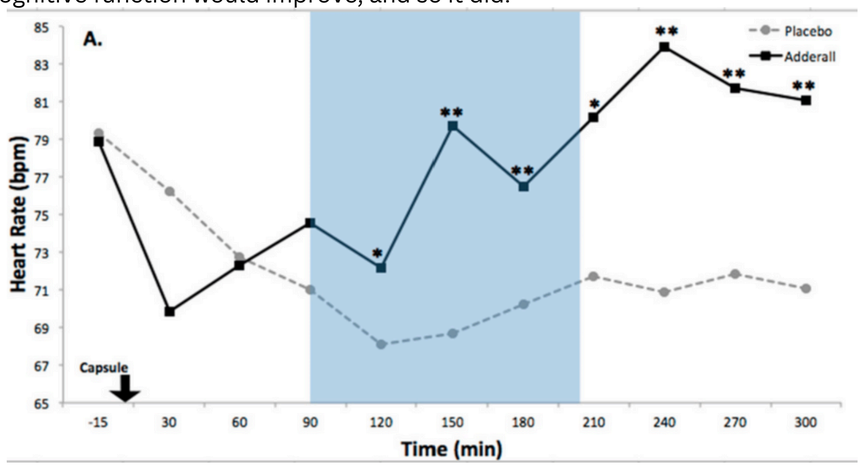

Figure 2: The effects of Adderall vs. a placebo on heart rate (bpm) over time after administration of capsule [8].

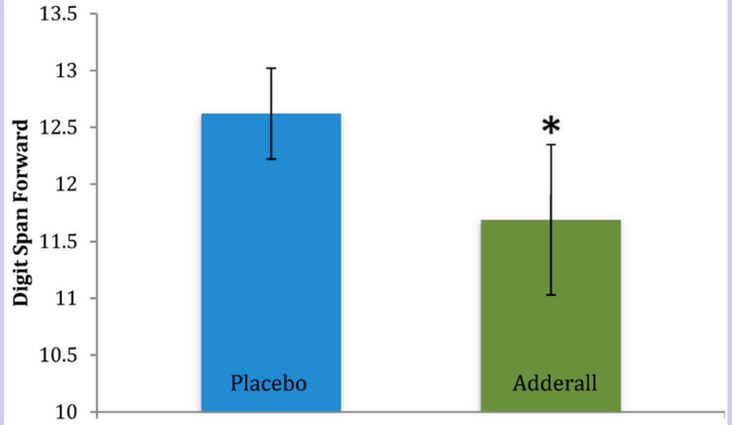

Figure 3: The effects of Adderall on working memory compared to a placebo. This was evaluated by the Digit Span Forward test which requires participants to remember a series of numbers and then recite it verbally in the same order [8].

Analysis and Conclusion

The effects of non-medical use (NMU) of Adderall (amphetamine) when compared to a placebo shows mixed results, but in most cases, there is negligible improvement in cognitive performance. The negative consequences of the NMU of Adderall, including cardiovascular complications, loss of appetite, and insomnia, heavily outweigh the insignificant neuroenhancements. To further investigate the cognitive effects and risks of the NMU of Adderall on college students, a more extensive study should be conducted with a larger sample size to obtain definitive results as most studies within this review had a small to intermediate number of participants.

Literature Cited

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