

# Amphetamines: Stopping ADHD or Maintaining Addiction

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**Abstract:** Extracted from the Ma-Hauge plant, Amphetamines have paradoxical usage in today's world. On one hand these are used in treatment of disorders like ADHD, narcolepsy and obesity and on the other their un-scrutinized usage by individual not only leads to structural changes in the brain but also causes psychological dependence. This review paper aims to bring to light the various effects-the good and the bad that are caused due to the amphetamine's usage. Also, this paper reviews the link between the medicinal usage and addiction of common amphetamine drugs. For the literature review, articles were collected from online databases such as EBSCO, ProQuest, Springer, PubMed, Jstor and Google Scholar. The literature search was done using keywords Amphetamines, MDMA, methamphetamine, Brain structures, Adderall, Ritalin.

**Keywords:** Amphetamines; MDMA; Methamphetamine; Brain Structures; Adderall; Ritalin.

## INTRODUCTION

Amphetamines belong to the class of drugs that stimulate the CNS resulting in an awareness, alertness and wakefulness. According to the Drug and cosmetic rules introduced in India in 1945, Amphetamines fall in the Schedule X class of prescription drugs that cannot be purchased over the counter without the prescription of qualified doctor. The legality and usage of amphetamine is different across the world; in some countries like Japan and South Korea, it is banned for even medicinal usage, while in US (Schedule 2 drug) and UK (Class B drug) it can be used for medicinal purposes only. This group also includes methamphetamine and MDMA both synthesized from amphetamine (1-methyl-2-phenethylamine), the first member of the group of compounds called amphetamines.

## EFFECT OF AMPHETAMINES

Amphetamines produce a lot of changes in the individual in varied areas. They act as cognitive enhancers, increase athletic abilities of individuals, prevent drowsiness and even work as an euphoriant.

According to the world drug report, in the year of 2004-2005, of the total treatment's seekers in India, 0.2% reported use of Amphetamines

(Murthy, et al., 2010). Due to the stimulating effect of this class of drugs, they are widely used for the treatment of ADHD, narcolepsy and obesity. Garrett, et al. (2015) in a study tried to see the effect amphetamines had on the variability of BOLD signal and cognitive performance on a working memory task (n-back) between young and old adults. They found that older adults met and some even exceeded young adult performance in BOLD signal variability levels. In another study by Colasanti, et al. (2012) found that the oral administration of amphetamine resulted in pharmacologically induced endogenous opioids release in different areas of the brain. Their sample consisted of 20 male participants thus they couldn't be generalized.

In all the studies that talk about the stimulating effect of amphetamines, there are a few studies that have pointed out the paradoxical nature of the psychoactive drug too. In older study by Tecce & Cole (1974) in found that thirteen of their 20 participants depicted the depressing effect of amphetamines. Even though it was a small sample, but significant differences between the participant results pointed that a better review needed to be done on the stimulating effect of amphetamines.

Use of amphetamines for recreation is a matter of concern because of its ability to produce psychosis called amphetamine induced psychosis in individuals (Farnia, et al., 2016). Patients with amphetamine psychosis showed altered brain

functions in their prefrontal cortex, temporal cortices and even some changes in the white matter tissue integrity. Review and research done along these lines by Robinson & Becker (1986) showed that in animals chronic AMPH (Amphetamine) treatment can produce two types of syndrome: AMPH neurotoxicity and behavioral sensitization. The first one, AMPH neurotoxicity is the hallucinatory like behavior due to amphetamine usage and behavioral sensitization refers to the progressive and enduring increase in the amphetamine induced behavior.

Long- and short-term recreational use of such drugs causes changes in the brain structure. Berman, O'Neill, Fears, Bartzokis, & London (2008) in a study compared brain volume of methamphetamine dependent young men, cocaine dependent men and men who did not use drugs using MRI. Results showed small amounts of temporal lobes primarily in the grey matter in individuals who abused methamphetamine and cocaine as compared to the control. Later, using high-resolution surface-based computational image analysis of structural MRI on 22 chronic methamphetamine users showed an average of 11.3% decrease in grey matter in the regions of cingulate, limbic and paralimbic cortices as compared with the control group.

## MEDICINAL USE AND ADDICTION

Amphetamines work by increasing the amount of dopamine and norepinephrine in the synapses of the neurons. This is accomplished in by increasing the release of dopamine, decreasing the uptake thus making these neurotransmitters available for longer times (Calipari, et al., 2013). This effect of the psychoactive drug is essential and is exploited in the treatment of ADHD. Some of the most common amphetamines used as medication include Dextroamphetamine, Levoamphetamine, Methylphenidate, Lisdexamfetamine, Adderall and Ritalin. These drugs can be used to treat ADHD, ADD narcolepsy and obesity but with this advantage comes a high price. They can not only have detrimental physical aspects to the individual like anxiety, paranoia, ulcer and insomnia but also cause psychological dependence in its users. In prescribed amounts, it can help in treatment of

ADHD but at the clinical use level maintaining balance is of utmost importance. When not taken for recreational use and in increased amounts it can cause increased blood pressure, aggression, tachycardia, headache, hyperactivity and insomnia but in large doses it can lead to hallucinations, paranoia, psychosis convulsion and kidney failure becoming life threatening to the user (Uddin, et al., 2017).

Adderall and Ritalin are known for the treatment of ADHD. Pelham, et al (1999) conducted the first ever investigation to assess the effectiveness of Adderall and Ritalin. They found that Adderall was more effective for children as the effect of Ritalin dissipate rapidly in comparison to Adderall and it was twice as potent as Ritalin. Rubia, et al. (2014) conducted fMRI on 20 adolescents who had ADHD and found that there is consistent increase insula activation which is an area responsible for cognitive control and also important regions in ADHD. Not only this, non-medicated use of psychostimulant drugs is also related with worse sleep quality and increased daytime sleepiness among users (Clegg-Kraynok, et al., 2011).

Using such medication in controlled dosage is helpful to control ADHD but may times individual misuse this to increase their concentration and ability to stay awake and alert. DeSantis & Hane (2010) conducted in depth interviews of 175 undergraduate students to understand how they understand their illegal use of ADHD stimulant drugs and the ways in which they justify their usage. This study resulted in interesting findings. These students justified their illegal usage of drugs by stressing over the fact that they are good 'prescription drugs' and not something dangerous bought off the street. Further, they believed that their actions were right as they were using it to increase their academic performance and not recreationally thus abdicating the blame and finally because their reasoning that they were using these drugs in moderation and thus they were being safe. One limitation of this study was that it just interviewed students from a particular region thus the generalisation cannot be done as the use of such stimulants can be different in different areas. In respect to the route of administration associated with the use of such drugs, Teter, McCabe, LaGrange, Cranford, & Boyd (2006) found out that

95.3% consumption was through oral administration of these illicit drugs with the illicit use of amphetamine-dextroamphetamine more than that of methylphenidate among college students.

Personality dimension of novelty seeking and sensation seeking also plays an important part in determining whether an individual will take up drugs or not (Kelly, et al., 2006). It was found that people scoring high on impulsive sensation seeking scale (SSS) of Zuckerman–Kuhlman personality questionnaire (ZKPQ) were vulnerable to abuse of amphetamines.

## CONCLUSION

Moderation is a word that can best describe the amphetamine usage. When this category of drugs is used in moderation, then they can be helpful and used as treatment medication. When we forget this key point then they can have harmful results. These drugs with their euphoric properties, alertness and enhancement qualities make it very easy to get addicted to them. They have prominent effect not only on the brain structures of individuals but also leave individuals with psychological dependencies. The use of these drugs as non-medicated psychostimulants is very common across the world in college age students because they increase alertness and concentration. Many students fall prey to this and leave colleges not only with their degrees but also with an addiction to amphetamines.

## REFERENCES

- [1] Berman, S., O'Neill, J., Fears, S., Bartzokis, G., & London, E. D. (2008, October). Abuse of Amphetamines and Structural Abnormalities in Brain. *National Institute of Health*. <https://doi.org/10.1196/annals.1441.031>
- [2] Calipari, E. S., & Ferris, M. J. (2013). Amphetamine Mechanisms and Actions at the Dopamine Terminal Revisited. *The Journal of neuroscience: the official journal of the Society for Neuroscience*, 33(12), 2923-2925. <https://doi.org/10.1523/jneurosci.1033-13.2013>
- [3] Clegg-Kraynok, M. M., McBean, A. L., & Montgomery-Downs, H. E. (2011). Sleep quality and characteristics of college students who use prescription psychostimulants nonmedically. *Sleep Medicine*, 12, 598-602. <https://doi.org/10.1016/j.sleep.2011.01.012>
- [4] Colasanti, A., Searle, G. E., Long, C. J., Hill, S. P., Reiley, R. R., Quelch, D., Rabiner, E. A. (2012, January). Endogenous Opioid Release in the Human Brain Reward System Induced by Acute Amphetamine Administration. *Biological Psychiatry*, 72(5), 371-377. <https://doi.org/10.1016/j.biopsych.2012.01.027>
- [5] DeSantis, A. D., & Hane, A. C. (2010). 'Adderall is Definitely Not a Drug': Justifications for the Illegal Use of ADHD Stimulants. *Substance Use & Misuse*, 45, 31-46. <https://doi.org/10.3109/10826080902858334>
- [6] Farnia, V., & Golshani, S. (2016). Substance Abuse Prevention Research Center. 2, 269-280.
- [7] Garrett, D. D., Nagel, I. E., Preuschhof, C., Burzynska, A. Z., Marchner, J., Wiegert, S., Lindenberger, U. (2015, April). Amphetamine modulates brain signal variability and working memory in younger and older adults. *Proceedings of the National Academy of Sciences*, 112(24), 7593-7598. <https://doi.org/10.1073/pnas.1504090112>
- [8] Kelly, T. H., Robbins, G., Martin, C. A., Fillmore, M. T., Lane, S. D., Harrington, N. G., & Rush, C. R. (2006). Individual differences in drug abuse vulnerability: d-Amphetamine and sensation-seeking status. *Psychopharmacology*, 189(1), 17-25. <https://doi.org/10.1007/s00213-006-0487-z>
- [9] Murthy, P., Manjunatha, N., Subodh, B., Chand, P., & Benegal, V. (2010). Substance use and addiction research in India. *Indian Journal of Psychiatry*, 52, 189-199. <https://doi.org/10.4103/0019-5545.69232>
- [10] Pelham, W. E., Aronoff, H. R., Midlam, J. K., Shapiro, C. J., Gnagy, E. M., Chronis, A. M., Waxmonsky, J. (1999, April). A Comparison of Ritalin and Adderall: Efficacy and Time-course in Children With Attention-deficit/Hyperactivity Disorder. *Pediatrics*, 103(4). <https://doi.org/10.1542/peds.103.4.e43>
- [11] Robinson, T. E., & Becker, J. B. (1986). Enduring changes in brain and behavior produced by chronic amphetamine administration: A review and evaluation of animal models of amphetamine psychosis. *Brain Research Reviews*, 11(2), 157-198. [https://doi.org/10.1016/0165-0173\(86\)90002-0](https://doi.org/10.1016/0165-0173(86)90002-0)

- [12] Rubia, K., Alegria, A. A., Cubillo, A. I., Smith, A. B., Brammer, M. J., & Radua, J. (2014). Effects of Stimulants on Brain Function in Attention-Deficit/Hyperactivity Disorder: A Systematic Review and Meta-Analysis. *Biological Psychiatry*, 76(8), 618-628. <https://doi.org/10.1016/j.biopsych.2013.10.016>
- [13] Tecce, J. J., & Cole, J. O. (1974). Amphetamine effects in man: paradoxical drowsiness and lowered electrical brain activity (CNV). *Science*, 185(4149), 451-453. <https://doi.org/10.1126/science.185.4149.451>
- [14] Teter, C. J., McCabe, S. E., LaGrange, K., Cranford, J. A., & Boyd, C. J. (2006). Illicit Use of Specific Prescription Stimulants Among College Students: Prevalence, Motives, and Routes of Administration. *Pharmacotherapy*, 26(10), 1501-1510. <https://doi.org/10.1592/phco.26.10.1501>
- [15] Uddin, M. S., Sufian, M. A., Kabir, M. T., Hossain, M. F., Nasrullah, M., Islam, I., Khanum, S. (2017, June). Amphetamines: Potent Recreational Drug of Abuse. *Journal of Addiction Research & Therapy*, 8, 1-12. <https://doi.org/10.4172/2155-6105.1000330>

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