

## The Good, Bad and Ugly of Memory Enhancing Drugs

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Received June 08, 2020; Revised June 10, 2020; Accepted June 12, 2020

### ABSTRACT

**Background:** Once an elderly lady came for consultation in my chamber and after she was done, she casually mentioned about her son who accompanied her saying that although he studies sincerely but finds it difficult to remember whatever he studies and requested me to suggest a memory enhancing pill for him. This posed a question whether there were actually any memory enhancing drugs available.

**Methods:** A thorough literature search was carried out in Pubmed and all articles till date related to memory enhancing drugs were searched with key words memory enhancing drugs, cognitive enhancement, Alzheimer's disease. Ethical, social and philosophical issues about memory enhancing drugs (MEDs) and anti-dementia drugs were analysed and health effects of these 'smart pills' were elaborated upon.

**Results:** There is a desire for quicker, sharper, and more reliable memories. Use of cognition enhancing drugs is an ethical dilemma and the safety of these drugs is yet to be proved.

**Conclusion:** Memory enhancement has a long way to go and memory enhancing drugs and anti-dementia drugs are of doubtful efficacy.

**Keywords:** Supracortical consciousness, Cognition, Cognitive faculty, Cognitive currency, Behavior, Attitude, Brain-as-sensor, Heart-as-sensor, Leadership, Deep Science

### INTRODUCTION

It is an irony that we tend to forget what we wish to remember and remember what we want to forget. Researchers, over the years, have increasingly and successfully understood the neurobiological basis of memory, trying their best to transmogrify memory enhancement- a theme for science fiction into reality. Milk has the reputation of sharpening memory since time immemorial because of the presence of phospholipids in the milk fat globule membrane [1]. Elderly people who go for regular, long walks give better results on memory tests conducted as compared to their sedentary peers [2]. A good sleep plays an important role in the consolidation of memories [3]. Studies have also claimed that amphetamines, sugar, caffeine, or herbal drugs enhances memory [4]. Cognitive deteriorations of aging in the form of Alzheimer's disease has initiated an exhaustive effort to look for drugs which can improve cognitive functioning. The quest for sharper and reliable memories made researchers hack the brain and pharmaceutical companies pursue drugs that might improve our capacity to remember [5]. Similar endeavours to enhance cognitive deficits following stroke have been investigated.

### DISCUSSION

#### Learning

Motor learning is defined as improvement of motor skills with repetitions, practise and re-practise.

#### Memory

Memory is associated with time perception, attention and emotional valence of memory contents. *Implicit* memory is the way we *act* such as how to ride a bicycle. *Explicit* memory is the conscious recollection of dates, numbers and events.

#### Mild cognitive impairment

It is defined as memory loss without any significant functional impairment [6] and most of these patients ultimately develop Alzheimer's disease.

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**Citation:** Sarla GS. (2021) The Good, Bad and Ugly of Memory Enhancing Drugs. *J Neurosurg Imaging Techniques*, 6(1): 323-326.

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### Alzheimer's disease

Alzheimer's disease is a consequence of increased life expectancy and is characterised by senile, progressive memory loss. Explicit memory is first hampered in Alzheimer's disease but affects implicit memory in advanced disease.

### Memory enhancing drugs

Memory enhancing drugs are cognition enhancing medicines being developed intended to help individuals with Alzheimer's disease, yet there is a colossal market for the utilization of memory enhancing drugs by individuals who just need to upgrade their memory instead of treating memory loss. This has triggered interest of pharmaceutical companies in marketing memory enhancing drugs stating improvement of cognition in healthy individuals and not merely in people with Alzheimer's disease considering the huge potential of the untapped market for it.

Modafinil is being tested for use by the military and has been shown to improve the simulator performance of helicopter pilots [7]. A study on the performance of airline pilots in flight simulators suggests that donepezil improves performance [8]. Caffeine has been used as a stimulant for at least a thousand years and is often consumed in extremely high dosages. The popularity of Starbucks may be due to the fact that a 16-ounce serving of its coffee contains 550 milligrams of caffeine which is approximately five times of that in a regular cup of coffee [9]. Nicotine in the form of cigarette and patch enhances cognitive abilities [10]. Amphetamines were extensively used by the armed forces in World War II and the Korean War [11].

### The ethical dilemma

Cognition enhancing drugs and performance enhancing drugs are the two branches of the same tree. If we can use of performance enhancing drugs in sports, shouldn't we do the same for cognition enhancing drugs to provide a level playing field and to ensure safety of the drug consumer. Won't it be unfair to allow use of cognition enhancing drugs in school exams and entrance tests or in the work place. The ethical issues related to the use of drugs may be fairness of their use, increased academic pressure and fears of coercion. However, use of cognition enhancing drugs by truck drivers who have to drive continuously for long hours and by shift workers who are sleep deprived is a point of debate.

### The social aspects

Cognition enhancement methods in the form of meditation and nutrition are better accepted in the society [12]. Adequate sleep and exercise also seem to be socially acceptable and prevalent methods of memory enhancement which parents tell their children about

[13]. Energy drinks like Red Bull, caffeine, or herbal drugs which are extensively available over the counter are labelled as soft enhancers [14].

### Future

Few researchers are of the opinion that cognition enhancement will be in vogue, a game-changer and harbinger of neurosciences in the years to come [15]. The reason for it might be increasing pressure at work due to increased competition and workload [16] leading to increasing use of such drugs by university students and teachers as success in academia depends on 'brainpower' [17,18].

### HARMFUL EFFECTS

The harmful effects of cognition enhancing drugs include arrhythmias, nausea, vomiting, sexual dysfunction, addiction, depression, sleep disturbances, anorexia, weight gain, hypertension, headache and personality changes [19]. The cost of the drugs may be disproportionately high as compared to the benefits they offer [20]. Overdosing by self-medication is common and these drugs may interact with other drugs which the patient might be consuming for some other ailment.

### ANTITHETIC

#### Smart pill

There is no scientific evidence to suggest that a 'smart pill' is available for use effectively and safely. Business journals have predicted that employers will press employees to pop-up smart pills on the job [21].

#### World Chess Federation

It is an irony that the Spanish Chess Federation forbids consumption of high levels of caffeine and at the same time permits the inhalation of unlimited amounts of aromatic nicotine outside the playing hall [22].

#### The musician

Listeners may criticize a musician who uses propranolol, a beta blocker drug that reduces performance anxiety even if the drug was used outside the competition [23].

#### Viagra

Medical insurance companies are paying for Viagra, the famous performance enhancing drug. How would they be able to object covering cognition enhancing drugs in their insurance scheme by the same logic [24]? After all, these magic pills are also the 'Viagra of memory.'

## CONCLUSION

There is a desire for quicker, sharper and more reliable memories. Adequate sleep, physical exercise in the form of regular, long walks, consumption of milk and coffee are the socially acceptable ways of cognitive enhancement. Caffeine, cocoa, energy drinks and nicotine are easily available substances for cognitive enhancement. Cognitive enhancing drugs were developed with the motive of helping patients with Alzheimer's disease who suffer from senile, progressive memory loss.

Memory enhancement has a long way to go and memory enhancing drugs and anti-dementia drugs are of doubtful efficacy. Use of cognition enhancing drugs is an ethical dilemma and the safety of these drugs is yet to be proved. But they will be in vogue shortly and prove to be a game-changer and harbinger of neurosciences in the years to come.

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