

Can Drugs Make You Smarter?

Nootropics are a class of drugs known as cognitive enhancers or smart drugs. These drugs have promises of enhanced concentration, boosted mental clarity, and overall improved mental performance. Some nootropics you have likely heard of before, including Adderall and Ritalin which have been proven effective at treating attention deficit hyperactivity disorder (ADHD) and narcolepsy. These synthetic prescriptions have undergone years of testing including numerous rounds of clinical trials before being approved by the Food and Drug Administration (FDA) for sale. In order to access these nootropics, you need a diagnosis and prescription from a doctor.

What about for healthy individuals who just want to improve their focus and memory without a visit to the doctors? Enter the readily available world of over-the-counter dietary supplements. Brands like Olly Nutrition have lines of dietary supplements dedicated to cognitive health, featuring products such as ‘Plant Power Focus’ and ‘Ultra Strength Brain Softgels’ that offer promises of supporting concentration, mental clarity, and healthy brain function [1]. These dietary supplements often contain ingredients such as vitamins, amino acids, or natural herbs believed to enhance memory and focus. There are two main problems with such dietary supplements. The first being that unlike Adderall and Ritalin which are prescription drugs, the FDA does not have the authority to test and approve of dietary supplements. That work lies in the hands of the manufacturers, whose main motive is to sell more products. The second problem is that of the ingredients that have been tested for improved cognition, they have often not been tested on young, healthy patients, the usual target of these supplements. Instead the supporting evidence often comes from studies on Alzheimer's patients or the elderly.

Nootropic dietary supplements have been on the rise for many years, with an expected growth of \$7.9 billion dollars by 2030 [2]. Many people are considering taking smart drugs, from college students to working professionals and those inbetween. The thought of taking one extra pill or gummy each day to have improved mental performance sounds enticing for many. The subreddit r/Nootropics has over 386,000 Members, with many posts asking about how to obtain certain nootropics [3], or questions about how to maximize the effects of nootropics [4]. Some people go as far as to call themselves ‘biohackers’, or someone who wants to gain ultimate control of their own biology [5], often using nootropics in combination with other methods such as fasting and cold exposure to unlock their ‘full brain power potential’. Proponents of nootropic dietary supplements include Dave Asprey, an author and pioneer for biohacking, and Ray Kurzweil, a well-known computer scientist [5]. Public figures like Asprey and Kurzweil help to fuel the public's perception of dietary supplement safety, often blurring the lines between real science and plain self-experimentation.

Beyond simply boosting mental performance, several other factors have influenced people's decision to take nootropics such as being concerned about cognitive decline with age [5], facing extreme pressure to be productive, or combating brain fog. Their close proximity to daily vitamins on the pharmacy shelves promotes a casual oversimplification of their potential harm. With all the available options on the market and a diverse array of individual motivations, a question still remains: should you be overlooking the safety risks and limited scientific evidence to prioritize a personal desire to obtain peak performance?

A study published in 2020 to the Journal of Alternative and Complementary Medicine investigated nootropic dietary supplements and their ingredients. They found that approximately

75% of the U.S. adult population regularly use dietary supplements, and among them about 22% of users have reported one or more adverse effects [6]. In addition, they cited research performed by Harvard School of Public Health which found that 72% of supplement users surveyed would continue to use their dietary supplements despite a negative governmental study, and that 78% of Americans view the dietary supplement industry as trustworthy, and the products as natural [6].

Ultimately, the study findings reveal a disconnect between American's perception and reality. They tested 12 nootropic dietary supplements and found that 8 of the 12 supplements tested had at least one ingredient listed on the supplement facts label not detected through analysis [6]. The discrepancy between label and ingredients raises concerns about whether consumers are even receiving the nootropic ingredient they are wanting to help with their cognitive function. Furthermore, in 10 of the supplements tested, they found ingredients that were not reported on the label. [6]. These ingredients were most often amino acids or preservatives, one such ingredient, adenosine, is not found in the FDA New Dietary Ingredient Notification database [6], violating the Federal Food, Drug, and Cosmetic Act which must permit adenosine to be sold as a dietary supplement before it can hit the market. Even more concerning, they found a mild stimulant, Sulbutiamine, which is on the FDA advisory list as it may cause miscarriages or harm in fetal development [6]. They found other nootropic dietary supplement labels were an outright lie, with one bottle explicitly labeled as decaffeinated, though caffeine was detected in the product [6]. This is especially risky for people with heart conditions, pregnant woman, and children who should keep their caffeine intake low.

The Department of Defense has established Operation Supplement Safety (OPSS) to help people make informed decisions on dietary supplements. This is a scorecard with seven criteria to assess the relative safety of dietary supplements, with a 'go' or 'no-go' rating [6]. Criteria include: Are there less than six ingredients on the supplement facts label, is the supplement facts label free of the words proprietary, blend, matrix, or complex, is there a third-party certification seal on the product bottle, among many others. Overall, 11 of the 12 products tested in this study are a definite 'no-go' according to the OPSS, and they conclude these 11 nootropic dietary supplements should be considered adulterated and misbranded [6].

One commonly used nootropic dietary supplement is apoeaquorin, it is the main active ingredient found in PrevaGen, a dietary supplement manufacturer [2]. Apoeaquorin is believed to bind to calcium in the brain, reducing build up which has been connected to Alzheimer's disease. However, the studies to support this are extremely limited. Very few clinical trials have been conducted and most of the information we know about apoeaquorin comes directly from the manufacturer PrevaGen, which only performed one randomized control trial [2]. This trial included 218 participants, and it is important to note their age ranges, from 40-91 years old. The trial consisted of a series of memory recall tests and the manufacturer determined statistically significant improvement in verbal learning and recall [2].

Apoeaquorin has not been tested by the manufacturer on 18-39 year olds, likely a major consumer of these dietary supplements. Nor did they conduct further trials to determine if their results were reproducible. The very front page of their website acknowledges that by writing "[results] based on a clinical study of subgroups..." [7]. One study, or as they refer to it, "a study" is not enough to prove effectiveness or to determine potential harmful side effects. Separate trials, not conducted by the manufacturer, found that apoeaquorin injected into rat hippocampus has been shown to be protective against Alzheimer's disease but the researchers

also noted oral ingestion of apoaequorin would not be able to cross the blood-brain barrier and thus would likely not produce any beneficial effects [2].

Another popular nootropic dietary supplement is citicoline, the drug form of choline. Choline is required for creating the neurotransmitter acetylcholine which plays a wide variety of roles in the brain [2]. Many adults do not consume the recommended daily intake of choline, but does that mean consuming citicoline will help boost their brain power? The results show some promise, but not for everyone. A randomized, double-blind, placebo-controlled trial of 100 participants ages 50-85 years old determined that the treatment group had statistically significantly higher scores on episodic and composite memory after consuming 500 mg/d of citicoline for 12 weeks [2]. The problems with this trial are the same problems brought up with Prevagen, the study sample is small, the age ranges are high, and follow-up studies are limited. Further research is needed to determine if the cognitive enhancements observed from citicoline could simply be replicated through the recommended daily intake of dietary choline alone.

It's easy to think that consumers of nootropic dietary supplements are ignorant or foolish for believing a pill or gummy can help promote cognitive function, but that is simply not the case. Consumers are not ignorant, instead they have been fed lies through carefully crafted marketing campaigns that make illegitimate promises of enhanced memory, focus, and mental clarity. Marketing for these products often includes cherry-picked studies, misleading statistics, and little to no scientific evidence from outside the manufacturer's own studies. Without FDA regulations, the public is left to try and decide what is fact or fiction, leaving them vulnerable to false claims and deceptive practices. With all the promises made by dietary supplement manufacturers, and with key players such as Ray Kurzweil and Dave Asprey promoting these products, it is easy to see why consumers gravitate towards nootropic dietary supplements and their promised benefits.

Works Cited

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