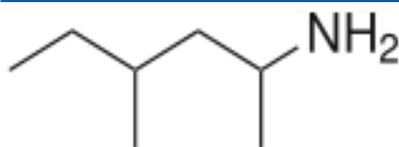


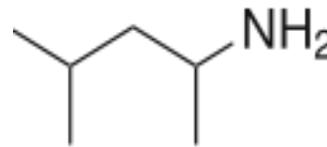
## DMAA



### Quick Facts

- DMAA: 1,3-dimethylamylamine
- 2-amino-4-methylhexane
- Methylhexaneamine
- Possible sources: *Geranium* and *Pelargonium*
- DMAA in the Shield Database: 122 products and 82 aliases

## DMBA



### Quick Facts

- DMBA: 1,3-dimethylbutylamine
- AMP: 2-amino-4-methylpentane
- Methylpentanamine
- Possible source: Pouchong tea
- DMBA in the Shield Database: 20 products and 12 aliases (and quickly growing)

## DMAA

DMAA (1,3-dimethylamylamine, methylhexaneamine, geranium extract and oil) was introduced in 1948 by Eli Lilly & Co. as a treatment for rhinitis and was removed from the market by the early 1970s. Currently, it is an unscheduled stimulant popular in pre-workout, weight loss, and performance enhancing dietary supplements. It is also frequently combined with ecstasy and other abused party drugs. DMAA is included on WADA's list of prohibited substances (1) as well as several other sports organization's banned lists. Although the US Food and Drug Administration (FDA) sent out letters to supplement manufacturers warning them to remove DMAA from their products in April 2013 (2), it is still easy to purchase dietary supplement products containing DMAA.

The exact mechanism of DMAA's action is poorly understood and no large clinical trials have been conducted to evaluate the pharmacology of or demonstrate the risks associated with taking DMAA. Numerous reported adverse clinical effects of DMAA include tachycardia, increased blood pressure, nausea, and vomiting. Some health professionals have estimated the vasoactive effects of DMAA to be greater than ephedrine but less than amphetamine. These effects are exacerbated when DMAA is co-administered with caffeine and other stimulants (3, 4). It is not rare to see DMAA mixed in dietary supplements with multiple other stimulants, increasing the risk to consumers.

DMAA containing supplements have been implicated as the causative agent in several serious adverse events including panic attacks, seizures, stress-induced cardiomyopathy (5), cerebral hemorrhage (4, 6), sudden cardiac death/cardiac arrest (7), acute liver injury and liver failure (8), nervous system, psychiatric disorders, and several deaths (9, 10).

Products containing DMAA are immensely popular among consumers and athletes as pre-workout supplements. For users, identifying an ingredient in a product as DMAA may be difficult since many

synonyms are used; there are 82 different aliases for DMAA listed in the Aegis Shield database. DMAA can be chemically synthesized. One of the most common forms of DMAA in dietary supplements is an extract of geranium plants. There is considerable debate, however, as to whether or not DMAA is naturally occurring in geranium plants (*Pelargonium graveolens* and other species) (6, 9, 11-13). Four of the five studies referenced here are peer-reviewed studies that have been unable to extract and detect DMAA from a variety of species of geranium flowers. It is of note that the one study that did detect DMAA in geranium plants was funded by a supplement company and was published in an open access journal.

## **DMBA (AMP citrate)**

As is the trend in the dietary supplement industry, when one ingredient is falling out of favor (in this case because of FDA oversight), a new ingredient is waiting to take its place. DMBA or AMP citrate (2-amino-4-methylpentane, 1,3-dimethylbutylamine, 4-methyl-2-pentanamine, methylpentanamine, Pouchong tea) is “the next DMAA.” This compound has a very similar chemical structure to DMAA and because of the structural similarities, the reported effects are similar to DMAA. AMP citrate has reportedly never previously been sold for human consumption (14). This compound is now frequently found in pre-workout and fat burning supplements at varying and unknown dosages and is commonly stacked with caffeine and other stimulants.

AMP citrate can be chemically synthesized. However, supplement manufacturers claim that it can be found in a Chinese tea called Pouchong; this has yet to be validated and experts doubt the claim. There are currently 12 aliases for AMP citrate in the Aegis Shield database. AMP citrate and Pouchong tea are the most common ingredient names for this compound. DMBA has never been studied in humans and its efficacy and safety of this DMAA analog are completely unknown (14).

Users report AMP citrate to be a strong central nervous stimulant that increases energy and focus. It has also anecdotally been reported to cause jitteriness, rapid heartbeat, dizziness, headache, and a crash after it has worn off. There are also reports of depression and anxiety with use. One website says, “If you have been looking for a DMAA alternative, this is as close as it will ever get.” Several popular supplement manufacturers have jumped on the AMP citrate trend and incorporated this ingredient into their pre-workout and weight loss products.

Because AMP citrate is a new ingredient there have yet to be any peer-reviewed studies assessing the pharmacology, toxicology, and safety of the compound.

As always, be sure to check with your physician or sports health professional before consuming or incorporating any dietary supplement into your daily routine.

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