



DMAA as a Dietary Supplement Ingredient

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Factors that may influence the likelihood that a provider will have this discussion include their understanding of the risks of medical imaging, the amount of time that is available with the patient prior to ordering a test, concerns related to prior false-negative imaging examination findings, and unfavorable outcomes related to a past approach to an incidentaloma. We found that most frontline providers in our study had very little training in the potential radiation risks from medical imaging and that these providers felt uncomfortable discussing the risks with patients. Alternatively, providers who feel comfortable may choose not to discuss the risks with patients for other reasons, such as relatively small perceived risk compared with the perceived benefits or time limitations. As further dialogue ensues about how to communicate with patients about the risks of medical testing, consideration should be given to the infrequency of these discussions in current practice. Future studies should investigate other potential reasons that providers are not engaging in these discussions and evaluate interventions to increase the frequency and efficacy of these discussions.

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Author Contributions: Drs Stickrath and Richlie had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Stickrath, Druck, and Richlie. *Acquisition of data:* Stickrath, Druck, and Hensley. *Analysis and interpretation of data:* Stickrath, Maddox, and Richlie. *Drafting of the manuscript:* Stickrath, Druck, and Hensley. *Critical revision of the manuscript for important intellectual content:* Stickrath, Druck, Hensley, Maddox, and Richlie. *Statistical analysis:* Druck. *Administrative, technical, and material support:* Stickrath, Druck, and Richlie. *Study supervision:* Stickrath, Hensley, Maddox, and Richlie.

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Online-Only Material: The eAppendix is available at <http://www.archinternmed.com>.

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DMAA as a Dietary Supplement Ingredient

The pharmaceutical amphetamine derivative 1,3-dimethylamylamine (DMAA) was introduced in 1948 as a nasal inhaler for rhinitis by Eli Lilly & Co. By the 1970s, it had been withdrawn as an approved pharmaceutical. Surprisingly, DMAA is currently used as an ingredient in roughly 200 sports supplements, many sold in major franchises throughout the United States, with sales topping \$100 million in 2010 alone (**Table**).¹⁻⁴

See also page 1035

For DMAA to be legally sold as a dietary supplement, it must be a naturally occurring substance with a documented history of use prior to 1994. Remarkably, the evidence to support the sale of DMAA-containing supplements hinges on a single study.⁵ In this 1 study, published in the now defunct *Journal of the Guizhou Institute of Technology*, geranium oil (extracted from the fresh leaves and stems of *Pelargonium graveolens*) was found to contain less than 0.7% DMAA based on a gas chromatography and mass spectrometry analysis. The researchers do not describe their methodology but presumably based their conclusions on matching an unknown peak spectrum of geranium oil with the library mass spectrum of DMAA. The appropriate confirmatory test, using a standardized preparation of DMAA to confirm its presence, was not described.

Since the publication of this study, more than a half-dozen peer-reviewed reports have been unable to confirm this finding.⁶ Health Canada, for one, has concluded that “there is no credible scientific evidence that DMAA is captured as an isolate of a plant.”⁶ This lack of evidence has not deterred multiple supplement companies from marketing DMAA as if it were isolated from geranium. For example, the popular Jack3d product (USPlabs) sold at GNC (General Nutrition Centers) is labeled as containing “1,3-dimethylamylamine (Geranium [Stem])” (label available from the author on request).

Table. List of DMAA-Containing Supplements Withdrawn From All Military Exchanges as of December 7, 2011¹

Supplement Proprietary Name	Manufacturer
Jack3d (tropical fruit and lemon lime)	USPlabs
OxyELITE Pro	USPlabs
Lipo 6 Black	Nutrex Research Inc
Lipo 6 Black Ultra	Nutrex Research Inc
Hemo Rage Black	Nutrex Research Inc
PWR Ultra Concentrated Pre Workout Revolution	iSatori Technologies LLC
Neurocore Powder	MuscleTech
HydroxyStim	MuscleTech
Lean EFX	Fahrenheit Nutrition
Napalm	Muscle Warfare
Nitric Blast	Sports Nutrition International
Biorhythm SSIN Juice	Exclusive Supplements
Code Red	MuscleMeds Performance Technologies
MethylHex4,2	SEI Pharmaceuticals
Arson Fat Burner Capsule	Muscle Asylum Project
Spirodex	Gaspari Nutrition

Given its wide availability, physicians should understand DMAA's potential health effects. Supplements containing DMAA have been implicated as potentially contributing agents in multiple serious adverse events, including panic attacks, seizures, stress-induced cardiomyopathy,⁷ and 2 deaths.² In Europe and New Zealand, DMAA use as a party drug has been implicated in at least 1 hemorrhagic stroke.⁸ Causality has yet to be proven, but these adverse effects are consistent with DMAA's known pharmacologic actions. In *The Dispensatory of the United States of America 1950 Edition*,⁹ DMAA's systemic toxic effects in animals was described as "greater than that of ephedrine and less than that of amphetamine,"^{9(p2049)} and the authors counseled that if DMAA's use as a nasal inhaler "produces side effects such as headache, nervousness, mental stimulation, or tremors, the drug should be discontinued."^{9(p2049)} Small trials have also demonstrated that DMAA-containing supplements increase blood pressure and heart rate.¹⁰

Last summer, Health Canada banned DMAA from all supplements,⁶ and last December, the US military removed DMAA-containing supplements from all military exchanges worldwide (Table).¹ In late April 2012, 6 years after DMAA had been introduced as a dietary supplement, the US Food and Drug Administration (FDA) sent warning letters to 10 manufacturers requiring them to provide evidence to support their conclusion that DMAA is a safe supplement ingredient.¹¹ Given that DMAA is a potentially dangerous ingredient and that manufacturers' claims that it is naturally derived are unsubstantiated, manufacturers and distributors should immediately recall all DMAA-containing supplements.

The extensive mainstream sales of DMAA combined with the FDA's delayed response expose the potentially serious public health risks entailed when consuming new supplement ingredients.

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Factors Associated With Serious Traffic Crashes: A Prospective Study in Southwest France

Drugs affecting driving ability (DADAs) directly¹⁻⁴ or by indicating at-risk diseases⁵ are classified in a 4-level standardized classification associated with a graded pictogram.⁶ A study in the French police database of crashes and in the national health care database showed an increased risk of being responsible in drivers exposed to level 2 or level 3 drugs⁷ but did not include information on sleepiness, the use of illicit drugs, or other occupational factors.

Our objective was to describe the factors associated with being responsible for a serious road crash and patient-reported use of labeled medicines.

Methods. All adult drivers hospitalized at least 24 hours (ie, a serious crash) in Limoges, Bordeaux, or Toulouse, France, in 2007 through 2009 were queried using structured questionnaires^{8,9} about the circumstances of the crash, use of medicines and drugs, and other risk factors (eg, alcohol, sleepiness at the wheel, sleep apnea, or concomitant diseases). Blood alcohol content was abstracted from patient files. Police reports provided responsibility for the crash. Exposure to risk factors, including medication, was compared between responsible