

Supplement Performance

By Anssi Manninen

Ephedrine, Caffeine and the Combo *Effects on Muscular Endurance*

Ephedrine is classified as a *sympathomimetic* drug and central nervous system stimulant. Its ability to act as a sympathetic agonist and increase thermogenesis (fat burning) has led to its use in weight loss/fat loss.¹ Ephedrine has also been coupled with both caffeine and aspirin to further enhance its effectiveness (i.e., ECA). Ephedrine stimulates release of norepinephrine, which stimulates the synthesis of prostaglandins by the activated tissues.¹ Aspirin inhibits the synthesis of prostaglandins and serves as a prostaglandin blocker, and thereby may prevent inhibition of norepinephrine release.¹ Further, as a central nervous system stimulant, it's used to reduce fatigue and increase alertness.

In most dietary supplements, ephedrine appears as an extract from one of two herbs: ephedra or Ma Huang. Ephedra species have a long tradition of use (more than 5,000 years) for respiratory ailments.² Unlike other herbs, active ingredients are well characterized and consist of ephedrine and related alkaloids (mostly ephedrine, pseudoephedrine, and norpseudoephedrine).² Recently, another herb, *Sida cordifolia*, was said to contain ephedrine alkaloids, but firm data on amounts are lacking, even from the supplier.²

It should be noted that the U.S. Olympic Committee (USOC) and the International Olympic Committee (IOC) prohibit use of ephedrine during competition. The ephedrines can be easily detected, like amphetamines, by extracting the urine with diethyl ether at pH 13 and by gas chromatography of the extract using a nitrogen-selective detector. However, IOC-accredited laboratories are advised to ignore small concentrations of ephedrines provided the pH and specific gravity of the urine is within normal limits.³

Latest Bell Study

There is growing body of evidence that combined ephedrine and caffeine ingestion improves performance.^{4,5,6,7,8} The latest paper was recently published by Dr. Douglas Bell and colleagues.⁹ The purpose of this study was to investigate the effects of ingesting caffeine, ephedrine and their combination on muscular endurance using a double-blind, repeated measures design. Ninety minutes after ingesting either caffeine (four milligrams per kilogram body weight [mg/kg]), ephedrine (0.8 mg/kg), a combination of caffeine + ephedrine, or a placebo, 13 male subjects performed a weight training circuit consisting of three supersets. Each superset consisted of the leg press followed by the bench press; two minutes of rest between supersets.

The trials involving ephedrine ingestion, when compared with the non-ephedrine trials (caffeine and placebo), showed ephedrine caused significant increases in the mean number of repetitions completed for both the leg-press and bench-press exercises, but only during the first supersets. Results indicated that the total weight lifted during all three sets was greater for the trials involving ephedrine ingestion.

The performance enhancement was attributed primarily to the effects of ephedrine; there was no evidence of an additive or synergistic interaction

between the caffeine and ephedrine. This finding contrasts with earlier research into the effects of caffeine + ephedrine on cycle ergometer exercise time to exhaustion at 80 percent maximal aerobic power⁹ in which the caffeine and ephedrine did appear to interact additively.¹²

The magnitude of the effect during the first set is highly significant for this type of exercise, considering it was induced only 90 minutes after ingesting caffeine + ephedrine. The 16 percent improvement in bench-press performance would otherwise be expected to require from four to about 12 weeks of strength training. However, as Dr. Bell and colleagues pointed out, these results should be considered in light of evidence suggesting a learning effect throughout the experiment. Nevertheless, results strongly support the conclusion that there was an ergogenic effect of the caffeine + ephedrine on this type of exercise.

The trials involving ephedrine ingestion caused significant increases in systolic blood pressure compared with non-ephedrine trials. However, the treatment did not affect diastolic blood pressure. Two subjects displayed extremely high hypertensive responses to the caffeine + ephedrine treatment. The subjects were otherwise normotensive, but had pre-exercise blood pressures of 204/90 and 214/112, respectively, 90 minutes after ingesting caffeine + ephedrine.

What About Side Effects?

According to Dr. Bell and colleagues, *“Our research should not be construed as advocacy for athletes or recreational fitness enthusiasts to use ephedrine or other ephedra alkaloid-containing (ECA) products. We acknowledge that there are serious risks such that demonstrated by the hypertensive responses observed in subjects in this study... It should be noted, however, that there is little, if any, scientific evidence that documents the associated health risks of acute or chronic use of C-E [caffeine + ephedrine] in prospectively designed studies.”*

For example, Dr. Boozer and colleagues at the New York Obesity Research Center recently published a paper examining long-term safety and efficacy for weight loss of an herbal Ma Huang and kola nut supplement.¹⁰ Authors concluded that in a six-month placebo-controlled trial, herbal ephedrine/caffeine (90/192 mg/day) promoted body weight and body fat reduction and improved blood lipids without significant adverse effects. However, it should be noted that weight loss trials frequently involve medical screening to detect pre-existing conditions, such as heart disease, that may predispose subjects to an increased risk of adverse effects. Whether persons taking ephedrine or ephedra without such medical screening have a similar risk of adverse events is unknown.¹¹

Between June 1, 1997 and March 31, 1999, the FDA received 140 reports of adverse events allegedly associated with the use of ephedrine-containing dietary supplements that contain, or were suspected of containing, ephedrine alkaloids.¹⁴ After review, FDA analysts felt there was a clear connection to ephedrine alkaloids in 60 of the cases, approximately one-third of which involved the cardiovascular system.

However, according to Dr. Steven Karch, *“The AERs [Adverse Event Reports] I have reviewed in this statement do not show that ephedra, when consumed in appropriate amounts, is causally related to the adverse events... FDA's literature review consists of many references that are either irrelevant or*

inappropriate to an analysis of the safety of ephedra products. Thus, the literature review's relevance in an analysis of the safety of ephedra products is questionable... In sum, my review of the above information leads me to a very different conclusion than that reached by FDA and its consultants, that ephedra products may be safely consumed when taken in accordance with the current national standards as reflected in the American Herbal Products Association trade recommendation for ephedra products.”¹⁴

Recently, *JAMA* meta-analysis concluded that ephedrine and ephedra-containing dietary supplements have modest short-term benefits with respect to weight loss and harms in terms of a two- to three-fold increase in psychiatric symptoms, autonomic symptoms, upper gastrointestinal symptoms and heart palpitations.

Since dietary supplements are not regulated for quality control the same way traditional pharmaceuticals are, the amount of active ingredients in ephedra-containing herbal products can vary tremendously. For example, Dr. White and colleagues determined the variability of ephedrine and pseudoephedrine among capsules from the same lot of Ma Huang.¹³ Although the label claimed each capsule contained 375 milligrams of Ma Huang per capsule, the amount varied from 368 to 411 milligrams.

Bottom Line

Ephedrine ingestion, either alone or in combination with caffeine, could lead to a significant increase in the number of repetitions that could be performed and the total amount of weight that could be lifted during weight training. However, ephedrine/ephedra is not for everyone and must be used responsibly. It is very important that you read product labels, warnings and cautions, and follow the directions.

SIDEBAR

Ephedra Products: Serving Limits, Warnings, Precautions

- Do not take more than 25 milligrams of ephedrine alkaloids per serving and not more than 100 milligrams per day.
- Consult a health care professional before consuming an ephedra-containing dietary supplement if you have heart disease, thyroid disease, diabetes, high blood pressure, depression or other psychiatric condition, glaucoma, difficulty in urinating, prostate enlargement, seizure disorder; or if you are using a monoamine oxidase inhibitor (MAOI) or any other prescription drug; or if you are using an over-the-counter drug containing ephedrine, pseudoephedrine or phenylpropanolamine (ingredients found in certain allergy, asthma, cough/cold and weight control products).
- Do not use ephedra products if you're under the age of 18. Do not use ephedra products if you are pregnant or nursing.
- Discontinue use and call a health care professional immediately if you experience rapid heartbeat, dizziness, severe headache, shortness of breath, or other similar symptoms.
- Exceeding the recommended serving will not improve results and may result in serious adverse health effects.

Source: *Ephedra Education Council, Washington, DC. www.ephedrafacts.com*

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