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FAQ on Caffeine and Energy Drinks

This answer is brought to you by many of the Australian nutrition professionals who regularly contribute to a nutrition email discussion group.

1. What do high-caffeine energy drinks consist of and why are those ingredients present?

The caffeine-containing energy drinks usually contain a wide range of ingredients, with different brands having similar, but not identical

formulations. One ingredient they all have in common is a form of sugar such as sucrose (table sugar) or glucose. Many also include a range of vitamins (especially B group vitamins). Some have amino acids (e.g. 'taurine') while herbal supplements such as Gingko biloba, Echinacea, Ginseng and St John's Wort are present in many. They also usually include guarana (a caffeine-containing extract from a South American plant). In the next five paragraphs the most likely reasons for the inclusion of these ingredients are discussed, together with an appraisal of their probable value (or otherwise) to health and fitness.

Sugar is present as a source of energy and also because it has an appealing taste. Sugar is rapidly digested and absorbed into the body, so the kilojoules of energy it provides are quickly made available for physical work. The inclusion of sugar in the drink is therefore sound from the physiological point of view.

B group vitamins are used by the body to release energy from food, but a well-balanced diet provides adequate intake of these vitamins, so they are probably not an important component of these drinks.

The rationale for providing amino acids (components of protein) such as taurine is unclear. It is believed that taurine plays a role in muscle contraction, especially in the heart, but the typical Australian diet is relatively high in protein, so few people are likely to be deficient in taurine.



Herbal supplements are often touted as providing health benefits, but there isn't much scientific evidence supporting most such claims. Also, the Therapeutic Goods Administration has warned that high intakes of these supplements can be harmful, and that some can interfere with the effectiveness of--or interact in harmful ways with--medicines.

Guarana is usually present in these drinks as the main source of caffeine. Caffeine is there as a 'stimulant', that is, to give a stimulus to both physical and cognitive (i.e. mental) performance. But a stimulant can be a 'double-edged sword'. As explained in detail below, excessive stimulation due to caffeine can have a detrimental effect not only on physical performance, but also on aspects of metabolism that influence health (such as blood pressure and heart rate).

2. How much caffeine do energy drinks contain and how does this compare with other caffeine-containing beverages?

The typical energy drink provides about 80 mg of caffeine per can (although this varies between brands). This is about the same as the amount of caffeine provided by an average strength cup of coffee, and about twice that in a cup of tea. It is also about twice the level of caffeine found in a can of carbonated, cola-flavoured soft drink.

3. What are the possible effects on health from the amount of caffeine in these drinks?

The caffeine level in most of these drinks is only equivalent to that in coffee, because many typical consumers are young--and quite high levels of consumption are common--there is at least the potential for health risks associated with energy drinks.

Many parents would not allow their young children to drink coffee or strong tea--because they know that these drinks contain caffeine--the same may not apply to energy drinks. For example, an Australian survey found that 27% of boys aged 8-12 had consumed high-caffeine energy drinks in the two-week period prior to the survey.

This may be at least partly because the quantity of caffeine isn't always stated on the label of energy drinks, and many people aren't aware of how much caffeine constitutes 'high-caffeine' anyway. Parents, guardians and other people in positions of responsibility (e.g. sports coaches) should be aware that young

children could have disturbed sleeping patterns, suffer bed-wetting and show symptoms of anxiety from ingesting the caffeine in just one can of energy drink. It is clear that pre teens should not consume high caffeine drinks and it is highly desirable to discourage their use by people in their early teens.

Some people are especially sensitive to caffeine, showing symptoms of caffeine sensitivity (tremors, sleep disturbances, gastrointestinal upsets) following consumption of relatively small doses of caffeine. Those who suffer these adverse reactions to caffeine-containing drinks such as coffee should not consume energy drinks. People with heart disease should avoid large intakes of caffeine. The sudden 'jolt' to metabolism caused by caffeine (which is a stimulant) can be enough to trigger a heart attack in people with pre-existing heart conditions. Pregnant women are also well advised to avoid high-caffeine beverages. During the first trimester (three months) of pregnancy, consuming as little as 100 mg of caffeine per day was associated with an increased risk of spontaneous abortion in studies conducted in Sweden.

Finally, these drinks are sometimes consumed in conjunction with alcoholic beverages. Even on their own, high-caffeine drinks will cause 'diuresis' (increased urine production). The combined effect of alcohol and caffeine will be to dehydrate people to an even greater extent than occurs with either caffeine or alcohol alone.

4. Do these drinks really provide a 'boost' to physical and/or cognitive performance?

There is no doubt that caffeine is an effective 'ergogenic aid' (enhances physical performance) and an aid to cognitive performance as it stimulates cardiac output and the central nervous system. Due to this, the International Olympic Committee (IOC) has banned its use above a certain level (as detected in the athlete's urine).

But as with so many substances, if a little is good, more is NOT better. In the Australian survey, some teenagers were reported to be consuming up to five cans of energy drink (up to ~400 mg of caffeine, depending on the brand) before sporting events. This is more than is needed to safely gain a boost to performance and carries with it a risk of increased blood pressure, anxiety, shaking, elevated heart rate and increased urine production (increasing the risk of dehydration).

[For more on the safe and effective use of caffeine to improve athletic performance, see the Appendix to this question].

5. Do these high-caffeine energy drinks have the same function in sport as 'sports drinks'?

High-caffeine energy drinks do not have the same role to play in sports as sports drinks (i.e. carbohydrate/electrolyte solutions). Caffeine is a stimulant, so it provides a short sharp boost to performance. On the other hand, sports drinks do not contain stimulants--only carbohydrate and salts (to replace those lost in sweat).

Also, the quantity of sugar present in energy drinks is often much higher (e.g. 10-12%) than in sports drinks (which are usually 6-8% sugar). High sugar concentration can slow absorption of water into the body, making these drinks unsuitable as rehydration drinks during prolonged and vigorous physical exercise. Sports drinks are the most appropriate hydration fluid during vigorous activity (especially if it is conducted in the heat). [For more information on suitable rehydration fluids see the FAQ on sports drinks in this series].

6. Can energy drinks be used as a satisfactory meal replacement?

Although high-caffeine energy drinks do provide some energy (in the form of sugar) and vitamins (some brands), this does not mean that they constitute a suitable meal replacement. They contain very little protein or minerals, and no dietary fibre. They are 'drinks', not meal replacers.

Summary

In summary, a can of high-caffeine energy drink generally provides about as much caffeine as a cup of coffee. When taken in small quantities (up to two or three cans per day) these drinks are as unlikely to be harmful to most adolescents and adults as drinking two or three cups of coffee.

There is convincing evidence that young children, caffeine-sensitive people, pregnant women and people with heart disease should avoid the high caffeine intakes that would result from consuming these drinks (or from consuming coffee).

Although caffeine does provide a boost to physical and mental performance, consuming many cans of these energy drinks shortly before physical activity is more likely to be detrimental than beneficial to athletes or other active people.

Recommended for further reading on caffeine

http://users.bigpond.net.au/allergydietitian/fi/fi_caffeine.html

Reference

Wahlquist, M.L. 1997 "Food and Nutrition - Australia, Asia and the Pacific", Allen and Unwin Pty Ltd, NSW.

APPENDIX: Caffeine as an 'ergogenic aid' to athletic performance

An ergogenic aid is a substance or technique that improves physical performance. Caffeine is an effective ergogenic aid, particularly for athletic events that involve endurance (e.g. marathon running, triathlon, long distance swimming). Caffeine has been shown to increase the use of fat as an energy substrate, thereby sparing glucose. For athletes who do choose to consume caffeine as an ergogenic aid, it is important to remember that there is a limit to the amount an athlete may consume before breaching the rules of the International Olympic Committee (IOC). Also, as noted in the main body of this FAQ, excess caffeine intake can lead to impaired performance.

The amount of caffeine an athlete can consume safely, and that may induce a performance enhancement, will vary according to previous history of caffeine intake, body size, concurrent intake of other caffeine-containing products, and the timing of consumption in relation to the athletic activity. Many athletes who consume caffeine beverages are unaware of their individual acceptable level of intake. An ergogenic benefit for endurance performance can be expected at a moderate intake (3-5 mg caffeine/kg body weight) with a very low risk of being tested above the acceptable IOC level for urinary caffeine concentration (which must not exceed 12µg/mL). For a 60-70 kg athlete, 3-5 mg caffeine/kg body weight corresponds to about three cups of coffee or three cans of caffeinated energy drink (assuming 80 mg of caffeine per can). Caffeine concentration in the blood peaks about 2-4 hours after caffeine consumption, so the caffeine boost is likely to be maximal when needed if the caffeine beverage is taken shortly before the endurance athletic event (e.g. 1-2 hours prior to the start).

A higher caffeine intake will not cause any greater performance benefit. In fact it may produce an illegal urinary level of caffeine and/or negative side effects. With many energy drinks having a high caffeine content, and often not being clearly labelled, the risk for excess intake of caffeine is likely to be high particularly for small or younger athletes.

The advice in this Appendix should not be construed as a recommendation to an endurance athlete to take caffeine to improve performance. Rather, if you do take caffeine, the advice is intended to minimise the risk of taking excessive quantities.

[Back to Frequently Asked Questions Index](#)

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