

Lifestyle & Culture

Caffeine – Wakes or breaks?



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Coffee was primarily discovered in the ancient coffee forest on the Ethiopian plateau in the 15th century. Coffee arrived in Europe in the 17th century and spread to other parts of the continent. Coffee contains caffeine, which is a psychoactive stimulant of the central nervous system. The caffeine content of seeds of different coffee species varies from 0.4 to 2.4% dry weight. Enzymes that break down caffeine are partially hereditary, therefore this may affect individuals differently. Caffeine works via short-term preventing tiredness and enhancing focus. Various amounts of this may be discovered in cola, tea, coffee, cocoa and chocolate. Along with alcohol and nicotine, caffeine is one of the top three mood-altering drugs used globally. A table displaying caffeine levels in various beverages consumed on a daily basis are shown below:

| Caffeine content per cup size | | |
|-------------------------------|--------|----------------------|
| Cups of coffee | ml | Caffeine level |
| One cup | 237 ml | 80-100mg of caffeine |

Caffeine content of different types of coffee drinks

| | | |
|---------------|-------|-----------|
| Espresso | 30ml | 64 mg |
| Cold brew | 237ml | 250 mg |
| Latte | 240ml | 64-126 mg |
| Mocha | 240ml | 70-140 mg |
| Decaf coffee | 237ml | 2-15 mg |
| Hot Chocolate | 237ml | 19mg |
| Green Tea | 237ml | 20mg |

Caffeine content of selected common foods and drug products

| | | |
|--------------------|---------------|-------|
| Chocolate | One bar (43g) | 31 mg |
| Soft drinks | 350ml | 34mg |
| Caffeine tablets | One tablet | 200mg |
| Black tea (brewed) | 230ml | 47mg |
| Red Bull | 237ml | 80mg |
| Can of cola | 237ml | 40mg |

Caffeine enters the circulation immediately after consumption and is entirely absorbed by the digestive system. The blood concentrations of caffeine reach its peak within the first hour to hour-and-a-half of consumption. From there, the substance is distributed throughout the



Photo: AI-generated images created by Prof. Blundell

body, it is able to cross the blood-brain barrier, enter the amniotic fluid and reach the foetus as well as infiltrating the breast milk and semen. The liver is where caffeine is metabolised most effectively.

There are possible risks of negative effects which may be brought about by increased daily caffeine consumption including general toxicity, cardiovascular effects, effects on bone status and calcium balance, behavioural changes, increased cancer risks and effects on male fertility.

General toxicity

The acute lethal dose in a 65kg adult has been estimated to be 10g/person. Death induced by excessive caffeine ingestion is rare, however there were cases which reported death after the ingestion of 6.5g caffeine, but survival of a patient who allegedly ingested 24g caffeine was also reported. Common clinical symptoms in caffeine toxicity ranging from nervousness, irritability and insomnia to sensory disturbances, diuresis, arrhythmia, tachycardia, elevated respiration and gastrointestinal disturbances.

Cardiovascular

Studies have shown that drinking coffee reduces the heart rate (when consumed in amounts greater than 150mg per person), increases total and low-density lipoprotein cholesterol levels (bad cholesterol) and increases systolic (by 5–15 mmHg) and/or diastolic blood pressure (by 5–10 mmHg) in adults of both sexes, regardless of age, race, blood pressure status or habitual caffeine intake. Numerous studies indicate that drinking more than four cups a day increases the risk of coronary heart disease or death, nevertheless, more research is needed in this area. According to the information currently available, moderate caffeine use (four or less cups of coffee per day or less than 400mg caffeine per day) has no negative effects on cardiovascular health.

Bone status and calcium balance

After a 10-hour fast, caffeine consumption (150-300mg) increase urine calcium excretion 2-3 hours later in both teenage males and women. The kidneys excrete more calcium as a result of caffeine.

A particular study showed healthy premenopausal women between the ages of 35 and 44 who consumed 400mg of caffeine per day for 19 straight days had signs of altered bone remodeling, but had no effect on fractional calcium absorption, endogenous fecal calcium or urine calcium excretion. While use of 150-300 ml of coffee per day (112-224mg of caffeine per day) would have minimal effect on calcium balance, consumption of more than 1000 ml of coffee per day (760mg of caffeine per day) may cause excessive calcium loss. This effect in calcium depletion potentially increases the risk factors for bone fractures.

Behavioural changes

According to research, drinking more coffee is associated with improved verbal memory, visuospatial thinking and response speeds. It was discovered that drinking five to six cups of tea or coffee daily had the best outcomes in alertness.

Some studies have found that single doses of caffeine between 32 and 200mg had little to no impact on mood; greater doses of caffeine, however, have been associated with decreased ratings for tiredness and incoordination as well as minor increases in hostility, anxiety and rage. Moderate caffeine use in healthy adults has not been associated with any substantial detrimental effects on mood or performance and most adverse effects from higher consumption rates would be self-limiting.

Cancer

There are trace amounts of the chemical acrylamide in roasted coffee beans and since it cannot be eliminated from

coffee, drinking it exposes you to the chemical. Acrylamide can be toxic in excess, thereby raising the chance of developing cancer. It's crucial to realise that there is no evidence linking acrylamide in coffee when taken in moderation, to an increased risk of cancer in people. For laboratory animals, the quantity of acrylamide that causes cancer is far higher than what humans receive from coffee. Caffeine is not anticipated to be a human carcinogen; statistics suggest that levels below five cups of coffee per day (500mg caffeine per day) do not raise the risk of cancer. More study, however, is needed in this area. Individual studies have shown that coffee consumption decreases the risk of endometrial and liver cancer and it can be an excellent source of antioxidant protection.

Human fertility

Females

Numerous biological reasons might account for how coffee delays conception. The use of caffeine has been associated with endometriosis or tubal disease, a lengthened tubal transit time, changed hormone levels (including oestradiol) and a reduced viability of the fertilized ovum. Epidemiological studies indicate that caffeine usage at dose levels of >300mg per day may reduce fecundability in women who are fertile, but there are many debatable research in this area.

Males

Based on the limited data, it has been found that caffeine consumption at dosages more than 400mg per day may decrease sperm motility and/or increase the proportion of dead spermatozoa (only in heavy smokers), but it is unlikely to have a detrimental effect on male fertility in general.

Further studies are carried out in view of the controversial findings on the involvement of caffeine in miscarriages, foetal development and the increased risk in preterm delivery. A consensus in the studies highlight that a caffeine consumption >300mg/day during pregnancy may interfere with fetal growth

Conclusion

A regular moderate coffee intake was linked with a reduced risk of developing dementia, Alzheimer's, Parkinson's and type 2 diabetes. Studies show that for a moderate caffeine consumption, the adult population may consume up to 400mg of caffeine per day (equivalent to 6mg/kg in a 65kg adult). It is recommended that reproductive-aged women should drink less than 300mg of caffeine per day (equal to 4.6mg/kg in a 65kg individual). The American Academy of Pediatrics advises against children and teenagers consuming coffee and other stimulants since the FDA has not established a limit for them. This will inevitably reduce the risks of harm by caffeine use.

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