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from the institute for scientific information on coffee

coffee & health topics

Intended for professional audiences

Fluid balance

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1. Summary

- The study of the effect of coffee, and caffeine, on fluid balance is split into two areas: caffeine intake during exercise and caffeine intake at rest in the general population.
 - In normal life activities, caffeine consumption does not lead to dehydration, according to the latest research.
 - Studies conclude that during exercise, moderate caffeine consumption is beneficial for endurance performance and does not contribute to dehydration.
- Advice to abstain from drinking moderate amounts of caffeinated coffee in order to maintain adequate fluid balance is unfounded.
 - Coffee drinking in moderation contributes to our fluid intake and does not lead to dehydration. Black coffee contains more than 95% water.
 - While there may be a mild, short-term diuretic effect of caffeine, this effect is not strong enough to outweigh the benefits of fluid intake from coffee consumption.

2. Coffee, caffeine and hydration in the general population

No increase in urinary excretion in regular caffeine consumers

- A 1997 study¹ reported a significant increase in volume of urine excreted in individuals drinking coffee, compared with those drinking an equivalent amount of water. The subjects in this study had abstained from consuming any caffeine for five days prior to the treatment, effectively making them 'caffeine naive'. This more pronounced effect on urinary excretion following re-introduction of caffeine is well-documented.
- More recent, robust studies^{2,3} have failed to find any effects on urinary excretion and weight change in subjects using caffeinated beverages at different levels of caffeine intake.
- A further literature review⁴ concluded that short-term stimulation of urine output will occur in individuals who have been deprived of caffeine, when given fairly large doses in one sitting (at least 250-300mg caffeine equivalent to the amount found in 2-3 cups of coffee or 5-8 cups of tea). However, it appears that a tolerance to caffeine develops, and these effects are diminished in individuals who regularly consume moderate amounts of tea or coffee.

Caffeinated beverages contribute to daily fluid intake

- In a review of the literature⁵, a Beverage Guidance Panel in the U.S. has stated that caffeine consumption of up to 500mg/day (the equivalent amount found in approximately 5 cups of regular coffee) does not cause dehydration.
- Similarly, proceedings⁶ from a conference in North America advise consumers that drinking a variety of caffeinated beverages, including coffee, can contribute to meeting the body's requirement for fluids. Indeed, black coffee contains more than 95% water.



3. Caffeine, hydration and exercise performance

No evidence of any detrimental effects of caffeine on exercise performance

A 2002 comprehensive review of the literature on caffeine and fluid balance during exercise⁷ concluded that a daily intake of 300mg of caffeine (the amount found in approximately 3 regular cups of coffee) may have a mild, short-term diuretic effect similar to that of water, with no significant effect on overall fluid balance. Additionally, the authors found no evidence for any detrimental effects of caffeine on hydration during exercise in hot climates. They concluded that advice to avoid caffeinated beverages before, and during, exercise are unfounded.

A more recent survey⁸ found no contribution of moderate levels of caffeine (less than 300mg) on dehydration, either at rest or during exercise, and suggests that similar conclusions can be drawn for caffeine's long-term effects.

Caffeine beneficial in endurance exercise

The evidence shows that caffeine ingestion in moderate quantities is beneficial for sports performance for endurance athletes^{9,10}. Additionally, a 2010 review¹⁰ does not support claims that caffeine induces diuresis during exercise.

Caffeine does not adversely affect temperature regulation

Several factors can reduce heat tolerance during exercise in hot environments. Reviews of the effects of caffeine¹¹ show no evidence that caffeine induces chronic dehydration, or negatively affects temperature regulation, in hot environments.

4. Conclusion

Scientific evidence shows that moderate consumption of caffeinated beverages, including coffee, does not lead to dehydration. Advice to abstain from drinking moderate quantities of caffeinated coffee, because of potential negative effects on fluid balance, is unfounded. Current advice states that caffeinated beverages, including coffee, can contribute to daily fluid intake.



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