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coffee & health topics

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Sports performance

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1. Summary

- Any effects of coffee consumption on sports performance are linked to the caffeine in coffee, rather than to coffee per se.
- There is clear evidence that caffeine can be an ergogenic aid, i.e. a substance that improves the capacity to do work or exercise:
 - The effect is most evident in endurance (aerobic) sports. Caffeine appears to help athletes reduce the amount of time it takes to run, cycle or row a set distance as well as reduce muscle pain.
- Although caffeine also appears to improve performance in certain types of short-term, high intensity (anaerobic) exercise in specific groups. e.g. in trained athletes performing intermittent exercises or team sports, the overall evidence on the effect of caffeine on short-term, high-intensity activities remains inconclusive.
- Caffeine most likely exerts its effect via a pathway that leads to an increased production of adrenalin, which stimulates energy production and improves blood flow to the muscles and heart.
- Caffeine may modulate fatigue and influence ratings of exertion, perceived pain and energy levels, all of which are likely to lead to improvements in performance.
- The International Society of Sports Nutrition issued a position statement on caffeine supplementation and sports performance in 2010 which summarizes the evidence to date.

2. Caffeine and performance in endurance (aerobic) exercise

Caffeine has been shown to improve performance in individuals taking part in endurance-type, aerobic exercise.

Caffeine linked to faster times in endurance races

A recent review of 33 trials¹ in which subjects had to run, cycle or row a set distance saw faster times recorded over the distance in individuals who consumed caffeine. This effect was seen in individuals taking moderate quantities of caffeine (3-6mg/kg body weight) before and/or during exercise.

In addition, the European Food Safety Authority (EFSA) recently stated that a cause and effect relationship has been established for caffeine intake and increased endurance performance (3mg/kg body weight 1 hour before exercise), endurance capacity (3mg/kg body weight 1 hour before exercise), and a reduction in perceived exertion (4mg/kg body weight 1 hour before exercise)².

Caffeine may help reduce muscle pain

Muscle pain during exercise can impinge on performance. Caffeine ingestion of 5mg/kg body weight has been found to reduce muscle pain in a group of subjects carrying out 30 minutes of high-intensity cycling, compared to another group who had not consumed any caffeine³.



3. Caffeine and performance in short-term high-intensity (anaerobic) exercise

Although there is some evidence pointing to positive effects of caffeine on short-term high intensity exercise, there is a wide variation in results between studies. EFSA does not currently consider there to be sufficient published science to support a cause and effect relationship².

Caffeine appears to improve performance in specific individuals

Studies in high intensity, anaerobic exercise⁴ found the effects of caffeine to be more pronounced in certain groups of people involved in specific sports, such as trained athletes engaging in power-based sports and team sports. This would support evidence for a positive effect of caffeine on those participating in sports requiring intermittent bouts of activity. Additionally, a moderate amount of caffeine was more effective than a high dose.

Caffeine and sports aids may have an additive effect

A recent study found that when caffeine was given to subjects playing a simulated soccer match, in addition to a carbohydrate-electrolyte supplement, there was a significant improvement in short distance sprinting and jumping in the group who consumed caffeine as well as their sports drink⁵.

The effects of caffeine appear to be time-limited

Two trials looking at anaerobic exercise repetition in trained⁶ and active⁷ subjects both reported that the ingestion of caffeine produced an improved performance in the first set of exercises, but this failed to be repeated in the second set. This would indicate that the effects of caffeine are short-term only.



5. Potential mechanisms

Effect of caffeine on fetal growth undetermined

Until recently, caffeine's ergogenic effects were thought to be due to caffeine's ability to increase levels of circulating free fatty acids in the body, which helps spare muscle glycogen stores as the fatty acids are used for energy. However, several other mechanisms are now under investigation.

Caffeine may increase adrenalin production in endurance sports

Recent research has concluded that caffeine affects endurance performance via a pathway that leads to an increased production of adrenalin, which stimulates energy production and improves blood flow to the muscles and the heart¹. Caffeine may modulate fatigue and influence ratings of exertion, perceived pain and energy levels, all of which are likely to lead to improvements in performance.

Caffeine's effects on anaerobic exercise still under investigation

A recent review⁸ has concluded that current theories do not wholly account for caffeine's effect on short-term anaerobic exercise. As more studies are carried out, it appears that the mechanisms behind the effects of caffeine on both aerobic and anaerobic exercise seem to be moving in the same direction. Research to date points to the adenosine antagonist (a pathway that leads to an increased production of adrenalin, which stimulates energy production and improves blood flow to the muscles and heart) as the most likely mechanism behind caffeine's effects^{1,4,9}.

6. Conclusion

The 2010 International Society of Sports Nutrition position statement on caffeine supplementation and sports performance⁹ summarises the evidence to date in the following seven points:

1. Caffeine is effective for enhancing sport performance in trained athletes when consumed in low to moderate dosages (~3-6mg/kg) and overall does not result in further enhancement in performance when consumed in higher dosages (≥ 9 mg/kg).
2. Caffeine exerts a greater ergogenic effect when consumed in an anhydrous state* as compared to coffee.
3. It has been shown that caffeine can enhance vigilance during bouts of extended exhaustive exercise, as well as periods of sustained sleep deprivation.
4. Caffeine is ergogenic for sustained maximal endurance exercise, and has been shown to be highly effective for time-trial performance.
5. Caffeine supplementation is beneficial for high-intensity exercise, including team sports such as soccer and rugby, both of which are categorized by intermittent activity within a period of prolonged duration.
6. The literature is equivocal when considering the effects of caffeine supplementation on strength-power performance, and additional research in this area is warranted.
7. The scientific literature does not support caffeine-induced diuresis during exercise, or any harmful change in fluid balance that would negatively affect performance.

*in capsule, tablet or powder form.



References

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