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The effects of tea (Camellia sinensis) or its bioactive compounds L-theanine or L-theanine plus caffeine on cognition, sleep, and mood in healthy participants: a systematic review and meta-analysis of randomised controlled trials

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Tea produced from the tea plant (*Camellia sinensis*) is potentially beneficial for health: it contains theanine and caffeine which may improve short-term physiological outcomes such as accuracy of attention,[1,2] and polyphenols, specifically flavan-3-ols, which may improve long-term health outcomes such as cardiovascular diseases.[3,4] The aim of this systematic review and meta-analysis was to update the overall understanding of the effects of tea, or theanine (alone or in combination with caffeine), on cognition, mood, and/or sleep outcomes in healthy participants.

The Cochrane Library, Embase, and Medline were systematically searched, up to and including August 2023, for randomised controlled trials investigating the short-term effects of tea, theanine alone, or theanine plus caffeine interventions, on cognition, mood, and sleep outcomes in healthy participants. Where possible, meta-analysis was performed using standardised mean differences (SMD), or mean differences, with 95% confidence intervals (CI), in random effects models. SMDs and CIs were re-expressed (ReSMD) in the units of the most common measurement tool used by the studies in each meta-analysis.

Fifty RCTs were included in the review; data from fifteen RCTs were eligible for at least one meta-analysis. In the first hour (h1) and second hour (h2) after intake, differences were found between the effects of theanine plus caffeine, and placebo, that favoured the former, on cognitive outcomes including choice reaction time (h1; ReSMD: -24.71 ms; 95 % CI: -51.90 to 2.48), digit vigilance task accuracy (h2; ReSMD: 1.59 %; 95 % CI: 0.17 to 3.01), and attention switching task accuracy (h2; ReSMD: 1.10 %; 95 % CI: 0.43 to 1.77), and mood outcomes including overall mood (h2; ReSMD: 3.46 units on the caffeine research visual analogue scale; 95 % CI: -1.36 to 8.28) and alertness(h2; ReSMD: 2.94 units on the Bond-Lader visual analogue scale; 95 % CI: −0.87 to 6.75). Improvements favouring theanine, compared to placebo, were found for cognitive outcomes including rapid visual information processing accuracy (h2; ReSMD: 1.20 %; 95 % CI: 0.75 to 1.65) and reaction time (h2; ReSMD: -9.77 ms; 95 % CI: -16.98 to -2.55), and choice reaction time (h1; ReSMD: -18.01 ms; 95% CI: -31.27 to -4.83). No consistent evidence was found to indicate whether tea or theanine were beneficial for sleep.

This meta-analysis provides evidence that theanine plus caffeine, and theanine alone, possibly improve attention and mood, however, tea-inequivalent doses, small numbers of studies eligible for meta-analysis, and confidence intervals showing uncertainty surrounding the direction and magnitude of overall effect sizes, were common. More research of tea or tea-equivalent bioactive doses, in free-living participants, would be beneficial. PROSPERO registration no. CRD42022351601

References

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