

New algorithm determines ideal caffeine dosage and timing for alertness

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According to a recent study, a newly developed algorithm may be the key to optimizing alertness with caffeine.

Caffeine is the most widely consumed stimulant to counter the effects of [sleep loss](#) on neurobehavioral [performance](#). However, to be safe and most effective, it must be consumed at the right time and in the right amount. This study proposed an automated optimization [algorithm](#) to identify safe and effective caffeine-dosing strategies that maximize alertness under any sleep-loss condition.

"We found that by using our algorithm, which determines when and how much caffeine a subject should consume, we can improve alertness by up to 64 percent, while consuming the same total amount of caffeine," said principal investigator and senior author Jaques Reifman, Ph.D. "Alternatively, a subject can reduce caffeine consumption by up to 65 percent and still achieve equivalent improvements in alertness."

Reifman is a senior research scientist and director of DoD Biotechnology High Performance Computing Software Applications Institute and the Telemedicine and Advanced Technology Research Center at the U.S. Army Medical Research and Materiel Command in Ft. Detrick, Maryland.

The study used a validated mathematical model, which predicts the effects of sleep loss and caffeine on psychomotor vigilance task (PVT) performance and combined it with a computationally efficient optimization algorithm to determine when and how much caffeine to consume to safely maximize alertness during sleep loss. The algorithm takes a user-provided sleep/wake schedule and maximum allowed caffeine as inputs and provides a caffeine-dosing [strategy](#) as the output.

The algorithm was assessed by computing and comparing dosing strategies for four previously published experimental studies of sleep loss. For each study, two dosing strategies were computed—one which enhanced the predicted PVT performance using the same total amount of caffeine as in the original studies, and another which achieved an

equivalent level of performance as in the original studies using a lower amount of caffeine.

Compared to the original dosing strategies used in the studies, the U.S. Army's algorithm identified strategies that enhanced neurobehavioral performance by up to 64 percent, or reduced [caffeine consumption](#) by up to 65 percent. According to the authors, these results suggest that the algorithm can tailor the timing and amount of caffeine to the particular sleep/wake schedule of each study condition to maximize its benefits.

"Our algorithm is the first quantitative tool that provides automated, customized guidance for safe and effective [caffeine](#) dosing to maximize [alertness](#) at the most needed times during any sleep-loss condition," said Reifman.

The research abstract was published recently in an [online supplement of the journal Sleep](#) and will be presented Monday, June 4, in Baltimore at SLEEP 2018, the 32nd annual meeting of the Associated Professional Sleep Societies LLC (APSS), which is a joint venture of the American Academy of Sleep Medicine and the Sleep Research Society.

More information: Abstract Title: Caffeine Dosage Strategies that Efficiently Enhance Alertness during Sleep Loss

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