

Caffeine for the Sustainment of Mental Task Performance Formulations for Military Operations

Caffeine has been consumed by people around the world for over one thousand years. When consumed in amounts commonly found in beverages, foods, and drugs, it has measurable effects on certain types of human performance. The most commonly observed effect of caffeine is increased alertness.

Military personnel face many situations in which extended alertness is required. These include sentry duty, deployment-related activities, emergency air transport, long-range flying missions, radar and sonar monitoring, submarine duty, and combat. As part of their duties in these situations, individuals are often required to perform complex cognitive tasks. The performance of these tasks may be compromised during periods of extended wakefulness.

Providing the opportunity and environment for adequate sleep would be ideal, but impractical for continuous military operations. The use of caffeine could help alleviate sleep deprivation-induced impairments in cognitive function in military situations.

The Committee on Military Nutrition Research of the Institute of Medicine's Food and Nutrition Board was asked by the U.S. Army Medical Research and Materiel Command (USAMRMC) to prepare a brief report that would assist the Department of Defense in transitioning civilian and military caffeine research to military application. Specifically, the USAMRMC indicated that **the intent is to provide a pharmacological/dietary supplement strategy to significantly counter performance deficits in special circumstances when doctrinal and behavioral solutions (adherence to appropriate work–rest cycles, naps, etc.) are not possible or break down.**

Key questions addressed:

1. Efficacy: Are there sufficient data to recommend a caffeine product to enhance performance? What are the specific indications and contraindications for use?

2. Safety: What are the health risks associated with use of caffeine, including acute health risks, long-term health risks, potential interactions with other drugs or factors specific to military operations, and potential problems of habituation of use?

3. Dose and labeling: What amounts should be recommended to (a) habituated caffeine users and (b) non-habituated users? What instructions should be provided on such a product?

4. Alternatives: Are there practical alternatives to caffeine that would better serve the intended purpose of enhancing performance in fatigued service members?

5. Formulation: (a) Does the inclusion of other food components (e.g., glucose) improve beneficial effects of caffeine, as previously suggested by the committee? (b) Is there a better approach to caffeine delivery than an energy bar (HOOAH bar)? Is it better to have more rapid absorption and action using caffeinated chewing gum, longer duration of action using sustained release caffeine products, or pill or beverage formulations?

Summary of Key Recommendations

- **Caffeine in amounts of 100 to 600 mg can be effective in maintaining cognitive performance particularly in situations of sleep deprivation.** Specifically it can be used in maintaining speed of reactions and visual and auditory vigilance, which in military operations could be a life or death situation.
- **A similar amount (200 to 600 mg) of caffeine is also effective in enhancing physical endurance and may be especially useful in restoring some of the physical endurance lost at high altitude.**
- **Use of caffeine under conditions of sustained military operations would not appear to pose any serious, irreversible acute or chronic health risks for military personnel in situations where increased doses might be recommended.**
- **Caffeine use increases the risk of dehydration, so fluid and food intake of personnel should be closely monitored in these situations.**
- **A caffeine delivery vehicle that provides caffeine in 100-mg increments with a total content not exceeding approximately 600 mg would appear to be the most appropriate dose for use in sustained military operations.**
- **No differential dosing is recommended for habitual and first-time caffeine users, since**

there is no general agreement regarding the extent to which tolerance develops to caffeine's cognitive effects in habitual users.

- **Military personnel who are habitual consumers of caffeine should not be restricted from caffeine use in preparation for the need of a caffeine supplement.**
- **Any product used as a vehicle for providing caffeine to military personnel should be prominently labeled,** including a statement on the principal display panel that the product contains added caffeine and should be used only to counteract performance deficits during sustained operations.
- **The label should indicate the level of caffeine per unit of product and the total amount per package or container.** This content information is vital for the command structure to make decisions about directions for use and for personnel to adapt consumption to their individual needs.
- **An in-depth training program on the benefits, directions for use, and potential side effects of caffeine should be designed for command personnel.** Military personnel should be given adequate training to ensure the benefits of caffeine supplementation and avoid any potential side effects. Such training should include the use of caffeine during periods of sleep deprivation and altered work–rest cycles in non-operational situations.
- **The military should have in place a doctrine related to the importance of sleep prior to extended missions and the importance of naps whenever possible during operations.**
- **At this time, caffeine should be the compound of choice for counteracting cognitive deficits** since many personnel have personal experience with the compound, it is not a restricted substance, it does not interfere with recovery sleep following periods of sleep deprivation, and it has very low abuse potential.
- **Military women should be informed that very high doses of caffeine may slightly increase risk of spontaneous abortion in the first trimester of pregnancy**
- **Additional research and field-testing should be conducted on the drug modafinil to further explore its potential for sustaining cognitive performance during military operations.**

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