

Caffeinated chewing gum on special forces performance: a cross-over study

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Project summary

The purpose of this project is to investigate the effects of caffeine chewing gum on the cognitive functions and special operations capabilities of special forces. Using a randomisation crossover design, 20-40 active-duty special forces members who had undergone leave and special forces reserve training were divided into a caffeine trial (CAF) and a placebo trial (PL). After chewing caffeine-containing gum containing 5 mg/kg (CAF group) or caffeine-free gum (PL group) for 15 minutes, we performed a simple reaction test, a stroop test, a visual search test, a grip strength test, a vertical jump test, a 20-metre sprint test, and a counter-terrorism simulation test. A heart rate monitor was used to measure the heart rate and heart rate variability of the participants. Saliva samples were collected and analysed for α -Amylase, cortisol and caffeine concentrations before the test, after a 15-minute break from chewing gum and at the end of the test. Completion time of cognitive functions, grip strength, vertical jump height, 20 m sprint time, time to completion of the counterterrorism simulation test, and target score will be analysed using paired-sample t-tests.

Introduction

Caffeine supplementation has been shown in many studies to increase explosive power, anaerobic capacity, concentration, and reduce muscle soreness and reaction time, and the caffeine mechanism during exercise can be effective in improving endurance-related performance(1, 2). However, some studies have found that caffeine supplementation is also effective in improving performance in shorter exercise sessions.

The mechanism may involve the metabolite of caffeine, methylxanthine, which improves the rate of glycolysis into glucose, making more glucose available to the body. On the other hand, some sports do not allow for timely caffeine supplementation during exercise, so whether the use of caffeinated chewing gum has the same performance-enhancing effect deserves further study.

For members of special forces, the use of caffeine in the form of caffeinated beverages or capsules may result in an increase in the frequency of urination due to overhydration, which may make it difficult to adjust to the demands of the mission. Therefore, the administration of caffeine in the form of caffeinated chewing gum may be one of the solutions to overhydration. Therefore, the purpose of this study was to investigate the effects of caffeine gum on the cognitive functions and special operations capabilities of special operations personnel.

Methods

Design

This study used a randomization crossover design with a double-blind experiment, divided into a caffeine trial (CAF) and a placebo trial (PL). After the first trial, participants rested for 7-10 days to recover and then proceeded to the next trial, which was expected to be completed within 1 month. During the trial period, all participants maintained their normal training status and there was no change in the training menu.

Participants

This study is expected to recruit 20-40 active duty special operations personnel who have received professional counter-terrorism and counter-detection training. Military Police Special Forces and is expected to be conducted by the experimenter after a recruitment seminar with the participants. Before the study, the experimenter

will be informed of any problems that may be encountered during the experiment, and the procedure will be fully explained. However, due to the confidentiality of the information provided by the special forces, all names and personal information will be withheld, so the information will be provided in the form of an instruction manual. This study received approval from the Institutional Review Board of Jen-Ai Hospital - Dali Branch (202400036B0). This study was conducted following the Declaration of Helsinki.

Protocol

Pre tests

Prior to the formal test, the participant will undergo at least two anti-terrorist combat simulations to familiarise him/herself with the process of the formal test. The timer will start when the participant passes through the entrance on the first floor. The test will simulate the daily counter-terrorism duties of special forces personnel, conducting space searches and clearing out enemies. Ten targets are placed in the space to be attacked. When the participant finishes clearing the enemies on the first floor, he/she will enter the ground floor to continue searching and clearing the enemies in the space and return to the entrance of the first floor as soon as possible when he/she touches the simulated hostages. Each enemy will be scored using a 10-point target paper. The task completion time and the total score of the target shooting will be used to calculate the intraclass correlation coefficient (ICC) and test-retest reliability for this SAR task. The second simulation test is the cognitive function test, which consists of a simple reaction test, a stroop test and a visual search test. Each participant was given at least 2-3 sessions to familiarise him/herself with the cognitive function tests.

Experimental procedure

The participants' diets were recorded 3 days prior to the first formal trial and they were asked to repeat the same diet before the next trial. On the day of the experiment, the same breakfast will be served to ensure that the energy intake of the participants is the same.

All experiments were scheduled to start at 8 am. Upon arrival at the assembly site, participants rested in a sitting position for at least 10 minutes. The saliva of the participants was then collected for subsequent biochemical analysis. At the same time. Participants wore a heart rate monitor to record their heart rate and heart rate variability during the experiment. Immediately thereafter, participants chewed either caffeine-containing chewing gum (CAF trial) containing 5 mg/kg or caffeine-free placebo gum (PL trial) for 10 minutes while warming up. After chewing, participants spat out the gum and rested quietly for 15 minutes to collect saliva samples again. Afterwards, a simple reaction test, a stroop test, and a visual search test were performed. At the end of the test, grip strength, reverse action jump and 20-metre sprint were performed under full armour (20 kg load). At the end of the test, the participant was tested on anti-terrorist operations with a Colt 9mm submachine gun. Completion times and target scores were recorded for subsequent analysis. Upon completion of the test, the participant collects another saliva sample to complete the test. The saliva samples are expected to be analysed for α -Amylase, cortisol and caffeine concentrations.

Caffeine and placebo gum

The caffeinated chewing gum used in this study (Military Energy Gum, Arctic Mint flavor; Stay Alert, Chicago, USA) has been used in previous studies (3). Each piece of gum contains 100 mg of caffeine in approximately 5 g of gum. The placebo gum used was a commercially available blue mint gum. In order to provide 4 mg of caffeine per kilogram of body weight and to achieve a double-blind effect, all chewing

gums will be mashed, ground, homogenized, and reshaped with 0.3 g of peppermint flavoring powder, and will be similar in color, appearance, taste, weight, and size. All chewing gums were prepared by specialized personnel and given to the on-site testers after numbering. After chewing the gum, a questionnaire was given to the subjects to confirm whether they could tell the difference between the two chewing gums.

Statistical analysis

All data are presented as averages \pm standard deviations. The Shapiro–Wilk test was used to examine the normality of the data. The result of were analyzed through a paired sample t test. All data were calculated using SPSS (version 20, Chicago, IL, USA), and the significance level was $\alpha < 0.05$.

Reference

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