



## Caffeine consumption among active duty United States Air Force personnel



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### ABSTRACT

Data from the National Health and Nutrition Examination Survey (NHANES) indicated that 89% of Americans regularly consumed caffeinated products, but these data did not include military personnel. This cross-sectional study examined caffeine consumption prevalence, amount of daily consumption, and factors associated with caffeine intake in active duty United States (US) Air Force personnel. Service members (N = 1787) stationed in the US and overseas completed a detailed questionnaire describing their intake of caffeine-containing products in addition to their demographic, lifestyle, and military characteristics. Overall, 84% reported consuming caffeinated products  $\geq 1$  time/week with caffeine consumers ingesting a mean  $\pm$  standard error of  $212 \pm 9$  mg/day ( $224 \pm 11$  mg/day for men,  $180 \pm 12$  mg/day for women). The most commonly consumed caffeinated products (% users) were sodas (56%), coffee (45%), teas (36%), and energy drinks (27%). Multivariate logistic regression modeling indicated that characteristics independently associated with caffeine consumption ( $\geq 1$  time/week) included older age, ethnicity other than black, tobacco use, less aerobic training, and less sleep; energy drink use was associated with male gender, younger age, tobacco use, and less sleep. Compared to NHANES data, the prevalence of caffeine consumption in Air Force personnel was similar but daily consumption (mg/day) was higher.

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### 1. Introduction

Caffeine is a mildly psychoactive substance that is widely consumed. Data from nationally representative samples indicated that about 89% of American adults consume caffeinated products with virtually no difference between men and women in how frequently the products are consumed (Fulgoni et al., 2015; Mitchell et al., 2014). Comprehensive reviews conducted for the United States (US) Department of Agriculture (USDA) and Health Canada have concluded that consumption of caffeine  $< 400$  mg/day is generally safe and may even confer some health benefits (Nawrot et al., 2003; USDA, 2015). The USDA commissioned report indicated that in healthy adults there was evidence that moderate coffee consumption was associated with reduced risk of

cardiovascular disease, liver and endometrial cancers, Type 2 diabetes, Parkinson's disease, and overall mortality (USDA, 2015). Both the USDA and Health Canada commissioned reports recommended lower daily caffeine consumption for pregnant women,  $< 300$  mg in the Canadian report and  $\leq 200$  mg/day in the USDA report. Some concern was expressed in the USDA report because of the increased consumption of energy drinks by young adults (USDA, 2015). Data from the National Health and Nutrition Examination Survey (NHANES) indicated a trend of increased consumption of caffeine from energy drinks from 2001 to 2010 in 19–22 year olds, although this was largely offset by a reduction in caffeine from sodas so that there was little change in overall caffeine consumption (Branum et al., 2014).

Investigations that have obtained representative data on caffeine intake in Americans (Branum et al., 2014; Drownowski and Rehm, 2016; Frary et al., 2005; Fulgoni et al., 2015; Mitchell et al., 2014) have not provided information on US military service members (SMs). Air Force personnel have a number of physically

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and cognitively demanding tasks that include intelligence gathering, tactical planning, search and rescue, air traffic control, and combat actions that can require long periods of complex and time-intensive operations. Other physical demands include early morning physical training and limited sleep during training, operations, and deployments. These tasks may lead SMs to consume more caffeinated substances than the general population. Previous studies have investigated caffeine consumption in Army (Lieberman et al., 2012), Navy, and Marine Corps personnel (Knapik et al., 2016) but studies have not been conducted in the Air Force to date. The purpose of this report was to complete the examination of US military personnel by examining the caffeine consumption prevalence, daily consumption, and characteristics associated with intake among Air Force personnel.

## 2. Materials and methods

This investigation was a cross-sectional survey of caffeine consumption among US active-duty Air Force personnel approved by the institutional review board of the US Army Institute of Environmental Medicine. Investigators adhered to US Army regulation 70-25 and US Army Medical Research and Materiel Command Regulation 70-25 on the use of volunteers in research.

Questionnaires were distributed to SMs at ten US and two overseas installations. Survey sites were selected based on the availability of health care professionals available to assist with questionnaire administration. Individuals in basic training, on leave, in transition to another duty station, and/or incarcerated were not surveyed. No incentives were offered to SMs for completing the questionnaire. Prior to administration, participants were briefed by healthcare providers and told the questionnaire was anonymous, participation was voluntary, and all information would remain confidential. Data were collected in 2010 and 2011.

### 2.1. Survey (questionnaire) description

The first section of the questionnaire was designed to characterize participants. Questions included items on demographic (gender, age, height, weight, marital status, race/ethnicity, educational level), lifestyle (tobacco use, frequency and duration of aerobic training, frequency of resistance training, and average hours of sleep per night), and military (time in service, pay grade [rank], special operations status) characteristics. This descriptive section was followed by a section listing 31 types of caffeine-containing substances, including coffee, teas, soft drinks (sodas), energy drinks, and caffeinated gums and medications. The survey used a standard food frequency questionnaire method in which SMs selected among names of commonly consumed products or could write in caffeine-containing products not listed. SMs were asked to provide the number of times they consumed a product (per day, week, month) in the last 6 months and the serving size. Serving sizes were as follows: for coffee, teas, and soft drinks, 8, 12, 16, 20 and 24 + fluid ounces; for energy drinks, the number of cans or bottles with serving size listed with the product; for gums and medications, sticks of gum or number of pills. This questionnaire was the same one used in previous studies of Army, Navy, and Marine Corps personnel (Knapik et al., 2016; Lieberman et al., 2012).

### 2.2. Data analysis

Caffeine consumers were defined as those using any caffeinated product  $\geq 1$  time/week. Caffeine consumption (mg/day) was calculated based on the self-reported product listed by consumers, its serving size, and frequency of consumption. Sources of

information on caffeine content of specific products included product and company websites and a database of caffeine content in coffees, teas, sodas, and energy drinks (Caffeine Informer, 2015). For generic coffee, tea, and cola, the values in Knight et al. were used (Knight et al., 2004). Body mass index (BMI) was calculated as weight/height<sup>2</sup> (kg/m<sup>2</sup>). Weekly duration of aerobic training (minutes/week) was calculated by multiplying weekly exercise frequency (sessions/week) by the duration of training (minutes/session). Tobacco users were defined as those reporting use of any tobacco products in the last week while former users were those who reported they used tobacco products in the past but had quit within the last year or earlier.

Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) (Version 21.0.0.0, 2012, IBM Corporation). Caffeine products were grouped into 7 categories that included: 1) coffee, 2) hot tea, 3) other tea-based beverages, 4) colas, 5) other sodas, 6) energy drinks, and 7) caffeinated gums and medications. For some analyses, hot tea and other tea-based beverages were combined, as were colas and other sodas. All categories were combined to arrive at an aggregated caffeine intake (i.e., any caffeine consumption). Definitions of the caffeine categories are provided in Table 1.

Prevalences of consumption  $\geq 1$  time/week (%) with standard errors (SE) were calculated. Chi-square statistics were used to examine prevalence differences across various strata of demographic (sex, age, education level, marital status, race/ethnicity, BMI), lifestyle (tobacco use, weekly duration of aerobic training, frequency of resistance training, sleep duration) and military (time in service, rank, special operations status) characteristics. A one-way analysis of variance (ANOVA) was used to examine differences in daily average caffeine consumption (mg/day) across strata of these characteristics. Since some participants did not complete all of the questions, the number of participants is shown for each variable. Multivariate logistic regression was used to examine associations between the dependent variable “caffeine consumer” ( $\geq 1$  time/week) and independent variables that included the demographic (sex, age, education level, marital status, race/ethnicity, and BMI), and lifestyle (tobacco use, weekly duration of aerobic training, frequency of resistance training, and sleep duration) characteristics. Six separate regression models were developed for specific caffeine sources including any caffeine, coffee, tea (hot and other teas combined), soda (colas and other soda combined), energy drinks, and caffeinated gums and medications. A one-way ANOVA compared caffeine consumption across age groups in men and women separately.

Demographic data on the entire population of Air Force personnel were obtained from Defense Medical Epidemiological Database (DMED). These data included sex, age, marital status, and race. These demographics were compared to those of the volunteers in this study to examine representativeness of the sample.

## 3. Results

The final sample included 1787 active duty Air Force personnel with 1323 reporting they were male, 437 reporting female, and 27 who did not report their gender. The mean  $\pm$  standard deviation age, height, weight, and BMI of the men was  $28 \pm 7$  years,  $179 \pm 7$  cm,  $84 \pm 13$  kg and  $26.2 \pm 3.4$  kg/m<sup>2</sup>, respectively; for women these values were  $29 \pm 8$  years,  $164 \pm 8$  cm,  $67 \pm 11$  kg, and  $24.8 \pm 3.8$  kg/m<sup>2</sup>, respectively.

### 3.1. Caffeine-containing product prevalence

Table 2 provides prevalence of reported caffeine consumption by demographic, lifestyle, and military characteristics. Overall, 84%

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