Research Contribution

Journal of Foodservice Management & Education, Volume 11, Number 1, Pages 5–13 . ©2017
Published jointly by the Foodservice Systems Management Educational Council and the National Association of College & University Food Services

FACTORS INFLUENCING SELECTION AND NUTRIENT INTAKES OF NON-TRAINING ARMY DINING FACILITY PATRONS

Bethany A. Deschamps, PhD, RD, LD, CSCS[1*]; Junehee Kwon, PhD, RD[2]
[1]Major, U.S. Army, Madigan Army Medical Center, Tacoma, WA, USA
[2]Associate Professor, Kansas State University, Manhattan, KS, USA

ABSTRACT
To identify what influences soldiers' food selection and consumption behaviors, a variety of methods (i.e., survey, direct observations, digital photography, and plate waste evaluation) were used to measure soldiers' attitudes toward health, nutrition knowledge, reported food behaviors, and actual food selections and nutrient intake. Based on Go for Green® standards, 36% foods offered and 42% foods selected at an Army dining facility were considered least healthy. Perceived hunger was the only factor associated with food selection and nutrient intakes ($p<0.05$). Nutrition knowledge and attitudes toward health had little influence on actual behaviors. Foodservice professionals may use results to strengthen nutrition initiatives to yield behavior changes.

Keywords: obesity, food selection, nutrient intake, soldiers, healthy eating

Acknowledgements: We would like to thank the Retired Army Medical Specialist Corps Association (RAMSCA) for providing partial financial support for this research.

INTRODUCTION

Obesity remains a serious health problem in the United States (U.S.). According to the Centers for Disease Control and Prevention (CDC), 35.7% of all adults and 16.9% of children and adolescents were obese in 2010 (Ogden, Carroll, Kit, & Flegal, 2012). In 2012, state-wide obesity prevalence reached an all-time high with 13 states reporting obesity rates between 30 and 35% (CDC, 2012). Increasing obesity rates have negatively impacted the U.S. military, resulting in increased obesity rates among current service members, a decreased recruitment pool, and an influx of weight-related retention issues (Bray et al., 2009; Hsu, Nevin, Tobler, & Rubertone, 2007; Packnett, Niebuhr, Bedno, & Cowan, 2011; Yamane, 2007).

Routinely making nutritious food choices is a key strategy for obesity prevention and overall health (Seagle, Strain, Makris, & Reeves, 2009). In order to mitigate escalating weight-related problems among military personnel and to improve the quality of soldier's food and beverage choices, several nutrition programs and initiatives have been developed. Many are implemented in Army dining facilities (DFACs) to not only promote good nutrition, but also enable diners to make informed meal selections. DFACs have become the ideal location for such programs because they are utilized by thousands of service members daily (Bray et al., 2009). Point-of-purchase nutrition labeling was initially used in DFACs to provide soldiers with nutrition information for meal selections (Sproul, Canter, & Schmidt, 2003). While point-of-purchase nutrition labeling programs have been effective in other foodservice settings, such as university cafeterias (Chu, Frongillo, Jones, & Kaye, 2009), they were not as effective for improving military diners' food choices (Sproul et al., 2003).

In 2012, the point-of-purchase calorie labeling system in military DFACs was replaced with the *Go for Green®* Program, which places color coded labels for food items at the point-of-purchase and encourages diners to choose lower calorie, nutrient-dense food and beverage options. While it is unknown how effective this system is for improving nutrient quality of soldiers' dining selections, similar programs implemented in civilian worksite cafeterias were found to be overall ineffective for improving meal selections (Freedman & Connors, 2011; Hoefkens, Lachat, Kolsteren, Van Camp, & Verbeke, 2011; Vyth et al., 2011).

Recently, a more aggressive strategy was explored that incorporated not only *Go for Green®* but also modified menu selections in order to improve the healthfulness of offerings through changes to standardized menus (Crombie et al., 2013). Although such menu changes were found to be effective for improving nutrient intakes without compromising satisfaction, this strategy did not improve the quality of food selections, specifically fruit, vegetable and whole grain selections (Crombie et al., 2013).

Several factors such as taste, convenience, and price influence the quality of an individual's food selection behaviors (French, 2003; Glanz, Basil, Maibach, Goldberg, & Snyder, 1998). In addition, attitudes towards healthy eating and nutrition knowledge contribute to one's likelihood of making nutritious food choices (Deshpande, Basil, & Basil, 2009; Kolodinsky, Harvey-Berino, Berlin, Johnson, & Reynolds, 2007; Sun, 2008). While it is plausible that attitudes toward healthy eating and nutrition knowledge may have an influence on food selections of military diners or other similar populations, no research exists to confirm this.

Therefore, the purpose of this study was to evaluate soldiers' nutrition knowledge and attitudes toward health and to determine if these and other factors influence food selections and nutrient intakes of soldiers in a non-training status. This research aimed to strengthen current and future health and nutrition initiatives implemented in DFACs for military personnel by identifying what influence, if any, nutrition knowledge and attitudes toward health have on military diners' meal selections and nutrient intake.

METHODS

Subjects and Recruitment

The target population for this study was soldiers in a non-training status who were dining in Army DFACs. The research was conducted at a large DFAC on an Army base in a Midwestern region of the U.S., serving 400-700 meals during lunch each weekday. According to a G*Power Analysis (Version 3.1.9.2, 2014, Department of Psychology, Universität Düsseldorf) given effect size = 0.15, $\alpha = 0.05$, and power = 0.95 with up to five predictors; a sample size of 89 was needed to estimate the effect of knowledge and various attitudes toward health on food behaviors using linear multiple regression analysis.

*Corresponding Author: Phone: (785) 340-2811; E-mail: bethany.a.belanger.mil@mail.mil

Soldiers on this large military installation are a good representative sample of the target population, as they are recruited from various parts of the U.S. and are not initial trainees. Flyers and posters were placed near the two main entrances of the DFAC one week prior to data collection to notify potential participants of the study. Participant recruitment occurred on the data collection day at the DFAC entrances during the 90-minute lunch period. Researchers provided information about the study, and study participants created a four-digit code on a neon-colored laminated tray card. This card was later used to match the survey and food selection and consumption data. Soldiers utilizing the take-out option, diners other than current active duty service members (e.g., retirees, civilians), and DFAC staff members were ineligible to participate in the study. The study was approved by the Institutional Review Board of Kansas State University and the Madigan Army Medical Center, Fort Lewis, WA.

Instrument and Study Protocol Development

Two main components of data collection methods were developed for this study: assessment of food selection and consumption and a paper-based survey. The first component evaluated the healthfulness of food choices and nutrient intake. The survey measured participants' nutrition knowledge, attitudes toward health, self-reported food selection and consumption behaviors, and demographic characteristics.

Assessment of Food Selection and Consumption: Various food intake estimation methods were employed in combination to determine participants' food selection and consumption. A digital photography method assessed participants' food selections only. While this method was previously used to estimate both food selection and plate waste in foodservice settings (Crombie et al., 2013; Williamson, Allen, Martin, Alfonso, Gerald, & Hunt, 2003, 2004), our preliminary data collection trial revealed that reliability of such an estimation method could not be established. Therefore, the plate waste method was used when determining the amount of plate waste and ultimately the amount of food consumed.

In addition, the reference portion sizes in the previous studies were based on standardized recipe portion sizes (Crombie et al., 2013; Williamson et al., 2003, 2004). However, our preliminary evaluation showed discrepancies between the standardized recipe portion and actual serving sizes. The researchers considered that such variations in serving sizes frequently occur in many foodservice operations, and therefore, the reference portion sizes were determined based on the amount of food served by DFAC employees on the day of data collection.

After food selections were made, participants' food trays were photographed at one of two identical digital photography stations. Each photograph station included a digital camera (Nikon D3100, Nikon, Tokyo, Japan) mounted on a tripod at a 45-degree angle 20 inches above the food. Tray mats attached on the table and two rulers, which were placed horizontally and vertically next to each tray, were used for consistent photograph reference points.

Direct observation methods (Gittelsohn, Shankar, Pokhrel, & West, 1994) were used to identify the type and the amount of food selected for self-service items. The researchers established reference portions prior to data collection by repeated measures (n = 10) for all items using the standardized serving utensils. Research assistants recorded participants' tray numbers and the type and amount of each food item selected at each self-service area (i.e., salad bars) on an observation form. Participants' food selections at self-service stations were added to food selection data collected using the digital photography method to assess overall food selection.

Plate waste methods (Adams, Pelletier, Zive, & Sallis, 2005; Templeton, Marlette, & Panemangalore, 2005) were used to estimate the quantity of food left on each plate. After completing their meals, participants placed their trays with the tray card on the tray return belt. Once trays with the laminated cards reached the dishroom, research assistants collected them and photographed trays with leftover food items. Then, the amount of edible food left on the plate was weighed and recorded to the nearest gram using a calibrated digital scale.

Evaluation of Food Selection Quality and Nutrient Intake: The nutrition quality of food selected was assessed by percentages of healthy and unhealthy food choices based on the Army's *Go for Green®* Program standards (U.S. Army Food Service, 2012). The DFAC where the data collection occurred had implemented this labeling system to encourage patrons to make nutritious food choices. All food items offered were identified as green, amber, or red based on total calories and nutrient content according to *Go for Green®* standards (U.S. Army Food Service, 2012). Table 1 provides a summary of the *Go for Green®* program labeling criteria. The quality of food selection was assessed by the percentage of green items selected.

Table 1: Go for Green® Program Criteria

Category	Green-Labeled Items	Amber-Labeled Items	Red-Labeled Items
Entrees	**Single Items:** <300 calories <10 g fat **Full Dish:** <500 calories <18 g fat	**Single Items:** 300-500 calories 10-15 g fat **Full Dish:** 500-700 calories 18-25 g fat	**Single Items:** >500 calories >15 g fat **Full Dish:** >700 calories >25 g fat
Starchy Sides	<200 calories Higher fiber choices	200-300 calories	>200 calories
Vegetables	<100 calories	<100 calories	>200 calories
Dessert	<150 calories <6 g fat	150-300 calories 6-12 g fat	>300 calories >12 g fat
Beverage	Water, calorie-free/low calorie beverages, 100% fruit juice	Sports drinks	Fruit Juice (less than 100% juice), fruit drinks, energy drinks, Kool-aid®, regular soda
Dairy	Skim or 0-1% fat	Reduced fat or 2% fat	Whole or 4% fat

Note. Adapted from United States Army Quartermaster School Joint Culinary Center of Excellence (JCCoE). (2012). *Go for Green Program Criteria.* Retrieved from http://www.quartermaster.army.mil/jccoe/Operations_Directorate/QUAD/nutrition/Program_Criteria_g4g_Approved_Version_2013.pdf

Total energy (kilocalories), total fat, saturated fat, dietary cholesterol, total carbohydrates, dietary fiber, protein, vitamins A and C, iron, and sodium were calculated based on the food consumption data (i.e., reference portion size minus plate waste) using U.S. Department of Agriculture (USDA) Nutrient Database for Standard Reference, release 26 (USDA, Agriculture Research Service, 2013). The total nutrient consumption for each soldier was calculated by adding nutrients from every item using Microsoft Excel®.

Food selection and consumption assessment methods were pilot-tested with 50 patrons during one lunch period at another DFAC one menu cycle (i.e., 3 weeks) prior to the day of data collection. Minor adjustments were made to enhance data collection methods prior to collecting data.

Nutrition Knowledge, Attitudes Toward Health, and Self-reported Food Behaviors: Researchers developed a 50-item questionnaire to assess nutrition knowledge (*n* = 10), perceived importance of eating a healthy diet (*n* = 9), perceived healthfulness of their current diet (*n* = 1), benefits (*n* = 4) and barriers (*n* = 6) to eating a healthy diet, cues to action (*n* =5), self-reported food selection and consumption behaviors (*n* = 5), and perceived hunger and satiety levels before and after the meal (*n* = 2) based on literature review and expert input. Demographic information (*n* = 9) was also included to characterize the participants (i.e., age, gender, years of service). In addition, height and weight information was asked to assess the body mass index (BMI) of soldiers to identify any differences in current weight status based on knowledge, attitudes and reported behaviors.

Nutrition knowledge questions were developed using a multiple-choice format based on inputs from an expert panel of 20 current Army Registered Dietitians/Registered Dietitian Nutritionists (RD/RDNs). The panel members provided suggestions for important nutrition knowledge questions for soldiers based on their nutrition education and counseling experiences. Questions addressing various perceptions and attitudes toward health were measured using a five-point Likert scale. Typical food behavior questions used multiple answers and multiple-choice formats, and perceived hunger and satiety levels were rated using an 11-point Likert scale (1 being greatest imaginable hunger, 6 being neither hungry nor full, 11 being greatest imaginable fullness).

The final survey instrument was reviewed by a panel of military foodservice experts and foodservice researchers (n = 9) then pilot-tested during lunch at another DFAC with 30 soldiers one month prior to data collection. Each variable had a Cronbach's alpha of at least 0.85, and no further adjustments were made to the questionnaire.

Data Collection

Following the aforementioned protocol, participants were recruited and completed both the survey and analysis of food selection and consumption. After receiving information about the study and placing their laminated card containing their self-created four-digit code on their food tray, participants selected food and beverages then proceeded to one of two digital photography stations near seating areas. Research assistants handed out a consent form and the questionnaire for participants to complete while eating their meal as they approached one of the photography stations before consuming their meals. After their meal, research assistants collected completed questionnaires, the signed consent form, and trays for weighing plate waste and another digital photography for the record. Participants received a small token of appreciation upon completion (e.g., keychain flashlight).

Data Recoding and Statistical Analysis

Food Selection and Nutrient Quality: Food selection quality, the percentage of green-labeled food items selected according to the Army's *Go for Green®* Program, was calculated using the following equation:

$$\text{Food selection quality (\%)} = \frac{\text{total number of green labeled items selected}}{\text{total number of food items selected}} \times 100$$

Nutrient intake, calculated using the USDA nutrient database, was compared with the daily military dietary reference intakes (MDRI) and established macronutrient meal guidelines included in Army Regulation (AR) 40-25, *Nutrition Standards and Education* (Headquarters Department of the Army, Navy, and Air Force, 2001). Nutrient intake was evaluated based on whether a participant met or exceeded one-third of the MDRI or established meal guidelines.

Nutrition Knowledge, Attitudes toward Health, and Reported Behaviors: Descriptive statistics were calculated to summarize the data for all survey questions including demographic data. Microsoft Excel® was used to calculate BMI of soldiers for further analysis. Nutrition knowledge questions were coded as one for correct and zero for incorrect answers. The total score was calculated using compute function of SPSS (version 21.0, IBM Corporation) and ranged from zero to 10 points.

Attitudes toward health were measured using five-point Likert-type scales. In addition to descriptive statistics, responses of four or five on a five-point scale were placed into "endorsed" category while all other responses (neutral, disagree or strongly disagree) were considered not endorsed. Endorsed items were recoded with a one and not endorsed items a zero, and the total number of endorsed items was calculated and used for further statistical analysis.

Participants reported typical food choices, weekly breakfast frequency, fried food consumption, fruit and vegetable intake and sugar-sweetened beverage consumption patterns. For typical food choices, participants were asked which food items best represent what they would typically choose at a lunch or dinner meal. They were directed to select one food item from each meal category (i.e., entrée, starch, vegetable, dessert) listed. If none of the selections were applicable, a write-in option was also included. One green, amber and red-labeled food item was included in each meal category. All answers were recoded based on the *Go for Green®* labeling criteria, and the percentage of green-labeled items selected was determined using the aforementioned food selection equation.

Answers to breakfast frequency and fruit/vegetable intake were coded zero for least desirable through five for most desirable, with "I don't know" option being considered as missing. Fried food consumption was reverse-coded for most frequent consumption being zero and least frequent consumption being five. Participants who were regularly consuming sugar-sweetened beverages were asked to list the total number of 12, 16 and 20-ounce containers of sugar-sweetened beverages consumed daily and/or weekly. The number of total ounces of sugar-sweetened beverages consumed per week was calculated based on daily/weekly consumption data.

SPSS was used to conduct all analyses with $p < 0.05$ for statistical significance. Descriptive statistics were used to summarize the data, and Pearson bivariate correlation coefficients and logistic and multiple regression analyses were used to examine relationships between and among variables.

RESULTS

Participants

A total of 172 soldiers agreed to participate in the study. Of these, 154 surveys were returned, and 135 sets of pre- and post-consumption photographs were collected. Using the self-created four -digit code, we matched 105 surveys with digital photographs. Based on G*Power analysis, the numbers of returned surveys (n = 154), paired photographs (n = 135) and matched photographs collected (n = 105) for this study were adequate to detect relationships among variables of interest. Figure 1 describes the overall participant recruitment and usable data availability.

On average, participants were 24.9 years old (Standard Deviation [SD] = 6.1) with a BMI of 25.9 (SD = 3.1). The majority of participants were between 19 and 25 years old (64%) and had a BMI greater than 25.0 (62%). Most participants were male (93%), meal card holders (soldiers provided meals on behalf of the government) (80%), at the rank of E1-E4 (enlisted ranks 1 through 4, 79%), had completed ≤ 3 years of military service (74%), and possessed a high school diploma (68%). A small number of participants (4%) were enrolled in the active duty weight control program.

Actual and Self-reported Food Selection and Consumption Behaviors

Table 2 presents DFAC offerings available at lunch on the data collection day and their classification based on the *Go for Green®* labeling standards. The mean percentages of green-, amber- and red-labeled items selected by soldiers at DFAC were somewhat similar with percentages of color-labeled food items offered. The percentage of green items offered in the DFAC was 36%, while 21% were amber- and 43% were red-labeled (Table 2). The observed food choices of green-, amber-, and red-labeled items were 38%, 19%, and 42%, respectively. Participants reported better food selection behaviors on the survey than their observed behaviors. The mean percentages of self-reported green-, amber-, and red-labeled choices were 57%, 21%, and 22%, respectively.

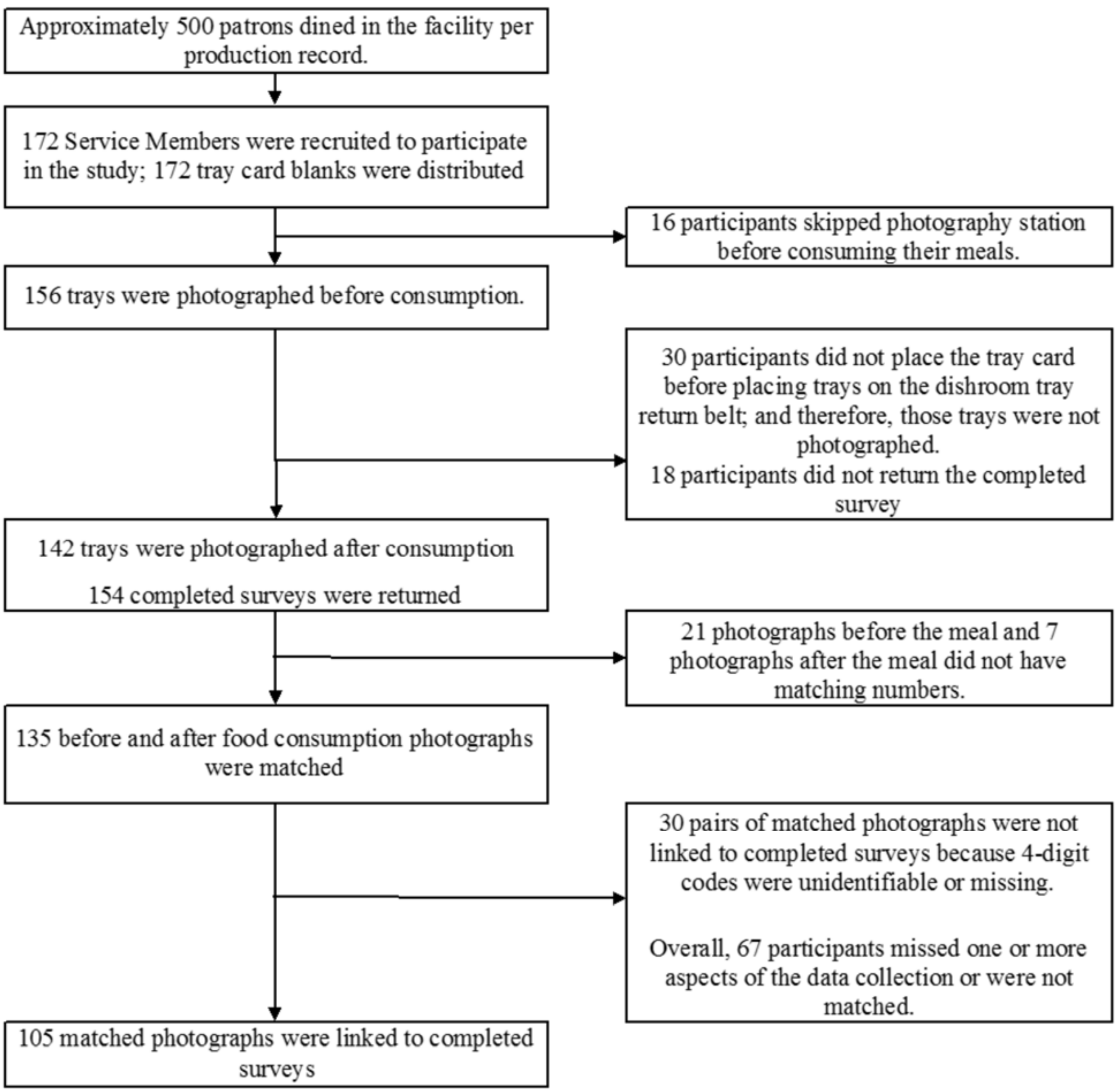

Figure 1. Summary of Recruitment Process

Table 2. Summary of Non-Trainee DFAC Meal Offerings Based on *Go for Green* Labeling Criteria

Meal Category	N (%[a])	Items by Color		
		Green	Amber	Red
Entrée	2 (3%)	1	1	0
Side Dishes	8 (11%)	4	1	3
Salad Bar	24 (31%)	7	4	13
Sandwich Bar	13 (17%)	2	2	9
Short Order	8 (11%)	5	3	0
Desserts	6 (8%)	4	1	1
Condiments	14 (19%)	4	4	6
Total Number of Items (%[b])		27 (36%)	16 (21%)	32 (43%)

Note. DFAC = Dining Facility; [a, b] calculations based on total number of meal items offered (n = 75).

Descriptive statistics of nutrient intake are provided in Table 3. On average, participants consumed 886 kilocalories comprised of 41% carbohydrates (net), 18% protein, and 40% fat. Over half of the participants consumed 33% of the MDRI for protein, iron, vitamin C and cholesterol, while only 18% met recommended intakes for vitamin A.

A large number of soldiers (79%) reported consuming sugar-sweetened beverages (e.g., regular soda, sweetened tea). The mean score of weekly total volume of self-reported sugar-sweetened beverage consumption was 236 fluid ounces (29.5 cups), with over 64% of participants consuming at least 128 fluid ounces (1 gallon) or more weekly.

Nutrition Knowledge, Attitudes toward Health, and Perceived Hunger Level

Nutrition knowledge was measured using 10 multiple-choice questions and defined as the sum of correct responses. The mean score of nutrition knowledge was 6 of 10 or 60%, and 28% of participants answered at least 80% of the questions correctly while 21% answered 30% or less of the questions correctly. Most participants recognized meals that are lower in total fat (88%) and saturated fat (77%). However, less than half of the participants were not aware of the best food choices prior to physical activities (e.g., complex carbohydrates) and less than one-third identified the recommended number of daily servings of fruits and vegetables. Table 4 provides a summary of the percentage of correct and incorrect responses to nutrition knowledge questions.

Table 5 lists frequencies and percentages of participants' responses to the five variables used to determine attitudes toward health. Most soldiers (71%) perceived their diets were healthy, and eating a variety of foods (79%) and a lot of fruits and vegetables (75%) were important aspects of a healthy diet. Lack of convenience (49%) was the main barrier to eating a healthy diet and food labels (55%) was the most frequently identified factor influencing healthy eating.

Perceived hunger and satiety levels before and after the meal revealed participants were very hungry (Mean = 3.0 on the 11-point scale) prior to meal consumption and moderately to very full (Mean = 8.6 on the 11-point scale) after the meal. Over one-fifth of participants (22%) reported extreme or greatest imaginable hunger levels (1 or 2) before the meal and 25% reported being extremely full or experiencing greatest imaginable fullness (10 or 11) afterwards.

Factors Associated with Food Selection and Consumption Behaviors

Multiple regression analyses showed significant relationships between some constructs related to attitudes toward health and reported food selection and consumption behaviors (Table 6). Perceived adequacy of current diet was positively associated with the number of green-labeled items typically chosen at a meal (i.e., reported food selection) ($\beta = 0.25$, $p < 0.01$) and breakfast frequency ($\beta = 0.21$, $p < 0.05$) and negatively associated with fried food intake ($\beta = -0.18$, $p < 0.05$). Perceived importance of eating healthy diet was positively associated with fruit and vegetable intake ($\beta = 0.21$, $p < 0.05$). When constructs related to attitudes toward health were

Table 3. Summary of Non-Training Military Diners' Lunch Meal Nutrient Intakes (n = 135)

Variable	Female or Male MDRI Standards [a]	M ± SD	Range	Participants who consumed ≥33% MDRI	
				n	%[b]
Energy (kcal)	2300 or 3250	886 ± 326	(248 – 1895)	33	31
Carbohydrates (g)	50-55% of total energy	91 ± 39	(19 – 218)	NA[c]	NA
Dietary Fiber (g)	NA	9 ± 5	(1 – 26)	NA[c]	NA
Protein (g)	10-15% of total energy	38 ± 15	(10 – 72)	77	53
Sodium (mg)	3600 or 5000 mg per day	1784 ± 872	(331 – 5479)	32	30
Iron (gm)	10 or 15 mg per day	6 ± 3	(2 – 13)	82	57
Vitamin C (mg)	75 or 90 mg per day	45 ± 44	(0 – 180)	48	33
Vitamin A (IU)	800 or1000 mg RE per day	2430 ± 3156	(86 – 15731)	19	13
Cholesterol (mg)	≤ 300 mg per day	133 ± 68	(0 – 339)	66	62
Total Fat (%)	< 30% of total energy	40 ± 18	(7 – 52)	NA[c]	NA
Saturated Fat (%)	< 10% of total energy	11 ± 6	(0 – 16)	NA[c]	NA

Note. MDRI = Military Dietary Reference Intakes, NA = Not applicable

[a] MDRI nutrient intake standards extracted from Army Regulation 40-25, "Nutrition Standards and Education" by Headquarters, Departments of the Army, Navy, and Air Force, 2001.

Values for energy, protein, and associated nutrients expressed as average daily nutrient intakes and based on moderate activity levels and reference body weight of 79 kg (174 lb) for military men and 62 kg (136 lb) for military women.

[b] Percentages calculated based on sample size n=135.

[c] Not applicable because MDRI does not specify the amounts of carbohydrates, fiber, total fat, and saturated fat.

Table 4. Percentage of Correct Responses to Nutrition Knowledge Questions (n = 135)	
Nutrition Knowledge Question	% Correct [a]
1. Which meal is LOWER in total fat?	88
2. Which meal is LOWER in saturated fat?	77
3. Which of the following food items is LOWEST in saturated fat?	72
4. Which of the following foods would be considered the BEST low-calorie, nutrient-rich food choice?	70
5. Which of the following food choices is the BEST source of omega-3 fatty acids?	70
6. Which of the following food or beverage items is considered the BEST source of complex carbohydrates?	61
7. Which of the following choices would be considered SAFE weight loss?	51
8. Which nutrient would be the BEST to consume prior to engaging in physical activity lasting approximately an hour?	46
9. According to the USDA's "Choose My Plate" guidelines, approximately how much of your plate should be filled with fruits and/or vegetables?	32
10. Which of the following alcohol servings contains the MOST calories?	24

[a] Percentages calculated based on 135 total responses

evaluated for predicting reported food behaviors, results showed that attitudes toward health was significant for the number of green labeled choices ($p < 0.01$), breakfast frequency ($p < 0.001$) and fried food intake ($p < 0.05$) but not for fruit and vegetable intake ($p > 0.05$). In addition, attitudes toward health were not associated with the reported amount of sugar-sweetened beverage consumed.

Contrary to the fact that attitudes toward health were related to reported food selection and consumption behaviors, results showed no correlations between attitudes toward health and actual food selection and consumption behaviors. Logistic regression results showed that attitudes toward health predicted whether participants met the MDRI for protein ($p < 0.01$) but not for amount of kilocalories, cholesterol, sodium, iron, and vitamins A and C ($p > 0.05$). Additionally, attitudes toward health failed to predict whether participants met established recommendations for percent carbohydrates, total fat, and saturated fat ($p > 0.05$) or associated with percentage of green-labeled food selection.

Perceived hunger levels was the only factor that showed significant correlation with the actual food selection and consumption behaviors. Intuitively, greater hunger levels were associated with higher intakes of kilocalories, protein, cholesterol, sodium, total fat, and saturated fat ($p < 0.01$). Likewise, soldiers who consumed higher kilocalories reported being very satiated following their meal. In summary, the hungrier soldiers were before coming to eat lunch, the fuller they were after the meal because they ate a greater amount of food.

DISCUSSION

A scant amount of research exists evaluating eating behaviors of military diners and to date, such research focused on evaluating the influence nutrition interventions have on soldiers nutrient intakes and overall satisfaction (Crombie et al., 2013; Sproul et al., 2003). No research has attempted to connect soldiers' beliefs, attitudes and nutrition knowledge with the quality of their food choices and nutrient intake. To our knowledge, this study is the first to address this gap and to evaluate these relationships with both reported and actual behaviors for military personnel.

We found using a combination of previously established food intake estimation methods (Templeton et al., 2005; Williamson et al., 2003) was effective for estimating participants' meal selections and food consumption. Our evaluation of soldiers' macronutrient intakes was consistent with previous findings, which were estimated using digital photographs (Crombie et al., 2013). Using a combination of methods, even though it required a larger number of research assistants than using the digital photography method only, researchers were able to effectively estimate food consumptions while minimizing service disruptions due to research activities being conducted in the dining room. As previous studies identified, soldiers' actual selections and nutrient intakes were more closely related to DFAC meal offerings and less with reported food selection behaviors (Cullen, Watson, & Zakeri, 2008; Vecchiarelli, Takayanagi, & Neumann, 2006). While green-labeled items were available, a majority of the main course offerings

Table 5. Frequencies and Percentages of Non-Training Soldiers' Endorsed Items for Attitudes Toward Health (n = 144)

	Endorsement[a]	
Construct	n	%[b]
Perception of current diet	97	71
Perceived benefits to eating a healthy diet		
Maintain health body weight	131	95
Improve overall health	131	94
Improve physical performance	127	92
Decrease body fat percentage	120	87
Perceived barriers to eating a healthy diet		
Healthy food is less convenient	67	49
Others around me make unhealthy food choices	55	40
Healthy food is unavailable in the dining facility	51	37
Healthy food is unaffordable	42	31
I lack enough nutrition knowledge to make healthy food choices	27	20
I don't desire to eat healthy food	21	15
Perceived importance of eating a healthy diet		
Contains a variety of foods	107	79
High in fruits and vegetables	103	75
High in fiber	97	71
Low in cholesterol	93	69
Low in saturated fat	90	67
Low in sugar	89	65
Low in total fat	87	64
Low or moderate in salt or sodium	80	59
Lower in calories	79	58
Cues to action		
Identified or labeled as healthy	77	55
Recommended by a family member	72	52
Recommended by a healthcare professional	70	51
Recommended by a friend or colleague	66	48
Recommended by a work supervisor	57	41

[a] Endorsed responses include the participants who strongly agree or agree with each question

[b] Percentages calculated based on 144 total responses.

Table 6. Multiple Regression Analysis Predicting Non-Training Diners' Reported Food Behaviors from Attitudes Toward Health

	Reported Food Behaviors[a]							
	Green Labeled Choices		Breakfast Frequency		Fried Food Intake		Fruit/Vegetable Intake	
Variables	**β**	**95% CI**	**β**	**95% CI**	**β**	**95% CI**	**β**	**95% CI**
Perceived Adequacy of Current Diet	0.25**	[0.15, 0.94]	0.21*	[0.09, 1.01]	-0.18*	[-0.75,-0.01]	0.07	[-0.21, 0.46]
Perceived Benefits	0.18*	[0.01, 0.35]	0.12	[-0.06, 0.34]	-0.08	[-0.23, 0.09]	-0.01	[-0.15, 0.14]
Perceived Barriers	0.04	[-0.09, 0.14]	-0.02	[-0.15, 0.12]	-0.10	[-0.05, 0.17]	-0.14	[-0.17, 0.02]
Importance of Healthy Diet	0.02	[-0.05, 0.07]	0.16	[-0.01, 0.13]	0.07	[-0.04, 0.08]	0.21*	[0.01, 0.11]
Cues to Action	0.00	[-0.09, 0.09]	0.12	[-0.03, 0.18]	-0.21*	[-0.19,-0.01]	-0.15	[-0.14, 0.02]
R^2	.11		.16		.11		.06	
F	3.34**		4.89***		3.16*		1.52	

Note. CI = confidence interval.
N = 126.
[a]based on survey questions assessing reported food selection and consumption behaviors.
* *p* < .05.
** *p* < .01
*** *p* < .001

were red- and amber-labeled choices, making it difficult for military diners to choose healthy food items and conducive for making high calorie, low nutrient food choices.

Consistent with previous studies evaluating the relationship among health-related beliefs and reported diet quality (Deshpande et al., 2009; Sapp & Jensen, 1998; Sapp & Weng, 2007), we found soldiers' attitudes toward health were associated with most self-reported dietary behaviors. Similar associations were also found between nutrition knowledge and self-reported food behaviors, which was also supported by previous studies (Drichoutis, Lazaridis, & Nayga, 2005; Kolodinsky et al., 2007).

One exception to this association between attitudes toward health and self-reported behaviors was sugar-sweetened beverage consumption. Regardless of their attitudes toward health, a majority of soldiers (75%) regularly consumed sugar-sweetened beverages. Although we did not measure how much they drank during the meal due to complexity and inability to keep track of refills, we observed that a majority of soldiers chose sugar-sweetened beverages. Their reported behaviors related to sugar-sweetened beverage consumption were observable in dining areas and showed similarity to previous studies evaluating sugar-sweetened beverage consumption trends among U.S. adults and adolescents (Bleich, Wang, Wang, & Gortmaker, 2009; Claire Wang, Bleich, & Gortmaker, 2008). The percentage of soldiers who reported consuming sugar-sweetened beverages on a regular basis and the estimated amount consumed were considerable despite recommendations to consume less.

While soldiers' nutrition knowledge and attitudes toward health influenced their reported behaviors, this was not the case with their actual eating behaviors. We did find, however, a strong association between perceived hunger level and nutrient intake. Soldiers' reporting greater hunger levels consumed more kilocalories, fat, cholesterol and sodium and also reported greater fullness after the meal. As demonstrated in previous studies (Almiron-Roig, Grathwohl, Green, & Erkner, 2009; Farajian, Katsagani, & Zampelas, 2010; Williams, Noakes, Keogh, Foster, & Clifton, 2006), our results suggest that for this population, attenuating hunger levels prior to meals may improve the quality and self-regulate quantity of foods consumed. Additionally, this finding, along with previous studies, support the possibility that other factors, such as hunger, taste, availability, and convenience, were more influential on food selection and consumption behaviors (Glanz et al., 1998; Levi, Chan, & Pence, 2006).

There are several limitations to this study. First, the target population of this study was soldiers in non-training status in the U.S. Therefore, results cannot be generalized beyond this specific population such as initial military trainees. It is also plausible that those who participated in the study may have been more conscientious about health and wellness, and thus, non-response bias may exist in our data. Because participation was completely voluntary; we could not avoid this bias, and those who may have felt uncomfortable sharing their food behaviors may have opted out from the data collection. In addition, because health and fitness is a condition of their employment, social desirability bias may have impacted our data.

Second, since limited resources were available to fund research assistants, data collection for this study occurred over a lunch meal period at one DFAC. Patrons' food selections and nutrient intake in this particular DFAC may have been different from patrons at other DFACs and/or at breakfast and dinner times. In addition, participants' food selections were assessed on only one occasion. Analyzing soldiers' food selections and intake over several meals, across different meals and/or at different DFACs may provide better generalizability. The current study used 19 volunteers and research assistants to collect data from soldiers due to the large number of patrons being served within a short time period with multiple self-service stations. Future studies may assess participants' food choices and consumptions over multiple occasions, at different meals and at more than one DFAC for a comprehensive analysis of actual food selection and intake of this population.

Lastly, the research team did not take beverage consumption into consideration for food selection quality or nutrient intake. This was due to the layout of the DFAC and difficulty in keeping track of refills. Therefore, the nutrient analyses we presented do not include nutrients and energy intakes from beverages.

CONCLUSIONS

This study evaluated self-reported and actual food selection and consumption behaviors, nutrient intakes, and factors affecting these behaviors of non-training Army DFAC patrons (i.e., soldiers' nutrition knowledge and attitudes toward health). The results of the study indicated that while knowledge and attitudes were associated with self-reported food selection and consumption behaviors, only physiological cues, such as hunger, and food availability impacted actual food selection and intake. Furthermore, we found overall soldiers were knowledgeable about nutrition and possessed positive attitudes toward health, but their nutrient intakes failed to meet the established guidelines. The results of this study provide evidence that for this and other similar populations (i.e., young, male, and generally healthy and active), nutrition education only may not result in improved food choices and nutrient intakes when consuming meals in cafeteria settings.

Foodservice professionals or RD/RDN can use these results when developing strategies to influence and improve the healthfulness of young populations' dietary behaviors in away-from-home settings. Extending beyond simply educating and informing consumers about healthy food choices, establishing initiatives that improve the nutrition quality of meal offerings (i.e., healthy menu offerings in DFACs) and the number of nutritious choices may influence food behaviors of this population. In addition, nutrition initiatives implementing in foodservice settings could include education that encourages healthful snacking between meals. These initiatives could also make nutritious snacks available to diners outside of meal periods to control hunger levels before meals and influence this and similar population to make healthy food choices.

REFERENCES

Adams, M. A., Pelletier, R. L., Zive, M. M., & Sallis, J. F. (2005). Salad bars and fruit and vegetable consumption in elementary schools: a plate waste study. *Journal of the American Dietetic Association, 105*, 1789–1792.

Almiron-Roig, E., Grathwohl, D., Green, H., & Erkner, A. (2009). Impact of some isoenergetic snacks on satiety and next meal intake in healthy adults. *Journal of Human Nutrition and Dietetics: The Official Journal of the British Dietetic Association, 22*, 469–474.

Bleich, S. N., Wang, Y. C., Wang, Y., & Gortmaker, S. L. (2009). Increasing consumption of sugar-sweetened beverages among US adults: 1988-1994 to 1999-2004. *The American Journal of Clinical Nutrition, 89*, 372–381.

Bray, R. M., Pemberton, M. R., Hourani, L. L., Witt, M., Olmsted, K. L., Brown, J. M., … Scheffler, S. (2009). Department of Defense survey of health related behaviors among active duty military personnel. DTIC Document. Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA527178

Centers for Disease Control and Prevention. (2012). Self-reported obesity among U.S. adults in 2012. Retrieved from http://www.cdc.gov/obesity/downloads/dnpao-state-obesity-prevalence-map-2012.pdf

Chu, Y. H., Frongillo, E. A., Jones, S. J., & Kaye, G. L. (2009). Improving patrons' meal selections through the use of point-of-selection nutrition labels. *American Journal of Public Health, 99*, 2001–2005.

Claire Wang, Y., Bleich, S. N., & Gortmaker, S. L. (2008). Increasing caloric contribution from sugar-sweetened beverages and 100% fruit juices among US children and adolescents, 1988–2004. Pediatrics, 121, 1604–1614.

Crombie, A. P., Funderburk, L. K., Smith, T. J., McGraw, S. M., Walker, L. A., Champagne, C. M., … Young, A. J. (2013). Effects of modified foodservice practices in military dining facilities on ad libitum nutritional intake of US army soldiers. Journal of the Academy of Nutrition and Dietetics, 113, 920–927.

Cullen, K. W., Watson, K., & Zakeri, I. (2008). Improvements in middle school student dietary intake after implementation of the Texas Public School Nutrition Policy. *American Journal of Public Health, 98*, 111–117.

Deshpande, S., Basil, M. D., & Basil, D. Z. (2009). Factors influencing healthy eating habits among college students: an application of the health belief model. *Health Marketing Quarterly, 26*, 145–164.

Drichoutis, A. C., Lazaridis, P., & Nayga, R. M. (2005). Nutrition knowledge and consumer use of nutritional food labels. *European Review of Agricultural Economics, 32*, 93–118.

Farajian, P., Katsagani, M., & Zampelas, A. (2010). Short-term effects of a snack including dried prunes on energy intake and satiety in normal-weight individuals. *Eating Behaviors, 11*, 201–203.

Freedman, M. R., & Connors, R. (2011). Point-of-purchase nutrition information influences food-purchasing behaviors of college students: a pilot study. *Journal of the American Dietetic Association, 111*(Suppl), S42–46.

French, S. A. (2003). Pricing effects on food choices. *The Journal of Nutrition, 133*, 841S–843S.

Gittelsohn, J., Shankar, A. V., Pokhrel, R. P., & West, K. P., Jr. (1994). Accuracy of estimating food intake by observation. *Journal of the American Dietetic Association, 94*, 1273–1277.

Glanz, K., Basil, M., Maibach, E., Goldberg, J., & Snyder, D. (1998). Why Americans eat what they do: taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *Journal of the American Dietetic Association, 98*, 1118–1126.

Headquarters Department of the Army, Navy, and Air Force. (2001). Army regulation 40-25: Nutrition standards and education. Washington, DC: Authors. Retrieved from http://www.apd.army.mil/pdffiles/r40_25.pdf

Hoefkens, C., Lachat, C., Kolsteren, P., Van Camp, J., & Verbeke, W. (2011). Posting point-of-purchase nutrition information in university canteens does not influence meal choice and nutrient intake. *The American Journal of Clinical Nutrition, 94*, 562–570.

Hsu, L. L., Nevin, R. L., Tobler, S. K., & Rubertone, M. V. (2007). Trends in overweight and obesity among 18-year-old applicants to the United States military, 1993–2006. *Journal of Adolescent Health Care: Official Publication of the Society for Adolescent Medicine, 41*, 610–612.

Kolodinsky, J., Harvey-Berino, J. R., Berlin, L., Johnson, R. K., & Reynolds, T. W. (2007). Knowledge of current dietary guidelines and food choice by college students: better eaters have higher knowledge of dietary guidance. *Journal of the American Dietetic Association, 107*, 1409–1413.

Levi, A., Chan, K. K., & Pence, D. (2006). Real men do not read labels: the effects of masculinity and involvement on college students' food decisions. *Journal of American College Health, 55*, 91–98.

Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2012). Prevalence of obesity in the United States, 2009-2010. The Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS). Hyattsville, MD. Retrieved from http://www. cdc. gov/nchs/data/databriefs/db82. pdf

Packnett, E. R., Niebuhr, D. W., Bedno, S. A., & Cowan, D. N. (2011). Body mass index, medical qualification status, and discharge during the first year of US Army service. *The American Journal of Clinical Nutrition, 93*(3), 608–614.

Sapp, S. G., & Jensen, H. H. (1998). An evaluation of the health belief model for predicting perceived and actual dietary quality. Journal of Applied Social Psychology, 28, 235–248.

Sapp, S. G., & Weng, C.-Y. (2007). Examination of the health-belief model to predict the dietary quality and body mass of adults. *International Journal of Consumer Studies, 31*, 189–194.

Seagle, H. M., Strain, G. W., Makris, A., Reeves, R. S., & American Dietetic Association. (2009). Position of the American Dietetic Association: Weight management. *Journal of the American Dietetic Association, 109*, 330–346.

Sproul, A. D., Canter, D. D., & Schmidt, J. B. (2003). Does point-of-purchase nutrition labeling influence meal selections? A test in an Army cafeteria. Military Medicine, *168*, 556–560.

Sun, Y.-H. C. (2008). Health concern, food choice motives, and attitudes toward healthy eating: the mediating role of food choice motives. *Appetite, 51*, 42–49.

Templeton, S. B., Marlette, M. A., & Panemangalore, M. (2005). Competitive foods increase the intake of energy and decrease the intake of certain nutrients by adolescents consuming school lunch. *Journal of the American Dietetic Association, 105*, 215–220.

United States Department of Agriculture, Agricultural Research Service. (2013). Composition of foods, raw, processed, prepared USDA national nutrient database for standard reference (Release 26). Retrieved from http://www.ars.usda.gov/SP2UserFiles/Place/12354500/Data/SR26/sr26_doc.pdf

U.S. Army Food Service. (2012). Go for green procedures and instructions. Retrieved from http://www.quartermaster.army.mil/jccoe/Operations_Directorate/QUAD/nutrition/G4G_Procedures_Sept_2012.pdf

Vecchiarelli, S., Takayanagi, S., & Neumann, C. (2006). Students' perceptions of the impact of nutrition policies on dietary behaviors. *The Journal of School Health*, *76*, 525–31.

Vyth, E. L., Steenhuis, I. H. M., Heymans, M. W., Roodenburg, A. J. C., Brug, J., & Seidell, J. C. (2011). Influence of placement of a nutrition logo on cafeteria menu items on lunchtime food Choices at Dutch work sites. *Journal of the American Dietetic Association, 111*, 131–136.

Williams, G., Noakes, M., Keogh, J., Foster, P., & Clifton, P. (2006). High protein high fibre snack bars reduce food intake and improve short term glucose and insulin profiles compared with high fat snack bars. *Asia Pacific Journal of Clinical Nutrition, 15*, 443–450.

Williamson, D. A., Allen, H. R., Martin, P. D., Alfonso, A., Gerald, B., & Hunt, A. (2004). Digital photography: a new method for estimating food intake in cafeteria settings. *Eating and Weight Disorders, 9*, 24–28.
Williamson, D. A., Allen, H. R., Martin, P. D., Alfonso, A. J., Gerald, B., & Hunt, A. (2003). Comparison of digital photography to weighed and visual estimation of portion sizes. *Journal of the American Dietetic Association, 103*, 1139–1145.
Yamane, G. K. (2007). Obesity in civilian adults: potential impact on eligibility for U.S. military enlistment. *Military Medicine, 172*, 1160–1165.