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EVALUATION OF A DINING FACILITY INTERVENTION ON U.S. ARMY SPECIAL OPERATIONS SOLDIERS' MEAL QUALITY, DINING SATISFACTION, AND COST EFFECTIVENESS

United States Army
Medical Research & Materiel Command

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USARIEM TECHNICAL REPORT T17-03

Evaluation of a Dining Facility Intervention on U.S. Army Special Operations Soldiers' Meal Quality, Dining Satisfaction, and Cost Effectiveness

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The study purpose was to test the initial effectiveness of this USASOC HPP (Human Performance Program) intervention and whether changes were sustained over time. Dietary intakes were assessed using food photography before and after three main meals over 2 days. Daily nutrient content and Healthy Eating Index (HEI) scores were computed. Descriptive and independent t-test analyses were performed pre to post HPP implementation (α=0.05; 80% power). A total of 688 Soldiers participated(98% male; mean age of 25.6±2.9 yrs). At 12-months, USASOC patrons exhibited a significantly higher sodium-adjusted HEI score (70.3±8.7 points; +4.6 pts; p=0.005) compared to the control DFAC (avg of 56.3 ±10.8 points over 12-months). Specific improvements in USASOC patron intake were +0.6 cups fruit (2.5 cups/d), +0.8 oz whole grains (5.9 oz/d), +1.9 oz protein (14.9 oz/d; 2.0g/kg BW), -0.3 oz refined grains (4.3 oz/d), and -0.13g/kg fat (1.24g/kg BW) ($p<0.05$). These data illustrate that education, introduction of healthy food options, and revised cooking practices are effective interventions for improving Warfighter meal quality.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

BACKGROUND

The Joint Chiefs of Staff and the Army Surgeon General consider nutrition as one of the pillars of health and readiness. Soldiers' eating behaviors are generally less than ideal with suboptimal consumption of fruits, vegetables, and other nutrient-rich foods. As approximately 74% of non-deployed military personnel consume at least one meal per day in military dining facilities (DFAC), interventions that encourage performance-based food choices and nutritious eating behaviors in this dining environment have the potential to positively influence eating patterns of large numbers of military personnel. The USASOC Human Performance Program (HPP) dietitians developed an intervention for implementation in one of their DFACs that included education, a shift to a performance-based menu and a population-specific point-of service labeling system in an attempt to improve their Soldiers' eating behaviors. The aim of this investigation was to test the feasibility, effectiveness, and sustainability of this intervention approach.

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EXECUTIVE SUMMARY

The USASOC Human Performance Program (HPP) dietitians developed a comprehensive strategy designed to improve Special Operations Forces (SOF) Warfighter eating behaviors through nutrition education and dining hall food changes that included a novel performance-based menu and point-of-service labeling system. The study purpose was to test the initial effectiveness of this HPP intervention and whether changes were sustained over time. Comparison to a best practice Army DFAC was included to control for seasonal changes in eating behavior. Diet quality through food photography, food cost relative to the plate cost, DFAC satisfaction, satiety and eating rate, and food service management practices were assessed at baseline, and 4, 8 and 12 months after initiating the intervention. Daily nutrient content and Healthy Eating Index (HEI) scores were computed. Descriptive, pre to post t-test, and ANOVA statistical analysis from baseline to 4, 8, and 12-month post-intervention were performed (α=0.05; 80% power). A total of 688 (98% male; mean age of 25.6±2.9 yrs) Soldiers participated. At 12-months, USASOC patrons exhibited a significantly higher sodium-adjusted HEI score (70.3±8.7 points; +4.6 pts; p=0.005) compared to the control DFAC (avg of 56.3 ±10.8 points over 12-months). The HPP nutrition program exceeded the national HEI score (ranging 48-57 pts). The improved HEI scores for USASOC patrons were attributed to significant increases of 0.4 cups/d fruit, 0.4 cups/d red/orange vegetables, 0.8 cups/d whole grains, 0.9 cups/d protein-based legumes, and 0.6 oz/d protein (p<0.05). USASOC patrons also exhibited significant reductions of 0.5 cups/d refined grains, 0.6 cups/d starchy vegetables, 0.9 cups/d milk (although 0.2 cups/d increase in yogurt), 11 g/d of oil, and 6 g/d of solid fat (p<0.05). These data illustrate that education, introduction of healthy food options, and revised cooking practices are effective interventions for improving Warfighter meal quality.

INTRODUCTION

A search of PubMed (performed 25 Sep 2014) and the Defense Technical Information Center (DTIC; performed 30 Sep 2014) was conducted using the keywords: Dining Facility (or Dining Hall); Special Forces (or Military); Healthy Eating Index 2010 (or HEI 2010); Menu Planning; Healthy Eating; and Performance. These searches identified a gap with limited research supporting military dining facility nutrition interventions.

The worksite environment is an ideal medium for promoting change in health habits, particularly in relation to nutrition.[1] Interventions in civilian worksite and university cafeterias have been effective in changing eating behaviors.[2] Successful interventions incorporate some form of informational or educational strategy[2], and incentives for purchase of healthy food items have resulted in higher sales[3-7] and improved intakes[7,8] of those items after incentives were removed.[5-8] Labeling foods based on energy density[9], as healthy choices[10,11], or suggesting alternatives within the nutrition labeling format at point-of-service[12], as well as using verbal prompts to encourage food selection have also been deemed effective to facilitate healthy food choices in ad libitum dining environments.

Approximately 74% of non-deployed military personnel consume at least one meal per day in military dining facilities (DFAC)[13], and as such, interventions that encourage performance-based food choices and eating behaviors in this dining environment could influence eating patterns of large numbers of military personnel. A study of the use of labels in an Army cafeteria did not effectively increase sales of target "healthy" entrees, whereas taste and food quality had the greatest impact on menu choice.[14] Fiedler and colleagues[15] incorporated "heart-healthy" menus at one of two DFACs that served US Air Force Basic Military Trainees, and demonstrated that the "heart-healthy" facility patrons reduced daily dietary fat intake from

35% to 19% by the end of basic training, while patrons of the standard garrison DFAC increased fat intake. Additionally, the Diet Quality Index improved only in trainees frequenting the "heart-healthy" facility, and customer satisfaction indicated customer acceptability of the "heart-healthy" menus. However, diners at DFACs in basic training installations are often "coached" on food selections by cadre,[16] thus the impact of this type of food service intervention on truly ad libitum eating remains to be seen. In an earlier USARIEM DFAC intervention with five of ten DFACs on Fort Bragg, NC, modest menu enhancements resulted in reductions in energy intake, total fat, and percent energy from fat and saturated fat, with no impact on fruit or vegetable intakes between the intervention and control groups despite positive customer satisfaction ratings.[17]

DFACs that serve the Army Special Operations Forces (ARSOF) community, specifically those engaged in special operations selection, assessment, and training operations, are faced with providing nutritional support for a population that often expends 140% of the typical garrison Soldiers daily expenditure.[18] Hence, the SOF leaders have specific interest in enabling performance-based nutrition to sustain high intensity operations, and to facilitate recovery between missions, training, and ultimately during dwell time between deployments. Across the DoD, data depicts Soldiers' intakes are less than ideal, to include low intakes of fruits, vegetables, and other nutrient rich foods.[13,19] Nutrient density is the ratio of nutrients to the amount of kilocalories in a food or beverage item and contains a substantial amount of vitamin, minerals, antioxidants, and/or fiber per serving.

The US Army Special Operations Command (USASOC) Human Performance Program (HPP) includes the Tactical Human Optimization Rapid Rehabilitation & Reconditioning ($THOR^3$) program. The objective of the USASOC HPP program is to provide a comprehensive, multidisciplinary training and treatment program designed to enable the sustained operations

required of ARSOF and to ensure peak readiness, preserve unit integrity, and prolong the careers of the ARSOF operators. The USASOC HPP dietitians designed a performance nutrition intervention incorporating classroom nutrition education and dining facility changes that included performance- based recipes, revised menus, and population-specific point-of-service labeling (Figure 1) for initial execution at the US Army J.F. Kennedy Special Warfare Center & School (SWCS). After receiving approval from the Army G-4 (finance), the Defense Logistics Agency (DLA), and the Joint Culinary Center of Excellence (JCCoE) to implement the USASOC HPP DFAC intervention, USARIEM was tasked with determining whether the program was acceptable from the perspective of patrons and dining hall staff, whether the intervention improved the self-selected diet quality of the patrons, was sustainable over time, and its feasibility for expansion.

Military Relevance

The Chairman of the Joint Chiefs of Staff and The Army Surgeon General promote nutrition and healthy eating as one of the pillars/domains of health and total fitness.[20,21] Establishment of a high food quality and nutrient-rich menu in combination with a point-of-service labeling and nutrition education program has the potential to improve the eating behaviors and diet quality of Soldiers with related downstream improvements to their health, wellness, and resiliency. This research supports the Military Operational Medicine Research Program's Task Area B: Recovery Nutrition.

Study Objectives & Hypotheses

Primary Objectives

1. Assess the effectiveness of the USASOC HPP DFAC nutrition intervention (new recipes, revised menus, and an unique food labeling system) and population-specific

education on patron diet quality, quantity, and dining satisfaction compared to current practice of a garrison DFAC not exposed to the experimental interventions while controlling for confounding effects from season (e.g., weather dependent food choices, seasonal foods).

2. Determine the average food plate cost during baseline feeding, after making substitutions to DFAC foods, and after addition of labeling, to compare against diet quality. Data will be used to make informed decisions regarding benefit of the intervention relative to cost.

Secondary Objective:

1. Assess if the DFAC intervention is accompanied by changes in Soldiers' self-reported lifestyle behaviors.
2. Determine if the DFAC intervention is associated with changes in subjective rating of appetite/satiety before and after eating in the DFAC.
3. Capture DFAC staff perspectives on barriers, challenges and experiences related to their respective DFAC operations.

Hypotheses

1. Healthy Eating Index 2010 (HEI-2010) scores and nutrient quality will be higher post-HPP DFAC enhancement compared to baseline assessment and the standard garrison DFAC.
2. The DFAC customer satisfaction ratings will be higher post-HPP DFAC enhancement compared to baseline and the garrison DFAC.
3. The HPP DFAC enhancement will result in changes in self-reported non-nutritional program lifestyle choices.

4. The HPP DFAC enhancement will be associated with a greater level of satiety between meals.
5. Average plate cost at the HPP DFAC will be comparable to that of the standard garrison DFAC.

RESEARCH DESIGN AND METHODS

Study Design

The evaluation was conducted using a non-randomized control trial time-series assessment with four data collection time points (Jan 2015, March 2015, September 2015, and January 2016). It was executed at two separate dining facilities (DFAC); an experimental and a control DFAC. The Control DFAC was included to account for seasonal changes in food preferences/availability or other situations acting independently from the HPP intervention to change food selection choices. Thus, significant change was not expected for the Control DFAC. The evaluation was conducted before the new HPP DFAC intervention had taken place (0 Month), at 4-months when the majority of new foods and menus were in place, at 8-months when the point-of-service (P-O-S) labels were introduced, and at 12-months to examine if any changes persisted over time (Figure 2).

Participant Population

The experimental DFAC served US Army Special Forces Soldiers and Special Forces Qualification Course (SFQC) students within the US Army John F. Kennedy Special Warfare Center and School (SWCS), Fort Bragg, NC. The Control "Falcon Inn" DFAC served Soldiers from the 2nd Brigade Combat Team (2BCT), 82nd Airborne Division. Each DFAC served between 500-800 Soldiers per meal at the time of the study.

Inclusion and Exclusion Criteria

Participants were included if on Active Duty status, adults (18 years and older), willing to consume three meals each day at the DFAC for two consecutive testing days. A participant could volunteer for subsequent data collection, if willing and available to participate. No exclusion criteria were set. Participants were not monetarily compensated for study participation; however, they were offered the privilege of moving to the front of the line at the DFAC on study days to allow maximum time for meal consumption and tray photography.

Number of Participants/Sample Size Estimations

It was hypothesized that the Control group would not yield a significant change pre to post-test, whereas the USASOC HPP DFAC menu and point-of-service labeling enhancements would result in improved dietary intakes and Heathy Eating Index 2010 (HEI) scores. Thus a significant improvement in eating behavior between the USASOC HPP DFAC intervention and Control groups was expected. SPSS SamplePower 3.0.1 (IBM, Chicago, IL) was used to estimate sample size; power was set at 80% with an alpha at 0.05 (two-tailed analysis). HEI scores between groups at post-test was anticipated to be a 15-point mean score difference with a 30-point standard deviation (effect size of 0.5) requiring 64 participants in each DFAC group.[22]

USASOC HPP DFAC Intervention

The USASOC HPP DFAC intervention (internally known as THOR^3; Tactical Human Optimization, Rapid Rehabilitation and Reconditioning) included modifications to the recipes and menu, food choice architecture to increase accessibility of higher quality foods, and a point-of-service labeling system (Appendix A). In addition, a nutrition education component, consisting of 1-6 hours of classroom instruction external to the SWCS DFAC facility, was

introduced to the SWCS training programs. This population-specific nutrition component emphasized the importance of snacking and food choices made within the DFAC to enhance task-specific cognitive and physical performance and promote recovery. Prior to the HPP DFAC intervention, several improvements were implemented within the DFAC, such as food choice architecture (strategic food placement) of fruits and vegetables within the serving area; however all revisions were consistent with existing Army Food Service Regulations. A two-phased implementation approach was used to assess recipe and menu revisions separately from the new point-of-service labeling.

1. During Phase I (months 0-4), menu enhancements were introduced at SWCS one 21-day cycle prior to the four month assessment. These modifications included:
    a. Addition of vegetable and vegetable juice blends (enhanced potassium, antioxidants, fruit and vegetable availability/convenience).
    b. Addition of Greek yogurts (high quality lean protein) to dessert areas and minimized choices offered that were high in saturated fat and sugar (e.g., bakery).
    c. Addition of plain tuna to the salad bar (high quality lean protein and omega-3 fatty acids).
    d. Addition of walnuts and/or mixed nuts to the salad bar (monounsaturated fats and omega-3 fatty acids).
    e. All bread options included 100% whole wheat option (complex whole grains) alongside of the refined white flour bread option.
    f. Pre-cut fruits were available on the salad bar and in the dessert areas (enhanced fruit availability and convenience).
    g. Placement of vegetables at the start of the serving line (enhanced vegetable availability).
    h. Reduction or elimination of saturated fats (e.g., use low fat mayonnaise or yogurt for prepared salads; replace butter with olive oil in recipes).

i. Addition of fresh fruit-infused water as a beverage option and elimination of sugary beverages (e.g., soda) from beverage options.

Note that although more whole grains and leaner protein sources were offered, high fat protein sources, refined grains, and some other lower quality foods were still offered after the HPP DFAC enhancement intervention.

2. During Phase II (5-8 months), introduction of the point-of-service labeling system occurred. The labeling system possessed similarities to the Army's color-coded Go For Green® program, which uses the stoplight approach to describe menu items (green = eat often, yellow = eat in moderation, red = eat rarely); however the HPP nutrition color coding system (blue = lean protein, purple = combination foods, orange = performance fats, green = quality carbohydrates) promoted fresh, lean, clean and performance-based, population-specific, macronutrient descriptors. The label incorporated the THOR^3 icon and an ammunition-style graphics (bullet casing icons) to describe the acceptability of the menu items (3-bullet icons = Best choice, 2-bullet icons = Good Choice, 1-bullet icon = Limit these choices) for constructing a nutritious meal. This labeling system is user-friendly and resonated with the SOF community. Refer to Appendix B for an example.

The SOF performance-based menu standards and guidelines[23] were developed jointly by the U.S. Special Operations Command Performance Dietitian Working Group consisting of Army, Navy and Air Force personnel within SOF. These standards were developed from the U.S. Olympic Training Center menu standards[24] as the foundation of the menu, which incorporated Dietary Guidelines for Americans 2010,[25] and then scrutinized to ensure the revised menu would meet the Joint Subsistence Policy Board DoD Menu Standards 2010.[26]

USASOC HPP DFAC Evaluation Timeline

The evaluation by USARIEM was conducted over four time periods to adequately assess baseline, HPP DFAC enhancement implementation, point of service labeling and program maintenance. Recruitment, study enrollment, and data collection occurred at both DFACs (SWCS and 2BCT) at each time point (Figure 2) as highlighted below. Note that 2BCT control DFAC was encouraged to continue food service operations as usual and included the use of the Go For Green® point-of-service labeling system.[27]

1. Baseline: Intent was to provide an understanding of patron diet quality and customer satisfaction prior to implementation of the USASOC HPP DFAC program.
2. Four Months: Intent was to examine change in nutrient intake and customer satisfaction following the initial implementation of new recipes and menu modification.
3. Eight Months: Intent was to examine the impact of the new point-of-service labeling.
4. Twelve Months: Intent was to examine the maintainability and cost effectiveness of the HPP DFAC performance nutrition intervention.

Research Procedures

Digital Photography Method.

The digital photography method was used to quantify food selection and intake of enrolled study participants. At each meal, foods and beverages selected by the DFAC participants prior to and after eating were photographed using digital video cameras. Photographs of participant meal trays did not include personally identifiable information (e.g., a person's face or uniform name tag). Camera angle and distance was standardized to allow the apparent size of all foods to remain consistent across photographs (Figure 3). Up to four camera stations were set up to photograph incoming trays (food selection), and outgoing post-meal

trays (plate waste) in an expedient manner. Participants could bring and return trays to any of the photography stations. Food trays were numbered to match individual trays before and after eating according to each participant's specific de-identified code number used on the paper survey in order to link participant survey responses with nutritional intakes. Pennington Biomedical Research Center (PBRC) staff was trained to man all camera stations, assisted by USARIEM research staff. A second camera at baseline was used at two of the four camera stations in order to evaluate whether an additional camera simplified and enhanced food estimation accuracy. Tray stations using two cameras during the baseline assessment eased adjudication time and improved nutritional intake assessment; thus subsequent data collections included two cameras at each camera tray station to improve efficiency.

Prior to participant meal photography, standardized reference portions of all possible food choices were weighed and recorded for comparison to the digital photographs of the participants' food trays. Digital photographs of all reference portion, patron food selection, and patron plate waste were incorporated into a computer application designed for estimation of food portion sizes (Food Photo 2.0, PBRC). Two research associates from PBRC used the software to simultaneously view all photos and estimate each food portion in the photographs to a tenth of a gram. Patron food intake was defined as the difference between food selection and plate waste. The food intake estimates were entered into a data entry grid in the computer software application for statistical analysis and food composition analysis using the PBRC nutrient database. PBRC uses the Moore's Extended Nutrient Database (MENu), which contains USDA food composition data from both the Food and Nutrient Database for Dietary Studies (NHANES database) and the Standard Release (SR) database. Recipes specific to those used in SWCS and 2BCT DFACs were entered into this system. Information on nutrient intake specific to each participant was generated. Previous studies with adults found this procedure was highly reliable and valid.[28,29]

The dietary measures included (but were not limited to): total calories, servings of food groups (fruit, vegetables, dairy, protein, grains, discretionary calories, and food group sub-categories), macronutrient (fat, protein, carbohydrate), fiber, added sugar, fatty acids, vitamins (including antioxidant and phytonutrients), and minerals.

Healthy Eating Index 2010 (HEI-2010).

The HEI-2010 is a tool to measure diet quality as it relates to the 2010 Dietary Guidelines for Americans and is based upon nutrients per 1,000 calories (kcal). Dietary intake data, captured from the photographed meal analysis, was used to calculate the HEI-2010 diet quality scores. The HEI-2010 evaluates 12-domains with a maximum number of points per domain ranging from 5-20 points and a maximum HEI-2010 total score of 100 points (Table 1). Nine categories assess nutrient and food group adequacy, while the remaining three categories assess foods that should be consumed in moderation. The domains with their respective maximum points in parentheses are total fruit (5 pts), whole fruit (5 pts), total vegetable (5 pts), greens and beans (5 pts), whole grains (10 pts), dairy (10 pts), total protein (5 pts), seafood and plant protein (5 pts), fatty acids (10 pts), refined grains (10 pts), sodium (10 pts), and empty calories (20 pts). Complete detail on the domains of the HEI-2010 can be accessed at http://riskfactor.cancer.gov/tools/hei/. Diet quality is classified as poor quality (≤50 points), needs improvement (51-80 points) and good quality (81-100 points). The US National HEI score average over the past ten years has ranged from 48-57 points.[30-32]

Paper Surveys. Two surveys were completed immediately after participants were enrolled in each study group at the 0, 4, 8 and 12-month iterations.

1) Demographics & Lifestyle survey (Appendix C) captured self-reported participant demographic data and lifestyle information to describe the sample populations. The survey

included: age, self-reported height and weight, ethnic and racial background, highest education level, rank, two questions related to meal timing and location, as well as habits and perceptions regarding physical activity, screen time (TV, video games, computer), hours of sleep, level of sleepiness/alertness, and the impact of DFAC food choices on several performance and wellbeing factors. The short international physical activity questionnaire (IPAQ) and Stanford Sleepiness Scale (SSS) were incorporated into the survey. The IPAQ is used to quantify daily vigorous intensity activity, moderate intensity activity, walking and sitting (open access at http://www.ipaq.ki.se/scoring.htm). The SSS is a 7-point scale assessing the level of sleepiness ranging from fully alert to extremely sleepy (open access at http://web.stanford.edu/~dement/sss.html).

2) Dining Facility Satisfaction (Appendix D) questionnaire assessed the sensory qualities (e.g., taste, texture, temperature, and appearance) of foods provided and consumed in the DFAC, food availability, thoughts on quality and health impact, and labeling of performance enhancing foods. The DFAC satisfaction survey was comprised of 17-items rated on a 7-point Likert Scale ranging from Strongly Agree to Strongly Disagree.

Satiety Labeled Intensity Magnitude (SLIM) Scale.

The SLIM scale is a tool assessing the degree of hunger or fullness at the time of pre-meal and post-meal tray photography. The SLIM scale is a continuous visual analog scale on a 100-mm line with descriptive labels for self-perceived hunger and fullness. Scoring ranged from -100 points (greatest level of hunger) to +100 points (greatest level of fullness). Participants were asked to view the SLIM scale and identify the level of hunger or fullness that represents their current state by drawing a horizontal line crossing the scale (Appendices E & F). The change in SLIM score was calculated as the difference from the Pre and Post eating scores to identify the degree of fullness (satiation). Research has

identified that the level of hunger is impacted by meal and snack timing, and often influences the types of food selected and degree of post-meal fullness (satiety).[33-35] The SLIM scale has been shown to be a sensitive, reliable, and an easy-to-use scale for measuring perceived satiety.[36]

The PreSLIM scale was also used to document the tray photography time, the last time food was consumed, and the type of snack (if applicable) (Appendix E). The Post SLIM scale also documented if the participant had enough time to eat (yes or no), meal length (shorter, typical or longer than usual), and an estimation of eating rate (ranging from relatively fast to relatively slow) (Appendix F). Three additional questions (dependent on time availability) were asked at post-meal photography to provide additional insight into customer satisfaction immediately following meal consumption: How satisfied are you with your meal selection today? If you could recommend one change in the DFAC, what would it be? If a significant amount of plate waste was noted, the investigator asked for a reason for leftover food on the plate.

Foodservice Staff Focus Group Sessions.

Focus group sessions were conducted at each of the DFACs at 4, 8, and 12-month study iterations. The purpose of focus groups was to capture foodservice staff experiences, challenges, and suggestions for DFAC improvement. Published studies using focus group sessions for health-related outcomes ranged in sample size of 10-60 participants[37-40]; thus 30 DFAC staff members from each DFAC at each iteration was considered sufficient to reach thematic saturation. Focus groups were formed based upon supervisory and non-supervisory positions. Questions for the focus group were developed collaboratively with the USARIEM dietitians, the HPP dietitians, and the DFAC food service advisors. Each focus group session was designed to host up to10 volunteers and lasted approximately 60

minutes. Sessions were audio recorded, and transcribed to draw unique and common themes. Consolidated data from the sessions were provided to leadership.

Data analysis

Descriptive demographic analysis is reported as mean ± standard deviation (SD) or frequency / percent depending on the scale of measurement. Data transformations included:

Dietary Intake: Foods and beverages were consolidated into top food and beverage choices for each DFAC over the four time periods based upon frequency of foods consumed. Patron nutrient intake was assessed as a daily average of three meals; patrons who did not consume at least one of each meal were excluded. Nutrient intake was compared between DFACs (SWCS and 2BCT), meals (breakfast, lunch, and dinner), and within each DFAC over the four time periods. Macronutrients (protein, fat and carbohydrate) were converted to kilograms (kg) per body weight (BW) and percent of total calories (kcal) to account for participant differences between height and weight. SWCS food group serving data were compared to the USDA 2015 dietary recommendations, based upon energy needs set at 2800 calories per day.[41]

HEI Score: HEI-2010 total and domain scores were assessed as a daily average of 3 meals for each DFAC patron and stratified by meal. Total HEI score was adjusted to account for the liberal military sodium recommendations; military dietary reference intake (MDRI) for this population recommended at no more than 5500 mg as opposed to the USDA recommendation of no more than 2300 mg for the US adult. Total HEI and Total HEI sodium-adjusted scores were categorized into Poor Quality diet (0-50 points or less), Needs Improvement (51-80 points), and High Quality (81-100 points). HEI-2010 scores and percent HEI classification were compared between DFACs (SWCS and 2BCT), meals (breakfast, lunch, and dinner) and for each DFAC over the four time periods.

Self-reported Demographic & Behavioral Data: Data for the overall sample were stratified by Army Physical Fitness Score (APFT; < or ≥ 280 points) and compared with nutrient intake and HEI diet quality categories.

SLIM Scale: Time to eat was defined as the time participants had access to their meal tray and was calculated as the difference in time documented at pre-meal versus post-meal. Snacks were classified into six categories: no snack, prepackaged protein, carbohydrate only, healthy food mix (protein + carbohydrate), meal size mix of foods, empty calories (high fat or sugar), and caffeinated snack. The hours since last meal was calculated based upon the previous post meal time. If the post meal time was missing, the following median between meal times were used: 3.5 hours between breakfast and lunch, 5.5 hours between lunch and dinner, 2 hours for time between a snack and meal, 13 hours from evening snack to early morning snack, and 15 hours from dinner to breakfast. Perceived hunger (PreSLIM score), time to eat, time since last meal, and snack type were compared to nutrient intake to identify an association between hunger level, self-reported eating rate, and food choice. Satiation (change in SLIM scale score) was compared to eating rate, nutrient intake, food groups, and HEI-2010 scores. The data were assessed as a collective data set and also compared between DFACs and by meal.

Plate Cost: Average plate cost was determined by the actual total cost of the food prepared and divided by actual headcount (number of customers fed). The USARIEM investigators coordinated with the onsite DFAC Senior Food Advisor for this information. Data were collected monthly between Jan 2015 and May 2016; an additional six months of assessment provided a full year of plate cost data after USASOC HPP DFAC intervention implementation.

DFAC Staff Focus Group Analysis:

Focus group sessions were transcribed from audio recordings prior to analysis. Participant responses were linked to an ID code to assess between study iteration, DFAC and

supervisory or non-supervisory role. Responses were also coded for discussion categories, patterns, and themes. The major categories in each discussion were further defined by coded sub-categories. Direct quotes were utilized to illustrate major and sub-categories with specific examples. Focus groups verbatim transcripts were managed and analyzed using Microsoft Word 2007 (Microsoft, Redmond, Washington) and SPSS Version 21 (IBM, Chicago, IL).

Statistical Analysis: Independent sample t-tests were used to assess if baseline differences existed between the control and intervention groups as well as changes from Pre- to Post-intervention. One-way analysis of variance (ANOVA) were completed to assess changes in eating behaviors and related outcomes over the four time points (0, 4, 8, 12-months) for each DFAC. Tukey's post-hoc analysis was performed to identify where statistical differences resided within a DFAC and between the DFACs at discrete time points. However, data was often documented from baseline (Pre-Test) for each DFAC and compared against the consolidated mean values for 4, 8, and 12-month data (Post-Test) for viewing ease. Data for 2BCT were consolidated for 0, 4, 8, and 12 month data for tabular data representation. Pearson's r or Spearman rho correlation assessment was performed to assess associations between nutrient intakes, HEI-2010 scores, appetite / satiety data, and lifestyle habits. Multiple regression analysis was performed to identify predictors of satiety based upon significant correlations. Food photography data between the first and second cameras were compared with the established technique to assess changes in efficiency of food intake estimation and adjudication.

RESULTS

Subject Demographics

A total of 688 Soldiers were enrolled between SWCS (n=428) and 2BCT (n=260) DFACs over

four iterations (Jan 2015, May 2015, Sep 2015, Jan 2016). Demographic descriptive data for the overall sample and stratified by DFAC are depicted in Tables 2 & 3. Overall 85% of the participants were Caucasian (13% Hispanic), 69% were junior enlisted (E1-E4), and 43% had some college education. The mean age of the overall sample was 25.6 ± 5.5 yrs with a BMI of 26.0 ± 2.9 kg/m^2, 4.1 ± 4.9 yrs of active duty service and, 6.5 ± 1.1 hrs of sleep, 5-7 hrs/d of daily screen time (including computer, TV, and video games), and scored 275.1 ± 22.2 points on the Army Physical Fitness Test (APFT). There were significant, yet expected, differences between SWCS and 2BCT patrons in age, BMI, years of active duty service, race, ethnicity, education, rank, physical activity levels, APFT scores, screen time, and hours of sleep. Overall 83% of the Soldiers reported they felt like they were in 'good' to the 'best' shape of their life, however self-reports were higher for SWCS than 2BCT patrons (88% vs. 76%; p<0.005). More SWCS patrons scored 280 points or higher on the APFT than 2BCT patrons (62% vs. 34%; p<0.001). Significantly more SWCS patrons reported feeling alert during the day compared to 2BCT patrons (63% vs. 44%; p<0.001) and also had more hours of nightly sleep (6.7 hrs vs. 6.2 hrs). Sixty-seven percent of the SWCS patrons were current students at the U.S. Army John F. Kennedy SWCS and had 5 hours of nutrition education included within their program of instruction during the 12-month study.

DFAC patrons' self-reported meal pattern and common eating location are highlighted in Table 4. Of the overall sample, 80% consumed breakfast, 92% consumed lunch, and 96% consumed dinner at least 5 times per week. Significantly more SWCS DFAC patrons reported consuming early morning snack (29% vs. 13% 2BCT; p<0.001), morning snack (28% vs. 16% 2BCT; p<0.001), and lunch (96% vs. 86% 2BCT; p<0.001). Meals were most commonly consumed at a military DFAC, whereas snacks were commonly obtained from the patron's home or barracks regardless of number of days (regularity) consumed.

Changes to the HPP DFAC Enhancement Intervention

The HPP DFAC intervention implementation rolled out as scheduled except for a delay in the point-of-service labeling. The original intent was to implement the new bullet icon labels at 7 months in order to assess if labeling facilitated a change in patron dietary intake at 8-months; however, the new point-of-service labeling was not implemented until a few days prior to the 8-month assessment for a variety of reasons: 1) The Army Food & Menu Information System (AFMIS) was unavailable for new recipe addition, which impacted forecast and purchase of new food ingredient; 2) Food ingredients and recipes choices on specific menu days exceeded plate cost and required food ingredient and menu-cycle adjustment; 3) DFAC staff required additional training on new recipes and menu enhancements (e.g., quinoa should be a cooked and not served raw); and 4) Food service equipment limitations resulted in manpower inefficiencies and schedule revisions. Menu and recipe modifications, although implemented at 4-months, continued to be revised and improved upon between the 4 and 8-month data points. Dietary intake at the 12-month data collection might be a better indicator of point-of-service (P-O-S) labeling impact on food choice. Also notable was that 2BCT implemented a "Healthy Bar" consisting of high quality food items (e.g., fruit, vegetables, nuts, whole grains) just prior to the 12-month data collections, that may have influenced patron choice beyond that expected if foodservice operations continued unchanged.

Effectiveness of the HPP DFAC Intervention

1. Healthy Eating Index-2010 (HEI-2010) Scores

HEI-2010 score was the primary measure to assess effectiveness of the USASOC HPP DFAC intervention. Total HEI-2010 score (Figure 4) for SWCS DFAC patrons significantly increased +3.35 points (baseline: 56.7 pts; 4-12 month mean: 61.0 pts; p=0.002), whereas 2BCT DFAC patron Total HEI-2010 scores remained consistent over the four time periods (mean of 49 pts

with a range of 48.0 - 50.7 pts). The Total HEI score was adjusted to account for the liberal military dietary reference intake maximum sodium value of 5500 mg/day for this sample population compared to the USDA recommendation of no more than 2300 mg/day. The sodium-adjusted HEI score for SWCS patrons shifted to an intervention mean of 70.3 points with a +4.7 point significant improvement (p=0.003).

Sodium adjusted HEI-Scores for each DFAC stratified by HEI-Score quality categories (poor, needs improvement, and good quality diet) are presented in Table 5. At baseline, 18% of SWCS patron meals were categorized as poor quality (HEI score ≤ 50 pts), 81% as needing improvement (51-80 pts), and 1% as good quality (≥81 pts); whereas 46% of 2BCT patron meals at baseline were categorized as poor quality, 54% as needing improvement, and 0.5% as good quality. After the HPP DFAC Intervention, SWCS patron diet quality significantly improved as only 11% of diets were rated poor quality, while 84% rated as needing improvement and 5% as good quality (p<0.001). The distribution of HEI score categories remained consistent for 2BCT over the 12-month study. When assessed by meal (breakfast, lunch and dinner), SWCS patrons' diet quality significantly shifted to higher quality at all three meals (Table 5).

HEI-2010 total and domain scores for SWCS and 2BCT patrons are reported in Table 6. SWCS patrons had significant increases in 5 of the 12 HEI-2010 domains. The HEI domains with the greatest magnitude of change for SWCS were a 26% increase in whole fruit, a 35% increase in total protein and a 183% increase in whole grains (all p<0.02). When changes in HEI-2010 domain scores were assessed by meal (breakfast, lunch and dinner), total fruit, whole fruit, whole grains, and empty calories exhibited point increases for all three meals, while dairy decreased at all three meals (not shown in table). SWCS HEI domain points were significantly higher than 2BCT (p<0.010) except for dairy and sodium.

2. Top 10 Food Choices

Figures 5 & 6 illustrate the changes in food categories for SWCS and 2BCT DFACs from baseline (Jan 2015) to 12-Month (Jan 2016) data collection time points.

SWCS Patrons (Figure 5): While several high quality, performance-based foods (fruits, vegetables, eggs, cheese and complex grains) remained in the Top 10 list at 12-months for SWCS, several new food additions to the HPP DFAC menu enhancements (e.g., legumes, beans and Greek Yogurt) transitioned to the Top 10 food choice list. Higher-fat pork breakfast meats were predominantly replaced by turkey bacon and sausage, and no longer a Top 10 food choice. Higher quality complex grains and starches (variety of beans/legumes) replaced refined grains and simple starch foods (e.g., potatoes, rice, pasta); neither were Top 10 food choices at 12-months although both were still available. High fat or sugar desserts were removed from the menu and replaced by a yogurt parfait bar (diced fruit, granola, and nuts). Poultry, a leaner protein source, always ranked higher than beef. Nuts and seeds, also high quality protein and high fiber starch foods, ranked #11-13 through all iterations. Complex grains moved from 9th place at baseline to 7th place at 4-months and finally 3rd place for the 8 & 12-month time periods. Thus the higher quality food options were not only available but consumed in higher quantities than the lower quality foods that were still available.

2BCT Patrons (Figure 6): Despite, healthier food options being available, several poor quality foods (i.e., high in fats and sugars; low in vitamins, minerals, fiber and phytonutrients) were on the Top 10 Food Choice lists (e.g., desserts, refined grains, pork breakfast meats) along with several higher quality, performance-based foods (e.g., fruit, vegetables, and cheese). Refined grains ranked in the Top #2-4 food choices across all four study iterations. Beef, typically higher in saturated fats, consistently ranked higher than poultry.

3. Beverage Choices

Beverage choices for SWCS and 2BCT patrons over the four time periods were assessed by category. The water category captures non-caloric (or very low calorie) enhanced, infused and club soda options. Sweetened beverages contain empty calories (typically 250 kcals per 12 ounce serving) due to added sugar, and include soda, lemonade, and sweetened iced tea. Although juice is a caloric beverage it was captured in a separate category due to the natural property of fruit juice without added sugars. The sports beverage category was defined as an electrolyte beverage containing fewer calories (typically ≤80 kcal per 12 ounce serving) than the sweetened beverage category. Beverage choices over the four time periods are reported in Figures 7 & 8 for SWCS and 2BCT DFACs.

SWCS Patrons: The top two beverage choices for SWCS patrons were milk (29-46% of beverages consumed) and juice (19-23%). Sugar-sweetened beverage ranked third at baseline (11% of beverages consumed) but dropped to the least consumed beverage (3%) for months 4-12, being replaced by water products (5-17% combined) and vegetable juice (7-10%). Coffee consumption (7-12% of beverages consumed) was higher than that for 2BCT patrons (1-6%).

2BCT Patrons: The top beverage choices for 2BCT patrons were milk (18-43% of beverages consumed) and sugar-sweetened beverages (28-48%). Sports beverages increased from 1% of beverage intake to 4-10% during months 4-12.

4. Dietary Intake Food Group Distribution

Dietary intake classified by food group servings provides the detail to understand why the HEI scores changed following the HPP DFAC intervention. Figure 9 displays the fruit, vegetables and dairy intakes for SWCS patrons pre- to post-DFAC implementation (reported in cups). For comparison, the 2015 USDA guideline recommendations for adults (based upon 2800

calories/day) are denoted by a red line while the average 2BCT intake over the 12-month study is denoted as light blue column bars. SWCS patrons had a significant increase in total fruit intake (25%; +0.5 cups) to 2.4 cups/day, which was close to the 2.5 cups/day USDA recommendation and attributed to a 50% increases in citrus & melon fruit (+0.34 cups) and a 54% increase in fruit juice (+0.23 cups). SWCS patrons had an 18% decrease in total vegetables (-0.70 cups) to 3.2 cups/day just below the 3.5 cups/day USDA recommendation, which was attributed to decreases in dark green vegetables (-0.25 cups) and total starchy vegetables (-0.6 cups; predominantly as potatoes). Despite the overall decrease in vegetables, SWCS patrons exhibited a significant increase in red / orange vegetables (+0.35 cups of which 0.22 cups was attributed to tomato intake) and legumes (+0.23 cups), both met the USDA recommendations. Total dairy servings did not significantly change over time with 2.9 cups/day consumption compared to the 3.0 cup USDA recommendation; however, milk decreased 39% (-0.9 cups) while yogurt intake increased 62% (+0.16 cups). Anecdotally, SWCS DFAC patrons reported that the milk dispensers often ran out during meal times, which may have contributed to decreased milk intakes along with increased intakes of water and electrolyte products during summer months.

Figure 10 depicts the intake of grains and protein sources reported in ounces (oz). Total grains did not significantly change after the HPP DFAC intervention with consumption at 5.4 oz of the 10 oz / day USDA recommendation. Whole grains significantly increased by 161% (+0.79 oz) while refined grains decreased 10% (-0.46 cups). Total protein foods (14 oz/day) did not significantly change after the HPP DFAC intervention; however, SWCS patrons met or exceeded the USDA recommendation, including soy, nuts and seeds (1.2 oz/day) and seafood (1.7 oz/day), both high in omega 3 or 6 fatty acids.

Figure 11 depicts discretionary calories from oils, fats and added sugar, reported in grams.

Discretionary calories should be consumed in moderation and thus the USDA recommendations represent a maximum recommended quantity. SWCS patron intake exhibited a 26% decrease in oils (-10.9 g/d) to 29.7g/d and dropped below the 36 g/d USDA recommended maximum. SWCS patrons had a 13% decrease in solid fat (-6.1 g/d) to 35.8g; however, intake was still above the 16 g/d USDA recommended maximum. Added sugar remained about 15 g/d, well below the 32 g/d USDA maximum recommended intake.

Table 7 displays the complete 25 food group category list with the change from baseline to 4-12 month average intake in cups, ounces or grams along with % change, and comparisons to 2BCT and USDA recommendations.

5. Dietary Intake - Macronutrient

Military dietary reference intakes (MDRI) and performance nutrition guidelines and recommendations exist for macronutrient intake.[42,43] Table 8 reports SWCS patron macronutrient intake pre- and post-DFAC implementation, compared against the overall 12-month 2BCT patron intake and macronutrient recommendations. Energy intake did not significantly change over time; averaging ~2750 kcal/d. Protein intake increased (+13.8 g/d; +0.2 g/kg body weight; +3.1% of total energy intake; p=0.011) to 2 g/kg body weight (BW) and 25% of energy, at the top of the performance recommendations (2 g/kg BW). Fat intake decreased (-15.7 g/d; -0.2 g/kg body weight; -3.9% of total energy intake p<0.001) to 1.2 g/kg and 32.8% of energy, which was improved but still above the maximum recommendation at 1 g/kg BW and 30% of energy. Of the dietary fats, decreases were observed in saturated fat (-4.5 g/d; 10.4% of total energy) to 28.6 g; monounsaturated (-4.5 g/d) to 37.8 g; and polyunsaturated fats (-6.9 g/d) to 24.6g, linoleic (omega-6; -6.2 g/d) to 21.2 g/d, and linolenic acid (omega-3; -0.7 g/d) to 2.4 g/d. The omega 6:3 ratio remained consistent at ~8.8:1, above the desired ratio of 5:1 but below the average US adult omega 6:3 ratio at 14 to 19:1. Fiber

intake increased 4.6 g/d to 29.5 g/d illustrating an improvement although still short of the daily recommendation of 35-38 g/d.

6. Dietary Intake - Vitamins

Vitamin intake of SWCS patrons pre- to post-HPP DFAC intervention, compared to 2BCT patron intake and MDRI recommendations are reported in Table 9. Several vitamin levels significantly increased from baseline and met MDRI recommendations: Beta Carotene (+2977 μg/d to a mean 11671 μg/d), Lycopene (+6164 μg/d to 11843 μg/d), Riboflavin (+0.4 mg/d to 2.4 mg/d), Vitamin B_6 (+0.6 mg/d to 4.4 mg/d), Vitamin B_{12} (+1.3 μg/d to 9.8 μg/d), and Folate (+133 μg/d to 710 μg/d). Two vitamins significantly decreased from baseline but still met MDRI recommendations: Vitamin D (-1.6 μg/d to 1.6 μg/d) and Vitamin K (-75 μg/d to 313 μg/d). All vitamin intake values after the USASOC HPP DFAC intervention were above that of 2BCT patrons except for Vitamin D.

7. Dietary Intake - Minerals

Mineral intake for SWCS patrons pre- to post HPP DFAC intervention, compared to 2BCT patron intake and MDRI recommendations are reported in Table 10. Two minerals significantly changed: calcium (-193 mg/d to 1386 mg/d) and selenium (+13 mg/d to 206 mg/d). However, all minerals met the MDRI recommendations.

8. DFAC Customer Satisfaction

DFAC customer satisfaction results for SWCS DFAC over the four data collection time points are reported in Figures 12 & 13 with overall 12-month 2BCT patron data for comparison. A total of 17 questions were asked about DFAC satisfaction related to the availability, quality, and portion size of specific foods (13 questions), as well as usefulness of the point-of-service

labeling (P-O-S) (4 questions). SWCS patron opinions on DFAC food service significantly improved on 11 of the 13 food-related customer satisfaction items post-HPP DFAC intervention (Figure 12), whereas 2BCT patron satisfaction remained consistent over the 12-month study. SWCS patrons agreed that food choices were adequate (67%) and healthy foods (79%), performance-based foods (72%), and fresh fruits (63%) were available (all $p<0.03$), all of which significantly increased from the 40-48% reported agreeance at baseline. SWCS patrons agreed that the salad bar offered a variety of fresh vegetables (76%, up from 53% at baseline); the main dishes were healthy and performance based (73%, up from 32%) and that side dishes were prepared without added fats (57%, up from 42%) (all $p<0.01$). Significant changes were observed for availability of healthy and performance-based desserts (31-47% fluctuation, up from 17%) and vegetarian options (33-46% fluctuation, up from 20%) (both $p<0.001$) although continued increases are desirable.

P-O-S labeling was implemented two days prior to the 8-month data collection. No change in any of the four satisfaction questions occurred between baseline and 4-month data collections. P-O-S labeling results (Figure 13) depict improvement in usefulness and actual use; however, only one of four questions at the 12-month data collection was significantly different from baseline. Fifty-nine percent agree that nutrition labels provide knowledge to make performance-based food choices (up from 39%; $p=0.018$).

9. Impact of DFAC Food on Self-Reported Performance & Wellbeing Factors

Along with actual food intake, opinions about the impact of DFAC food on patron self-reported performance and wellbeing factors were assessed. Table 11 depicts baseline opinions compared to 4-12 month percentages. Significant increases were observed for SWCS patrons on 10 of 12 factors ($p<0.05$), specifically: feeling energized (+12% units to 55%), improve mental performance (+12% units to 49%), improved physical performance (+17%

units to 57%), sustained physical performance for longer periods (+13% units to 56%), feeling good about self (+20% units to 58%), recovery after vigorous (+14% units to 55%) and moderate (+13% units to 56%) activity, reduce injury (+16% units to 39%), improve sleep (+12% units to 37%), and improve responses to emotions and stress (+14% units to 45%). No change was observed in 2BCT patrons' opinion regarding the impact of DFAC food on performance and wellbeing factors over the 12-month study.

There were no changes to percentages of feeling alert, ratings of physical readiness or APFT scoring category (<280 pts vs. ≥ 280 pts) from baseline to 4-12 months data collection for either DFAC (not reported in table).

10. Food Plate Cost

Average plate cost was tracked from baseline over the 12-month study and extended an additional 6 months (18 months total; Jan 2016 to May 2016) to account for a full year of the USASOC HPP DFAC intervention (Figure 14). Basic Daily Food Allowance (BDFA) for a standard garrison DFAC is $10.49, whereas SOF-specific DFACs were granted a 125% increase for a BDFA of $13.11. Plate costs for the new HPP DFAC intervention were higher the first six months of implementation (up to $14.20/day) but then stabilized in the subsequent six months to a cost below the BDFA ranging from $12.05 to $12.95/day.

Analysis of specific plate cost fluctuations over the time period yielded a variety of causes. The new HPP performance-based menu and new catalog items originally incurred costs above the BDFA (up to $14.20/day) due to: difficulty forecasting usage of new foods and recipes due to inability to add them to the Armed Forces Menu Information System (AFMIS) until 4 months after implementation; minimum bulk and special purchase requirements by Sysco Foods (prime vendor), unfamiliarity of DFAC staff with using and preparing new

ingredients and recipes; the unexpected novelty effect of new food items by patrons resulting in increased (and unplanned) consumption rates at all three meals; special Army celebrations which result in an occasional spike in plate cost. Several management and operational adjustments led to improved food service practices efficiency and plate cost stabilization: addition of 2nd SWCS Performance Dietitian to facilitate communication and training on new recipe preparation; staff schedule adjustments to account for preparation of 'from scratch' recipes; modifying daily menu to balance out daily food costs (i.e., serving high cost items such as salmon and steak on different days); addition of new food service equipment to increase foodservice operations efficiency; access to AFMIS to improve forecasting ability; reduction or elimination of individual packaged foods (e.g., yogurt, milk, cereal, granola bars) that are easily taken as To-Go items, and substitution of some ingredients not on the catalog or missing due to forecasting issues. SWCS plate costs were consistently recorded below the BDFA of $13.11 and ranged from $12.05 to $12.95/day from Jan – May 2016 (8-12 months post DFAC intervention).

Appetite & Satiety (SLIM Scale, Meal Timing)

Time since last meal, snack type prior to meal (when applicable), appetite & satiety, meal time, self-reported meal length, and self-reported eating rate for each DFAC by meal are reported in Table 12. PreSLIM score represents the degree of hunger (-100 pts greatest imaginable hunger to 0 pts not hungry); PostSLIM score represents the degree of fullness/satiety (0 pts not full to +100 pts greatest imaginable fullness); and the change in SLIM score represents the degree of satiation (magnitude of change from hunger to fullness). The time difference from pre-meal tray photograph to post-meal tray photograph is defined as 'meal time' in minutes; however this may not reflect actual eating time. Snack type is self-reported data at the time of pre-meal tray photography based upon the question "When did

you last eat?" Meal length and eating rate are self-reported data at the time of post-meal tray photography.

There were significant differences in all variables noted in Table 12 when assessed by meal for each DFAC, but not over time. Breakfast had a higher percent of patrons reporting shorter dining times and a faster rate of eating over a mean of 17.1 minutes; whereas dinner had a greater percent reporting longer than usual dining times and slower rates of eating over a mean of 22.7 minutes. More SWCS patrons consumed snacks before breakfast (51%) compared to lunch (25%) and dinner (35%). SWCS patrons most commonly reported consuming prepackaged protein (e.g., protein shake or protein bar) or a carbohydrate-based snack (e.g., refined or whole grain, fruit, or vegetables). When the consolidated DFAC and meal data were compared to diet quality and intake, several significant correlations were obtained. Degree of hunger premeal was associated with a greater magnitude change in fullness ($r = -0.724$; $p<0.001$). The greater the degree of hunger, a higher quantity of macronutrients and total energy were consumed (protein $r =-0.152$; fat $r=-0.155$; carbohydrate $r=-0.183$; kcal $r=-0.208$; all $p<0.001$). As macronutrient and energy intake increased, a greater change in the magnitude of fullness was reported (protein $r =0.183$; fat $r=0.183$; carbohydrate $r=0.186$; kcal=0.237; all $p<0.001$) and thus a greater level of satiation.

A multiple regression was calculated to predict the degree of satiation (transition from hunger to fullness) based upon the following significant correlations observed: hours since last meal, initial hunger level (PreSLIM Score), meal time, self-reported meal length, having enough time to eat, total energy intake (kcal), macronutrient intake (protein, fat and carbohydrate intake reported as g/kg body weight), and food group servings (fruit, vegetable, starchy vegetables, grains, legumes, nuts/seeds, and dairy). A significant regression equation was found ($F(1,2342)) = 461.879$, $p<0.001$, with an R^2 of 0.542; meaning 54.2% of the variance in

magnitude of satiation was explained by the initial degree of hunger, protein and carbohydrate intake, whole grain intake, the meal length and having enough time to eat. DFAC patrons' predicted satiation is equal to 46.741 - 0.978 (PreSLIM Score points) + 7.770 (Protein g/kg BW) + 2.465 (Carbohydrate g/kg BW) + 2.76 (Meal Length) – 7.032 (Enough Time) – 1.28 (Whole Grain ounces), where Meal Length is coded 1=shorter than usual, 2=typical, 3=longer than usual, and Enough Time is coded 1=Yes and 2=No.

Fitness Level & Nutrient Intake

This study did not measure indices of performance beyond self-reported physical readiness and APFT scores. Sixty-one percent of SWCS patrons compared to 33% 2BCT patrons, scored ≥ 280 points. When DFAC patrons APFT scores were stratified by HEI diet quality category (sodium adjusted), a significant difference was observed (Figure 15). APFT score increased with increasing diet quality; 270.1 ± 20.2 points for poor diet quality, 275.8 ± 22.0 points for a needs improvement diet, and 283.1 ± 16.2 points for high quality diet (p=0.034). Inadequate sample power prevented data analysis stratified by DFAC.

DFAC Staff Food Service Operations: Focus Group Qualitative Results

A total of 205 DFAC staff members participated in focus group sessions at the 4, 8, and 12-month iterations; 13 SWCS supervisors, 76 non-supervisor SWCS staff, 25 2BCT supervisors, and 91 non-supervisory 2BCT staff. Qualitative data analysis generated six common themes from DFAC staff: 1) DFAC food choices and quality is linked to Soldier morale; 2) Staff take pride in meal service; 3) Staff recognize the need for consumer education on how to make healthy / performance-based food choices; 4) Recipe cards are old, tedious to use, should be revamped, and added to the Army Food Management Information System (AFMIS); 5) Staff morale affects foodservice operations and the quality of meals served; and 6) Staff are highly

receptive to receiving training related to new recipes, healthy cooking techniques, and to increase culinary skills.

Unique SWCS DFAC themes were identified at 4, 8, and 12-months during the SWCS DFAC staff focus group session. SWCS staff encountered initial challenges associated with new recipes, unfamiliar ingredients (including spices), time to cook from scratch, and the need for upgraded equipment to support change in cooking procedures (more baking, steaming compared to frying and grilling), consistency in portion control and questions related to the new P-O-S labeling. SWCS management experienced challenges with prime vendor procurement requirements, staff training and communication, food forecasting and food waste containment. Many of the forecasting and staff issues were resolved once new recipes and ingredients were added to AFMIS, staff training was provided, and management made a concerted effort to improve production schedule and redistribute the workload. By the 12-month end of study, SWCS DFAC staff confirmed high acceptability of the USASOC HPP DFAC intervention, took ownership of the program, and acknowledged the desire to maintain the program.

Results of multiple cameras to Improve Food Photography Estimation Accuracy

Estimation of 5667 foods was completed by 14 PBRC research analysts. The proportion of errors tended to be less for 2 cameras (33.3%) than one (35.4%), but the difference was not statistically significant (p=0.111). In terms of nutrient evaluation of all meals, energy and macronutrient content differences between the two methodologies were not different. While it was hypothesized that 2 cameras would be superior to single cameras, this ancillary study did not reveal significant differences; although a 2nd camera may resolve some questions related to viewing angle.

DISCUSSION

The Joint Chiefs of Staff, The Army Surgeon General, and top military leaders have made readiness a #1 priority and acknowledge that nutrition is one of the critical pillars / domains for health and readiness.[20,21,44] The primary finding of this evaluation was that the USASOC HPP performance-based DFAC intervention produced modest but persistent increases in diet quality. Several nutrition metrics, including food choice, diet quality, opinions about the value of food, and DFAC customer satisfaction were significantly improved. SWCS Soldiers' intake demonstrated a significant HEI-2010 score transition from lower to higher quality food choices across all three meals. The SWCS Soldiers attained an average HEI score of 70 points (adjusted for liberal military sodium recommendations), 15 points higher than Soldiers dining at the award-winning Control DFAC operating within the current DoD foodservice guidelines. The improved SWCS Soldiers' HEI scores were attributed to choosing the new USASOC HPP DFAC intervention foods rich in protein, fiber, vitamins, minerals, and phytonutrients as demonstrated by significant increases in daily intake of fruit (0.4 cups/d), red/orange vegetables (0.4 cups/d), whole grains (0.8 cups/d), protein-based legumes (0.9 cups/d), yogurt (0.2 cups/d), and lean protein (0.6 oz/d) ($p<0.05$). USASOC Soldiers also exhibited significant reductions of less desirable food choices: refined grains (0.5 cups/d), starchy vegetables (0.6 cups/d), oils (11 g/d) and solid fat (6 g/d) ($p<0.05$).

SWCS Soldier satisfaction for 11 of 13 ratings related to DFAC food appeal, options, quality, and availability increased significantly over the course of the 12-month study. In addition, after the USASOC HPP DFAC intervention, significantly more SWCS Soldiers reported that DFAC foods impacted 10 of 12 performance and wellbeing factors related to improved mental and physical performance, physical activity recovery, sleep quality, injury mitigation, and response to stress and emotions. Thus, the value of nutrition in promoting military performance and

readiness was acknowledged and validated by SWCS Soldier food choice when performance-based foods were available. These USASOC HPP intervention findings further support past study results in which diet quality was improved following a DFAC intervention, and improved diet quality was associated with beneficial changes to health and resiliency metrics.[15,17,22,45,46]

Food choice architecture and P-O-S labeling may positively influence food choice at the point of purchase; however, research on P-O-S effectiveness to promote healthy food choices has yielded mixed results.[2,14,47-49] In this study, the P-O-S labeling was introduced a few days prior to the 8-month data collection time point and continued through to the 12-month evaluation. At end-point there was a near doubling of SWCS patrons agreeing that the P-O-S labeling provided knowledge to make performance-based food choices (39% increased to 59%), yet over the same time period the HEI remained essentially unchanged (+1 point). Co-incident P-O-S marketing might in part have contributed to the lack of effectiveness at producing positive effect on diet quality. In addition, research has identified that age, formal education, income, and food costs influence diet quality.[31,50,51]

SWCS Soldiers were expected to have higher HEI scores when compared to 2BCT Soldiers, partially due to covariates of age (higher education, more years of military service, and higher military ranks), but also due to the nature of being in the Special Forces. Nutrition education on the value of food in health and resilience contribute to healthy food choice decisions.[51,52] The USASOC HPP performance nutrition program incorporates 5 hours of performance nutrition education by registered dietitian nutritionists (RDN) and this occurred prior to the DFAC intervention. As such, this may have contributed to higher than expected baseline SWCS HEI scores and the 8-point total score difference (out of 100 points) between SWCS and 2BCT Soldiers. We also cannot discount the contribution of this education to the magnitude of change that occurred after the new foods were introduced into the SWCS

DFAC.

Research supports that diet quality increases as the food costs and the monetary value of the diet ($/day) increases, due to the cost associated with fresh, lean and performance-based foods such as nuts, beans, fruits, vegetables, whole grains, and lean proteins.[52-55] USASOC DFACs are currently granted additional basic daily food allowances (BDFA) compared to the typical Army DFACs ($13.11 vs. $10.49/day) due to the additional energy and nutrient requirements associated with their physical training program. The HPP DFAC intervention offers foods that are colorful, flavorful, incorporate fresh and seasonal foods as well as new seasonings; and utilize cost-saving strategies such as bulk purchase and reduction in pre-packaged foods. Changes were implemented across all meals and sections of the DFAC including short order grill, hot entrees, side dishes, salads, fruits, desserts, condiments, and beverages. The USASOC HPP DFAC intervention was sustainable within the authorized 125% SOF BDFA, but exceeded the standard garrison BDFA. The USASOC HPP DFAC intervention (education, menu, and labeling) was developed to be population- and task-specific for the SOF, not for a broad-reaching population. Therefore, the USASOC HPP DFAC program will require modifications to successfully transition to larger Army and DoD.

Several study strengths exist. Deviation from the foodservice policy was granted for the implementation of the USASOC HPP DFAC intervention and provided the opportunity for an evidence-based approach to verify whether the intervention truly promoted optimal Soldier fueling. The use of food photography to quantify daily nutrient intakes (over 3-6 meals) strengthened the evidence through enhanced accuracy of actual dietary consumption compared to studies relying on self-reported food intake data through dietary recall or food frequency questionnaires. The mixed model design of quantitative nutrient intake analysis in conjunction with focus group sessions with DFAC staff provided the opportunity to accurately

account for program implementation challenges and successes to inform future program expansion.

Several study limitations exist. The USASOC HPP DFAC program implementation did not follow the prescribed plan. New food and recipe introductions continued over a four month period after program initiation, and P-O-S labeling occurred during the planned sustainment phase, preventing a clear-cut assessment of each program subcomponent. The study also followed a time-series research design with new Soldiers participating at each data collection time point thereby introducing potential biases in the group differences observed. Future assessment of the USASOC HPP DFAC intervention would benefit from a repeated measures longitudinal design assessing nutrient intake of the same Soldiers at subsequent time points. Another potential confounder was that 5-hours of nutrition education were introduced prior to the HPP DFAC intervention. Future research should examine the independent effectiveness of educational strategies to promote performance-based eating behaviors. The study was not designed to measure the impact of food choice on military performance over time. An association exists between Soldiers' dietary intake and fitness scores but conclusions cannot be drawn from this study. Future research should examine the impact of optimal fueling on military readiness and important health metrics over a longer period than a few months.

CONCLUSIONS

This study demonstrated that USASOC HPP performance dietitians were successful in designing and implementing a performance-based program to address nutrition in support of the US Special Operations Command (USSOCOM) HPP goals and also the US Army's Performance Triad and Chairman of the Joint Chiefs of Staff Total Force Fitness framework.[20,44] The USASOC HPP DFAC nutrition intervention was determined to be feasible, effective and sustainable in a high-paced SOF DFAC. Classroom nutrition education in

conjunction with the USASOC HPP DFAC intervention provided the knowledge and dining environment conducive to promoting the most appropriate food choices and support optimal Soldier readiness. The SOF community places value on the engagement of RDNs as the subject matter experts by embedding them into unit infrastructure. Military leaders can capitalize on the RDN expertise as well as understanding of evidence-based performance nutrition research to reassess current regulations and policies related to warfighter fueling.

RECOMMENDATIONS

To achieve success with future USASOC HPP DFAC intervention expansion, multiple considerations must be addressed: ensuring patron acceptability; foodservice staff self-efficacy with meal preparation; meal cost containment through efficient food production practices; prime vendor limitations; and most importantly leadership support and shared vision that nutrition is a tool to promote short and long-term health and readiness benefits.

Suggested strategies to sustain and expand this program are: 1) Empower DFAC staff by investing in training, education and appreciation. 2) Provide a voice to DFAC staff during the planning, implementation and evaluation phases to ensure buy-in and ownership of the program. Staff focus group sessions during this study identified inconsistency in food portion control, food waste management, and unexpected patron demands impacting accurate food forecasting. In addition, they provided shift schedule suggestions to improve efficiency in operations, identified that food quality changes positively impacted dish room activities (e.g., elimination of fats and gravies eases cleaning), admitted to making DFAC recipes at home with a positive family reaction, acknowledged a positive response from Soldier patrons, and discussed uncertainty about how to use the new P-O-S labeling. 3) Incorporate on-going assessment and provision of necessary resources (such as ingredients, recipes, and equipment) and monitoring of food service operations to reduce food waste and control food

costs. 4) Promote on-going communication between key stakeholders both internal and external to the DFAC. 5) Promote consumer / Soldier performance-based nutrition education internal and external to the DFAC. This may require developing a HPP DFAC program marketing plan with specific educational materials and consultation from local and SOF RDNs. A transferable USASOC HPP DFAC intervention package should include: new AFMIS recipes, menu cycle and equipment recommendations, a work shift plan, a training plan for new recipe preparation and P-O-S label use, templates for P-O-S materials, specific food service operations lessons learned with recommended corrective actions, and guidance on conducting staff feedback sessions to mitigate potential threats to implementation success.

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Table 1. Healthy Eating Index-2010 (HEI) Domains & Scoring Standards.

Domains	Maximum Points	Standard for Maximum Score	Standard for Minimum Score of Zero
Adequacy:			
Total Fruit	5	≥0.8 cup equiv/ 1,000 kcal	No Fruit
Whole Fruit	5	≥0.4 cup equiv/1,000 kcal	No Whole Fruit
Total Vegetables	5	≥1.1 cup equiv/ 1,000 kcal	No Vegetables
Greens and Beans	5	≥0.2 cup equiv/1,000 kcal	No Dark Green Vegetables or Beans and Peas
Whole Grains	10	≥1.5 oz equiv/1,000 kcal	No Whole Grains
Dairy	10	≥1.3 cup equiv/1,000 kcal	No Dairy
Total Protein Foods	5	≥2.5 oz equiv/1,000 kcal	No Protein Foods
Seafood and Plant Proteins	5	≥0.8 oz equiv/ 1,000 kcal	No Seafood or Plant Proteins
Fatty Acids	10	(PUFAs + MUFAs)/SFAs ≥2.5	(PUFAs + MUFAs)/SFAs ≤1.2
Moderation:			
Refined Grains	10	≤1.8 oz equiv/1,000 kcal	≥4.3 oz equiv. per 1,000 kcal
Sodium	10	≤1.1 gram/1,000 kcal	≥2.0 grams per 1,000 kcal
Empty Calories	20	≤19% of energy	≥50% of energy

Note: equiv=equivalent; oz=ounces; PUFA=Polyunsaturated Fats; MUFA=Monounsaturated Fats; SFA=Saturated Fats; kcal=kilocalorie

Table 2. DFAC Patron Demographic Descriptive Data of Continuous Variables.

Overall Demographics	Overall (n=688)	SWCS (n=428)	2BCT (n=260)	*p*-value between DFACs
	Mean (SD)	Mean (SD)	Mean (SD)	
Current age (years)	25.6 (5.5)	27.5 (5.7)	22.4 (3.1)	<0.001
BMI (kg/m^2)	26.0 (2.9)	26.2 (2.7)	25.6 (3.3)	0.007
Years of Active Duty	4.1 (4.9)	5.1 (5.7)	2.4 (2.6)	<0.001
Vigorous PA (hours/day)	1.2 (0.8)	1.2 (0.9)	1.1 (0.8)	ns
Moderate PA (hours/day)	0.7 (0.9)	0.6 (0.7)	0.9 (1.2)	<0.001
Walking (hours/day)	1.3 (2.1)	0.9 (1.3)	1.9 (2.8)	<0.001
Sitting (hours/day)	5.3 (3.4)	5.4 (3.3)	5.0 (3.6)	ns
APFT score	275.1 (22.2)	280.2 (20.5)	266.8 (22.3)	<0.001
Number of pushups	70.6 (12.1)	71.9 (10.9)	68.3 (13.7)	0.001
Number of sit ups	75.5(9.9)	76.9 (9.7)	73.1 (9.9)	<0.001
Total Run Time (minutes)	13.6 (1.3)	13.4 (1.2)	14.0 (1.3)	<0.001
Weekday Screen Time (hours/day)	5.2 (3.5)	4.9 (3.5)	5.7 (3.6)	0.006
Weekend Screen Time (hours/day)	7.6 (4.1)	6.9 (3.9)	8.7 (4.3)	<0.001
Hours of sleep	6.5 (1.1)	6.7 (1.0)	6.2 (1.3)	<0.001

Note: SWCS=Special Warfare Center & School; 2BCT=2nd Brigade Combat Team; DFAC=Dining Facility; ns=not significant

Table 3. DFAC Patron Demographic Descriptive Data of Categorical Variables.

	Overall (n=688) n (%)	SWCS (n=428) n (%)	2BCT (n=260) n (%)	*p*-value between DFACs
SWCS DFAC	428 (62)			
2BCT DFAC	261 (38)			
Males	666 (98)	426 (100)	240 (95)	<0.001
Race				
Caucasian	579 (85)	384 (90)	195 (77)	<0.001
African American/Black	45 (7)	14 (3)	31 (12)	
Asian	12 (2)	7 (2)	5 (2)	
Other	45 (6)	21 (5)	21 (9)	
Hispanic	86 (13)	33 (8)	53 (21)	<0.001
Education				
Up to High School	193 (28)	55 (13)	138 (54)	<0.01
Some up to AAS	289 (43)	192 (45)	97 (38)	
Bachelor's Degree	179 (26)	162 (38)	17 (7)	
Graduate Degree	19 (3)	17 (4)	2 (1)	
Rank				
E1-E4	486 (69)	237 (56)	229 (91)	<0.001
E5-E7	95 (14)	71 (17)	24 (10)	
WOC	60 (9)	60 (14)	0 (0)	
WO1-CW4	35 (5)	35 (8)	0 (0)	
O1-O3	21 (3)	21 (5)	0 (0)	
SWCS Student	286 (42)	285 (67)	0 (0)	<0.001
APFT Score ≥ 280 points	337 (51)	254 (62)	83 (34)	<0.001
Alert / Sleepiness				
Alert	378 (56)	265 (63)	112 (44)	<0.001
Not Fully Alert / Sleepy	293 (44)	153 (37)	140 (56)	
Physical Readiness				
Good to Best Shape	560 (83)	370 (88)	190 (76)	<0.001
Neither Good nor Bad, Bad or Worst Shape	112 (17)	52 (12)	60 (24)	

Note: SWCS=Special Warfare Center & School; 2BCT=2nd Brigade Combat Team; DFAC=Dining facility; AAS=Associates Degree; E1-E4=Enlisted ranks (Private through Specialist); E5-E7=noncommissioned officer ranks (Sergeant through Sergeant First Class); WOC=Warrant Officer Candidate; WO1-CW4=Warrant Officer ranks (Warrant Officer through Chief Warrant Officer); O1-O3=Officer ranks (2nd Lieutenant through Captain).

Table 4. DFAC Patron Meal and Snack Pattern & Most Common Dining Location.

Meals / Snacks Consumed (5 times/week) & Top Locations (regardless of times/week)	Overall %	SWCS %	2BCT %	*p*-value between DFACs
Early Morning Snack	23	29	13	<0.001
Home / Barrack	24	31	12	<0.001
Convenience source	3	2	4	
Breakfast	82	80	84	ns
DFAC	58	56	62	0.021
Home / Barracks	37	40	31	
Convenience source	5	4	7	
Morning Snack	23	28	16	<0.001
Home / Barracks	20	25	12	ns
Convenience source	11	8	16	
Lunch	92	96	86	<0.001
DFAC	69	75	59	ns
Home / Barracks	18	17	19	
Convenience source	13	8	20	
Afternoon Snack	38	41	34	ns
Home / Barracks	29	33	24	ns
Convenience source	18	15	25	
Dinner	96	97	94	ns
DFAC	59	64	50	ns
Home / Barracks	20	18	24	
Convenience source	21	18	26	
Evening Snack	55	56	53	ns
Home / Barracks	46	49	41	ns
Convenience source.	16	13	22	

Note: SWCS=Special Warfare Center & School; 2BCT=2nd Brigade Combat Team; DFAC=Dining Facility; ns=not significant. Location of meals was assessed by the question “During the past 7 days, where did most of your (specific meal/snack inserted) come from?” The meal options were consolidated to: did not eat, home/barracks, military dining facility, or convenience source (store, fast food, buffet, restaurant, vending, etc.) and may reflect meals / snacks eaten less than 5 times per week.

Table 5. Healthy Eating Index-2010 (HEI-2010) Diet Quality Category (Adjusted for Sodium) by DFAC Pre to Post-DFAC Intervention.

HEI Score Categories (adjusted for sodium)	SWCS			2BCT		
	0-Month %	4-12 Month %	Pre-Post *p*-value	0-Month %	4-12 Month %	Pre-Post *p*-value
All Meals						
Poor Quality	17.8	11.1	<0.001	45.7	39.6	ns
Needs Improvement	80.8	83.6		53.8	60.4	
Good Quality	1.4	5.3		0.5	0.0	
Breakfast						
Poor Quality	12.5	7.4	0.042	29.1	23.4	ns
Needs Improvement	83.1	85.5		69.6	76.6	
Good Quality	4.4	7.1		1.3	0.0	
Lunch						
Poor Quality	21.7	12.5	<0.001	59.2	52.6	ns
Needs Improvement	78.3	83.5		40.8	47.4	
Good Quality	0.0	4.0		0.0	0.0	
Dinner						
Poor Quality	18.2	13.4	0.027	52.3	44.6	ns
Needs Improvement	81.8	81.8		47.7	55.4	
Good Quality	0.0	4.7		0.0	0.0	

Note: Poor Quality = HEI Score ≤50 pts; Needs Improvement = HEI Score 51-80 pts; Good Quality = 81-100 pts; SWCS 0-month included 443 meals and 4-12-months 1197 meals); 2BCT 0-month included 199 meals and 4-12 months 565 meals); percentage based upon the HEI score adjusted for sodium score to account for liberal military dietary reference intake of no more than 5500 mg for this sample population.

Table 6. Healthy Eating Index-2010 (HEI-2010) Scores of SWCS DFAC Patrons Pre- to Post-DFAC Intervention.

HEI-2010 Domains & Total Score (points)	Comparison		SWCS DFAC Patron Intake				Pre-Post *p*-value
	Max Points Available	2BCT (n=200) 0-12 Month Mean (SD)	0-Mo (n=97) Mean (SD)	4-12 Month (n=285) Mean (SD)	Change	Percent Change	
Total Fruit *	5	2.80 (1.9)	2.87 (1.6)	3.26 (1.7)	+0.39	**+13%**	ns
Whole Fruit *	5	1.43 (1.8)	1.83 (1.6)	2.30 (1.9)	+0.47	**+26%**	0.018
Total Vegetables *	5	3.52 (1.3)	4.33 (1.0)	4.04 (1.2)	-0.29	-7%	0.021
Greens & Beans *	5	1.68 (1.8)	3.66 (1.6)	3.26 (1.9)	-0.40	-11%	0.042
Total Protein *	5	3.38 (1.4)	2.96 (1.3)	3.99 (1.2)	+1.03	**+35%**	<0.001
Seafood & Plant Protein *	5	1.64 (1.8)	2.52 (1.9)	3.05 (1.8)	+0.53	**+21%**	0.014
Whole Grains *	10	1.45 (2.1)	1.05 (1.5)	2.98 (2.7)	+1.93	**+183%**	<0.001
Dairy	10	6.62 (3.1)	7.20 (3.0)	6.38 (3.0)	-0.82	-11%	0.022
Fatty Acids *	10	5.88 (2.4)	7.59 (2.3)	6.90 (2.5)	-0.69	-9%	0.018
Refined Grains *	10	7.46 (2.6)	8.72 (1.8)	8.75 (2.0)	-0.03	0%	ns
Sodium *	10	2.73 (2.6)	1.04 (1.6)	1.32 (1.8)	+0.28	+27%	ns
Empty Calories *	20	13.91 (4.8)	17.24 (3.3)	17.86 (2.5)	+0.62	+4.6%	ns
Total HEI Score *	100	49.01 (10.4)	56.7 (8.8)	60.1 (9.0)	+3.35	+6%	0.002
Total HEI Score * (Sodium adjustment)	100	56.28 (10.8)	65.7 (8.7)	68.7 (8.6)	+3.0	+5%	0.003

Note: SWCS=Special Warfare Center & School; Mo=Month; SD=standard deviation; ns=not significant; * $p<0.01$ between SWCS and 2BCT patrons.

Table 7. Food Group Intake of SWCS DFAC Patrons Pre- to Post-DFAC Intervention.

Food Group with Subgroups	Comparison		SWCS DFAC Patron Intake				Pre-Post *p*-value
	USDA Reco	2BCT (n=169) 0-12 Mo Mean	0-Month (n=87) Mean	4-12 Month (n=233) Mean	Change	% Change	
Total Fruit (cups)	2.5	2.01	1.92	2.40	+0.48	**+25%**	0.013
Citrus & Melon	N/A	0.63	0.68	1.02	+0.34	**+50%**	0.001
Other Fruit	N/A	0.90	0.82	0.73	-0.09	-11%	ns
Fruit Juice	N/A	0.48	0.42	0.65	+0.23	**+54%**	0.014
Total Vegetables (cups)	3.5	2.66	3.90	3.20	-0.70	-18%	<0.001
Dark Green Veg	0.36	0.33	0.82	1.62	-0.25	**-98%**	<0.001
Total Red Orange Veg	1.0	0.43	0.75	1.09	+0.34	**+45%**	<0.001
Total Starch Veg	1.0	1.1	1.30	0.72	-0.58	-29%	<0.001
Legumes (Vegetables)	0.36	0.07	0.10	0.32	+0.22	**+220%**	<0.001
Total Grains (ounces)	6.9	6.88	5.06	5.39	+0.33	+7%	ns
Whole Grains	5	0.61	0.49	1.28	+0.79	**161%**	<0.001
Refined Grains	5	6.28	4.57	4.11	-0.46	-10%	ns
Total Protein (ounces)	7	9.78	13.32	14.17	+0.85	+6%	ns
Meat, Poultry, Eggs	4.7	6.75	8.51	8.89	+0.82	+4%	ns
Cured Meats	N/A	1.62	2.28	2.37	+0.09	+4%	ns
Seafood	1.4	0.84	1.40	1.68	+0.28	+20%	ns
Soy, Nuts & Seeds	0.85	0.55	1.12	1.23	+0.11	+10%	ns
Legumes (Protein)	N/A	0.28	0.40	1.29	+0.89	**+223%**	<0.001
Total Dairy (cups)	3.0	3.25	3.46	2.30	-1.16	-34%	0.025
Milk	N/A	2.04	2.30	1.40	-0.90	-39%	<0.001
Yogurt	N/A	0.19	0.29	0.47	+0.18	**+62%**	0.001
Cheese	N/A	1.02	0.87	1.00	+0.15	+15%	ns
Oils (grams)	≤36	34.53	40.32	29.68	-10.64	**-26%**	<0.001
Solid Fats (grams)	≤16	47.56	41.30	35.78	-5.52	-13%	0.004
Added Sugar (grams)	≤32	23.40	16.06	14.99	-1.07	-7%	ns

Note: SWCS=Special Warfare Center & School; 2BCT=2nd Brigade Combat Team; DFAC=Dining Facility; USDA Reco=2015 Dietary Recommendation at 2800 kcal/day (solid fat & added sugar based upon 2010); N/A=Not Available; ns=not significant

Table 8. Macronutrient Intake of SWCS DFAC Patrons Pre- to Post-DFAC Intervention.

Macronutrients	Comparison		SWCS DFAC Patron Intake				Pre-Post *p*-value
	Recommend-ation	2BCT (n=169) 0-12 Month Mean (SD)	0-Mo (n=87) Mean (SD)	4-12 Month (n=233) Mean (SD)	Change	% Change	
Food Energy (kcal)	3000-4600	2860 (858)	2842 (613)	2750 (670)	-92.0	-3%	ns
Kcal / kg BW	N/A	36.8 (11.8)	33.9 (7.6)	32.7 (8.4)	-1.2	-4%	ns
Protein (g/kg BW)	1.2-2.0	1.6 (0.5)	1.8 (0.5)	2.0 (0.5)	+0.2	+11%	0.011
Fat (g/kg BW)	≤ 1.0	1.4 (0.5)	1.4 (0.4)	1.2 (0.4)	-0.2	-14%	<0.001
Carbohydrate (g/kg BW)	3-13	4.5 (1.6)	3.7 (1.1)	3.6 (1.3)	-0.1	-3%	ns
% PRO of Total Kcal	20-25	18.1 (4.3)	21.6 (3.7)	24.7 (4.9)	+3.1	+14%	<0.001
% FAT of Total Kcal	≤ 30	34.8 (6.6)	36.7 (6.1)	32.8 (6.5)	-3.9	-11%	<0.001
% CHO of Total Kcal	≤ 55	48.4 (8.8)	42.9 (7.2)	43.7 (8.4)	+0.8	+2%	ns
Total Dietary Fiber (g)	35-38	21.1 (8.1)	24.9 (8.2)	29.5 (10.7)	+4.6	+18%	<0.001
Cholesterol (mg)	<300	656 (236)	714 (236)	702 (280)	-12	-2%	ns
Saturated Fat (g)	≤10% of kcal	34.5 (12.9)	33.1 (9.5)	28.6 (9.3)	-4.5	-14%	<0.001
Monounsaturated Fat (g)	N/A	41.1 (14.3)	42.3 (13.3)	37.8 (13.2)	-4.5	-11%	0.008
Polyunsaturated Fat (g)	N/A	27.1 (11.8)	31.5 (10.4)	24.6 (9.9)	-6.9	-22%	<0.001
Omeag-6 (g) *(18:2 Linoleic)*	18	23.6 (10.5)	27.4 (9.2)	21.2 (8.8)	-6.2	-23%	<0.001
Omega-3 (g) *(18:3 Linolenic)*	1.7	2.6 (1.3)	3.1 (1.2)	2.4 (1.2)	-0.7	-23%	<0.001

Note: SWCS=Special Warfare Center & School; 2BCT=2nd Brigade Combat Team; DFAC=Dining Facility; SD=Standard deviation; PRO=Protein; CHO=Carbohydrate; g=grams; kcal=calories; BW=body weight; mg=milligrams; ns=not significant; N/A=Not Available; Recommendation based upon the military dietary reference intakes (MDRI) for males in the mean age group or the performance guidelines for athletes.

Table 9. Vitamin Intake of SWCS DFAC Patrons Pre- to Post-DFAC Intervention.

Vitamins	Comparison		SWCS DFAC Patron Intake				Pre-Post *p*-value
	Recommend-ation	2BCT (n=169) 0-12 Month Mean (SD)	0-Month (n=87) Mean (SD)	4-12 Month (n=233) Mean (SD)	Change	% Change	
Vitamin A (µg RAE)	1000	1167 (577)	1547 (646)	1660 (909)	+112	+7%	ns
Carotene beta (µg)	10000	4185 (3791)	8694 (6328)	11671 (10093)	+2977	+34%	0.002
Vitamin E (mg)	15	11.2 (4.7)	13.7 (4.6)	14.4 (5.9)	+0.7	+5%	ns
Vitamin D (µg)	5	12.5 (9.4)	11.3 (5.9)	9.7 (6.7)	-1.6	-14%	0.048
Lycopene (µg)	10000	4604 (4933)	5679 (7752)	11843(12928)	+6164	+108%	<0.001
Lutein zeaxanthin (µg)	6000	3615 (2884)	7367 (5621)	6863 (6237)	-504	-7%	ns
Vitamin C (mg)	90	161 (135)	241 (142)	235 (156)	-6.4	-2%	ns
Thiamin (mg)	1.2	2.1 (0.7)	2.0 (0.5)	2.4 (0.8)	+0.4	+20%	<0.001
Riboflavin (mg)	1.3	3.1 (1.3)	3.4 (1.0)	3.5 (1.2)	+0.1	+3%	ns
Niacin (mg)	16	30.8 (10.0)	36.1 (10.5)	38.3 (10.5)	+2.2	+6%	ns
Vitamin B_6 (mg)	1.3	3.2 (1.2)	3.8 (1.1)	4.4 (1.5)	+0.6	+16%	<0.001
Folate DFE (µg)	400	679 (314)	687 (250)	898 (507)	+211	+31%	<0.001
Vitamin B_{12} (µg)	2.4	1.3 (2.2)	8.5 (3.8)	9.8 (5.6)	+1.3	+15%	0.025
Vitamin K (µg)	80	187 (139)	388 (252)	313 (275)	-75	-19%	0.026

Note: SWCS=Special Warfare Center & School; 2BCT=2nd Brigade Combat Team; DFAC=Dining Facility; SD=Standard deviation; µg=micrograms; mg=milligrams; DFE=dietary folate equivalent; ns=not significant; Recommendation based upon the military dietary reference intakes (MDRI) for males in the mean age group.

Table 10. Mineral Intake of SWCS DFAC Patrons Pre- to Post-DFAC Intervention.

Minerals	Comparison		SWCS DFAC Patron Intake				Pre-Post *p*-value
	Recommend-ation	2BCT (n=169) 0-12 Month Mean (SD)	0-Month (n=87) Mean (SD)	4-12 Month (n=233) Mean (SD)	Change	% Change	
Calcium (mg)	1000	1542 (785)	1579 (762)	1386 (647)	-193	-12%	0.024
Iron (mg)	10	18.3 (6.7)	18.6 (5.0)	19.2 (6.0)	+0.6	+3%	ns
Magnesium (mg)	420	373 (127)	446 (125)	464 (131)	+18	+4%	ns
Phosphorus (mg)	700	2242 (799)	2472 (715)	2487 (713)	+15	+1%	ns
Potassium (mg)	3200	4182 (1507)	5090 (1317)	5034 (1368)	-55	-1%	ns
Sodium (mg)	<5000	5288 (1602)	5931 (1203)	5887 (1337)	-44	-1%	ns
Zinc (mg)	15	16.0 (6.0)	16.9 (5.3)	17.9 (5.5)	+1.0	+6%	ns
Selenium (µg)	55	169.4 (49.1)	193 (47)	206 (50)	+13	+7%	0.033

Note: SWCS=Special Warfare Center & School; 2BCT=2nd Brigade Combat Team; DFAC=Dining Facility; SD=Standard deviation; µg=micrograms; mg=milligrams; ns=not significant; Recommendation based upon the military dietary reference intakes (MDRI) for males in the mean age group.

Table 11. Impact of DFAC Food on Self-Reported Performance & Wellbeing Factors.

Reported Most/Always	SWCS			2BCT		
	% 0-Mo	% 4-12 Mo	Pre-Post *p*-value	% 0-Mo	% 4-12 Mo	Pre-Post *p*-value
Feel Energized	43.0	55.2	0.038	40.5	35.9	ns
Improve Mood	49.5	51.7	ns	37.3	35.5	ns
Feel Satisfied Hours after Meal	51.6	55.4	ns	47.6	45.2	ns
Improve Mental Performance	37.4	49.2	0.045	38.1	47.6	ns
Improve Physical Performance	40.9	57.4	0.005	41.7	52.4	ns
Sustain Physical Performance Longer	43.0	56.3	0.023	42.9	50.0	ns
Feel Good about Self	37.6	57.5	0.001	42.5	48.2	ns
Recovery after Vigorous Activity	40.9	54.6	0.019	48.8	52.9	ns
Recovery after Moderate Activity	42.9	56.2	0.024	50.0	49.4	ns
Reduce Injury	22.6	38.8	0.004	34.5	35.3	ns
Improve Sleep	25.0	37.4	0.027	30.1	31.8	ns
Improve response to Emotions and Stress	31.2	44.5	0.02	31.0	38.2	ns

Note: DFAC=Dining Facility; SWCS=Special Warfare Center & School; 2BCT=2nd Brigade Combat Team; Mo=month; ns=not significant

Table 12. Hunger, Satiety, Meal Timing, Meal Length and Snack Type between Meals by DFAC.

	SWSC Mean (SD)			2BCT Mean (SD)		
	Breakfast (n=528)	Lunch (n=597)	Dinner (n=510)	Breakfast (n=284)	Lunch (n=270)	Dinner (n=209)
Hours Since Last Meal	10.7 (4.6)	4.1 (3.3)	4.6 (2.4)	13.2 (3.5)	4.5 (4.3)	5.1 (2.2)
Meal Time (minutes) *	17.1 (8.4)	19.6 (8.4)	22.7 (10.5)	15.5 (6.1)	19.4 (10.2)	17.0 (6.3)
Pre SLIM Score (Hunger) *	-37.4 (17.4)	-31.4 (18.6)	-33.9 (20.8)	-38.5 (20.6)	-27.3 (20.8)	-30.0 (23.4)
Post SLIM Score (Satiety) *	53.0 (16.6)	50.9 (18.7)	52.3 (20.5)	51.8 (19.1)	51.4 (22.1)	48.8 (23.2)
Change in SLIM Score *	90.4 (25.5)	82.5 (25.7)	86.4 (28.1)	90.8 (26.9)	78.8 (29.3)	78.9 (30.0)
	Percent			**Percent**		
Meal Length *						
Shorter than Usual	18.9	16.3	6.1	18.1	17.2	15.7
Typical	73.5	73.4	73.9	75.5	67.4	69.6
Longer than Usual	7.6	10.3	20.0	6.4	15.4	14.7
Eating Rate *						
Slow / Very Slow	7.1	13.0	24.7	10.3	23.2	23.6
Medium	58.3	56.9	61.8	58.9	56.9	54.9
Fast / Very Fast	34.7	30.2	13.5	30.8	19.8	21.6
Snack Type Prior to Meal *						
No Snack	49.8	75.3	66.2	73.7	90.3	83.7
Prepackaged Protein	20.8	9.6	13.9	4.3	1.1	1.9
Carb-only Snack	10.9	6.4	4.3	5.0	3.0	4.8
Healthy Food Mix (protein and carb)	6.5	4.2	7.0	3.2	1.1	2.9
Meal Size Mix of Foods	6.5	3.2	4.9	6.4	1.9	3.3
Empty Calorie Snacks (high fat or sugar)	4.8	1.2	3.3	7.5	2.2	2.9
Caffeine Product	0.8	0.2	0.4	0	0.4	0.5

* $p<0.05$ between meals for both DFACs; PreSLIM score represents degree of hunger (-100 pts greatest imaginable hunger to 0 pts not hungry); PostSLIM score represents degree of fullness/satiety (0 pts not full to +100 pts greatest imaginable fullness); Change in SLIM score represents the degree of satiation (transition from hunger to fullness).

Figure 1. US Special Operations Forces Performance-Based Menu Standards.

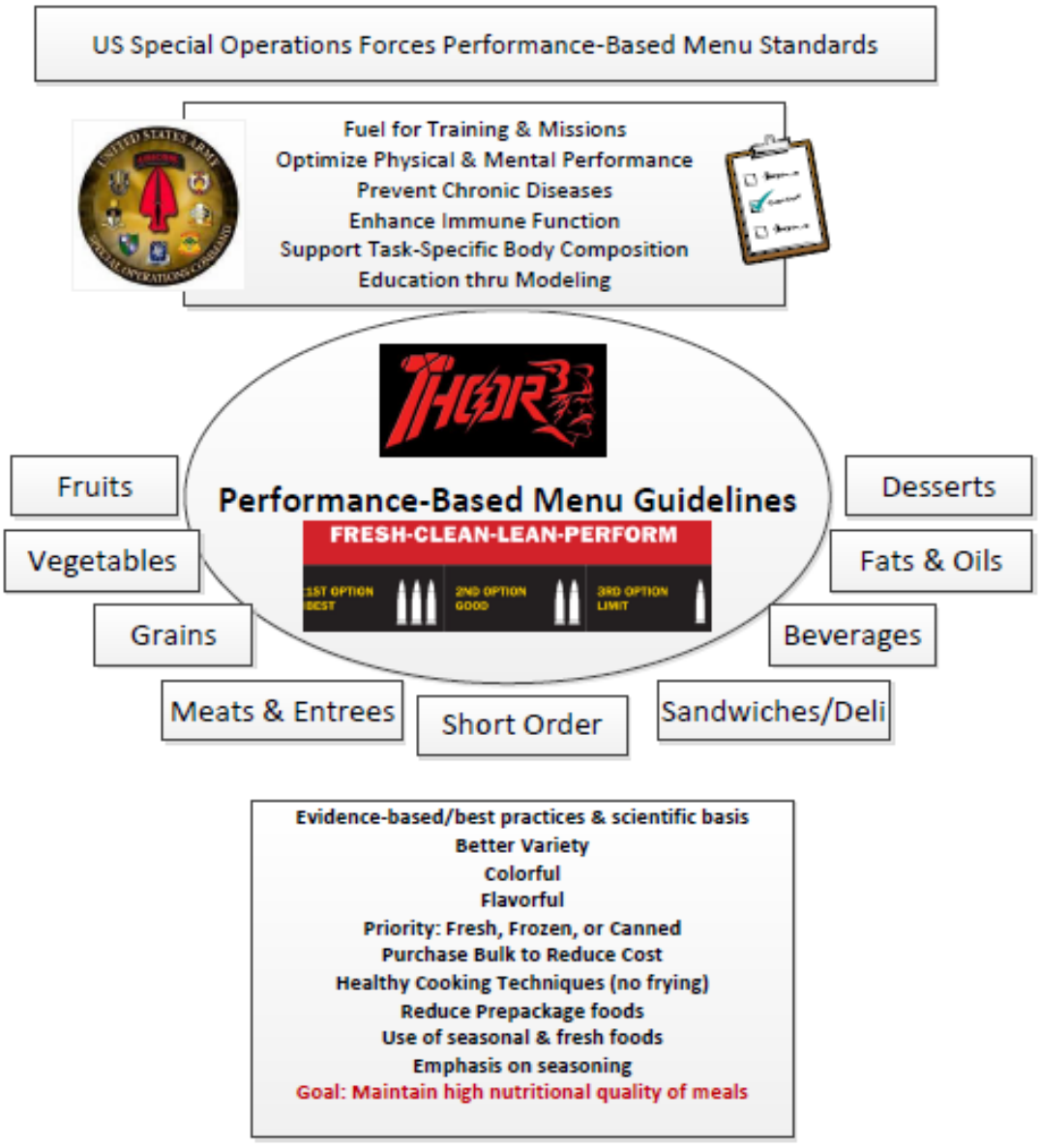


Figure 2. Human Performance Program DFAC Implementation & Evaluation Timeline.

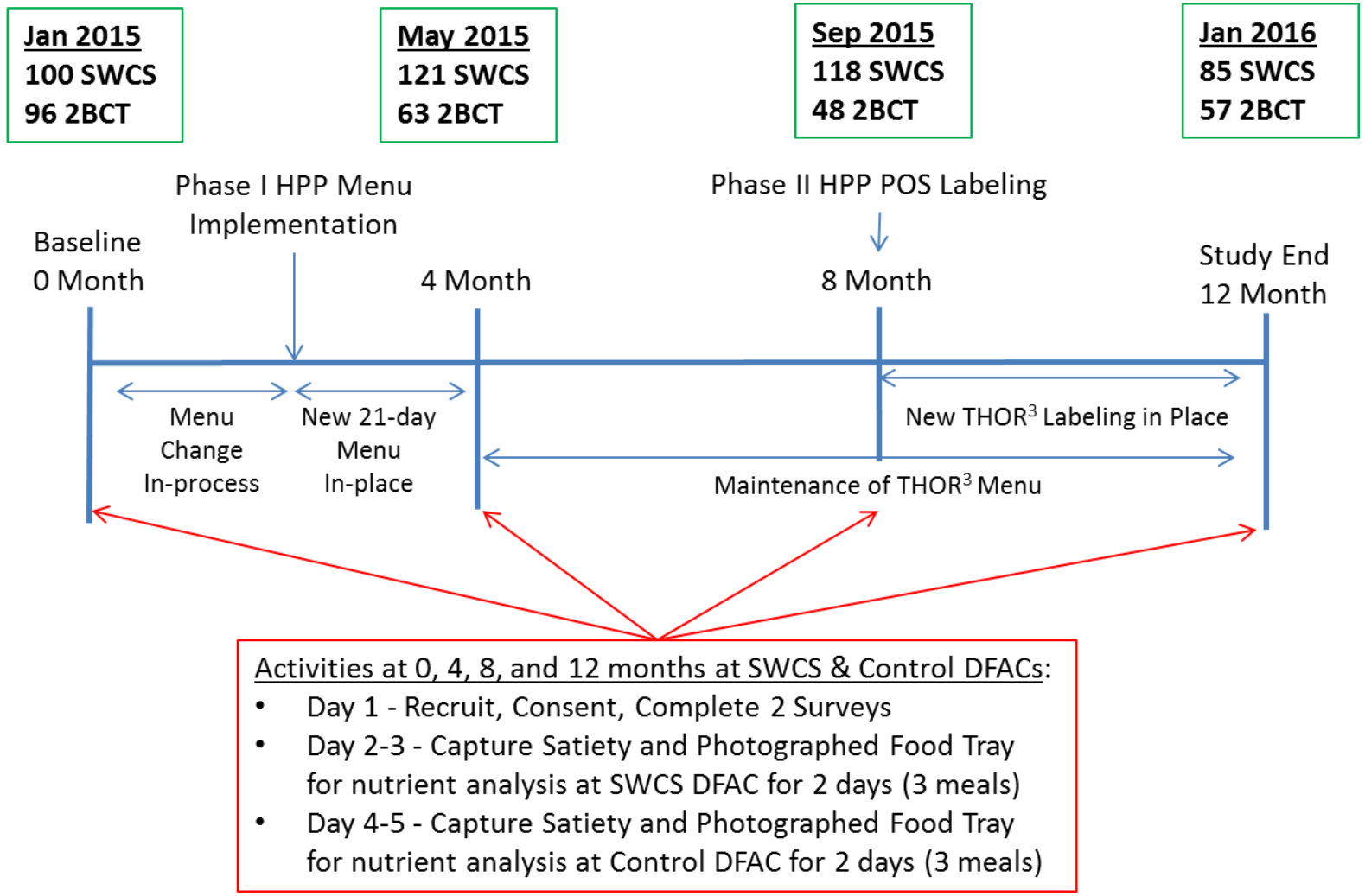
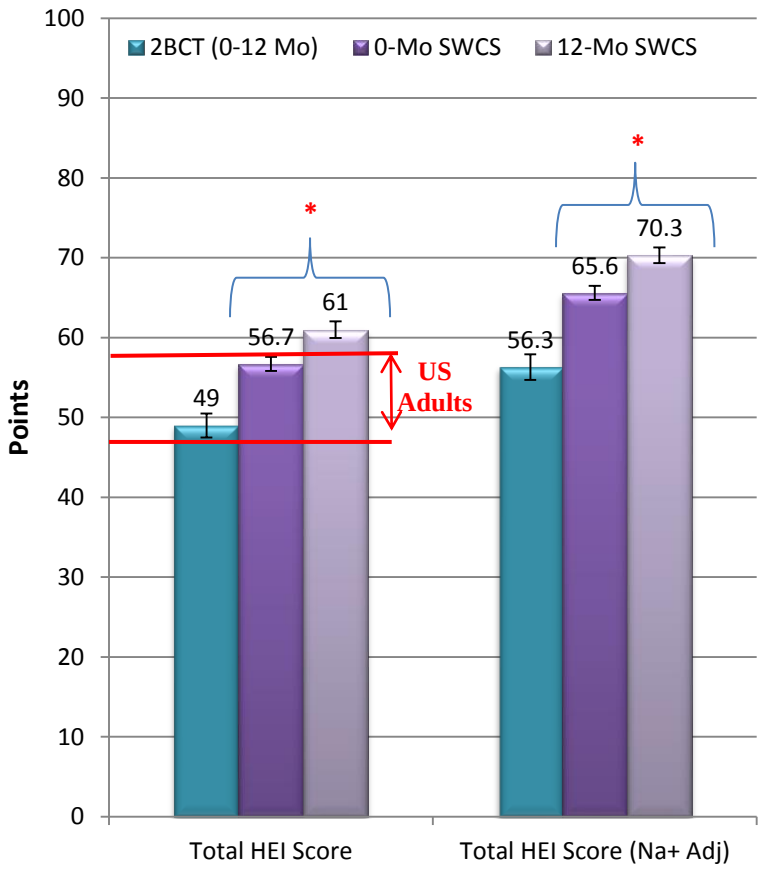


Figure 3. Digital Food Photography Station Example.

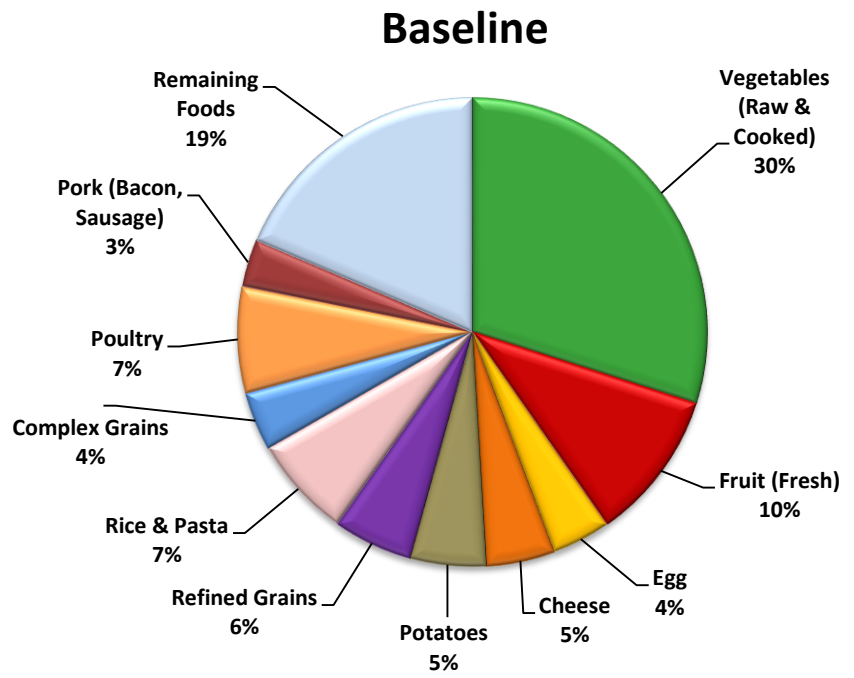
Figure 4. Total Healthy Eating Index-2010 (HEI) Score Change by DFAC (Baseline compared to 12-months).



* *p* <0.005

Note: SWCS=Special Warfare Center & School; 2BCT=2nd Brigade Combat Team; Mo=month; Maximum of 100 points possible; Na+Adj=HEI score adjusted for sodium score to account for liberal military dietary reference intake of no more than 5500 mg for this sample population.

Figure 5. Top 10 Food Choice Categories of SWCS DFAC Patrons Pre-Post Assessment.



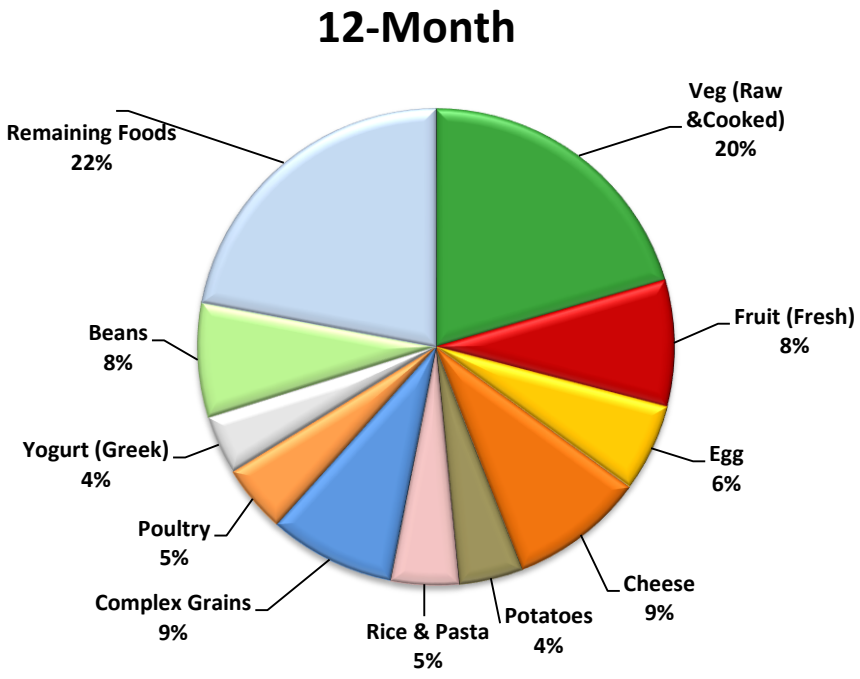


Figure 6. Top 10 Food Choice Categories of 2BCT DFAC Patrons Pre-Post Assessment.

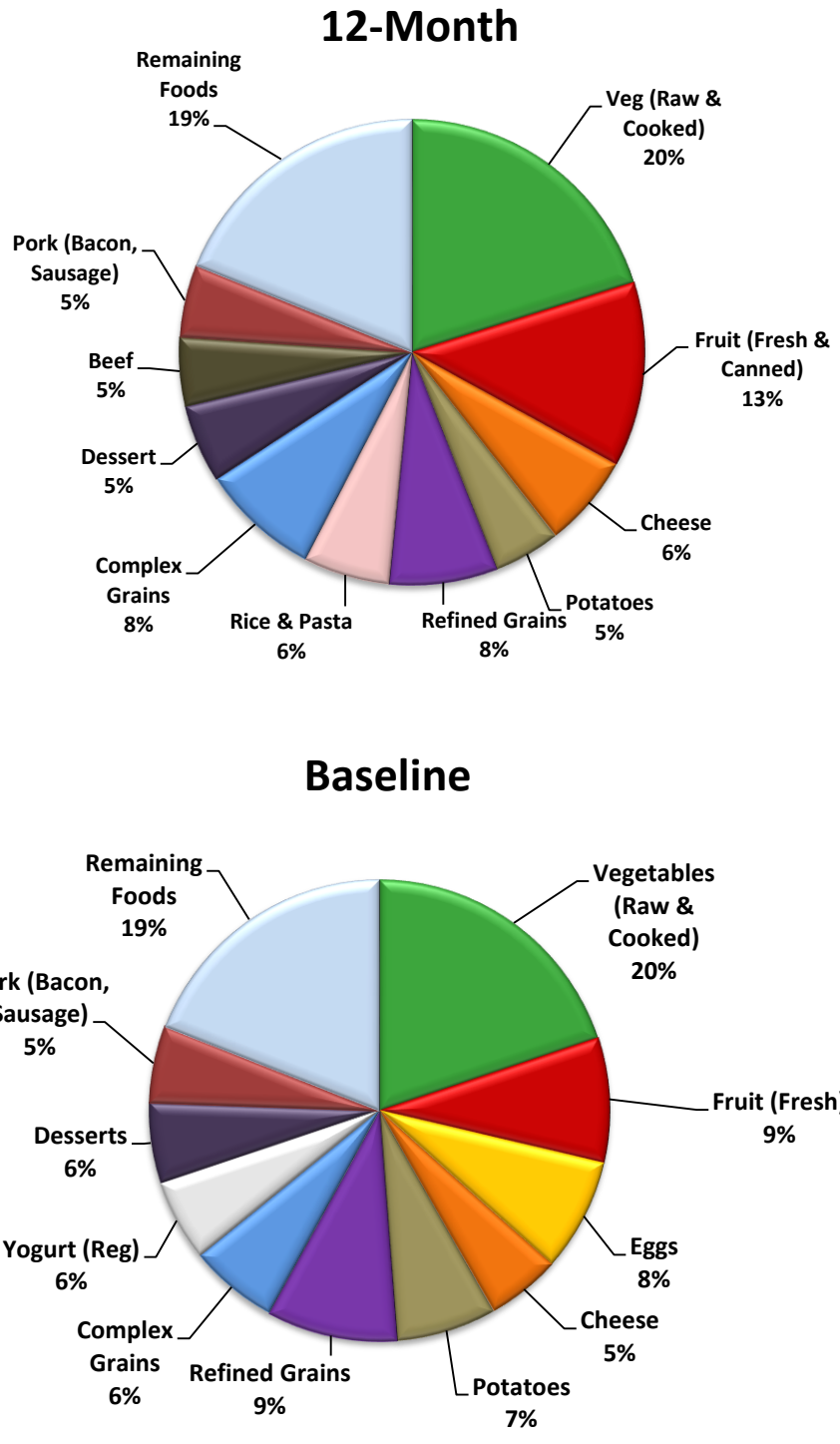


Figure 7. Beverage Choice of SWCS DFAC Patrons Pre-Post Assessment.

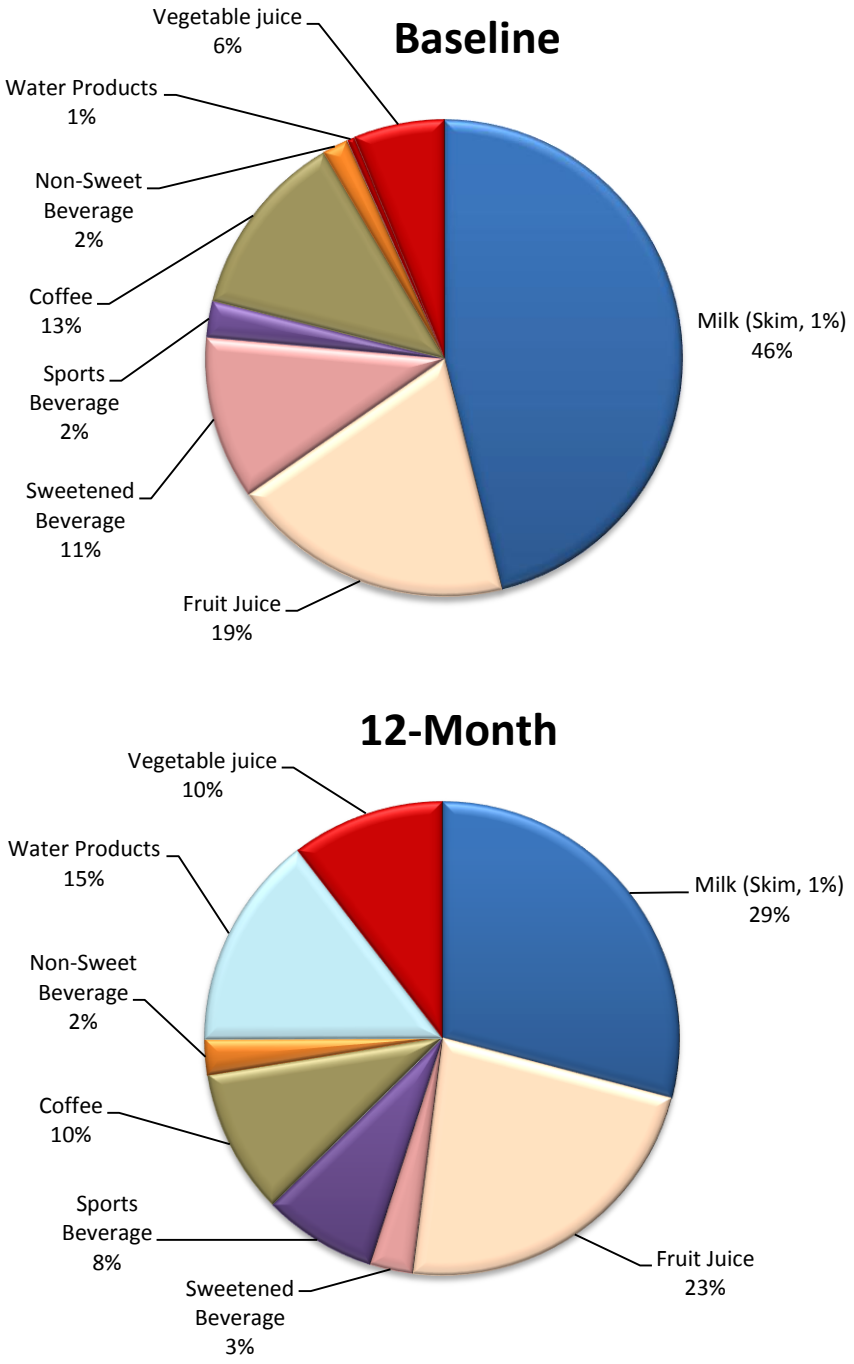


Figure 8. Beverage Choice Categories of 2BCT DFAC Patrons Pre-Post Assessment.

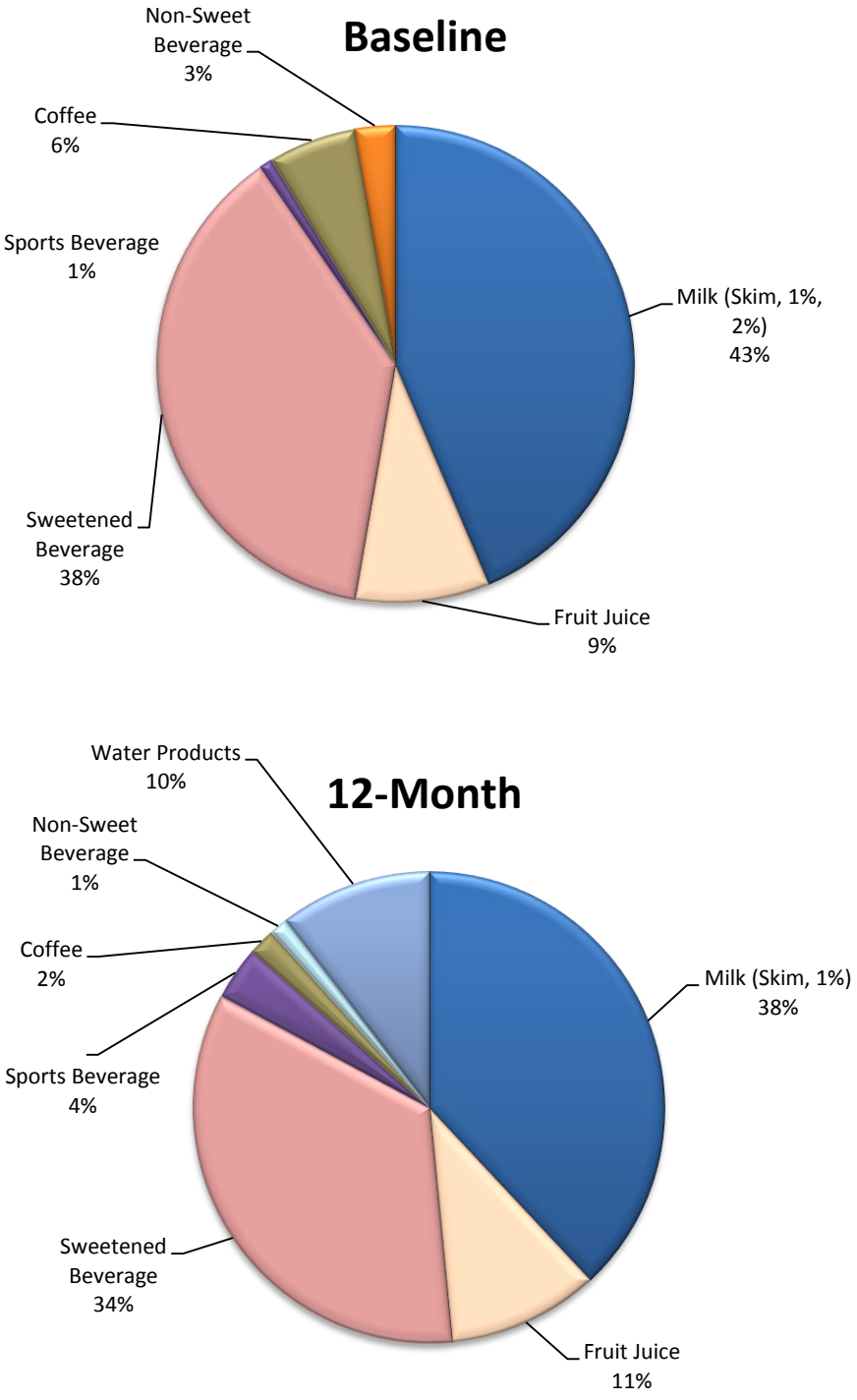


Figure 9. SWCS Patron Fruit, Vegetable, and Dairy Servings (Cups) Pre- to Post-HPP DFAC Intervention Compared to 2BCT & USDA Recommendations

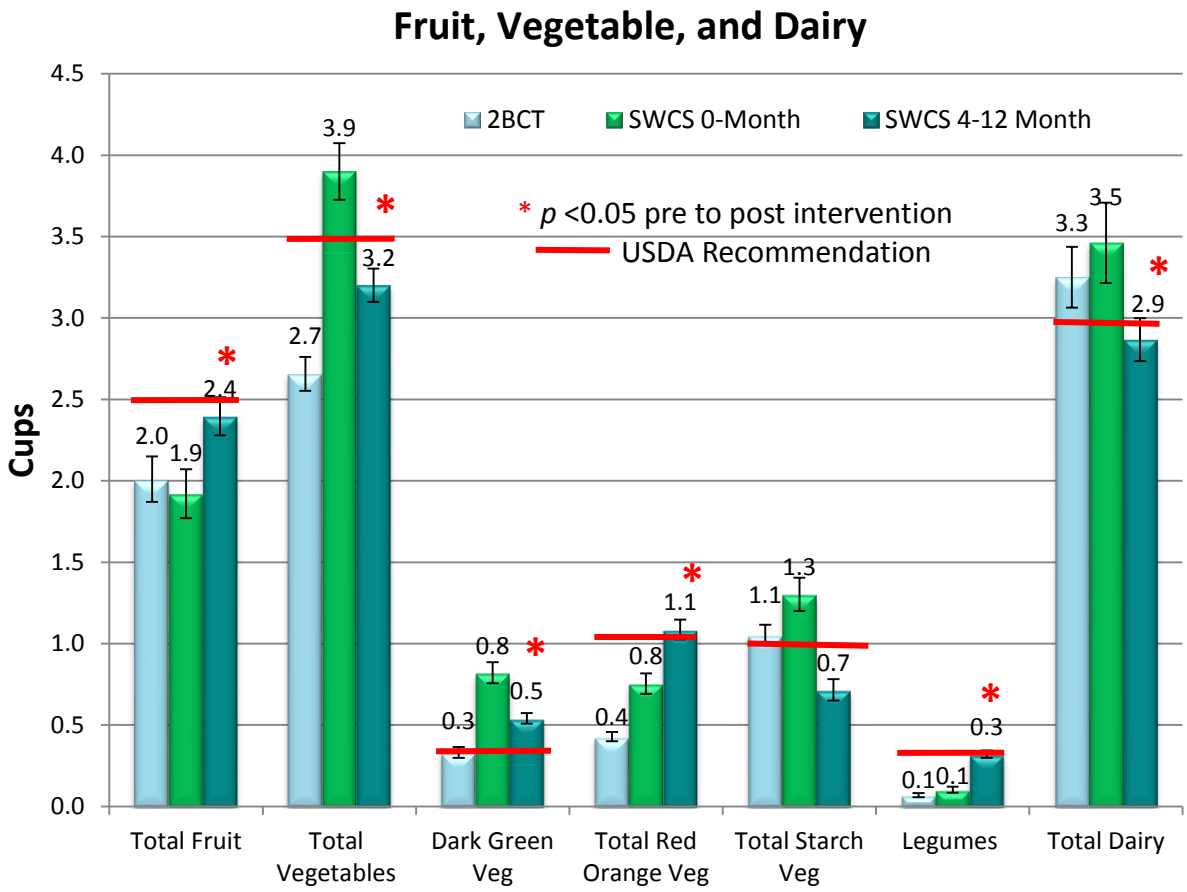


Figure 10. SWCS Patron Grains and Protein Food Servings (Ounces) Pre- to Post-HPP DFAC Intervention Compared to 2BCT & USDA Recommendations

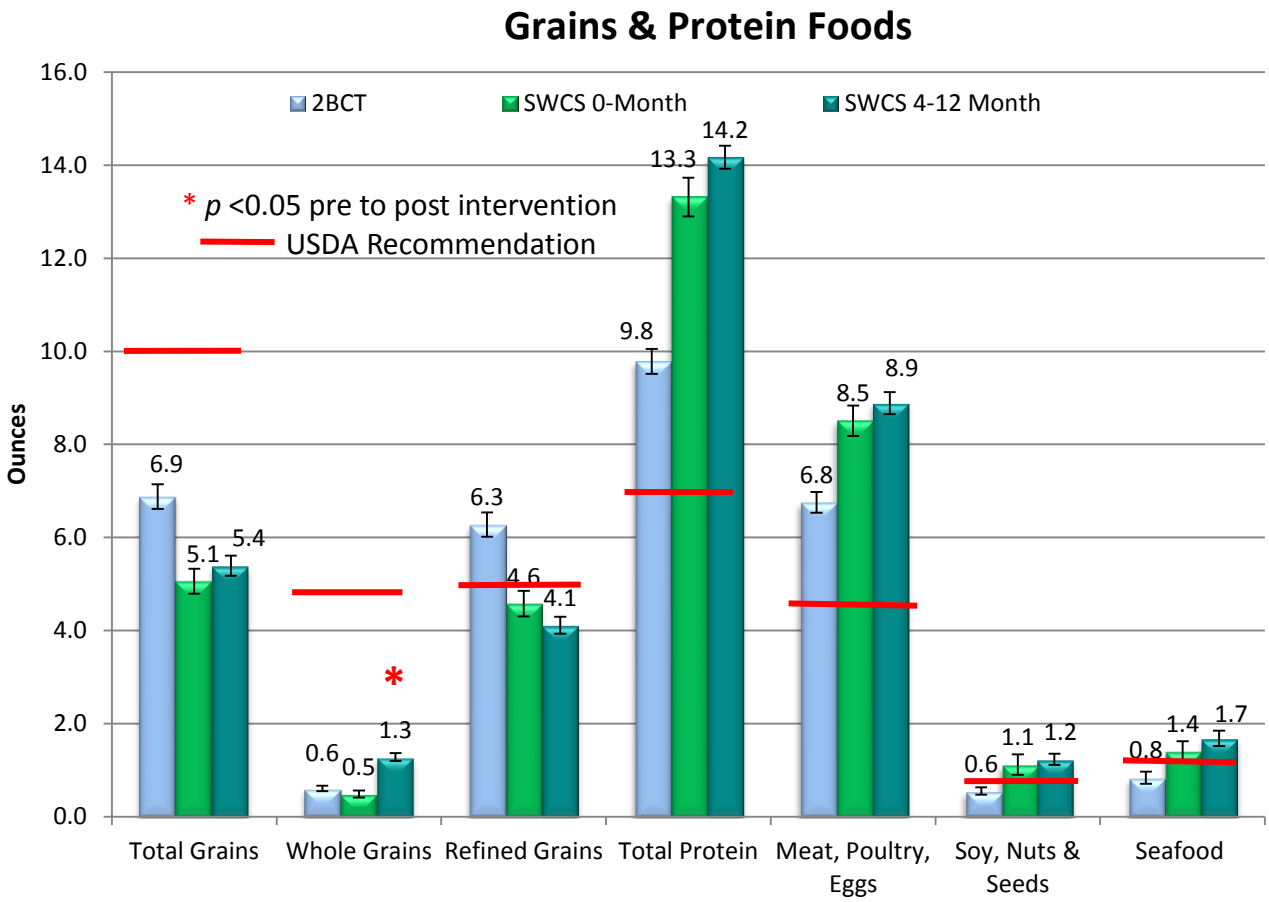


Figure 11. SWCS Patron Discretionary Calories (Grams) Pre- to Post-HPP DFAC Intervention Compared to 2BCT & USDA Recommendations

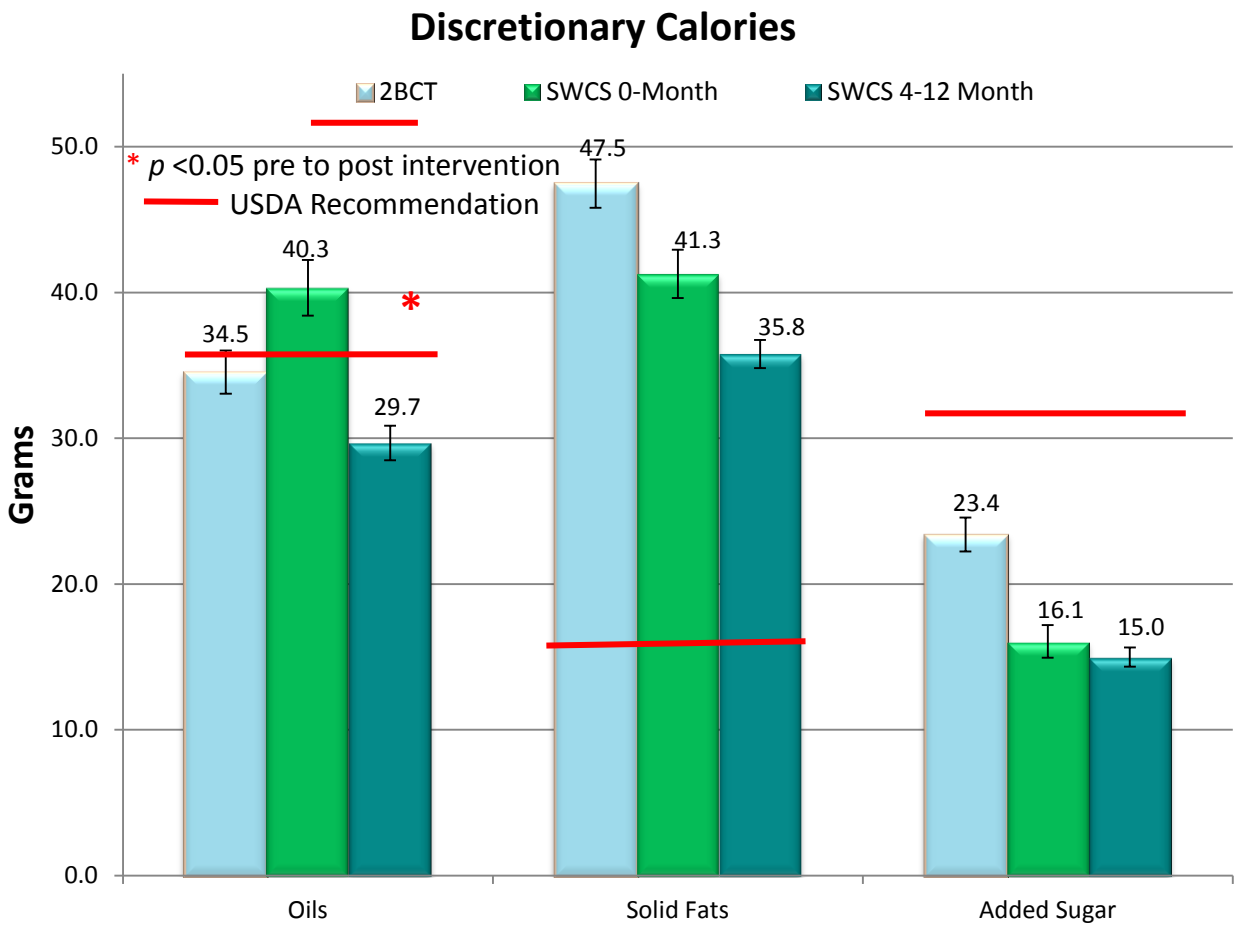


Figure 12. Customer Satisfaction Related to Food Appeal, Options and Availability of SWCS DFAC Patrons by Iteration.

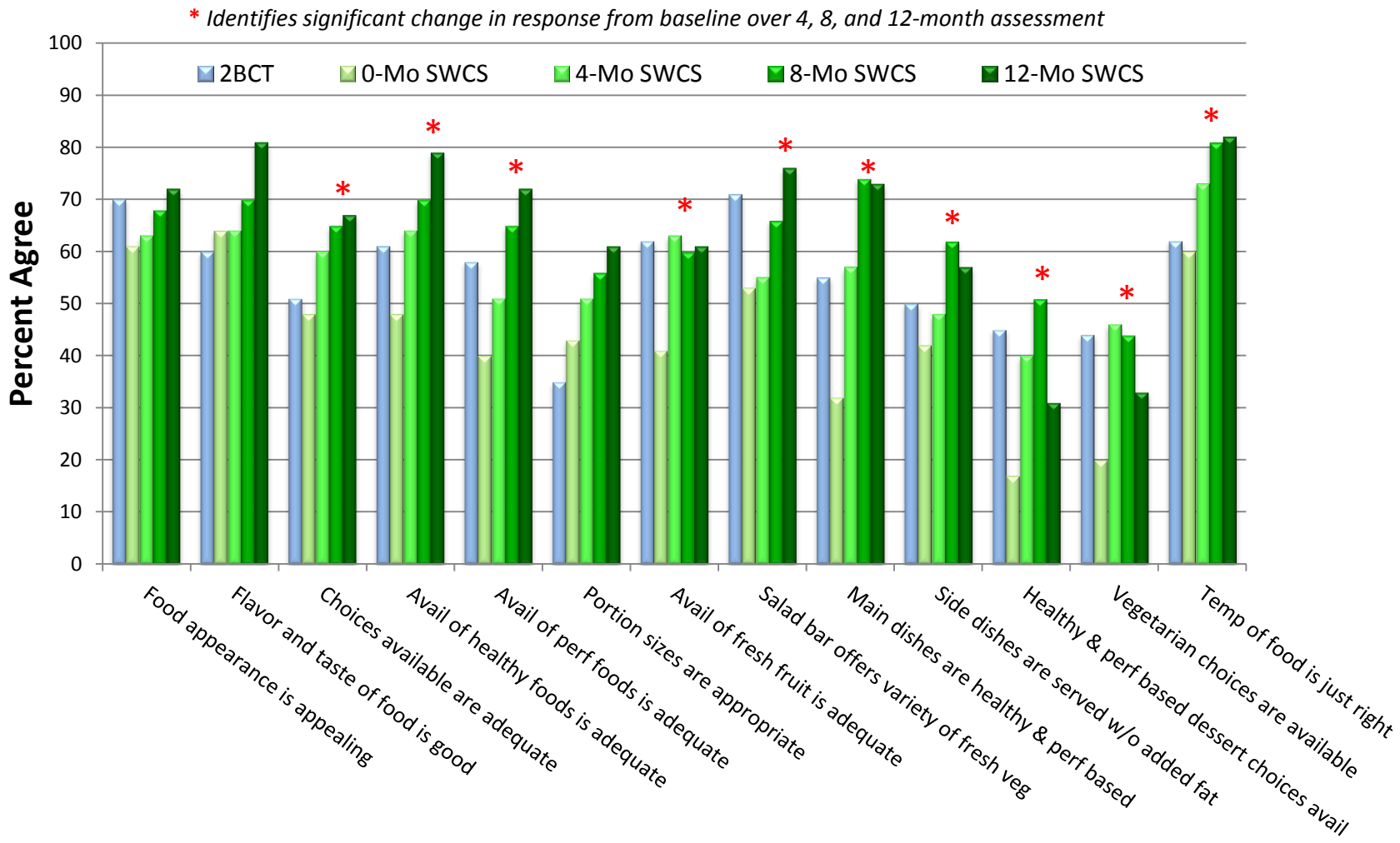


Figure 13. Customer Satisfaction Related to Point-of-Service Labeling of SWCS DFAC Patrons by Iteration.

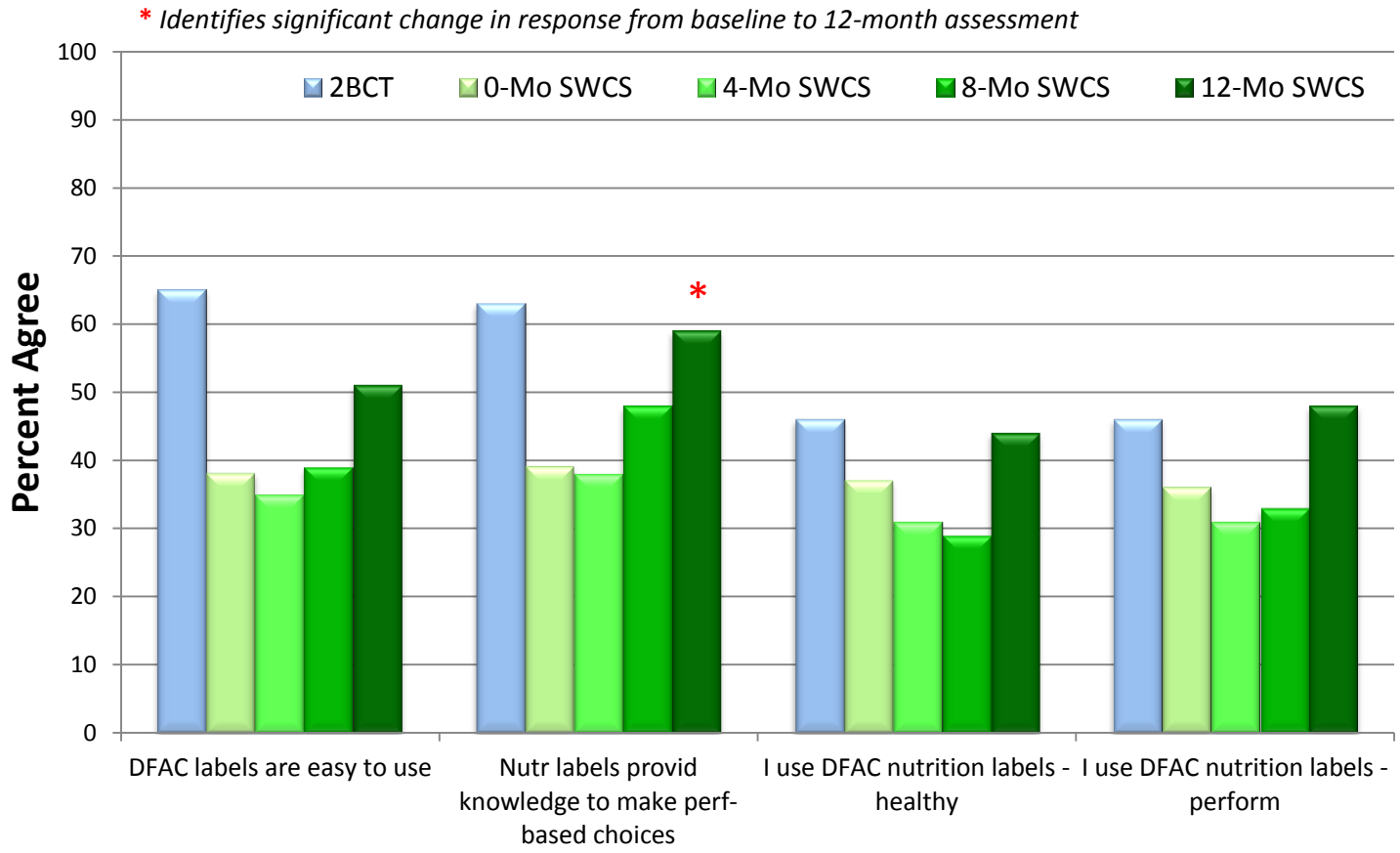
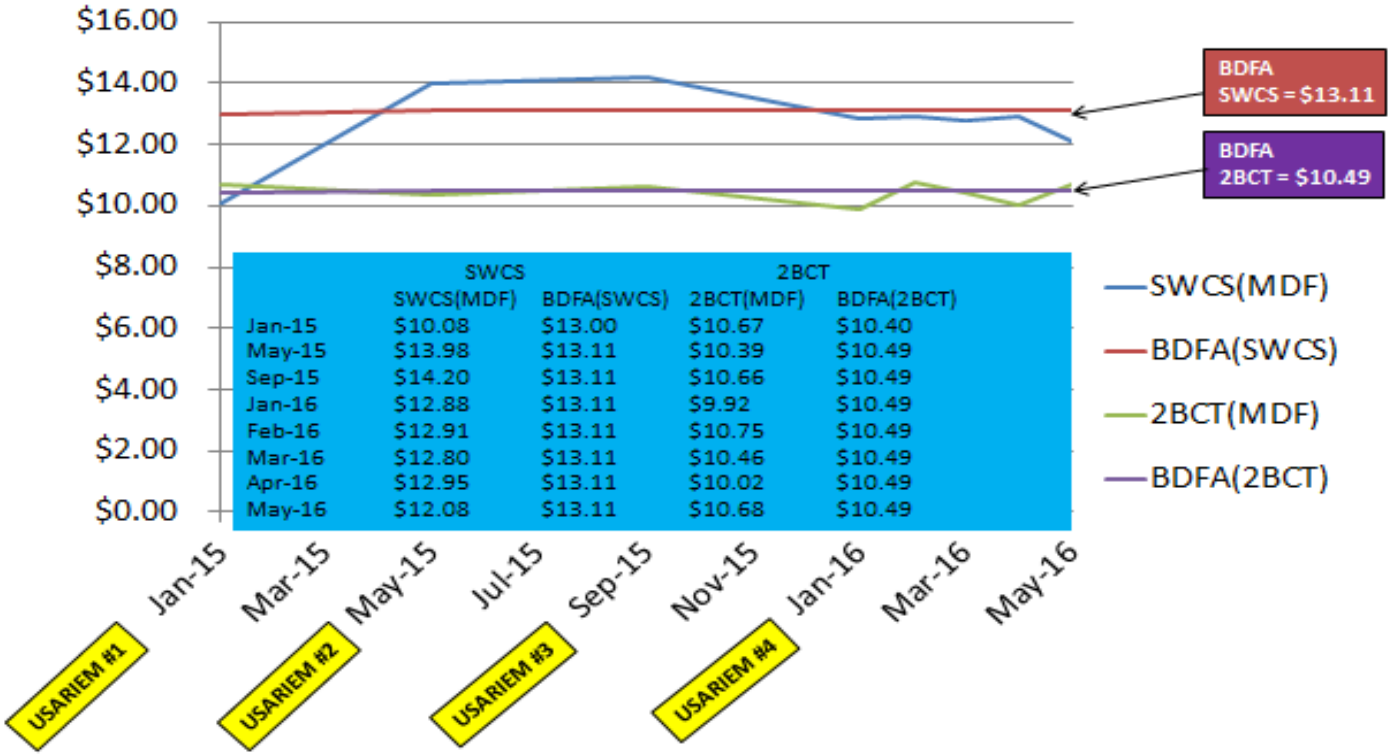
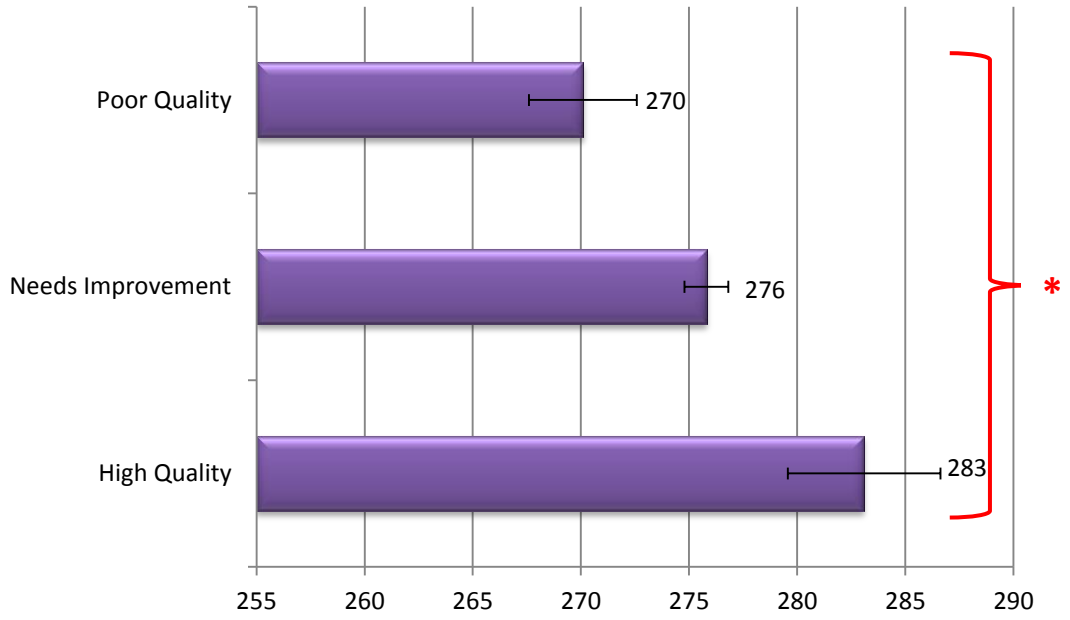


Figure 14. Average Plate Cost Analysis (Jan 2015 to May 2016) by DFAC.



	SWCS		2BCT	
	SWCS(MDF)	BDFA(SWCS)	2BCT(MDF)	BDFA(2BCT)
Jan-15	$10.08	$13.00	$10.67	$10.40
May-15	$13.98	$13.11	$10.39	$10.49
Sep-15	$14.20	$13.11	$10.66	$10.49
Jan-16	$12.88	$13.11	$9.92	$10.49
Feb-16	$12.91	$13.11	$10.75	$10.49
Mar-16	$12.80	$13.11	$10.46	$10.49
Apr-16	$12.95	$13.11	$10.02	$10.49
May-16	$12.08	$13.11	$10.68	$10.49

Figure 15. Mean Total APFT Score by Healthy Eating Index Score-2010 (Sodium Adjusted) Diet Quality Category.



* Significant difference in APFT score between HEI quality category (p<0.034)

Note: Poor Quality Diet = 0-50 points; Diet Needs Improvement = 51-80 points; High Quality Diet = 81-100 points

Appendix A: Special Operations Forces Performance-Based Menu Standards and Guidelines

1 May 2012

MEMORANDUM FOR RECORD

SUBJECT: Special Operations Forces (SOF) Performance-Based Menu Standards and Guidelines

1. Due to the long-term, high physical and cognitive performance demands on SOF human weapon systems, dining facilities identified as serving primarily SOF personnel should provide a performance-based menu that fuels training and missions, optimizes physical and mental performance, prevents chronic disease, enhances the immune system, supports task-specific body composition and provides education through modeling.

2. The SOF performance-based menu standards and guidelines were developed from the Dietary Guidelines for Americans 2010, Joint Subsistence Policy Board DoD Menu Standards 2010, U.S. Olympic Training Center (OTC) menu standards and sport and performance optimization scientific evidence in order to meet these criteria.

3. These standards were developed by the U.S. Special Operations Command (USSOCOM) Performance Dietitian (PD) Working Group. The USSOCOM PD Working Group included performance dietitians working with Army, Navy and Air Force SOF personnel.

4. SOF Performance-Based Menu Standards and Guidelines should be incorporated into all dining facilities serving predominately SOF populations, within the limits of each Service's applicable food operations regulations and policies.

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Acting

Special Operations Forces (SOF) Performance-Based Menu Standards and Guidelines

Goals of SOF Performance-Based Menu Guidelines

- Provide a performance-based menu that fuels training and missions, optimizes physical and mental performance, prevents chronic disease, enhances the immune system, supports task-specific body composition and provides education through modeling
- Provide a varied, colorful, flavorful and balanced menu based on national guidelines, sport nutrition best-practices and current scientific evidence.
- Minimize/reduce food costs and waste by serving foods in bulk and reducing use of individual serving products (PC)
- Enhance nutritional quality and safety of the menu through seasonally grown foods as budgets allow
- Maintain and enhance nutritional quality of menu by appropriate cooking techniques
- Reduce pre-packaged and convenience foods and food products served and replace with freshly prepared items or more natural alternatives

1. Fruit/Fruit Juices
   a. Standards:
      (1) Juices served will be 100% juice
      (2) Two or more fresh fruit choices per meal, cut up and ready to eat
      (3) Seasonal fruits incorporated into menu as much as possible
   b. Guidelines
      (1) Bananas available at breakfast daily
      (2) Frozen or canned (light syrup or own juice) fruits when fresh fruit not available. Priority: 1. Fresh 2. Frozen 3. Canned
      (3) Unsweetened dried fruits available at meals (e.g. purple of gold raisins, apricots, figs, apples, mangos, pineapple, cranberries, blueberries, cherries, pears, plums, etc.)
      (4) If dried fruit unavailable, offer unsweetened pureed fruit or compote (e.g., apple sauce, stewed fruit, etc.)
      (5) Fruits on dessert and salad bars to be cut up and ready to eat

2. Vegetables
   a. Standards
      (1) At least two hot vegetables per meal without added fat; one starch and one non-starch deep-colored vegetable
      (2) One legume/bean served ≥ 3 times per week
      (3) Seasonal vegetables incorporated into menu as much as possible
   b. Guidelines
      (1) No fried vegetables
      (2) Legumes/beans include, but are not limited to, peanuts, black eyed peas, lentils, lima beans, black beans, kidney beans, cannellini beans, pinto beans,

baked beans, chickpeas/garbanzo beans, navy beans, and refried beans with ≤10% saturated fat

(3) Starchy vegetables include, but are not limited to, potatoes, corn, peas, sweet potatoes, yams, acorn squash, butternut squash and pumpkin

3. Salad Bar
   a. Standards
      (1) Salad bar includes leafy green salad and one fresh topping from each of the following categories:
         (i) Red colored produce
         (ii) Orange/yellow colored produce
         (iii) Green colored produce
         (iv) Blue/purple colored produce
         (v) White/tan/brown colored produce
         (vi) Unmixed proteins
         (vii) Dried fruits
         (viii) Nuts
      (2) Two colors of fruits, cut up and ready to eat
      (3) Seven salad dressings (two regular, four containing ≤10% saturated fat)
      (4) Cold salads prepared with dressing that contain ≤10% saturated fat
      (5) Seasonal fruits and vegetables incorporated into menu as much as possible
   b. Guidelines
      (1) Leafy green salad minimum standard is 50% dark green leaves such as romaine or spinach leaves
      (2) Cold salad recipes are made with dressings that contain ≤10% saturated fat
      (3) Salad dressings must meet the following criteria:
         (i) Two regular creamy dressings
         (ii) Five dressings that contain ≤10% saturated fat
      (4) Appropriate fresh toppings include one item from each of the following categories, preferably seasonal
         (i) Red vegetables (e.g. beets, red peppers, radishes, radicchio, red onions, red potatoes, tomatoes, etc.) and fruits (e.g. red apples, cranberries, red grapes, pink/red grapefruit, raspberries, strawberries, watermelon, red pears, pomegranates, blood organs, cherries, etc.)
         (ii) Orange/yellow vegetables (e.g. butternut squash, carrots, yellow peppers, yellow potatoes, pumpkin, squash, yellow beets, rutabaga, etc.) and fruits (yellow apples, apricots, cantaloupe, grapefruit, nectarines, organs, peaches, yellow pears, pineapple, tangerines, mangoes, papaya, yellow figs, yellow watermelon, golden kiwifruit, persimmons, etc.)
         (iii) Green vegetables (e.g. asparagus, broccoli, Brussels sprouts, Chinese cabbage, green beans, green cabbage, celery, cucumbers, endive, leafy greens, leeks, lettuce, green onions, okra, peas, green peppers, snow peas, spinach, sugar snap peas, zucchini, arugula, broccoflower,

broccoli rabe, chayote squash, watercress) and fruits (e.g. green apples, green grapes, honeydew, kiwifruit, limes, avocados, etc.)

(iv) Blue/purple vegetables (e.g. black olives, purple cabbage, eggplant, purple-flesh potatoes, purple asparagus, purple carrots, purple Belgian endive, purple peppers, etc.) and fruits (e.g. blackberries, blueberries, concord grapes, dried plums, purple grapes, plums, raisins, purple figs, black currants, elderberries, etc.)

(v) White/tan/brown vegetables (e.g. cauliflower, garlic, mushrooms, onions, parsnips, white-flesh potatoes, shallots, turnips, white corn, ginger, Jerusalem artichokes, jicama, kohlrabi, etc.) and fruits (e.g. bananas, dates, white nectarines, white peaches, brown pears, etc.)

(vi) Unmixed proteins (i.e. no added mayonnaise) (e.g. canned tuna, canned and deboned salmon, hard boiled eggs, diced ham, diced chicken, diced turkey, green soybeans, hard boiled eggs, 1% or 2% fat cottage cheese, etc.)

(vii) Dried fruits (e.g. apricots, apples, purple or gold raisins, cranberries, pineapples, mangos, blueberries, cherries, figs, blueberries, pears, plums, etc.)

(viii) Nuts (e.g. almonds, Brazil nuts, cashews, chestnuts, hazelnuts/filberts, macadamia, pecans, pine nuts, pistachio, walnuts, sunflower seeds, pumpkin seeds, pecans, mixed nuts, etc.)

4. Grains/Starches
   a. Standards
      (1) Bread varieties, minimum standards: three choices of breads, and one variety bread (i.e. roll, cornbread, garlic bread, muffin, bagel, English muffin, Sandwich/bagel thins, fruit or vegetable breads, or biscuit) offered with meals
      (2) At least one bread offered that is 100% whole grain (i.e. 3 grams fiber per serving) and at least one bread offered is folate and iron-fortified
      (3) Choice of six whole grain, ready to eat cold cereals: four must be without sugar coating and at least 2 contain 3 grams fiber per serving
      (4) Bulk dispensing of two highest volume cereals is mandatory
      (5) One hot cereal without added fat or sugars at breakfast
      (6) At least one non-fried hot starch served per meal without added fat (e.g. potatoes, rice, pasta, quinoa, couscous, etc.)
   b. Guidelines
      (1) Recommend the following bread options:
         (i) One sliced, white option
         (ii) One sliced, 100% whole-grain option
         (iii) One specialty bread (e.g. cinnamon-raisin, zucchini, banana, pumpkin bran, etc.)
         (iv) Two English muffin type options (one white, one 100% whole-grain or sandwich/bagel thins)
         (v) Two bagel options, at least one with ≥3 grams of fiber
      (2) Cereal bars offered will contain at least 3 grams of fiber per serving

(3) Hot cereal options include, but are not limited to, oatmeal, grits, cream of wheat, malt-o-meal, and quinoa

5. Short Order Station
   a. Standards
      (1) Four grilled short order type items (i.e. two hot meat sandwiches, one grilled stir-fry, and one hot vegetarian sandwich)
      (2) One grilled, fresh vegetable or one hot vegetable on short order line
      (3) Choice of two additional short order entrees (e.g., but not limited to, grilled chicken breast, pizza, wrap or flatbread sandwich, lean meat or vegetarian burrito, lean meat or vegetarian fajitas, etc.)
      (4) Offer one baked side item throughout entire meal service
      (5) Offer assorted chips and pretzels. Offer at least one baked or low fat chip product.
   b. Guidelines
      (1) As a standard, offer whole grain buns for burgers and hotdogs
      (2) Use non-fat cooking sprays as needed instead of buttering breads for grilled sandwiches, stir-fry, vegetables, etc.
      (3) Only lean ground beef and turkey (≥90% lean) burgers with no fillers or extenders
      (4) Offer variety in cheeses used for grilled sandwiches (to include, but not limited to, provolone, Swiss, American, cheddar, feta, bleu, jalapeno, etc.)
      (5) Offer grilled fresh vegetable or hot non-starchy vegetable on short order line
         (i) As a cost saver, consider using previous day's pre-cut salad/fruit bar options for placement in pizzas and stir-fry or as grilled fresh vegetable options
      (6) Pizza topping options (lists are not all-inclusive):
         (i) Lean meats (e.g. marinated chicken such as pesto, jerk, bar-b-que, Buffalo, plain, herb vinaigrette; lean beef, lean meatballs, chicken or turkey sausages, pepperoni, turkey, ham, etc.)
         (ii) Cheeses (e.g. bleu, part-skim mozzarella, fresh mozzarella, cheddar, feta, parmesan, provolone, ricotta, etc.)
         (iii) Bases/sauces (e.g. red sauce, pesto, olive oil and garlic, bar-b-que, etc.)
         (iv) Vegetables/fruits (e.g. green, black or Kalamata olives, mushrooms, tomatoes, sun dried tomatoes, jarred or canned artichoke hearts, bell peppers of various colors, banana peppers, broccoli, onions [red, white, yellow or caramelized], garlic, jalapenos, pineapple, roasted red potatoes, spinach, fresh basil, etc.)
      (7) Grilled stir-fry options, one from each of the following categories:
         (i) Starch (e.g. pasta, rice, potato, etc.)
         (ii) Lean meat (e.g. chicken, lean beef, lean pork, turkey, etc.)
         (iii) Vegetable
         (iv) Sauce (e.g. broth, bar-b-que, olive/canola oil and garlic, pesto, jerk, sweet and sour, General Tso's sauce, sesame, French onion, etc.) and

seasoning (e.g. garlic, pepper, salt , seasoning salt, lemon pepper, sesame seeds, pesto, basil, oregano, onion powder, etc.)

(a) As a cost saver, use previous day's pastas, cooked meats, and precut salad/fruit bar options. Combine pasta, rice potato, etc. with fresh cut vegetables and fruits with pre-cooked cut up lean meats and seasoning/sauces

(b) The following examples are not all-inclusive, but are meant to provide concept clarification:

- Option A: pasta, spinach, tomatoes, mushrooms, chicken or lean beef, garlic, olive/canola oil
- Option B: rice, broccoli, carrots, onions, mandarin organs, chicken or lean beef, and sweet and sour or General Tso's sauce
- Option C: potato, carrots, beets, bell peppers, onions, chicken or lean beef, light oil and onion soup seasoning with broth

(8) Baked short order side item options to include, but not limited to, baked or roasted (whole or cut up) white or sweet potatoes with no added fats or sugars, baked onion rings, or baked French fries (e.g. shoe string, sweet potato, steak cut, potato gems, etc.)

6. Sandwich/Deli Station
   a. Standards
      (1) Two varieties of bread offered: one 100% whole grain (i.e. 3 grams fiber per serving) and one variety bread choice
      (2) Two sliced lean meat options (e.g. turkey, lean ham, chicken, turkey pastrami, roast beef, etc.)
      (3) Two sliced cheese options
   b. Guidelines
      (1) One 100% whole-grain (3 grams fiber per serving) and one variety bread choice
      (2) Lean, sliced deli meat options (e.g. turkey, lean ham, chicken, turkey pastrami, roast beef, chicken, etc.)

7. Meats and Entrees
   a. Standards
      (1) One red-meat option (i.e., beef or game meat) and either one white-meat (i.e., poultry or pork) or fish/seafood option that are ≤30% fat, ≤10% saturated fat
      (2) Fish served a minimum of two times per week
         (i) At least one fish served per week that is high in omega-3 fats (i.e., salmon, tuna, trout, herring, mackerel, and sardines)
   b. Guidelines
      (1) Methods of preparation to include, but not limited to, baking, braising, broiling, grilling, poaching, roasting, sautéing, steaming, stir-frying, stewing, searing, etc.

(2) Visible fat removed
(3) No fried entrees
(i) Exceptions for special occasions such as holiday meals, Service birthdays or other celebrations
(ii) No more than two special occasions per month
(iii) Special occasion menus will be approved by the command dietitian
(4) Preferred cuts may include, but are not limited to, round, loin, leg, breast, tenderloin, etc.
(5) Only lean ground beef and turkey (≥90% lean) with no fillers or extenders
(6) One or more vegetarian options at the lunch and dinner meals
(7) Serve gravy and sauces separately
(8) Choice of two breakfast meats, one of which must be ≤30% total fat, ≤10% saturated fat (e.g. turkey, lean ham, Canadian bacon, etc.)

8. Dairy and Eggs
a. Standards
(1) All milk, cheese, egg products to be ≤10% saturated fat (with the exception of whole eggs)
b. Guidelines
(1) All mile fortified with vitamin A and vitamin D
(2) Offer 1% or skim milk as the primary milk option (white and chocolate varieties offered at all meals)
(3) Use 1% or skim milk in recipes when feasible
(4) Offer dairy choices that contain ≤10% saturated fat (e.g. cottage cheese, sour cream, cream cheese, shredded cheese, sliced cheese, etc.)

9. Fats and Oils
a. Standards
(1) Use fats containing ≤10% saturated fat
b. Guidelines
(1) No oils or fats containing trans-fats will be used in oils, shortenings, or spreads for cooking, baking or dressing
(2) Salad dressings, mayonnaise and dairy products will be ≤10% saturated fat
(3) Use olive oil or olive/canola oil blends for most food preparations
(4) Use sesame, peanut or coconut oil/milk for Asian cooking
(5) Avoid partially hydrogenated oils and margarines
(6) Avoid frying of food
(7) Serve avocado in season at salad bars and with Mexican/Southwestern foods

10. Beverages
a. Standards
(1) The following options offered at every meal:
(i) Water
(ii) Skim milk

(iii) 1% white milk
(iv) 1% chocolate milk
(v) Sports (5-8% carbohydrate and electrolyte) beverage
(vi) Two 100% fruit and/or vegetable juice (may contain more than one)
(vii) Coffee (with no ingredients added)
(viii) Tea (herbal and caffeinated)
(ix) Carbonated beverages (two regular, two diet)

(2) All milk options must be labeled to reflect fat content (i.e., skim/fat free, 1% low fat)

b. Guidelines

(1) Offer lactose-free alternative (e.g. lactose free milk, soy milk, etc.) based on customer demand
(2) Sugar-free beverage flavoring powders or low-calorie flavoring packets for addition to water will be offered for all meals if used in feeding operations
(3) Water dispenser available in beverage area
(4) Coffee and hot tea available at all meals
(5) Brewed decaffeinated coffee available at all meals based on customer demand
(6) If soda is served, offer one of each of the following options at every lunch and dinner meal:
(i) One low-calorie dark soda
(ii) One low-calorie clear soda
(iii) One caffeine-free soda
(7) If ice tea is served, offer at least one sugar-free option

11. Condiments

a. Standards

(1) All sauces, condiments and spreads should be ≤15% saturated fat

b. Guidelines

(1) Coffee and tea creamers:
(i) Low-fat (i.e. 1% fat) milk and artificial sweetener
(ii) Flavored creamers if operating budget permits, at least one reduced-fat variety
(iii) No trans-fat
(2) Offer only mayonnaise, margarine, sour cream and cream cheese with ≤10% saturated fat
(3) Sodium restriction is not warranted in this population; no sodium limitations on condiments

12. Soups

a. Standards

(1) One of each of the following options offered each meal
(i) One pureed vegetable soup, preferably a colored vegetable as primary base (e.g. tomato, carrot-ginger, pumpkin, cauliflower, etc.) or creamy soup made with ≤30% total fat, ≤10% saturated fat

(ii) One broth type mixed soup with vegetables, rice, pasta, beans, chicken, turkey, stew, chili type

b. Guidelines
   (1) Offer at least one soup at lunch based on customer demand
   (2) One trans-fat free baked product to accompany soup option

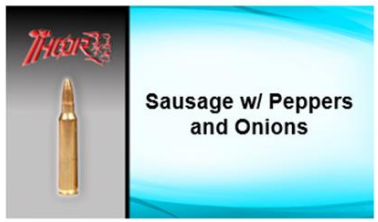
13. Desserts
   a. Standards
      (1) One cut up fresh fruit
      (2) One trans-fat free baked product
   b. Guidelines
      (1) Fresh fruit served on all dessert bars should be cut up and ready to eat
      (2) Offer one ≤10% saturated fat dessert
      (3) Offer one trans-fat free product (e.g. custard, pudding, coffee cake, cookies, ice cream, frozen yogurt, parfaits, etc.)

Appendix B: HPP THOR^3 Point-of-Service Label Examples

USASOC HPP Point-of-Service Labeling Examples for Foods

Green = Quality Carbohydrates
Blue = Lean Proteins
Orange = Performance Fats
Purple = Combination Foods

Quality Rating:
3 Bullet = Best Choice
2 Bullet = Good Choice
1 Bullet = Limit Intake



Appendix C: Demographic & Lifestyle Survey

Dining Satisfaction and Diet Quality of Soldiers Eating at Two Fort Bragg DFACs (15-04-HC)

Demographics & Lifestyle Information

Thank you for participating in this study. Please answer the following questions by filling in the circles that corresponds with your answer. All of the information you provide be kept confidential. Thank you.

MARKING INSTRUCTIONS	VOLUNTEER NUMBER	FILL IN TODAY'S DATE
• Use a No. 2 pencil only. • Do not use ink, ballpoint, or felt tip pens. • Make solid marks / fill the response completely • Erase cleanly any marks you wish to change. • Make no stray marks on this form. CORRECT: ● INCORRECT: ⊘⊠◒◔		MONTH DAY YEAR 20__

1. Gender:
   - M Male
   - F Female

2. What is your age today?

AGE years	

3. Your height in inches? (without shoes/boots)

HEIGHT inches	

for reference:
5 feet = 60 inches
6 feet = 72 inches

4. Your weight in pounds? (without clothing)

WEIGHT pounds		

5. What is your ethnic background?
   - 1 Hispanic or Latino
   - 2 Not Hispanic or Latino

RACE_OTHER

6. What is your racial background? (select all that apply)
   - 1 White or Caucasian
   - 2 Black or African American
   - 3 Native American/Alaskan Native
   - 4 Asian
   - 5 Native Hawaiian/Pacific Islander
   - 6 Other:_____

7. Please indicate the HIGHEST level of education you have completed (pick only one)
   - 1 Some high school (no GED or diploma)
   - 2 High school graduate (GED or diploma)
   - 3 Some college courses
   - 4 Associate degree (two-year college)
   - 5 Bachelors degree (four-year college)
   - 6 Graduate degree

8. What is your rank?

Enlisted	1 2 3 4 5 6 7 8 9
Officer	1 2 3 4 5 6 7 8 9
WO	1 2 3 4 5

Page 1

NATICK FORM 4990 (One-Time) 12 MAR 2015

9. Are you a SWCS student in the Special Forces Qualification Course (SFQC)?

1 Yes
2 No

10. What is your primary MOS? Description:_____

11. How long have you been in the Armed Services?

Active Duty

1 Less than one year **OR** If a year or more, please fill in the number of years (start with leading zero's when needed).

12. During the past 7 days, which meals and snacks did you eat on a regular basis (at least 5 times per week)?

Please fill in one response for each line:

Yes	No	
Y	N	A. Early morning snack
Y	N	B. Breakfast
Y	N	C. Morning snack
Y	N	D. Lunch
Y	N	E. Afternoon snack
Y	N	F. Dinner
Y	N	G. Evening snack

13. During the past 7 days, where did *MOST* of your meals and snacks come from? Select ONLY ONE choice for each meal and snack.

	EARLY MORNING SNACK	BREAKFAST	MORNING SNACK	LUNCH	AFTERNOON SNACK	DINNER	EVENING SNACK
Do not eat a meal/snack at this time	1	1	1	1	1	1	1
Home/Barracks (current residence)	2	2	2	2	2	2	2
Military dining facility	3	3	3	3	3	3	3
Fast food restaurants	4	4	4	4	4	4	4
Restaurants (table service)	5	5	5	5	5	5	5
Cafeterias (non military)	6	6	6	6	6	6	6
All you can eat buffets	7	7	7	7	7	7	7
Vending machines	8	8	8	8	8	8	8
Convenient stores	9	9	9	9	9	9	9
Other_____	10	10	10	10	10	10	10

Q13_oth

For questions 14-17, during the last 7 days, think about only those physical activities that you did continuously for at least 10 minutes at a time. On how many days did you do each type of activity and on the average, for how long?

14. VIGOROUS physical activity
(makes you breathe much harder than usual with heavy sweating; e.g. lifting weights, aerobics, or fast running / bicycling)?

Number of days per week: 0 1 2 3 4 5 6 7 X

TIME per day: Hr. | Min.

15. MODERATE physical activity
(makes you breathe somewhat harder than usual; e.g. jogging, carrying light loads, or bicycling at a regular pace)?

Number of days per week: 0 1 2 3 4 5 6 7 X

TIME per day: Hr. | Min.

16. WALK for at least 10 minutes at a time?
This includes walking at work and at home, walking to travel from place to place, and other walking that you did solely for recreation, sport, exercise or leisure.

Number of days per week: 0 1 2 3 4 5 6 7 X

TIME per day: Hr. | Min.

17. How much time in total did you usually spend SITTING on a week day?
This includes while at work or home, while doing course work and during leisure time, sitting at a desk, visiting friends, reading, traveling in a vehicle, and sitting or lying down to watch television.

TIME per day: Hr. | Min.

Use the table below to indicate how many hours during a typical day (24 hrs), during the week and then again during the weekends, you spend engaged in electronic activities.

18. DURING WEEKDAYS							
WATCHING TV		VIDEO GAMES		USING COMPUTER FOR WORK OR SCHOOL		USING COMPUTER FOR LEISURE	
0 0		0 0		0 0		0 0	
1 1		1 1		1 1		1 1	
2 2		2 2		2 2		2 2	
3 3		3 3		3 3		3 3	
4 4		4 4		4 4		4 4	
5 5		5 5		5 5		5 5	
6 6		6 6		6 6		6 6	
7 7		7 7		7 7		7 7	
8 8		8 8		8 8		8 8	
9 9		9 9		9 9		9 9	

19. DURING WEEKEND							
WATCHING TV		VIDEO GAMES		USING COMPUTER FOR WORK OR SCHOOL		USING COMPUTER FOR LEISURE	
0 0		0 0		0 0		0 0	
1 1		1 1		1 1		1 1	
2 2		2 2		2 2		2 2	
3 3		3 3		3 3		3 3	
4 4		4 4		4 4		4 4	
5 5		5 5		5 5		5 5	
6 6		6 6		6 6		6 6	
7 7		7 7		7 7		7 7	
8 8		8 8		8 8		8 8	
9 9		9 9		9 9		9 9	

20. How would you rate your physical readiness for military training or combat at this time?

1. Best physical shape in my life
2. Good physical shape
3. Neither good nor bad physical shape
4. Bad physical shape
5. Worst physical shape in my life

21. APFT score

0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

22. Number of pushups

0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

23. Number of sit ups

0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

24. 2 MILE RUN TIME

minutes		/ seconds	
		/	
0 0		0 0	
1 1		1 1	
2 2		2 2	
3 3		3 3	
4 4		4 4	
5 5		5 5	
6 6		6	
7 7		7	
8 8		8	
9 9		9	

25. Alternate APFT event:

1. Bike
2. Walk
3. Swim
4. Other_____

26. DATE OF LAST APFT		
MONTH		0 1
		0 1 2 3 4 5 6 7 8 9
DAY		0 1 2 3
		0 1 2 3 4 5 6 7 8 9
YEAR 20__		0 1 2
		0 1 2 3 4 5 6 7 8 9

SLEEP

27. During the last 7 days, how would you rate your sleepiness during the day?

1. Feeling active, vital, alert, or wide awake
2. Functioning at high level, but not at peak; able to concentrate
3. Awake but relaxed; responsive but not fully alert
4. Somewhat foggy; let down
5. Foggy; losing interest in remaining awake; slowed down
6. Sleepy, woozy, fighting sleep; prefer to lie down
7. No longer fighting sleep, sleep onset soon; having dream-like thoughts

28. During the last 7 days, on average how many hours of sleep did you get in a 24-hour period? ***(to nearest ½ hr)***

Hours per day	
Hr.	Min.
0 0	0 0
1 1	1 1
2 2	2 2
3	3 3
4	4 4
5	5 5
6	6
7	7
8	8
9	9

PERFORMANCE

29. During the last 7 days, did your food choices in the dining facility have an effect on:

	NEVER	SOMETIMES	MOST OF THE TIME	ALWAYS
Feeling energized throughout the day?	1	2	3	4
Improving your mood during the day?	1	2	3	4
Feeling satisfied for several hours after meals (not over hungry nor over full)?	1	2	3	4
Improving your mental performance (e.g. ability to think clearly, focus, learn, and ability to recall information during the day)?	1	2	3	4
Improving your level of physical performance (e.g. during workout or military training)?	1	2	3	4
Improving your ability to sustain physical performance longer?	1	2	3	4
Feeling good about yourself?	1	2	3	4
Improving your recovery after a vigorous physical activity OR workout? *(recovery refers to how quickly your muscles and cardiovascular systems rebound after a workout or physical activity)*	1	2	3	4
Improving your recovery after a moderate physical activity OR workout? *(recovery refers to how quickly your your muscles and cardiovascular systems rebound after a workout or physical activity)*	1	2	3	4
Reducing injury?	1	2	3	4
Improving your sleep quality?	1	2	3	4
Improving your response to emotional or psychological stress?	1	2	3	4

Appendix D: Dining Facility Satisfaction Survey

Dining Facility Satisfaction Survey

MARKING INSTRUCTIONS	VOLUNTEER NUMBER	FILL IN TODAY'S DATE
• Use a No. 2 pencil only. • Do not use ink, ballpoint, or felt tip pens. • Make solid marks / fill the response completely • Erase cleanly any marks you wish to change. • Make no stray marks on this form. CORRECT: ● INCORRECT: ⊘ ⊠ ◒ ◔		MONTH DAY YEAR 20__

Thank you for participating in this study. Please answer the following questions by filling in the circles that reflect your experience with the food service. All of the information you provide be kept confidential. Thank you.

Complete by marking the boxes that reflect your experience with our Food service.

		STRONGLY AGREE	MODERATELY AGREE	AGREE	UNDECIDED	DISAGREE	MODERATELY DISAGREE	STRONGLY DISAGREE
1.	Appearance of the food is pleasing	1	2	3	4	5	6	7
2.	Flavor and taste of the food is good	1	2	3	4	5	6	7
3.	Choices available are adequate	1	2	3	4	5	6	7
4.	Availability of healthy foods is adequate	1	2	3	4	5	6	7
5.	Availability of performance foods is adequate	1	2	3	4	5	6	7
6.	Portion sizes are appropriate	1	2	3	4	5	6	7
7.	Availability of fresh fruit is adequate	1	2	3	4	5	6	7
8.	The salad bar offers a variety of fresh vegetables	1	2	3	4	5	6	7
9.	The main dishes served are healthy and performance-based	1	2	3	4	5	6	7
10.	The side dishes are served without added fat (ex: butter)	1	2	3	4	5	6	7
11.	Healthy and performance-based dessert choices are available	1	2	3	4	5	6	7
12.	Temperature of food (ex: hot food is hot) is just right	1	2	3	4	5	6	7
13.	Vegetarian food choices are available	1	2	3	4	5	6	7
14.	I find the DFAC nutrition labels easy to use	1	2	3	4	5	6	7
15.	Nutrition labels provide knowledge to make performance based choices	1	2	3	4	5	6	7
16.	I use the DFAC nutrition labels to chose healthy foods	1	2	3	4	5	6	7
17.	I use the DFAC nutrition labels to chose performance foods	1	2	3	4	5	6	7

NATICK FORM 4991 (One-Time) 12 MAR 2015

Appendix E: PreSLIM Scale

Appendix D1 - Pre-SLIM scale

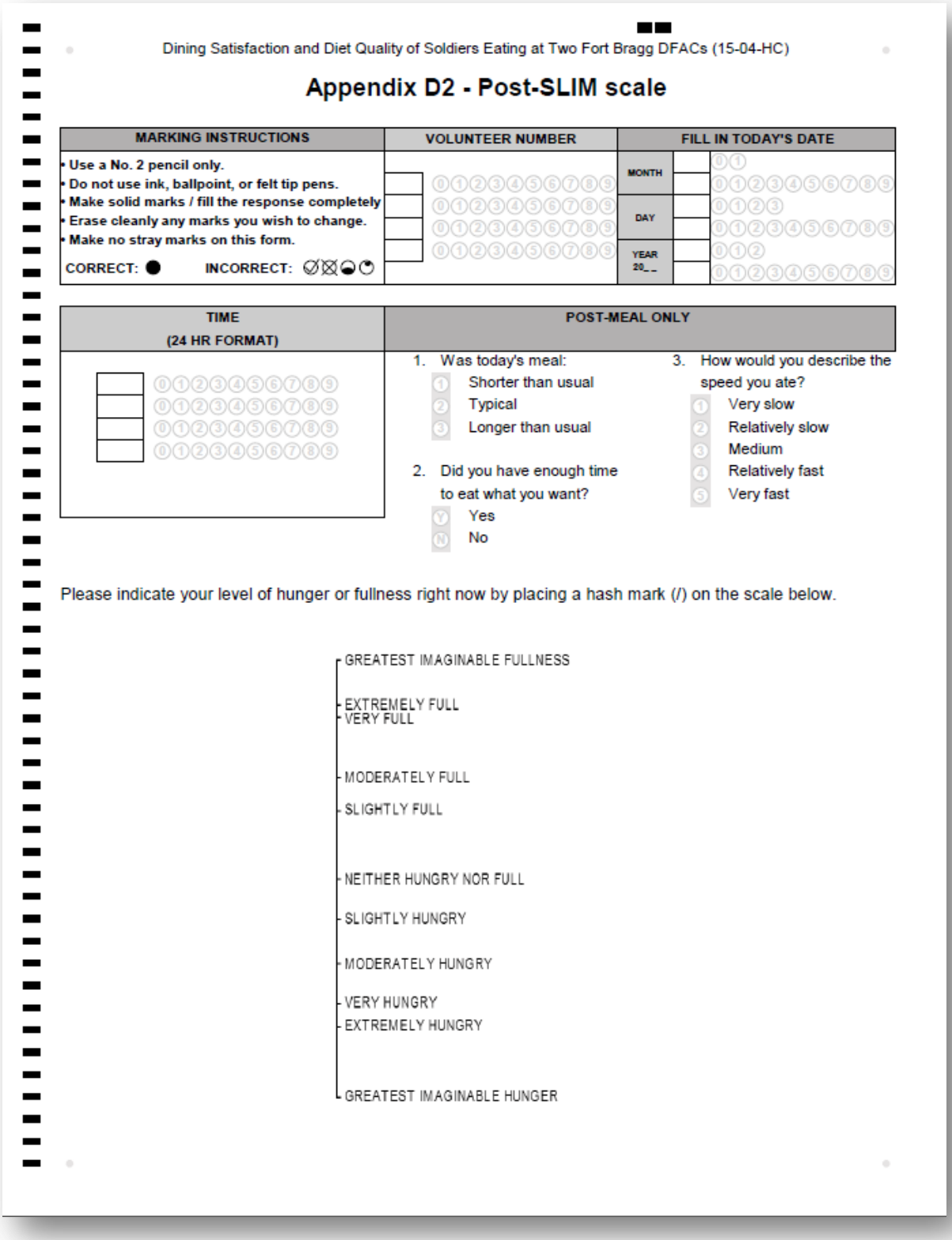
MARKING INSTRUCTIONS	VOLUNTEER NUMBER	FILL IN TODAY'S DATE
• Use a No. 2 pencil only. • Do not use ink, ballpoint, or felt tip pens. • Make solid marks / fill the response completely • Erase cleanly any marks you wish to change. • Make no stray marks on this form. CORRECT: ● INCORRECT: ⊘ ⊠ ◒ ◔	☐ 0 1 2 3 4 5 6 7 8 9 ☐ 0 1 2 3 4 5 6 7 8 9 ☐ 0 1 2 3 4 5 6 7 8 9 ☐ 0 1 2 3 4 5 6 7 8 9	MONTH ☐ ☐ 0 1 ☐ 0 1 2 3 4 5 6 7 8 9 DAY ☐ ☐ 0 1 2 3 ☐ 0 1 2 3 4 5 6 7 8 9 YEAR 20__ ☐ ☐ 0 1 2 ☐ 0 1 2 3 4 5 6 7 8 9

TIME (24 HR FORMAT)	PRE-MEAL ONLY	
	WHAT WAS YOUR LAST MEAL	*IF A SNACK, WHAT DID YOU EAT?
☐ 0 1 2 3 4 5 6 7 8 9 ☐ 0 1 2 3 4 5 6 7 8 9 ☐ 0 1 2 3 4 5 6 7 8 9 ☐ 0 1 2 3 4 5 6 7 8 9	① Early morning snack* ② Breakfast ③ Morning snack* ④ Lunch ⑤ Afternoon snack* ⑥ Dinner ⑦ Evening snack*	_____ _____ _____

Please indicate your level of hunger or fullness right now by placing a hash mark (/) on the scale below.

- GREATEST IMAGINABLE FULLNESS
- EXTREMELY FULL
- VERY FULL
- MODERATELY FULL
- SLIGHTLY FULL
- NEITHER HUNGRY NOR FULL
- SLIGHTLY HUNGRY
- MODERATELY HUNGRY
- VERY HUNGRY
- EXTREMELY HUNGRY
- GREATEST IMAGINABLE HUNGER

Appendix F: PostSLIM Scale



Dining Satisfaction and Diet Quality of Soldiers Eating at Two Fort Bragg DFACs (15-04-HC)

Appendix D2 - Post-SLIM scale

MARKING INSTRUCTIONS	VOLUNTEER NUMBER	FILL IN TODAY'S DATE
• Use a No. 2 pencil only. • Do not use ink, ballpoint, or felt tip pens. • Make solid marks / fill the response completely • Erase cleanly any marks you wish to change. • Make no stray marks on this form. CORRECT: ● INCORRECT: ⊘⊠◒◔		MONTH DAY YEAR 20__

TIME (24 HR FORMAT)	POST-MEAL ONLY
	1. Was today's meal: (1) Shorter than usual (2) Typical (3) Longer than usual 2. Did you have enough time to eat what you want? (Y) Yes (N) No 3. How would you describe the speed you ate? (1) Very slow (2) Relatively slow (3) Medium (4) Relatively fast (5) Very fast

Please indicate your level of hunger or fullness right now by placing a hash mark (/) on the scale below.

- GREATEST IMAGINABLE FULLNESS
- EXTREMELY FULL
- VERY FULL
- MODERATELY FULL
- SLIGHTLY FULL
- NEITHER HUNGRY NOR FULL
- SLIGHTLY HUNGRY
- MODERATELY HUNGRY
- VERY HUNGRY
- EXTREMELY HUNGRY
- GREATEST IMAGINABLE HUNGER