REPORT DOCUMENTATION PAGE	*Form Approved* *OMB No. 0704-0188*

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
5/17/2018	Technical Report T18-07	2013-2018

4. TITLE AND SUBTITLE
Using Plates and Trays with “MyPlate” Images to Encourage Healthy Food Choices: A Pilot Study at Military Dining Facilities

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

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5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Military Nutrition Division
U.S. Army Research Institute of Environmental Medicine
Building 42 - Kansas Street
Natick, MA 01760

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Medical Research and Materiel Command,
Fort Detrick, MD 21702

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
Objective: To examine the effectiveness of a MyPlate intervention for improving dietary intake and nutrition knowledge.
Method: Plates and trays displaying the MyPlate image replaced plain plates and trays, foods were labeled according to their corresponding MyPlate food group, and posters introduced the new food labeling system. Dietary intake of facility patrons was measured during 12 lunch meals using the food photography method. Repeated-measures ANOVA, one-way ANOVA, paired t-test, and McNemar’s test were used.
Results: Dairy consumption increased from baseline to intervention (0.5±0.4 cups/meal to 0.8±0.5 cups/meal, $P < 0.05$). The number of participants that correctly labelled all 5 food groups on a MyPlate diagram increased from baseline to post-intervention ($n = 5$ versus $n = 15$, $P < 0.01$).
Conclusions and Implications: A brief MyPlate intervention increased nutrition knowledge and dairy consumption. Future research should investigate the effectiveness of the MyPlate intervention for improving diet quality and nutrition knowledge in larger military

15. SUBJECT TERMS
MyPlate, My Plate, plate, tray, intervention, cafeteria, dining facility, military, nutrition education

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
Unclassified	Unclassified	Unclassified	Unclassified	28	Tracey J. Smith
					19b. TELEPHONE NUMBER *(Include area code)* (508) 233-4868

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U.S. Army
Research Institute of
Environmental Medicine

Natick, Massachusetts

TECHNICAL REPORT NO. T18-07
17 May 2018

USING PLATES AND TRAYS WITH "MYPLATE" IMAGES TO ENCOURAGE HEALTHY FOOD CHOICES: A PILOT STUDY AT MILITARY DINING FACILITIES

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United States Army
Medical Research & Materiel Command

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USARIEM TECHNICAL REPORT XXXX

Military Nutrition Division

May 2017

Using Plates and Trays with "MyPlate" Images to Encourage Healthy Food Choices: A Pilot Study at Military Dining Facilities

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AKNOWLEDGMENTS

Author contributions: Jenna Scisco, Tracey Smith, Susan McGraw, Catherine Champagne, Andrew Young, and Scott Montain designed the study. Kristie O'Connor, Dianna Carpentieri, and Jenna Scisco collected the data. Kristie O'Connor, Susan McGraw, Catherine Champagne, and Jenna Scisco analyzed the data. Kristie O'Connor and Jenna Scisco wrote the first draft of the manuscript. All authors reviewed and commented on drafts of the manuscript.

The authors would like to thank the study participants and the dining hall staff at both the Natick Soldier Systems Center DFAC and Coast Guard Base Boston. We would also like to thank the following research assistants from MND USARIEM for their assistance in conducting this project: Nicholes Armstrong, MS, RD; Christopher Cummings, BS, BA; SGT Matthew Lavallee, BS; Laura Lutz, MS, RD; Holly McClung, MS, RD, CSSD, LDN; SPC Gregory Shobayo, BS.

EXECUTIVE SUMMARY

Introduction: The physical environment (e.g., a cafeteria or military DFAC) is an important target for improving diet quality. However, it is unknown if a simple visual aid instrument, such as MyPlate, could be used to encourage healthy food choices in these environments. This study examined the effectiveness of a MyPlate intervention for improving dietary intake and nutrition knowledge in military dining facilities.

Materials and Methods: This study utilized a single-group A-B-A (reversal) design that was 6 weeks or 12 weeks in duration, depending on study site. Participants were eligible for the study if they were at least 18 years old and typically ate lunch in their dining facility or galley once per week. The study was conducted at the Natick Soldier Systems Center dining facility (DFAC) in Natick, MA, and at the Coast Guard Base Boston galley. Nineteen participants enrolled in the study at each location, with 18 and 9 participants, respectively, providing adequate intake data for analysis. Plates and trays displaying the MyPlate image replaced plain plates and trays, foods were labeled according to their corresponding MyPlate food group, and posters introduced the new food labeling system. Dietary intake was measured during 12 lunch meals using the food photography method. Nutrition knowledge was measured with a questionnaire. Repeated-measures ANOVA, one-way ANOVA, paired t-test, and McNemar's test were used to analyze the results.

Results: Dairy consumption increased from baseline to intervention (0.5±0.4 cups/meal to 0.8±0.5 cups/meal, $P < 0.05$). There were no significant changes in consumption from baseline to intervention of fruits, vegetables, whole grains or protein. Participants were already consuming the USDA recommended amount of vegetables at baseline. Negligible amounts of whole grain foods were served during lunch at all three phases of the study. The number of participants that correctly labelled all 5 food groups on a MyPlate diagram increased from baseline to post-intervention (n = 5 versus n = 15, $P < 0.01$).

Conclusion: A brief MyPlate intervention increased nutrition knowledge and dairy consumption at one of the two sites. To further understand the potential effectiveness of a MyPlate intervention, future research should be conducted at a larger military dining facility where there is a known problem with under consumption of the key healthy foods, and food options from all 5 food groups are being served regularly.

INTRODUCTION

Despite efforts to decrease obesity in the United States, the National Health and Nutrition Examination Survey (NHANES) estimates that amongst 20-39 year olds (the age group that aligns with the majority of active duty military personnel), more than 60% are either overweight or obese.[1] Similar to the civilian population, 50% of military personnel ages 26-35 are overweight, and 13% are obese.[2] Countermeasures to reduce obesity are warranted, given the association with increased rates of chronic diseases and injuries[3,4] and higher health care costs.[5]

The nutritional quality of dietary intake is a concern for both civilians and military personnel. The 2015 Dietary Guidelines for Americans emphasize the daily consumption of lean proteins, fruits, vegetables, whole grains, and low-fat dairy products in order to maintain a healthy body weight and meet the requirements for macro and micronutrients to promote health.[6] However, only 11.2% of active duty military personnel met the fruit requirement (2 cups/day), 12.9% met the vegetable requirement (2.5 cups/day women, 3 cups/day men), 12.7% met the whole grain requirement (3 oz eq/day women, 4 oz eq/day men), and 12.6% consumed ≥3 servings of dairy per day.[2] These low rates of adherence to dietary guidelines, coupled with high rates of overweight and obesity among military personnel, indicate a need for strategies to improve diet quality of service members.

A target for interventions to improve diet quality is the physical environment (e.g., cafeterias and dining facilities serving military personnel).[7] Interventions employed in group feeding settings can reach many people simultaneously and may make healthy food choices easier for the target population.[8] Approximately 24% of military personnel reportedly consumed breakfast at least twice per week from a military DFAC, while 33% and 18% consumed lunch or dinner, respectively, from a military DFAC. [9] Thus, an intervention promoting better diet quality in military DFACs could influence the dietary intake of military personnel.

To improve adherence to dietary guidelines in military DFACs, we speculated that a simple visual aid instrument to model healthy food choices, such as the MyPlate icon, could be used. The MyPlate icon shows five main food groups (fruits, vegetables, grains, protein, and dairy) and promotes healthy eating.[10,11] For example, participants who adhered to verbal instructions to follow either the MyPlate or Half Plate Rule (i.e., make half your plate fruits and vegetables) during their usual meals reported, via food records, eating more vegetables and less calories than a control group.[12] The impact of these dietary instructions may be further enhanced by printing the MyPlate or Half Plate message onto the actual meal plate, thus providing a direct cue for specific food groups and their relative proportions to be selected to achieve a healthy diet. Furthermore, more objective measures of food intake (e.g., food photography) are needed in order to assess the effectiveness of a MyPlate intervention.

In this small scale, pilot study, we sought to determine whether this type of intervention would show sufficient promise for affecting healthy food choices and increasing nutrition knowledge so as to merit evaluation in a larger multi-site investigation. Therefore, we implemented a multi-faceted MyPlate intervention with MyPlate image-adorned plates, trays, and posters at two small military DFACs in the Boston area. This study is the first to measure the efficacy of a MyPlate intervention in military DFACs for improving dietary intake and MyPlate knowledge.

METHODS

Participants & Study Design

The protocol was approved by the U.S. Army Research Institute of Environmental Medicine’s Institutional Review Board and participants gave their free and informed consent. The investigators adhered to the policies for protection of human subjects as prescribed DOD

Instruction 3216.02, and the research was conducted in adherence with the provisions of 32 CFR Part 219. Individuals were included if they were ≥18 years old and typically ate at the dining facility at least once per a week. Each of the two study locations was broken into three phases and used a single-group, repeated measures design (Figure 1). Two locations were chosen to improve the generalizability of our findings in terms of study location (Army vs. Coast Guard base) and study length (6 vs. 12 weeks). It was expected that consistent findings across the two sites would indicate a more robust effect of the intervention, whereas a finding in one location might be more specific to a feature of that location or the intervention length. Due to study participants at the Natick Soldier Systems Center (NSSC) being available to participate for a maximum of 6 weeks, a 6 week study duration was selected for this location. At the Coast Guard Base Boston (CGBB) galley, the menu repeated itself every 4 weeks, allowing for natural control of foods offered during the three study phases. Therefore, a 12 week study duration was selected for the CGBB galley.

Intervention

The following changes were made to the DFAC/Galley during the intervention (see Figure 2): (1) MyPlate plates with the message "Make Half Your Plate Fruits and Vegetables" replaced plain plates routinely used in the facilities. (2) MyPlate labeled trays replaced plain trays routinely used. (3) Foods on the service line were labeled with a MyPlate quadrant or circle magnet. (4) Posters were displayed in the dining hall area and demonstrated how the plates and trays could be used to select foods from the five food groups. On one poster, pictures of a selected assortment of daily food offerings were shown on the appropriate color-coded food group. Additionally, employees working on the service line placed foods on the proper corresponding quadrant on the MyPlate plate.

Measures

The digital food photography method tracked the same participant's food intake at up to four separate lunch meals in each of the three study phases. This method is a reliable and valid way to measure intake in cafeteria environments.[13] A camera station took two pictures: one picture captured a participant's food selections and a second picture captured their refuse. Two raters independently estimated intake of each individual food and beverage by comparing pictures of the participant's food selection and refuse to reference pictures. Reference pictures were one serving of a food item, photographed before lunch began at each facility; each reference portion was measured in grams. A third rater made a final approximation when there was a discrepancy of ≥10% between the two raters which occurred for 17% of the ratings. Interrater reliability (IRR) was in the excellent range, ICC= 0.95, indicating that raters 1 and 2 had a high degree of agreement.[14] The intake estimates and a list of all foods were provided to Pennington Biomedical Research Center (PBRC). PBRC matched all foods to the Food and Nutrient Database for Dietary Studies descriptors (FNDDS version 5, March 2012). The FNDDS provided detailed nutrient information for each item which was used to determine intake of MyPlate food group servings. In addition to reporting intake by food group, calcium is also reported because this nutrient is relevant to dairy consumption.

The CGBB galley was on a four week rotating menu, keeping food offerings consistent. However, NSSC DFAC was not on a rotating menu. In order to measure possible differences in availability of different food groups across study phases within a location, a study team member used a checklist to record every food item offered on the days we measured food intake. Then, FNDDS data was used to categorize foods into their respective food groups. To be included as a food group item, the item required the following amount per serving based on guidelines available at choosemyplate.gov: fruit (≥1/2 cup), vegetable (≥1/2 cup), non-potato vegetable (≥1/2 cup), whole grain (≥0.5 oz.), refined grain (≥0.5 oz.), protein (≥5g), total dairy (≥0.1 cup), and milk (≥0.1 cup). For example, a banana contained ≥1/2 cup of fruit and therefore was categorized as one item in the fruit category. However, blueberry pie contained < 1/2 cup of fruit and therefore was not categorized as an item in the fruit category. Mixed dishes could be counted in more than one category; for example, meat lasagna was categorized as refined grain, dairy, and protein.

Questionnaires were developed by the principal investigator and revised through two rounds of obtaining feedback on the clarity and content of the questions from three registered dietitians and an expert survey developer. The Nutrition Knowledge Questionnaire (NKQ; 6 questions) was based on the MyPlate icon and consumer messages from choosemyplate.gov. Figure 3 provides a sample question; participants were asked to fill in a blank black and white MyPlate image with the correct food groups. The Nutrition Attitudes and Behaviors Questionnaire (NABQ; 41 questions) included modified questions from the Food and Drug Administration's (FDA) Health and Diet Survey: Dietary Guidelines Supplement. These validated questions had high internal reliability in previous research ($\alpha = 0.81$).[15,16] Participants responded to items such as "Eating foods from the five food groups every day is very important to me" using Likert-type response scales. Both the NKQ and NABQ were administered to each participant at baseline and post-intervention. The Intervention Awareness Questionnaire (IAQ; 14 questions) was administered post-intervention to each participant. An example item is "Did you notice any changes to your dining facility or galley during your participation in this study? If YES, what changes did you notice?". The participant circled changes from a list of possibilities; some were accurate (e.g., MyPlate plates) and some were inaccurate (e.g., MyPlate aprons) to check for inattention. Demographic information, including education level, height, weight, active military status, and rank, were self-reported on a demographics questionnaire.

Data Analysis

Statistical analyses were conducted with IBM SPSS Statistics version 21 (IBM Corp., Armonk, New York). Repeated measures ANOVA compared intake between baseline, intervention, and post-intervention. Participants were asked to attend up to four lunch meals during each of the three phases, with two meals per phase being the minimum acceptable frequency for inclusion in the analysis. Intake was the average of the two to four meals measured from a dining participant during each phase. One-way ANOVA compared average food group availability between each phase. The average food group availability during a study phase was the total number of items in each food group from the four measurement days for that phase divided by four. Paired t-tests compared changes in nutrition attitudes and behaviors from baseline to post-intervention. McNemar's test for repeated-measures nominal data assessed changes in MyPlate food group knowledge. Statistical significance was a P-value <0.05. Due to small sample sizes in this study limiting statistical significance, Cohen's *d* effect size measures of small, medium, large (.20, .50 and .80, respectively) were also calculated[17], similar to research on a Nutri-plate and its impact on food selection and consumption.[18]

RESULTS

Demographic data and frequency of completion of study components are listed in Table 1.

NSSC DFAC Results

Awareness and knowledge of the MyPlate image increased as a result of the intervention. Prior to the intervention, 6 of the 19 participants reportedly had never seen the MyPlate image, while only 1 participant reported at post-intervention that they had not seen the image. Correct labeling of the dairy circle increased 52%, and correctly naming all 5 food groups on a MyPlate diagram increased 52% from baseline to post-intervention (Table 2).

With regard to dietary intake, baseline levels of vegetables and protein at lunch met or exceeded 1/3 of the USDA recommendations, and all the other food groups were under 1/3 the recommendations (Table 3). Dairy consumption increased 62% from baseline to intervention and then reverted back to baseline dairy consumption during the post-intervention phase (Table 3). Interestingly, this increase in dairy consumption occurred despite less dairy product availability during the intervention phase compared to baseline and post-intervention (Table 4). Protein intake decreased over time (Table 3), and protein availability also decreased from baseline to intervention but returned to baseline levels during the post-intervention phase (Table 4). There were no changes in fruit, vegetable, and whole grain consumption. Vegetable availability decreased during the course of the study (Table 4) but was > 1/3 the USDA recommendations during all phases (Table 3). Whole grain consumption was very low (Table 3). Consumption of refined grains was above 1/3rd of the upper limit (Table 3).

Self-reported nutrition attitudes and behaviors changed from baseline to post-intervention. Agreement with the following statements increased: (1) “It is possible for me to eat foods from all five food groups at every meal” (5.8±1.0 to 6.3±1.1, $P<0.05$, Cohen’s $d = -0.34$), (2) “Eating foods from the five food groups every day is very important to me” (5.4±1.0 to 6.1±1.0, $P<0.05$, Cohen’s $d = -0.5$), and (3) “I am actively trying to eat foods from the five food groups every day” (5.1±1.0 to 5.8±1.0, $P<0.05$, Cohen’s $d = -0.5$) (data not presented in Tables). The plates and trays were the most memorable changes, with 95% (18/19) and 90% (17/19), respectively, remembering them.

CGBB Galley Results

At baseline, 7 of the 11 participants reportedly had never seen the MyPlate image, while only 1 participant reported at post-intervention that they had not seen the image. There was no significant change in the labeling of the food groups at the CGBB Galley (Table 2).

Baseline levels of vegetables and protein at lunch met or exceeded 1/3 of the USDA recommendations, baseline fruit intake was close to 1/3 the recommendations, and all the other food groups were under 1/3 the recommendations (Table 3). Fruit intake was > 1/3 the USDA recommendations during the intervention (Table 3), and fruit availability increased from baseline to intervention (Table 4). Availability of protein decreased over the course of the study (Table 4). Participants consumed greater than 1/3 of the recommendations for vegetables during all three phases (Table 3). The small quantity of whole grains consumed decreased from baseline to post-intervention (Table 3). Consumption of refined grains was above 1/3rd of the upper limit (Table 3). The plates and trays were the most memorable changes, with 69% (9/13) and 77% (10/13), respectively, remembering them.

DISCUSSION

The aim of our pilot study was to determine if the MyPlate intervention showed sufficient promise for affecting healthy food choices and increasing nutrition knowledge, in a small sample of military personnel and civilians eating at military dining facilities, so as to warrant a large scale clinical investigation in multiple DFAC sites. To the authors' knowledge, this was the first study to implement MyPlate plates, trays, posters, and magnets into a military dining facility. Although the MyPlate intervention did not result in meaningful changes in fruit, whole grain, and vegetable intake, the MyPlate intervention during lunch at a military dining facility did effectively increase MyPlate knowledge and dairy intake to warrant further large-scale investigation within the military setting.

The present study advances the literature on the effectiveness of MyPlate for impacting dietary intake. Other research suggested that the MyPlate image could be used as a tool to increase intake from the five food groups, but objective intake data was not collected.[12,19] Using the food photography method, the present study found that participants consumed 62% more dairy when using the MyPlate materials when compared to baseline at the Army DFAC. This increase in dairy intake (1) occurred despite fewer dairy products being offered during the intervention compared to the baseline and post-intervention phases, (2) disappeared when the MyPlate materials were removed, indicating that this effect could be due to the MyPlate intervention and not an increase in dairy intake over time, and (3) was coupled with an increase in correctly labeling the dairy circle on the MyPlate image which could reflect the saliency of the dairy circle on the trays, in that it stands apart from the plate with four quadrants. However, the increase in dairy consumption was not found at the Coast Guard Galley. If future, larger studies demonstrate that the MyPlate intervention promotes increases in dairy intake, then there is the potential that increasing dairy intake, and thus calcium, vitamin D, and specific dairy proteins, could have numerous health benefits to the military population.[20,21] For the nearly three quarters of active duty enlisted military personnel who are 30 or younger, adequate consumption of calcium and vitamin D can build up skeletal mass and decrease the chances of skeletal injury later in life.[22] Furthermore, the quality of dietary protein is important for muscle and bone health, with dairy proteins considered to be of the highest quality.[21,23] The high quality proteins in dairy may assist military personnel by aiding in the loss of body fat, while preserving lean body mass during weight loss or periods of increased metabolic demand and constrained dietary intake.[24–26]

It appears that the intervention contributed to changes in MyPlate knowledge and dairy intake even though the participants were not engaged in traditional classroom nutrition education. The MyPlate trays and plates were the most memorable to study participants, compared to the posters and food labels, indicating that plates and trays may be more effective at conveying an educational message. Awareness of the MyPlate plates and trays was lower at the CGBB galley as compared to the NSSC DFAC which could be attributed to a longer time lapse (4 weeks vs. 2 weeks) between removal of the MyPlate materials and participants completing the awareness questionnaire.

There were several limitations to our pilot study. We studied small dining facilities at two local sites which resulted in a small sample size and limited our ability to detect statistically significant changes across intervention phases. In addition, attendance at lunch meals was low at the Coast Guard galley due to the nature of their work (e.g., on a Coast Guard vessel all day) leading to a small sample for dietary intake at this location. The dining facilities served negligible amounts of whole grains (i.e., neither location offered any food items which met the requirement of $\geq$ 0.5 oz eq per serving of whole grains to be considered a whole grain food), thus limiting opportunities for dietary change in this category. Furthermore, the quality of the baseline lunch intake was already better than the general military diet; and, participants consumed adequate amounts of vegetables at baseline, making it less likely that vegetable intake would increase. The present study did not have a control group, and changes due to external influences cannot be completely ruled out.

Anecdotally, we noted that how a food was presented and where it was located might have impacted food selection. For example, at the CGBB galley, prepared fruit (chopped, peeled, sliced) was the first food participants encountered, whereas at the NSSC DFAC, whole fruits were encountered last. This difference in preparation and location may be one reason why adequate fruit was consumed at the CGBB galley during the intervention phase.[27,28] Although increasing access to healthy food may seem like an effective solution for improving dietary intake, a recent study which attempted this in multiple large DFACs, along with food labeling, found that there was no significant increase in consumption of fruits, vegetables, and whole grains.[29] Perhaps, a multi-component intervention to include the use of MyPlate plates and trays, along with improved access to all food groups, could be more effective for improving dietary intake.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Environmental interventions are needed to optimize nutritional intake in both the civilian and military dining environments. Future research should test the MyPlate intervention in larger and more diverse military dining facilities, where foods from all five food groups are being served but not adequately consumed. Practically, if the increase in dairy knowledge and intake is replicated in future research, military personnel could experience muscle, bone, and body composition benefits.

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Figure 1. MyPlate Study Design

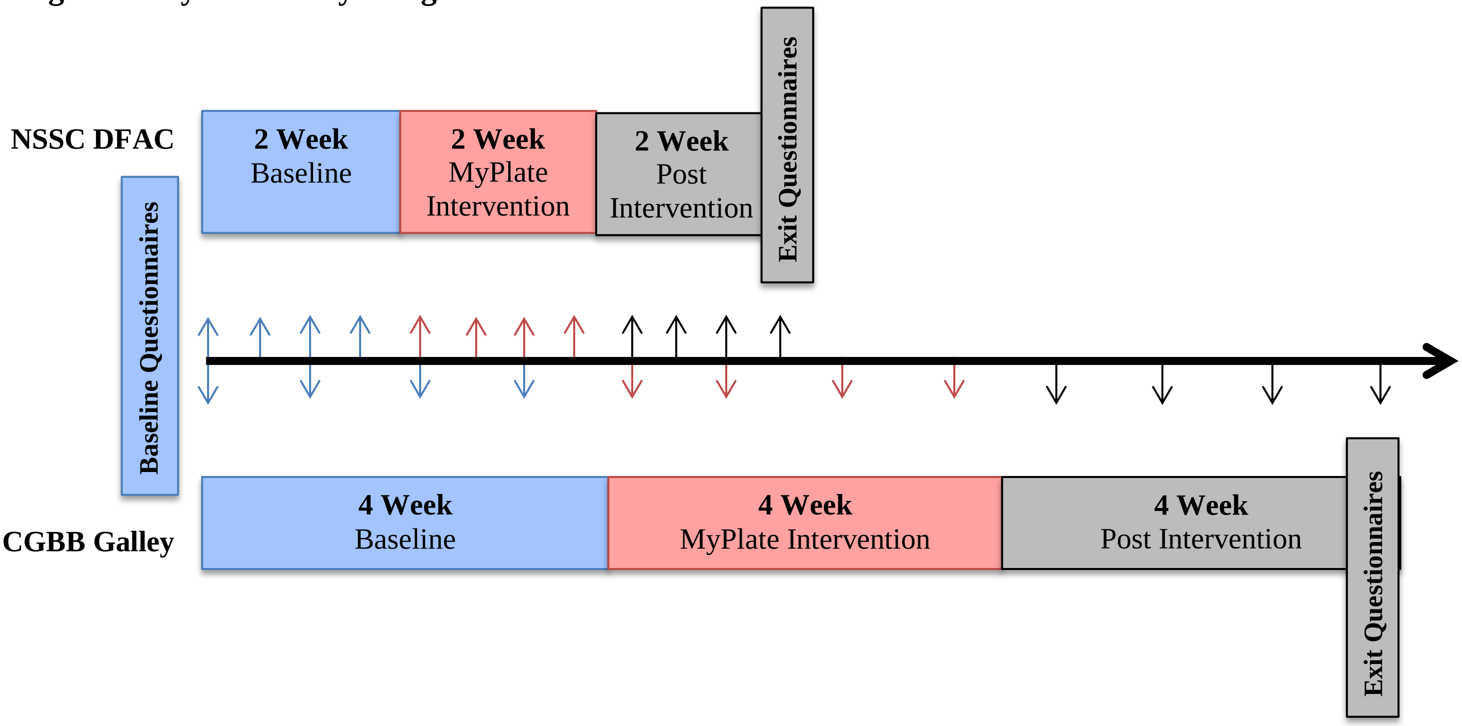


Figure 1. MyPlate Study Design. Data collection was a total of 6 weeks at the Natick Soldier Systems Center (NSSC) dining facility (DFAC) and 12 weeks at the Coast Guard Base Boston (CGBB) Galley. Both study locations consisted of 12 data collection days indicated by arrows: 4 days during the baseline phase (blue), 4 days during the intervention phase (red) and 4 days during the post-intervention phase (gray). The NKQ, NABQ, and demographics questionnaire were the baseline questionnaires, and the NKQ, NABQ, and IAQ were the exit questionnaires.

Figure 2: MyPlate Study Phases

Phase 1: Baseline

Phase 1: Original plain dining hall plates and trays were used.

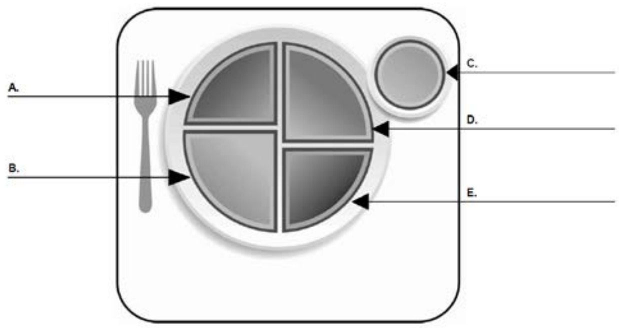
Phase 2: Intervention

Phase 2: MyPlate plates and trays replaced the plain plates and trays, MyPlate posters were displayed, and magnets were used to label the appropriate MyPlate quadrant or circle associated with that food.

Phase 3:
Post-intervention

Phase 3: All MyPlate intervention items were removed and the standard plain plates and trays were returned.

Figure 3: Sample Question from the Nutrition Knowledge Questionnaire



On the lines A thru E, write the name of the food group category that should be on the plate or in the circle according to MyPlate. If you do not know the food group category, write “I don’t know”.

Figure 3. Sample Question for the MyPlate Study Extracted from the Nutrition Knowledge Questionnaire. This question was administered at baseline and after the post-intervention phase.

Table 1: Study Completion and Background Data for Participants Enrolled in the MyPlate Study.

	NSSC DFAC n (%)	CGBB Galley n (%)
Age (y)†		
Median (Range)	23 (19-56)	34 (30-69)
Sex †		
Male	15 (83)	8 (89)
Female	3 (17)	1 (11)
Body Mass Index†		
Mean ±SD	25.3±2.8	25.7±3.1
Range	21-32	20-30
Education†		
High School Degree	18 (100)	9 (100)
Bachelor's Degree or Higher	7 (39)	8 (89)
Active Military †	18 (100)	9 (89)
Rank †		
Enlisted	13 (72)	3 (33)
Officer	5 (28)	5 (56)
Completed questionnaire components		
Intervention Awareness Qre	19 (100)	13 (81)
Nutrition Knowledge Qre	19 (100)	11 (69)
Nutrition Attitudes and Behaviors Qre	19 (100)	13 (81)
Adequate dining facility attendance[1]	18 (95)	9 (56)
Average frequency of lunch meal attendance†	**Mean±SD**	**Mean±SD**
Baseline	3.9±0.5	3.1±0.7
Intervention	4.0±0.2	2.9±0.7
Post-intervention	3.5±0.7	2.9±0.7

Table 1.Study Completion and Background Data for Participants Enrolled in the MyPlate Study at Either the Natick Soldier Systems Center (NSSC) Dining Facility (DFAC), or the Coast Guard Base Boston (CGBB) Galley. 19 volunteers were recruited at each of the locations.

[1] One male was dropped from the NSSC DFAC, and four males and three females were dropped from the CGBB Galley due to not meeting the requirement to attend at least two lunch meals during each of the three study phases (baseline, intervention, and post-intervention). An additional two males and one female dropped from the CGBB Galley due to other circumstances.

†Data is for those with adequate dining facility attendance defined as attending at least two lunch meals during each of the three study phases (baseline, intervention, and post-intervention)

Table 2: Baseline and Post-Intervention Knowledge of the MyPlate Food Groups.

	NSSC DFAC n (%)		**CGBB Galley n (%)**	
	Baseline	Post-intervention	Baseline	Post-intervention
Fruit Quadrant	4 (21)	10 (53)	2 (18)	5 (46)
Vegetable Quadrant	3 (16)	6 (32)	1 (9)	6 (55)
Protein Quadrant	2 (11)	4 (21)	1 (9)	4 (36)
Grains Quadrant	2 (11)	5 (26)	1 (9)	4 (36)
Dairy Quadrant	6 (32)	16 (84)*	2 (19)	6 (55)
All 5 food groups regardless of location	6 (32)	16 (84)*	2 (18)	5 (46)
Recognized small quadrant as fruit.	5 (26)	15 (79)	3 (27)	7 (64)
Recognized small quadrant as protein.	3 (16)	8 (42)	2 (18)	7 (64)
Recognized large quadrant as grains.	4 (21)	10 (53)	2 (18)	5 (53)
Recognized large quadrant as vegetable.	8 (42)	13 (68)	5 (46)	10 (91)

Table 2. Baseline and Post-Intervention Knowledge of the MyPlate Food Groups at the NSSC DFAC (n=19) and CGBB Galley (n=11). *N* and percentage listed in table represent participants who responded with the correct food group at that specific location on the plate.
[*] Statistically significant change from baseline to post-intervention, McNemar's test, $P < 0.05$.

Table 3: Comparison of Amount of Food Consumed by Participants

Food Type Study Phase	**NSSC DFAC (N=18)** Mean±SD	**CGBB Galley (N=9)** Mean±SD	Cohen's *d* comparison	**NSSC DFAC** Cohen's *d* value	**CGBB Galley** Cohen's *d* value	**1/3 USDA Recommended daily amount (19-30 year old)**
Food Energy, Kcals*						
Baseline	910±198	758±225	Base – Int	0.07	-0.09	1/3 MDRI
Intervention	897±236[‡]	776±193	Int – Post	**0.98**	**-0.53**	Women:767 kcal/d
Post-Intervention	782±216[§]	845±302	Base – Post	**0.84**	**-0.46**	Men: 1133 kcal/d
Milk, cup eq						
Baseline	0.22±0.32	0.27±0.40	Base – Int	**-0.53**	-0.17	
Intervention	0.36±0.49	0.28±0.40	Int – Post	**0.46**	0.19	1 cup
Post-Intervention	0.18±0.19	0.27±0.40	Base – Post	0.151	0.00	
Total milk yogurt cheese, cup eq*						
Baseline	0.50±0.41	0.53±0.52	Base – Int	**-0.93**	0.43	
Intervention	0.81±0.51[‡]	0.47±0.48	Int – Post	**0.63**	-0.12	1 cup
Post-Intervention	0.57±0.33	0.49±0.46	Base – Post	-0.23	0.20	
Fruit, cup eq						
Baseline	0.32±0.46	0.55±0.52	Base – Int	0.00	-0.32	
Intervention	0.32±0.38	0.76±0.86[#]	Int – Post	-0.02	0.32	0.67 cup
Post-Intervention	0.33±0.35	0.58±0.54	Base – Post	-0.02	-0.14	
All Vegetables, cup eq						
Baseline	1.2±0.37[#]	2.0±1.21[#]	Base – Int	0.23	0.00	
Intervention	1.1±0.37[#]	2.0±1.31[#]	Int – Post	-0.29	-0.29	Women: 0.83 cup
Post-Intervention	1.2±0.31[#]	2.3±1.50[#]	Base – Post	0.00	-0.35	Men: 1 cup
Vegetables No White Potato, cup eq						
Baseline	0.9±.41	1.7±1.29[#]	Base – Int	0	-0.19	Women: 0.83 cup
Intervention	0.9±.39	1.8±1.23[#]	Int – Post	0	-0.15	Men: 1 cup
Post-Intervention	0.9±.31	1.9±1.41[#]	Base – Post	0	-0.32	
Protein, g*						
Baseline	45±13[§]	39±10.1	Base – Int	**0.55**	-0.13	1/3 MDRI
Intervention	41±11	40±10.1	Int – Post	0.41	-0.23	Women:18-37 g/d
Post-Intervention	37±11	43±15.5	Base – Post	**0.67**	-0.39	Men: 23-45 g/d
Whole grains, oz eq						
Baseline	0.01±0.06	0.28±0.45	Base – Int	0	0.38	Women 1 oz eq
Intervention	0.01±0.02	0.14±0.28	Int – Post	-0.15	0.35	Men 1.3 oz eq
Post-Intervention	0.02±0.07	0.06±0.17	Base – Post	-0.10	**0.45**	
Refined grains, oz eq*						
Baseline	2.33±0.9[#]	2.00±1.4[#]	Base – Int	0.16	-0.27	Upper Limit
Intervention	2.15±0.9[#]	2.43±2.0[#]	Int – Post	**0.53**	0.12	Women 1 oz eq
Post-Intervention	1.74±0.7[#]	2.24±2.1[#]	Base – Post	**0.61**	-0.14	Men 1.3 oz eq
Calcium, mg*						
Baseline	292±147[†]	336±181[#]	Base – Int	**-0.64**	0.07	1/3 MDRI
Intervention	379±168[#]	332±159	Int – Post	**0.48**	-0.05	333 mg/day
Post-Intervention	312±135	335±162[#]	Base – Post	-0.14	0.02	

Table 3. Comparison of the Volume of Food Consumed at Lunch During the Three Phases of the Study. Medium to large effect sizes are **bolded**. Equivalent is abbreviated as eq.
* Significant F-test for repeated measures ANOVA for NSSC DFAC, $P < 0.05$.
† Significant difference between baseline and intervention, $P < 0.05$.
‡ Significant difference between intervention and post-intervention, $P < 0.05$.
§ Significant difference between baseline and post-intervention, $P < 0.05$.
# Mean consumption exceeds 1/3 of the USDA Recommended daily amount or UL, Source: USDA ChooseMyPlate.gov.
MDRI is the Military Dietary Reference Intakes; Source AR 40-25 issued 3 January 2017. Recommendations for energy intake and protein are estimates and vary depending on the individual.

Table 4: Average Number of Food Items Available from Each of the Food Groups

Food Type Study Phase	NSSC DFAC (N=18) Mean±SD	CGBB Galley (N=9) Mean±SD	Cohen's *d* comparison	NSSC DFAC (N=18) Cohen's *d* value	CGBB Galley (N=9) Cohen's *d* value
Milk, cup eq					
Baseline	8.5±1.3	3.3±0.5	Base – Int	**1.1**	0
Intervention	6.8±1.7	3.3±1.9	Int – Post	**-1.6**	0
Post-Intervention	9.8±2.1	3.3±1.0	Base – Post	**-0.8**	0
Total dairy (milk, yogurt, & cheese) cup eq					
Baseline (0.10 cup)	15.8±1.9	7.3±1.3	Base – Int	**0.8**	0.2
Intervention (0.10 cup)	14.3±1.7	7.0±2.2	Int – Post	**-1.5**	0.1
Post-Intervention (0.10 cup)	16.8±1.7	6.8±1.3	Base – Post	**-0.6**	0.4
Fruit, cup eq					
Baseline	12.0±0.8	6.3±0.5	Base – Int	0.4	**-0.5**
Intervention	11.5±1.7	6.8±1.7	Int – Post	**-0.7**	0.0
Post-Intervention	13.0±2.9	6.8±0.5	Base – Post	**-0.5**	**-1.0**
***All Vegetables, cup eq**					
Baseline	18.5±1	21.5±1.7	Base – Int	**1.3**	0.2
Intervention	17.5±0.6	21.3±1.7	Int – Post	**1.6**	0.1
Post-Intervention	15.5±1.9	21.0±2.6	Base – Post	**2.1**	0.1
Vegetables No White Potato, cup eq					
Baseline	14.8±1.3	20.8±1.5	Base – Int	0.3	**0.9**
Intervention	14.5±0.6	19.5±1.3	Int – Post	**1.5**	0.3
Post-Intervention	13.0±1.4	19.0±1.8	Base – Post	**1.3**	**1.1**
Protein, g					
Baseline	22.5±2.4	26.3±1.7	Base – Int	**0.8**	**1.1**
Intervention	20.5±2.4	24.5±1.7	Int – Post	**-0.6**	**0.7**
Post-Intervention	22.0±2.9	23.3±1.7	Base – Post	0.2	**1.8**
Whole grains, oz eq [a]					
Baseline	0.0	0.0	Base – Int	0.0	0.0
Intervention	0.0	0.0	Int – Post	0.0	0.0
Post-Intervention	0.0	0.0	Base – Post	0.0	0.0
Refined grains, oz eq					
Baseline	16.0±2.9	16.0±2.1	Base – Int	**0.7**	**-0.7**
Intervention	13.3±4.6	17.0±0.8	Int – Post	**-1.0**	0.3
Post-Intervention	17.5±4.1	16.5±3.1	Base – Post	-0.4	-0.2

Table 4. Average number of food items available for each of the food groups by phase (Baseline, Intervention, Post-Intervention) and location. Medium to large effect sizes are **bolded**. Equivalent is abbreviated as eq. One-way ANOVA was run. Mixed dishes required the amount listed in parentheses to be included as 1 item; fruit (≥1/2 cup), vegetable (≥1/2 cup), non-potato vegetable (≥1/2 cup), whole grain (≥0.5 oz.), refined grain (≥0.5 oz.), protein (≥5g), total dairy (≥0.1 cup), and milk (≥0.1 cup).
* indicate significance ($P < 0.05$) between baseline and post-intervention phases in the NSSC DFAC.
[a] No items available that met the serving requirement of ≥0.5 oz of whole grains.