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NUTRITIONAL ASSESSMENT OF CADETS AT THE U.S. MILITARY ACADEMY: PART 2. ASSESSMENT OF NUTRITIONAL INTAKE

U S ARMY RESEARCH INSTITUTE
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NUTRITIONAL ASSESSMENT OF CADETS AT THE U.S. MILITARY ACADEMY: PART 2. ASSESSMENT OF NUTRITIONAL INTAKE

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The dietary intakes of U.S. Military Academy (USMA) cadets were assessed during seven days in Spring 1990 to determine the nutritional ramifications of optional attendance at weekday evening meals and the impact of the Army Nutrition Initiatives on lowering intakes of sodium, fat, and cholesterol over a ten year period. The cadets were grouped by gender (119 males, 86 females) and the number of weekday evening meals (0-1, 2-3,4-5) consumed in the Cadet Mess. The mean nutrient intakes of all groups, except the 0-1 female group which had low protein, magnesium, and zinc intakes, met the Military Recommended Dietary Allowances (MRDA). In general, the greater the number of meals consumed in the Cadet Mess the higher ($p < 0.05$) the percentage of cadets with adequate intakes (≥ 100% MRDA). However, in each group, there were individuals with low (< 70% MRDA) intakes. Cadets eating the fewest meals in the Cadet Mess were heavier and fatter, but no differences in body composition were detected by level of energy intake. Serum lipids were unaffected by energy intake, and iron status was not affected by iron intakes. In the last decade, fat consumption decreased from 38% to 32% of the calories; cholesterol intake decreased from 500 mg to 327 mg/cadet/day. Sodium intakes were also within acceptable limits. Thus, the dietary changes made by USMA in compliance with the Army Nutrition Initiatives had a favorable impact on the dietary intakes of the cadets.

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SUMMARY

U.S. Military Academy (USMA) cadets' nutrient intakes were assessed to determine the nutritional ramifications of optional attendance at weekday evening meals. Prior to the institution of this new policy, all cadets were required to attend weekday evening meals in the Cadet Mess. This study also permitted an evaluation of the progress that West Point has made over a 10-year period in reducing fat, cholesterol, and sodium consumption (Army Nutrition Initiatives) in the Cadet Mess.

In general, the nutrient intakes of male and female cadets were adequate to meet the Military Recommended Dietary Allowances (MRDA) found in AR 40-25, regardless of the number of evening meals consumed in the Cadet Mess. However, there were individuals (particularly within the female group consuming the fewest evening meals in the Cadet Mess) who consumed low levels of some nutrients (e.g., 35% of these female cadets consumed less than 70% of the MRDA for folacin). Nutrient intakes, while adequate on a group mean basis, improved significantly and consistently and the likelihood of an optimal intake of certain nutrients (e.g., folacin, vitamin B_6, vitamin A, zinc) increased as the number of evening meals consumed in the Cadet Mess increased.

Male cadets obtained 61% of their mean energy intake from the Cadet Mess, whereas female cadets derived only 54% of their mean energy intake from the Cadet Mess. Increasing the number of evening meals consumed in the Cadet Mess would be one way of addressing some of the low nutrient intakes observed in individual female cadets; however, this would, in turn, increase caloric intake, which may be the reason some cadets chose not to eat in the Cadet Mess. Vitamin and mineral intakes from supplements were sporadic and bore little relationship to actual dietary need in individuals.

Male cadets, due to their high energy intake, appeared to have no nutritional deficiencies. Female cadets also generally exhibited good iron, calcium, and magnesium intakes. The adequate iron intakes were reflected in correspondingly good markers of iron status. However, the tenuous iron status of some female cadets, as illustrated by low serum iron and hemoglobin levels, were related to a blood donation in the week prior to testing.

Apparent progress was made in reducing the fat and cholesterol consumption since the Cadet Mess was last assessed in 1979. Fat consumption decreased from 38% of the calories to 32% of the calories, and cholesterol consumption decreased by approximately 200 mg/person/day. Sodium intakes were within acceptable limits (1500-1600 mg/1000 kcal).

The results of this study indicate that although the optional weekday evening meal policy did not jeopardize cadet nutritional status, there was a positive relationship between the number of evening meals consumed in the Cadet Mess and levels of nutrient intakes. This could be interpreted to mean that cadets made generally poorer food item selections from restaurants and vending machines when this option was substituted for the evening meal in the Cadet Mess. It also could be interpreted that cadets consumed less total calories (perhaps by design) when they ate outside the Mess and this resulted in lower total nutrient intakes. In any event, it appeared that choosing to eat evening meals in the Cadet Mess helped to ensure a good nutrient intake pattern.

Recommendations can be made to continue to offer lower fat, cholesterol, and sodium menus and to educate cadets about healthful food selections. This latter point is especially important not only for the long term health and well-being of future Army leaders, but also so that optional nutrition habits are promoted from the top.

INTRODUCTION

This report presents the results of the 1990 Nutritional Assessment of the U.S. Military Academy (USMA) cadets at West Point performed by the U.S. Army Research Institute of Environmental Medicine (USARIEM). The nutritional intake of male and female cadets at the USMA is contained in this report. An earlier report (Friedl et al., 1990) described the anthropometry, iron status, and blood lipids of this population.

During this century, eating patterns of Americans have changed drastically and many of these changes have not been healthful. There has been an increase in the number of diseases related to overconsumption of foods high in energy, fat, sugar, salt, and alcohol (DHHS, 1988). In 1980, nutrition was identified as a contributing risk factor in five of the ten leading causes of death in the United States. Research over the past decade has shown that controlling excess dietary fat, sugar, and alcohol reduces the risk of developing heart disease, high blood pressure, stroke, non-insulin-dependent diabetes, cirrhosis of the liver, and some forms of cancer (DHHS, 1988).

A heightened awareness of nutrition related health issues has generated several recent Department of the Army Nutrition Initiatives, some of which have been implemented in U.S. Army garrison dining facilities. Since 1985, the Army has introduced nutrition initiatives into the Armed Forces Recipe Service (TM 10-412, 1989), the Army Master Menu (SB 10-260, 1990), and the Army Food Service Program in an attempt to provide soldiers with diets lower in sodium, fat, and cholesterol (AR 30-1, 1988). While the USMA Cadet Mess does not follow the Armed Forces Master Menu (their menus are planned locally by the dietitian and food service personnel at West Point), the Nutrition Initiatives still apply to the USMA food service.

During the 1978-79 USMA academic year, 3.5% of the male cadets, and 20% of the female cadets were identified as being overweight by the standards of the USMA. The Commandant of the USMA Corps of Cadets requested a study be undertaken to determine factors contributing to weight gain by cadets during their academic careers. Researchers from Letterman Army Institute of Research (LAIR) obtained and examined data on body composition, work performance, energy expenditure, activity patterns, dietary intake, hematological parameters, and lipid profiles of male and female cadets. Although the study was intended to examine factors responsible for

weight gain in cadets during their academic careers, very few of the cadets who were enrolled in the Cadet Weight Control Program volunteered for the study; thus, it was primarily a study of cadets who were within the weight standards. Historical data existed from this 1979 Nutrition Study on USMA cadets (Kretsch et al., 1986) which permitted an opportunity to assess the "progress" made toward reducing fat, cholesterol, and sodium intakes at the USMA.

The 1979 West Point nutritional assessment indicated that Cadet Mess food provided 50% to 70% of the energy intake of cadets, with the remainder from food consumed outside of the Mess. Fourth Class cadets (freshmen or plebes) obtained approximately 70% of their energy intake from the Cadet Mess, with this percentage declining yearly to a level where the First Class cadets (seniors) obtained only half of their energy intake from the Mess. The nutrient intake analyses revealed that, with the exception of iron and folacin, cadets received adequate vitamins and minerals (Kretsch et al., 1986). These results suggested that modifications to the diet were necessary to increase the intakes of iron and folacin. Other recommendations included reducing the percentage of energy obtained from fat and simple sugars while increasing those from complex carbohydrates.

Subsequently, the USMA requested that the U.S. Army Research Institute of Environmental Medicine (ARIEM) conduct an evaluation to determine what progress had been made in improving nutrient intakes during the intervening ten years (Appendix A). In the 1979 study, attendance at all weekday meals in the Cadet Mess was mandatory for plebes; breakfast was optional for the upper classmen, and the five weekend meals (three meals on Saturday and Brunch and dinner on Sunday) were optional for all cadets. However, a new meal policy was implemented in 1989 in which only weekday breakfast and lunch meals were mandatory while evening and weekend meals were optional for all cadets. Thus, a second objective of the study requested by the USMA was an evaluation of the impact of the newly implemented optional meal policy on the nutritional health of the USMA cadets.

OBJECTIVES

1. To evaluate the nutritional adequacy of meals provided at the U.S. Military Academy (USMA).

2. To assess the nutritional intakes of USMA cadets and to determine the effect of the optional weekday evening meal policy on the nutritional intake of USMA cadets.

3. To determine the impact of the Army's Nutrition Initiatives on lowering intakes of sodium, fat, and cholesterol.

4. To compare results of this study with those of a similar study conducted 10 years earlier at West Point.

METHODS

STUDY VOLUNTEERS

The USMA administered an electronic mail questionnaire to 4374 cadets early in March 1990. This questionnaire was designed to identify meal patterns, provide demographic information, and solicit volunteers for this study; 205 cadets (119 males and 86 females) volunteered, participated in, and completed the study. Before beginning data collection, the cadets were briefed on study procedures. The cadets then signed Volunteer Agreement Affidavits (Appendix B). Each cadet received a packet of written instructions, forms for recording their dietary intake, and a 6-inch plastic ruler to measure foods that needed to be quantified in dimensions (e.g., pieces of meat, cake, cookies, brownies).

STUDY GROUPS

To ascertain the effect of the optional meal policy on the nutritional intake of the cadets, the USMA categorized male and female cadets into three groups based on the number of weekday evening meals (0-1, 2-3, and 4-5) that the cadets reported they consumed in the Cadet Mess. These cadets completed food records, and were subsequently interviewed on their dietary intakes by trained dietitians. A subgroup

(n=33) of male cadets (mostly from the 4-5 group), added just before the study began, completed daily food records but were not interviewed. The addition of this group permitted a comparison of the suitability of using food records alone versus food records plus interview. Table 1 shows the group populations as determined from the actual consumption data. All of the data reported later in this report are based on these final group populations.

Table 1. Study Group Distribution

Weekday Evening Meals	Interviewed		Non-Interviewed
	Females n=86	Males n=86	Males n=33
0-1	46	30	1
2-3	23	30	12
4-5	17	26	20

MEAL SERVICE DESCRIPTION

The 205 cadets who volunteered for the study ate at the same time as the rest of the Cadet Corps. Cadets sat together at ten-person tables, where the food was served "family-style" with one Fourth Class cadet (freshman or plebe) at each table assisting in serving the meal. Meal duration was approximately 20 to 30 minutes.

CADET MESS MENUS

During the study, the USMA authorized four different menu categories for cadet feeding: Regular, Heavy, Corps, and TRIMM. The majority of cadets consumed the Regular Menu (Appendix C). Cadets entitled to Heavy and Corps meals also received the Regular Menu but usually sat at special tables that provided the cadets with 1½ times the amount of food issued to other tables. Cadets receiving the TRIMM Menu also sat at special tables that were served a special lower fat, lower calorie menu (Appendix D) on weekdays and the Regular Menu on weekends. The USMA Cadet Mess does not follow the Armed Forces Master Menu; their menus are planned locally by the dietitian and food service personnel at the Academy at West Point. Further,

the USMA does not utilize the Defense Personnel Support Center for procurement of their foods.

DATA COLLECTION

Background Data and Medical History

Each cadet completed a brief questionnaire regarding background data (demographic and personal information), medical history, and usual eating patterns (Appendix E).

Anthropometric and Biochemical Measurements

The methodologies for anthropometric (body weight, height, percent body fat) and biochemical (serum lipids and iron status) measures were published in an earlier report (Friedl et al., 1990). Serum cholesterol and HDL-cholesterol were analyzed using a standardization program (Regional Lipid Analysis Basic Survey, Northwest Lipid Research Laboratories, Seattle, Wash.) Samples were tested in an automated assay (Ciba-Corning 550 Express) using manufacturer supplied reagents. Bias for the assay was less than 3% and 5% for HDL-cholesterol and cholesterol, respectively.

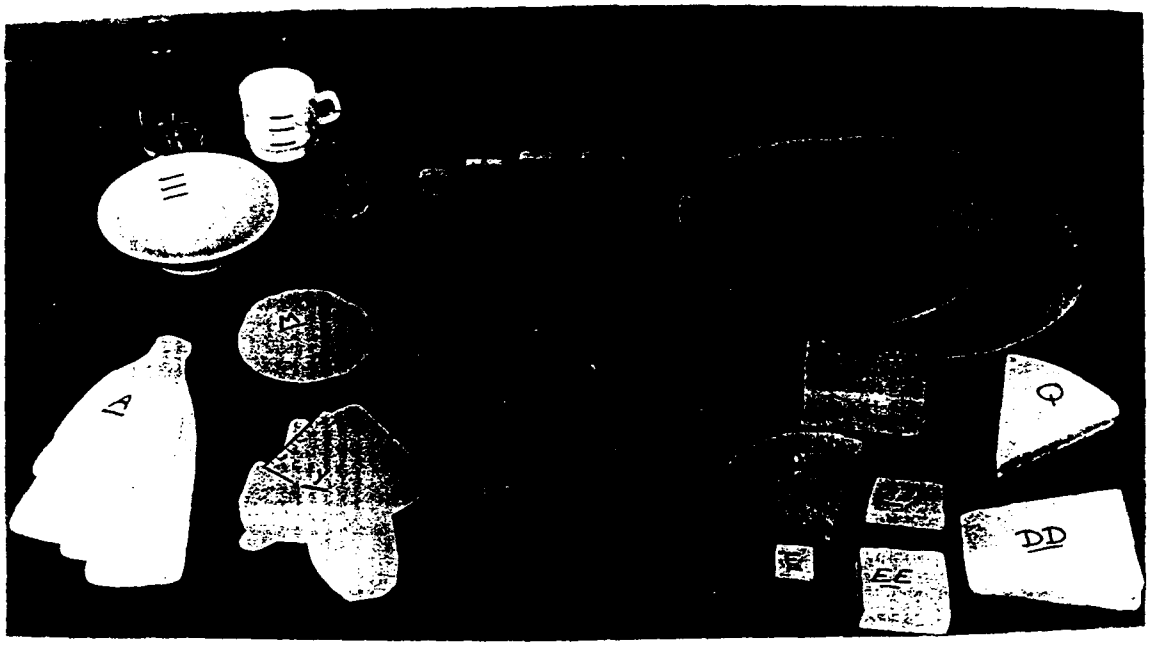
Dietary Intake Assessment

Food Records and Interview. All participants in the study recorded total dietary intake data (food, beverages, supplements, salt, and water) for seven consecutive days on preprinted food records that folded to pocket-size (Appendix F). Trained dietitians used the cadets' completed food records to assist them with a 24-hour recall during the daily interviews. The interviews were conducted utilizing volumetric aids and food models according to the method of Frank et al. (1985) which was developed and validated at the Louisiana State University Medical Center.

At the daily interview, which lasted a maximum of 20 minutes, dietitians reviewed food records, verified portion-size estimates, and obtained additional information on medications used, type of meal, and usual eating pattern. The dietitian used sample dinnerware and flatware commonly available in the Cadet Mess in conjunction with

graduated, volumetric aids (molds representing various sizes of food portions) and paperboard and styrofoam portion-size models (Figure 1) to verify the reported portion-size estimates. Each dietitian had a notebook containing aids to help probe for meal components and snacks overlooked by the cadets. The aids included menus from 21 local restaurants, colored photographs of condiments, meal supplements, and snack foods available at the Academy. Cadets who used supplements (vitamins, minerals, nutritional or ergogenic aids) provided information on their contents to the interviewing dietitian. The USMA dietitian distributed Exceed[1] (a supplemental nourishment beverage that provided some carbohydrate and protein as well as vitamins and minerals) to a few male cadets and one female cadet. This beverage was coded as a Cadet Mess supplied food, not a nutritional supplement. Dietitians also encouraged cadets to bring in food labels and recipes for foods consumed at home or elsewhere. All medications were recorded.

Figure 1. Visual Aids Used by the Dietitians to Verify Portion Size Estimates



Visual aids from top left are: Cadet Mess glassware and dinnerware marked with lines to indicate three different volumes; molds on Cadet Mess flatware that duplicated the volume occupied by 0.4, 0.6, 1.0, and 1.4 tablespoons of food; paperboard discs (FF, GG, and HH) that represented different pizza sizes, and (M) smaller food items with a circular shape (e.g., cookies, pancakes); paperboard shapes (A) that represented different beverage bottle sizes, and (Y) foods having distinctive shapes (e.g., pork chops, luncheon meat, banana); molds (C, S, and Z) that represented 1 1/2, 3/4, and 1/3 cups of food; and styrofoam models (M,Q,D BB,E,EE,and DD) that represented other food shapes and volumes.

[1]Citation of trade names does not constitute an official Department of the Army endorsement or approval of the product.

Upon completing each dietary interview, the dietitians completed an Interviewer Coding Form (Appendix G). This form included the dietary intake data for each cadet. Dietitians assigned food identification codes to each food item (the 205 dietary intake records contained more than 34,000 line entries) and adhered to the following guidelines in transcribing each cadet's data:

a. The 24-hour day began at 0500 hours on the date of record.

b. They coded a fifteen-minute interval between eating sessions as a different eating period.

c. They categorized food(s) as a snack instead of a meal when the cadet ate less than 120 kilocalories (kcal).

Recipe Data Collection. Trained recipe specialists worked in the cadet dining facility food preparation areas recording (for each recipe) information on the type and amount of each ingredient and preparation procedures. The USMA had their own unique recipes and did not use the Armed Forces Recipe Service (TM 10-412, 1989). Recipe specialists weighed portions of all prepared food items. For products not having a discrete portion size (food mixtures such as stews, gravies, and soups), the recipe specialist used the weight of a cup of product as the standard for converting volume measures to gram weights. The recipe specialists also obtained labels and specification information on recipe ingredients and commercial foods served without further preparation such as baked goods and some desserts.

NUTRITIONAL ANALYSES OF MENUS/RECIPES AND DIETARY INTAKE

The Regular and TRIMM menus from USMA Cadet Mess were analyzed for nutrient content using the Computerized Analysis of Nutrients (CAN) System developed by USARIEM (Rose et al., 1989). In general, a serving consisted of one tenth of the amount in a "family-style" serving dish put on a ten-cadet table in the Cadet Mess.

The CAN system was used for nutrient analysis of recipes, menus, and dietary intakes. In addition, the Food Intake Analysis System (FIAS) (U of TX, 1990) was

used for some recipe analyses. FIAS was developed by the University of Texas Health Science Center at Houston and the USDA Human Nutrition Information Center (HNIS). These two systems include the United States Department of Agriculture (USDA) Standard Reference Tables, Version 8 and updates thereof, and the Continuing Survey of Food Intakes by Individuals (CSFII) food composition databases. Nutrient analyses provided data for energy, protein, fat, carbohydrate, ascorbic acid, thiamin, riboflavin, niacin, vitamin B_6, folacin, vitamin B_{12}, vitamin A, calcium, phosphorus, magnesium, iron, zinc, potassium, sodium, saturated fat, monounsaturated fat, polyunsaturated fat, and cholesterol. We solicited food composition data from more than 200 food and vitamin manufacturers and the information was used to make appropriate selections from the database. We added nutrient data on 150 products (e.g., vitamins and unique brand name products) directly to the study database.

Recipe coders analyzed more than 400 recipes: USMA recipes and other recipes obtained from cadets and outside sources. They also estimated recipes and entered nutrient data for approximately 1100 different food items consumed at parties, homes, and at the other 250 food establishments patronized by the cadets that did not provide recipe or nutrient data (Appendix H). In computing recipe nutrient data on an "as consumed basis," data on cooked ingredients were used whenever possible. USDA Handbook No. 102 data (Matthews and Garrison, 1975) was also used to determine cooked yields from raw ingredients and appropriate USDA processing codes were selected from the CAN System to estimate vitamin and mineral losses due to reheating and holding soups, entrees, and vegetables hot until served.

Nutritional Evaluation Standards

Military Recommended Dietary Allowances. Appendix I provides the Military Recommended Dietary Allowances (MRDA) for military personnel. The MRDA are the daily essential nutrient intake levels presently considered to meet known nutritional needs of practically all 17 to 50 year old, moderately-active male and female military personnel. These allowances provide broad dietary guidelines for healthy military groups and were the standards used in assessing the nutritional adequacy of the West Point Cadet Mess menus and the cadets' dietary intakes. These MRDA have not

changed since the report ... the 1979 USMA nutrition study was published (Kretsch et al., 1986).

To permit comparisons of the percent of cadets with less than adequate nutrient intakes between the 1979 study (Kretsch et al., 1986) and this study, we used the same criteria established by Kretsch and colleagues. That is, for all nutrients (except for energy):

a. Nutrient intakes were adequate if consumption equalled or exceeded the standard.

b. Nutrient intakes were marginal if consumption was between 70% and 99% of the standard.

c. Nutrient intakes were low if consumption was less than 70% of the standard.

Nutrient Density Index. The MRDA also provides a nutrient density index (NDI), which shows the recommended nutrient concentration per 1000 kcal (Appendix I). The NDI is a technique for evaluating the nutritional adequacy of individual foods, recipes, meals, and menus. AR 40-25 recommends a single value for both males and females. Because the NDI is generally higher for females, due to their lower calorie requirement, the U.S. Army adopted the female nutrient values for most nutrient densities except sodium and iron. The computed iron density of 6 mg per 1000 kcal is an interpolation between the male and female MRDA for iron and the U.S. Army picked this value as being reasonable and consistent with the amounts of iron found in the usual food supply. The NDI of the Cadet Mess Regular and TRIMM menus was calculated.

Dietary Sources

To facilitate a comparison with the 1979 USMA study (Kretsch et al., 1986), food sources were grouped into the same four categories used in that study: Cadet Mess, home, restaurant, and vendor. Appendix H indicates the type of establishment included under each source category.

STATISTICAL ANALYSIS

SPSS-X was used for statistical analyses (SPSS-X User's Guide, 1988). The level of significance chosen was $p < 0.05$. Descriptive statistics and t-test procedures were used to evaluate the nutritional adequacy of the meals provided at the USMA, to assess the nutritional intakes of USMA cadets, and to determine the impact of the U.S. Army's Nutrition Initiatives on lowering intakes of sodium, fat, and cholesterol. Repeated measures analyses of variance (ANOVA) was used to determine if there were differences among the study groups (0-1, 2-3, and 4-5 weekday evening meals), and among the interviewing dietitians. When the overall main effect was significant, a post-hoc test (Student-Newman Keuls) was used to determine where the differences existed. Two-tailed t-tests were used to determine if there were differences among the interviewed and non-interviewed cadets. The Cadet Mess menus and the mean daily nutrient intakes were compared with the MRDA (AR 40-25, 1985). The percentages of energy derived from each source (Cadet Mess, home, restaurant, and vendor), by cadet on a daily basis, were computed, and the means by gender, academic classes, and study groups were generated. The percentages of energy and protein derived from breakfast, lunch, dinner, and snacks by cadet on a daily basis were computed, and the means by gender and by study groups were also generated. A z-test procedure was used to test for significance of difference between proportions. The mean dietary intake data were divided into quartiles or tertiles (to optimize sample size) for comparisons of anthropometric and biochemical data by ANOVA. Comparisons were also made by cadet study group.

RESULTS

BACKGROUND AND MEDICAL HISTORY QUESTIONNAIRE

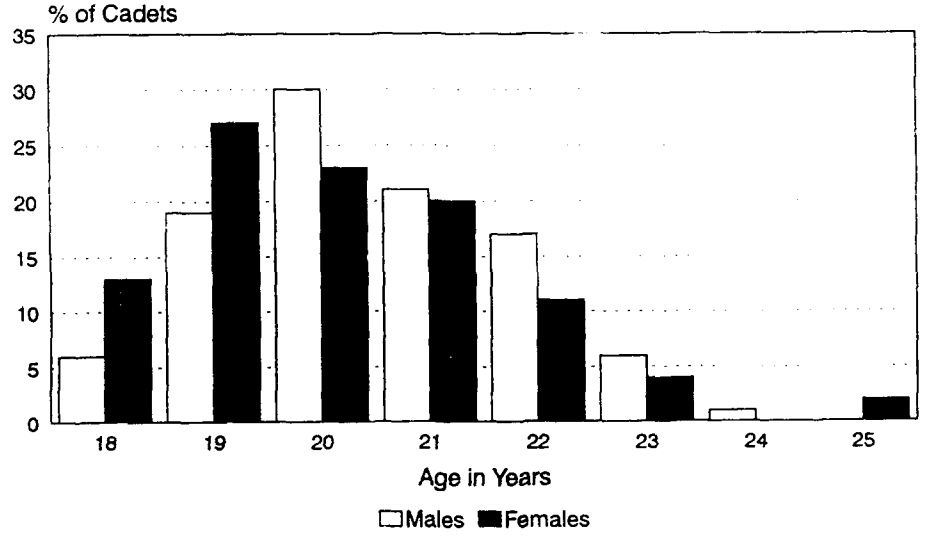
Only two of the 205 cadets did not turn-in completed questionnaires. The race or ethnic representations were comparable for both genders--males: 87% White, 6% Black, 3% Hispanic, 4% Asian, and 1% Other; females: 86% White, 4% Black, 2% Hispanic, 5% Asian, 1% American Indian or Alaskan, and 2% Other. Appendix J shows the ethnic representations by male and female study groups.

The age of the participants ranged from 18 to 25 years. Six percent of all males and 13% of all females participating in the study were 18 years old. Table 2 indicates the mean age of participants in each study group while Figure 2 shows age distribution by gender.

Table 2. Mean Age of Study Group Participants (Mean ± SD)

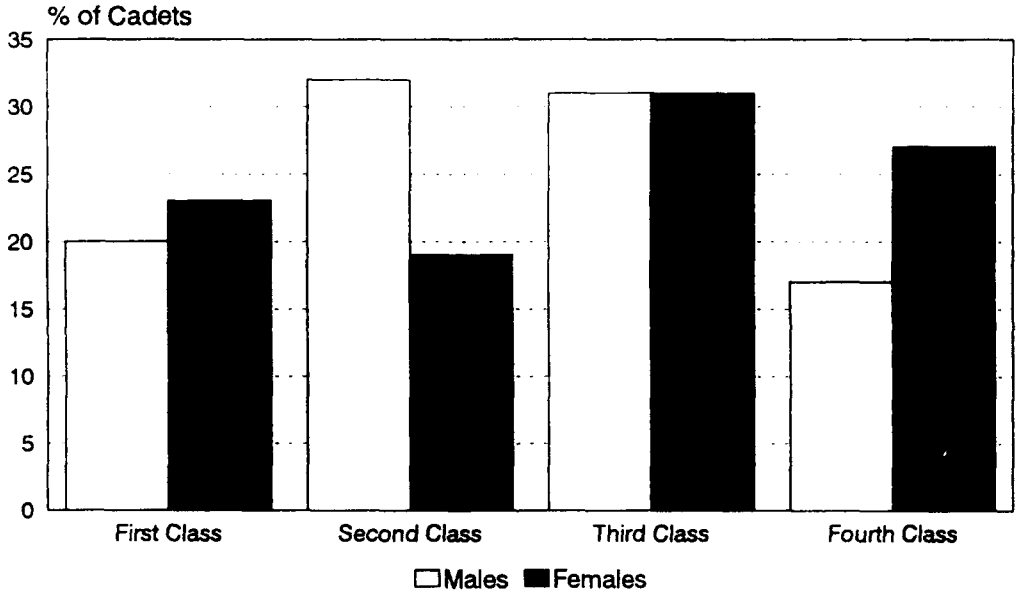
Weekday Evening Meals	Male Cadets	Female Cadets
0-1	20.9 ± 1.5	20.5 ± 1.6
2-3	20.5 ± 1.4	20.1 ± 1.4
4-5	20.1 ± 1.0	19.2 ± 1.1

Figure 2. Age of Study Volunteers



Each group contained representatives from all four academic classes. While the percent distribution of the four classes within each of the six groups varied considerably, ANOVAs comparing the energy (kcal) and protein contents of the dietary intakes of each class within each group showed there were no significant differences for either energy or protein among the four classes in any group ($p < 0.05$). As Figure 3 shows, the percent of cadets from each class in the total male and female cadet test populations ranged between 17% and 32%. This is comparable to the 1979 study where the range was 14% to 35%.

Figure 3. Academic Class Distribution of Study Volunteers



Appendix J summarizes cadet responses to the questions that asked general information or that related to food habits. All responses were tabulated as a percentage of each of the respective male and female cadet group populations.

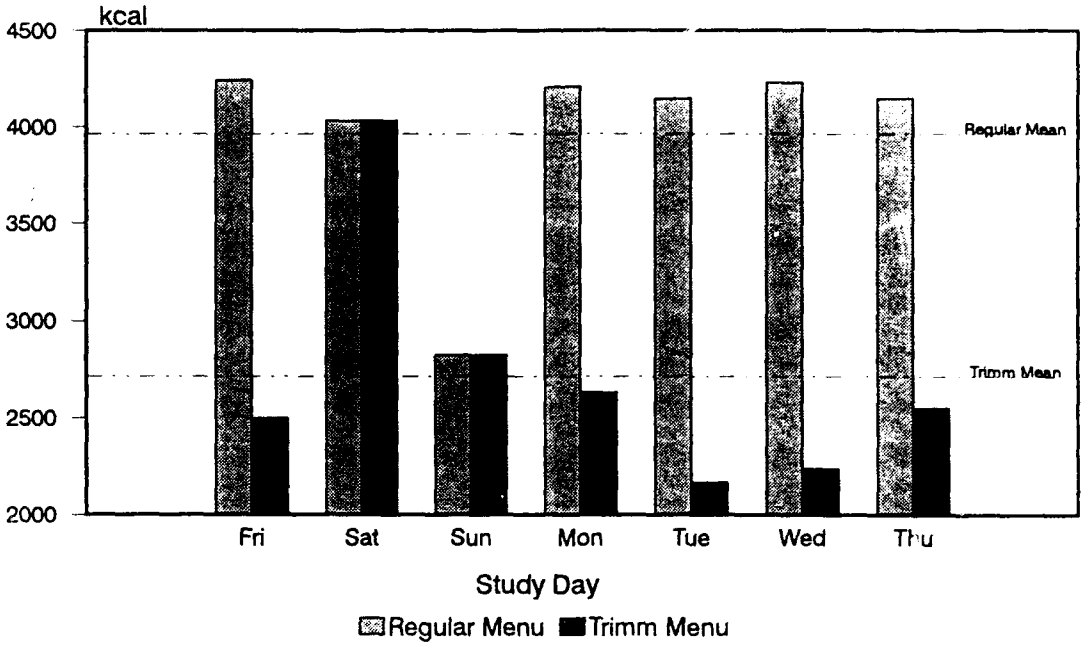
Of the 203 study volunteers responding to the questionnaire, 15% (all males) reported they were trying to gain weight while 37% of the males and 80% of the female cadets were trying to lose weight. Eighty-six percent of the males and 94% of the female cadets recorded that they performed 20-minute non-stop aerobic exercises three or more times a week while 79% and 77% of the respective male and female

cadets performed exercises that improved muscle strength three or more times a week. Only 4% of the male and 6% of the female cadets reported they had a physical condition that limited their exercise. Eighty percent of the male and 93% of the female cadets indicated that maintaining body weight was "very important" in maintaining health; while 88% and 94%, respectively, of male and female cadets responded that food was "very important" in maintaining health.

MENU NUTRITIONAL ANALYSIS

Figure 4 shows the energy provided per day, exclusive of the substitute or supplemental spreads and condiments (e.g., peanut butter, jam, cocoa flavored beverage powder, catsup, and hot sauce), by both the Regular and the TRIMM menus. Only the Regular Menu was served on the weekend. The lower intake on Sunday was due to the fact that the only meals served were brunch and dinner (a practical approach due to the lower attendance at the Cadet Mess on weekends).

Figure 4. Daily Energy Provided by Cadet Mess Menus[1]



[1]Supplemental or substitute spreads and condiments not included

Regular Menu

Table 3 provides the nutritional analysis of the Regular Menu served during the study. The average daily menu provided a total of 3974 kcal with 14% of the total energy derived from protein, 34% from fat, and 52% from carbohydrate. The menu provided adequate levels of protein and other nutrients not only to assure compliance with the MRDA for vitamins and minerals but also to meet the higher nutritional requirements of those cadets authorized to eat at Heavy and Corps tables.

The Regular Menu served: 2% milk, margarine only with bread (but not with rolls used for sandwiches), and eggs during 3 breakfasts. The egg mixture used for scrambled eggs was a combination of whites (48%) and whole eggs (52%), while all "ham" and "canadian bacon" were actually turkey ham. They served a corn oil margarine on the regular tables and used it in the kitchen for seasoning vegetables. The yogurt bar, which was available to all cadets, only served low-fat yogurt.

The menu, as analyzed, does not include the substitute or supplemental spreads and condiments which were supplied in multi-portion containers that remained on the table throughout the day for optional consumption during meal times. We calculated their potential daily nutritional contribution by using procurement data representing 30-day usage for the entire West Point population. On this basis, these substitute or supplemental foods provided an additional 269 kcal, 5.6 g of protein, 7.2 g of fat, and 53 g of carbohydrate per cadet per day.

Calculations based on the data in Table 3 show that the Regular Menu, as calculated without the supplemental or substitute spreads, and condiments, provided 11% of total kcal from saturated fat and 8% from polyunsaturated fat. While specific MRDAs have not been established for these fats, AR 40-25 (1985) recommends that a level of about 7% of kilocaloric intake as polyunsaturated fat be maintained in military menus to ensure an adequate intake of essential fatty acids.

The computed average nutrient density (nutrient concentrations per 1000 kcal) for the Regular Menu (Table 3) meets all of the NDI criteria shown on Appendix I.

Table 3. Nutrient Content, Nutrient Density, and Percent of MRDAs Supplied by USMA Regular Menu (7 Day Average[1])

Nutrients	Amount (Mean ± SD)	Nutrient Density (per 1000 kcal)	% of MRDA[2] for Males	% of MRDA[2] for Females
Energy, kcal	3974±512	-	124	166
Protein, g	151±14	38	151	188
Fat, g	150±26	-[3]	-	-
Carbohydrate, g	517±82	-	-	-
Dietary Fiber, g	21±3	-	-	-
Vitamin C, mg	441±68	111	735	735
Thiamin, mg	3.0±0.6	0.8	186	248
Riboflavin, mg	4.1±0.2	1.0	214	290
Niacin, mg	41±7	10.2	194	254
Vitamin B_6, mcg	2.9±0.4	0.7	132	145
Folacin, mcg	589±57	148	147	147
Vitamin B_{12}, mcg	9.1±1.8	2.3	304	304
Vitamin A, IU	11012±4024	2771	220	274
Calcium, mg	1923±344	484	240	240
Phosphorus, mg	2614±284	658	327	327
Magnesium, mg	494±58	124	141	165
Iron, mg	29±3	7.3	291	162
Zinc, mg	21±2	5.3	141	141
Potassium, mg	5386±398	1355	-	-
Sodium, mg	6308±956	1587	115	154
Saturated Fat, g	50±11	12	-	-
Monounsat Fat, g	53±10	13	-	-
Polyunsat Fat, g	35±5	9	-	-
Cholesterol, mg	503±137	127	-	--

[1]7-day Regular Menu (5 weekdays plus weekend). [2]Military Recommended Dietary Allowances for military personnel (17 to 50 years old) (AR 40-25, 1985). [3]No recommended allowance established.

TRIMM Menu

This menu served skim milk, reduced-fat soft margarine, low-fat salad dressing, light mayonnaise, eggs at only one breakfast per week, no fried foods and desserts low in calories (e.g., fruits, angel food cake, and pudding pops).

Table 4 provides the nutritional analysis of the TRIMM Menu served during the study. Since the USMA served the TRIMM Menu only on weekdays, the 7-day TRIMM Menu consisted of five TRIMM days (weekdays) plus the regular weekend menus. On this basis, the average TRIMM Menu provided a total of 2704 kcal with 19% of the energy derived from protein, 28% from fat, and 54% from carbohydrate. This menu provided adequate levels of protein, vitamins, and minerals to meet the MRDAs for both males and females. While it provided only 84% of the energy MRDA for males, this cannot be considered a deficiency since the USMA designed the TRIMM Menu to support weight loss or weight control. The substitute or supplemental spreads and condiments on the TRIMM tables would provide an additional 108 kcal, 6 g of protein, 1 g of fat, and 22 g of carbohydrate per cadet per day. Calculations made using the lipid data in Table 4 show that the TRIMM Menu provided 9% of total kcal from saturated fats and 6% from polyunsaturated fats.

The computed average nutrient density (nutrient concentrations per 1000 kcal) for the TRIMM Menu (Table 4) meets all of the NDI criteria shown in Appendix I. The TRIMM Menu also meets all of the NDI recommended in AR 40-25 (1985) for the 1500 to 1600 kcal/day reduced calorie menu recommended for military physical fitness and weight control programs, except for protein and magnesium. The NDI for these two nutrients are slightly below the respective 53 g and 200 mg NDI recommended for the 1500-1600 kcal/day reduced calorie menu.

Table 4. Nutrient Content, Nutrient Density, and Percent of MRDAs Supplied by USMA TRIMM Menu (7 Day Average[1])

Nutrients	Amount (Mean ± SD)	Nutrient Density (per 1000 kcal)	% of MRDA[2] for Males	% of MRDA[2] for Females
Energy, kcal	2704±626	-	84	113
Protein, g	131±4	49	131	164
Fat, g	84±40	-[3]	-	-
Carbohydrate, g	368±77	-	-	-
Dietary Fiber, g	25±7	-	-	-
Vitamin C, mg	284±73	105	474	474
Thiamin, mg	2.7±0.3	1.0	167	223
Riboflavin, mg	4.5±0.4	1.3	183	245
Niacin, mg	37±7	13.6	175	230
Vitamin B_6, mcg	3.0±0.8	1.1	136	150
Folacin, mcg	573±49	212	143	143
Vitamin B_{12}, mcg	7.8±2.6	2.9	262	262
Vitamin A, IU	9912±3821	3665	198	248
Calcium, mg	1612±363	596	202	202
Phosphorus, mg	2231±286	825	279	279
Magnesium, mg	455±60	168	130	152
Iron, mg	26±2.3	9.7	261	145
Zinc, mg	19±2.0	7.0	126	1126
Potassium, mg	4814±595	1780	-	-
Sodium, mg	5121±1282	1894	115	154
Saturated Fat, g	27±17	10	-	-
Monounsat Fat, g	28±12	1311	-	-
Polyunsat Fat, g	19±9	7	-	-
Cholesterol, mg	363±146	134	-	--

[1]5-day TRIMM menu plus the two Regular Menu weekend days. [2]Military Recommended Dietary Allowances for military personnel (17 to 50 years old) (AR 40-25, 1985). [3]No recommended allowance established.

DIETARY INTAKES

Male Groups: Assessment of Nutritional Intakes

Since a comparison of the nutrient intakes of the interviewed with non-interviewed male cadets' dietary intakes showed that they were not different ($p < 0.05$), they were combined.

Nine male cadets indicated they were entitled to eat Heavy meals, and 14 reported they were entitled to eat at Corps or Squad tables. However, three of the males cadets entitled to eat Heavy meals had mean energy intakes that were below the mean intake (3564 kcal) of all male cadets in the study. Nineteen percent, 10%, and 15% of the respective 0-1, 2-3, and 4-5 male groups consumed three or more TRIMM meals. Of the cadets in the 0-1, 2-3, and 4-5 male groups who ate TRIMM meals, 17%, none, and 14%, respectively, had mean energy intakes that were below the lower end of the MRDA range for energy (2800 kcal); while 50%, 50%, and 47% of the individuals eating TRIMM meals in these same respective male groups had mean energy intakes that exceeded the 3564 kcal mean energy intake of all males (n=119) in the study.

Table 5 provides the nutrients' means ± SD, median, and range (minimum and maximum) of total daily dietary intakes (24 nutrients) for the male cadets (n=119) in the study. Comparison of these data show that the mean and median values for all macronutrients, all minerals (except magnesium), and cholesterol are comparable in spite of the great spread in minimum and maximum values. The high intakes of nutritional supplements by only a few cadets skewed the mean values for some vitamins. The mean for alcohol (ethanol) is also skewed by a few high intakes.

Table 6 presents the mean total nutrient intakes of male cadets grouped by the number of weekday evening meals actually consumed in the Cadet Mess. Values (mean ± SD) with different superscript letters within a row are significantly different ($p < 0.05$). Comparisons of these intakes show that, except for vitamins, the greater the number of evening weekday meals consumed in the Cadet Mess, the higher the cadets' mean daily nutritional intake. There were significant differences ($p < 0.05$) among the mean nutrient intakes of the 0-1, 2-3, and 4-5 male groups for energy and

12 of the nutrients we evaluated (protein, fat, vitamin C, vitamin A, calcium, phosphorous, magnesium, potassium, sodium, monounsaturated fat, polyunsaturated fat, and cholesterol). In spite of these differences, the mean daily nutritional intakes of each male group met the MRDA for males.

Table 7 shows that when the nutritional supplements were omitted from the analysis, the mean intake for males in the 0-1 group was significantly lower in thiamin, riboflavin, niacin, vitamin B_6, folacin, vitamin B_{12}, vitamin A, calcium, phosphorus, magnesium, iron, and zinc than the mean intake of the 2-3 and 4-5 groups. The 0-1 group was significantly lower than the 4-5 group, but not the 2-3 group in vitamin C. Still, the mean daily intake of each vitamin for each group met the MRDA even when we excluded nutritional supplements from the computations.

Table 6 shows that the mean daily dietary intakes of each of the male cadet groups met the MRDA, but this comparison of mean group intakes did not pinpoint individual cadets with low mean daily intakes. Comparison of the range data (Table 5) with the MRDA (Table 6) shows that the minimum values for energy and 11 other nutrients (each of which represents the mean daily intake of an individual male cadet) were below their respective MRDAs. Therefore, we compared the mean daily nutritional intake of each cadet with the appropriate MRDA, and determined the percent compliance with the MRDA requirements as <70% (low), 70% to 99% (marginal), and ≥100% (adequate). Table 8 presents the results of this analysis.

Table 5. Mean, Median, and Range of Daily Nutritional Intakes of Male Cadets (n=119)

Nutrients	Mean±SD	Median	Minimum	Maximum
Energy, kcal	3564±686	3538	2211	6094
Protein, g	130±27	128	83	209
Fat, g	125±27	125	54	186
Carbohydrate, g	482±108	479	302	932
Vitamin C, mg	313±171	307	45	1188
Thiamin, mg	3.4±4.6	2.8	1.3	52
Riboflavin, mg	4.0±4.7	3.5	1.5	53
Niacin, mg	39±12	37	21	81
Vitamin B_6, mg	3.5±4.8	2.8	1.5	52
Folacin, mcg	538±236	494	187	1574
Vitamin B_{12}, mcg	8.0±5.3	7	2.9	55
Vitamin A, IU	7595±3022	7134	2226	19611
Calcium, mg	1525±434	1509	606	3645
Phosphorus, mg	2203±468	2177	1262	3787
Magnesium, mg	448±126	427	231	1116
Iron, mg	28±10	27	14	68
Zinc, mg	20±7	19	10	50
Potassium, mg	4217±993	4163	2126	7075
Sodium, mg	5583±1131	5503	3305	8906
Saturated Fat, g	43±10	43	18	67
Monounsat Fat ,g	46±10	46	20	78
Polyunsat Fat, g	25±7	24	10	43
Cholesterol, mg	420±108	408	222	832
Alcohol, g	5±11	0.06	0	87

Table 6. Comparison of Mean Daily Nutritional Intakes[1] of Male Cadet Groups

Nutrients	MRDA[2]	Male Cadets' Mean Daily Nutritional Intake		
		0-1 Study Group (n=31)	2-3 Study Group (n=42)	4-5 Study Group (n=46)
Energy, kcal	3200 (2800-3600)	3327±828[a]	3557±617[ab]	3730±603[b]
Protein, g	100	115±26[a]	131±24[b]	140±26[b]
Fat, g	-[3]	116±28[a]	126±26[ab]	131±25[b]
Carbohydrate, g	-	453±133	478±88	504±104
Dietary Fiber, g	-	18±7	20±7	20±7
Vitamin C, mg	60	256±153[a]	279±127[a]	382±195[b]
Thiamin, mg	1.6	4.2±9	3.1±0.9	3.0±0.9
Riboflavin, mg	1.9	4.7±9.1	3.7±1.1	3.8±1.0
Niacin, mg	21	35±12	41±12	41±11
Vitamin B_6, mg	2.2	4.2±8.9	3.5±2.6	3.1±1.0
Folacin, mcg	400	461±197	564±228	567±259
Vitamin B_{12}, mcg	3.0	8.0±9.1	7.9±3.3	8.0±3.0
Vitamin A, IU	5000	5864±2550[a]	7655±2542[b]	8708±3224[b]
Calcium, mg	800-1200	1351±495[a]	1524±331[ab]	1644±443[b]
Phosphorus, mg	800-1200	1994±499[a]	2193±394[b]	2353±463[b]
Magnesium, mg	350-400	412±138[a]	443±99[ab]	477±135[b]
Iron, mg	10-18	24±8	30±10	29±10
Zinc, mg	15	18±6	21±7	21±7
Potassium, mg	-[4]	3728±1004[a]	4205±928[b]	4557±919[c]
Sodium, mg	-[5]	5192±1222[a]	5678±1099[b]	5760±1055[b]
Saturated Fat, g	-	41±11	44±10	45±9
Monounsat Fat, g	-	43±10[a]	46±9[a]	49±10[b]
Polyunsat Fat, g	-[6]	22±6[a]	25±6[ab]	27±7[b]
Cholesterol, mg	-	376±77[a]	421±130[b]	449±95[b]
Alcohol, g	-	7±17	5±8	4±8

[1]Mean ± SD; values with different superscript letters within a row are significantly different ($p < 0.05$). [2]Military Recommended Dietary Allowances for males (17 to 50 years old) (AR 40-25, 1985). [3]No MRDA established. [4]Estimated safe and adequate daily dietary intake range is 1875-5625 mg of potassium. [5]Target for sodium for military personnel is 1700 mg per 1000 kilocalories; this equates to approximately 5500 mg for males. [6]Recommended level is at least 7 percent of kilocalories as polyunsaturated fat.

Table 7. Comparison of Mean Daily Nutritional Intakes[1] (Without Nutritional Supplements) of Male Cadet Groups

Nutrients	MRDA[2]	Male Cadets' Mean Daily Nutritional Intake		
		0-1 Study Group (n=31)	2-3 Study Group (n=42)	4-5 Study Group (n=46)
Vitamin C, mg	60	233±133[a]	275±127[a]	372±187[b]
Thiamin, mg	1.6	2.5±0.7[a]	3.1±0.9[b]	3.0±0.8[b]
Riboflavin, mg	1.9	3.0±0.8[a]	3.7±1.11[b]	3.8±1.0[b]
Niacin, mg	21	33±9[a]	41±12[b]	40±10[b]
Vitamin B_6, mg	2.2	2.5±0.8[a]	3.2±1.2[b]	3.1±0.9[b]
Folacin, mcg	400	450±192[a]	560±227[b]	555±255[b]
Vitamin B_{12}, mcg	3.0	6.2±2.2[a]	7.9±3.3[b]	7.8±2.7[b]
Vitamin A, IU	5000	5587±2251[a]	7603±2482[b]	8555±3178[b]
Calcium, mg	800-1200	1331±470[a]	1524±331[b]	1619±366[b]
Phosphorous, mg	800-1200	1979±487[a]	2193±394[b]	2344±453[b]
Magnesium, mg	350-400	395±111[a]	443±99[b]	464±101[b]
Iron, mg	10-18	23±7[a]	30±10[b]	29±10[b]
Zinc, mg	15	17±5[a]	21±7[b]	21±7[b]

[1]Mean ± SD; values with different superscript letters within a row are significantly different ($p < 0.05$).

[2]Military Recommended Dietary Allowances for males (17 to 50 years old) (AR 40-25, 1985).

Table 8. Percent of Male Cadets Within Each Study Group with Mean Daily Intakes at Selected[1] Levels of the Military Recommended Dietary Allowances (MRDA)[2]

Nutrients	0-1 Study Group (n=31)			2-3 Study Group (n=42)			4-5 Study Group (n=46)		
	Percent of MRDA			Percent of MRDA			Percent of MRDA		
	<70	70-99	≥100	<70	70-99	≥100	<70	70-99	≥100
Energy	6	36	58	-	26	74	-	24	76
Protein	-	39^{m}	61^{x}	-	10^{n}	90^{y}	-	2^{n}	98^{y}
Vitamin C	-	10^{m}	90^{x}	-	$-^{n}$	100^{y}	-	$-^{n}$	100^{y}
Thiamin	-	3	97	-	-	100	-	-	100
Riboflavin	-	6	94	-	-	100	-	-	100
Niacin	-	-	100	-	-	100	-	-	100
Vitamin B_6	6	32	61^{x}	-	14	86^{y}	-	15	85^{y}
Folacin	19^{a}	29	52^{x}	$-^{b}$	24	76^{y}	11^{a}	13	76^{y}
Vitamin B_{12}	-	3	97	-	-	100	-	-	100
Vitamin A	16^{a}	26^{m}	58^{x}	$-^{b}$	10^{mn}	90^{y}	$-^{b}$	9^{n}	91^{y}
Calcium	-	10^{m}	90^{x}	-	$-^{n}$	100^{y}	-	2^{mn}	98^{xy}
Phosphorus	-	-	100	-	-	100	-	-	100
Magnesium	6	26	68^{x}	2	12	86^{xy}	-	11	89^{y}
Iron	-	-	100	-	-	100	-	-	100
Zinc	6	26	68^{x}	-	12	88^{y}	-	13	87^{y}

[1]Nutritional intake criteria was: low equals <70%, marginal equals 70%-99%, and adequate equals ≥ 100% of MRDA.

[2]MRDAs used for energy, calcium, phosphorus, and magnesium were, respectively, 3200 kcal, 800 mg, 800 mg, and 350 mg.

NOTE: Statistical comparisons of the study groups were made for each nutrient at each selected MRDA level; percentages with different superscript letters are significantly different ($p < 0.05$); for clarity, different sets of letters were used for each MRDA level: a, b, and c for <70% MRDA; m, n, and p for 70-99% MRDA; and x, y, and z for ≥100% MRDA.

Table 9 presents the results of comparing the mean daily nutritional intake of each male cadet, with nutritional supplements excluded, against the MRDA and determining percent compliance with the MRDA requirements as < 70%, 70%-99%, and ≥ 100%. Comparison of Table 8 to 9 shows that the 0-1 male group was the only one where the elimination of the nutrients supplied by nutritional supplements made a difference in the percentages of the MRDA supplied by the intakes of the cadets in

that group. Without these supplements, the percentages of cadets in the 0-1 group that had adequate intakes of folacin, vitamin B_6, vitamin A, and zinc would have been 3% to 4% less.

Table 9. Percent of Male Cadets Within Each Study Group with Mean Daily Intakes (Without Nutritional Supplements) at Selected[1] Levels of the Military Recommended Dietary Allowances (MRDA)[2]

Nutrients	0-1 Study Group (n=31)			2-3 Study Group (n=42)			4-5 Study Group (n=46)		
	Percent of MRDA			Percent of MRDA			Percent of MRDA		
	<70	70-99	≥100	<70	70-99	≥100	<70	70-99	≥100
Energy	6	36	58	-	26	74	-	24	76
Protein	-	39^{m}	61^{x}	-	10^{n}	90^{xy}	-	2^{n}	98^{y}
Vitamin C	-	10^{m}	90^{x}	-	$-^{n}$	100^{xy}	-	$-^{n}$	100^{y}
Thiamin	-	3	97	-	-	100	-	-	100
Riboflavin	-	6	94	-	-	100	-	-	100
Niacin	-	6	94	-	-	100	-	-	100
Vitamin B_6	6	36^{m}	58^{x}	-	14^{n}	86^{xy}	-	15^{n}	85^{y}
Folacin	19^{a}	32^{m}	48^{x}	$-^{b}$	24^{mn}	76^{xy}	11^{ab}	13^{n}	76^{y}
Vitamin B_{12}	-	3	97	-	-	100	-	-	100
Vitamin A	19^{a}	26^{m}	55^{x}	$-^{b}$	10^{mn}	90^{y}	$-^{b}$	9^{n}	91^{y}
Calcium	-	10^{m}	90	-	$-^{n}$	100	-	2^{mn}	98
Phosphorus	-	-	100	-	-	100	-	-	100
Magnesium	6	26	68^{x}	2	12	86^{xy}	-	11	89^{y}
Iron	-	-	100	-	-	100	-	-	100
Zinc	6	29	64^{x}	-	12	88^{xy}	-	13	87^{y}

[1]Nutritional intake criteria was: low equals < 70%, marginal equals 70%-99%, and adequate equals ≥ 100% of MRDA.
[2]MRDAs used for energy, calcium, phosphorus, and magnesium were, respectively, 3200 kcal, 800 mg, 800 mg, and 350 mg.
NOTE: Statistical comparisons of the study groups were made for each nutrient at each selected MRDA level; percentages with different superscript letters are significantly different ($p < 0.05$); for clarity, different sets of letters were used for each MRDA level: a, b, and c for <70% MRDA; m, n, and p for 70-99% MRDA; and x,y, and z for ≥100% MRDA.

Tables 7 and 9 have been included in the report to show the impact of the nutritional supplements on each male group's mean dietary intake. However, since

these supplements did contribute to the total dietary intake, discussions of the male cadets' intake data will be based on the actual intake data which included supplements (Tables 6 and 8). The following paragraphs present the nutritional intake results for each type of nutrient summarized in Tables 6 and 8 with mean ± SD and percentages.

Energy. The mean energy intake of the 0-1 male group was significantly lower than the 4-5 male group but not the 2-3 group. The 2-3 group was not different from either the 0-1 or 4-5 groups.

Figure 5 presents the mean daily energy intakes of the 0-1, 2-3, and 4-5 male groups. The three male groups consumed less food on Sunday, although the 0-1 group intakes stayed near the Sunday level for most of the remainder of the week. Statistical comparison of the mean weekday values with separate Saturday and Sunday intakes showed that, for the male cadets, the weekday mean was significantly different from Sunday ($p < 0.05$) but not from Saturday.

Figure 5. Mean Daily Energy Intake of Male Cadet Groups

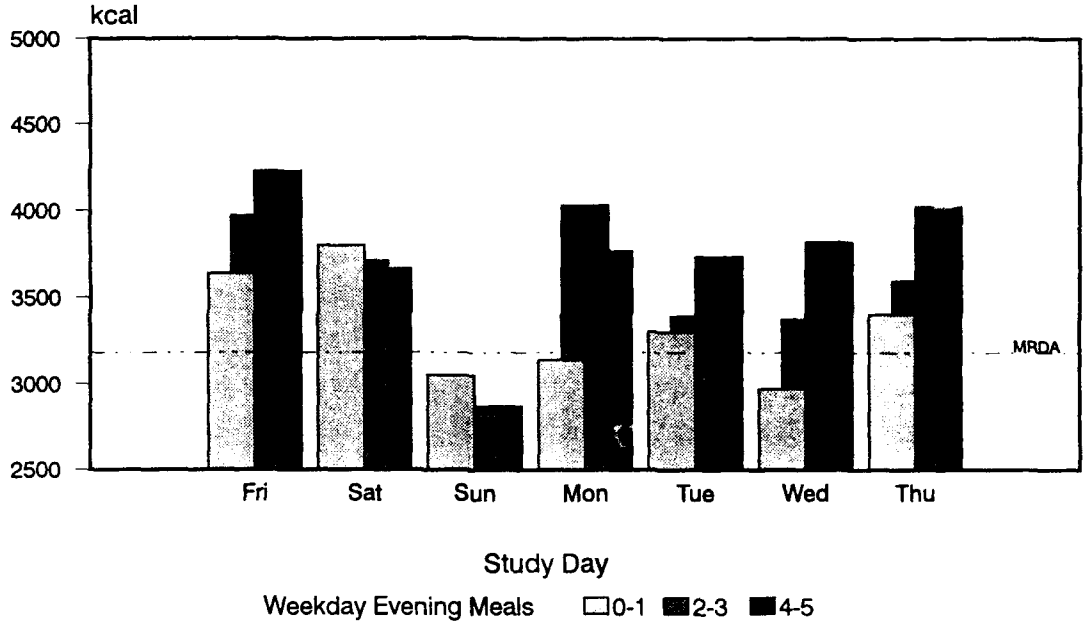
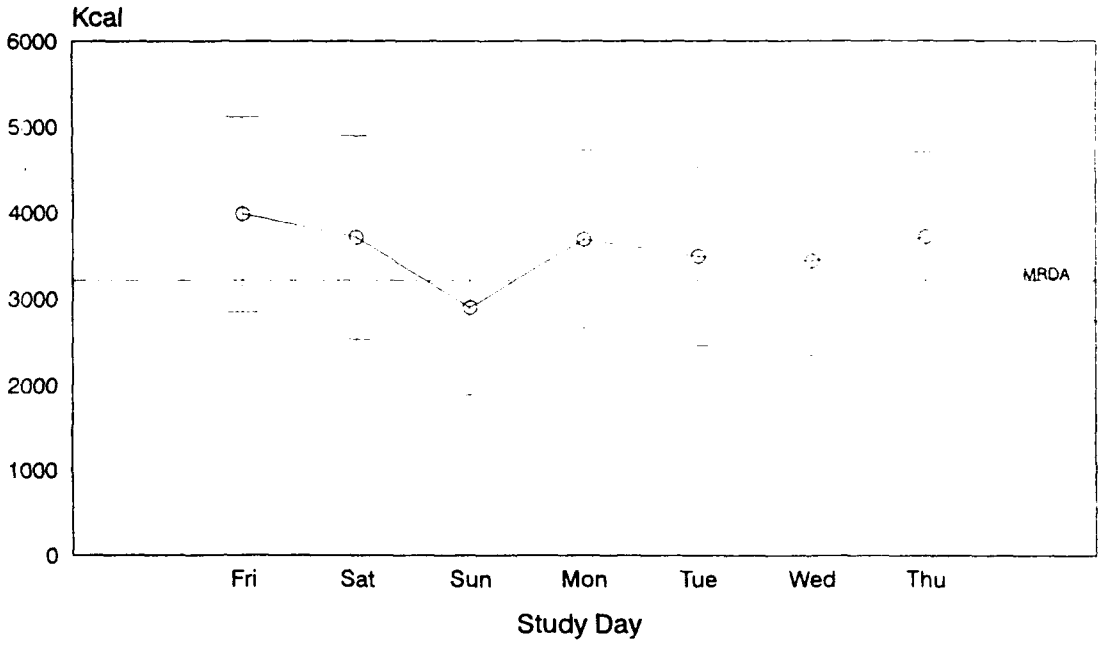


Figure 6 shows the mean daily energy intakes with standard deviations for the combined male groups. The mean weekday intake was 3667 ± 214 kcal (median = 3694 kcal) and the mean weekend intake was 3309 ± 575 kcal (median = 3308 kcal).

Figure 6. Daily Energy Intake of Male Cadets (Mean ± SD)

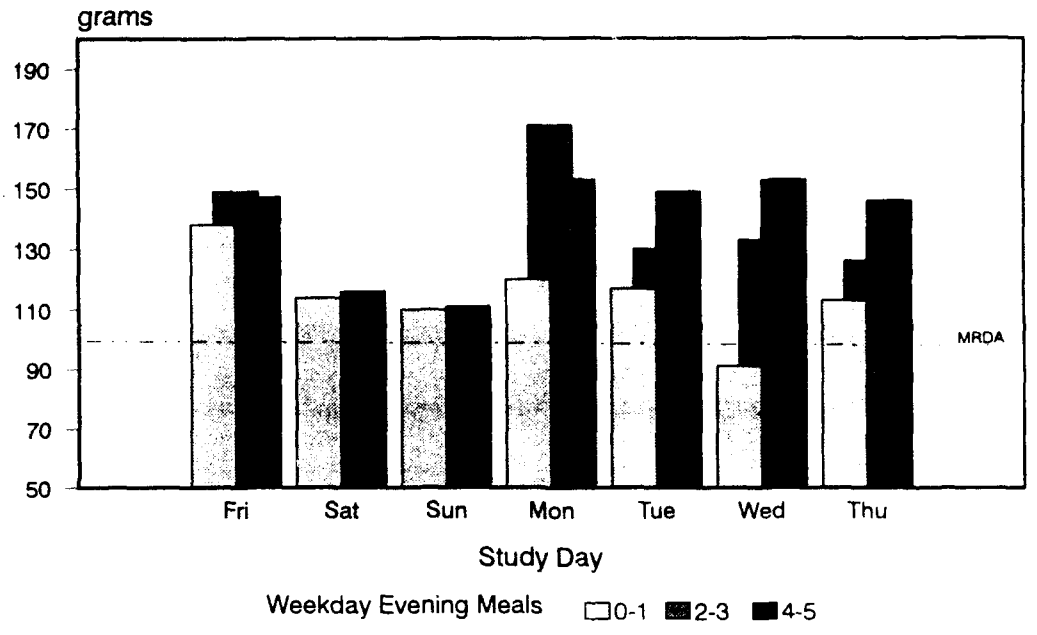
(n=119)



Protein. The mean daily protein intake of the 0-1 group was significantly lower than the 2-3 and 4-5 groups. While Table 6 shows that the mean protein intakes of all male groups exceeded the MRDA, Table 8 shows 39%, 10%, and 2% of the cadets in the respective 0-1, 2-3, and 4-5 groups had marginal intakes of protein. The mean daily intakes of protein provided 1.5 g, 1.8 g, and 1.9 g of protein per kg of body weight per cadet in the respective 0-1, 2-3, and 4-5 male cadet groups. Figure 7 shows the mean daily protein intake of the 0-1, 2-3, and 4-5 male cadet groups.

Paralleling the energy intakes, protein intakes were also lowest on Sunday for all male groups except the 0-1 group on Wednesday.

Figure 7. Mean Daily Protein Intake of Male Cadet Groups



Fat. The mean dietary fat intake of the 0-1 male cadet group was significantly lower than that of the 4-5 male group, but not the 2-3 male group. Table 10 shows the percent of cadets in each male group that derived specified percentages (ranging in 5% increments from less than 20% to more than 40%) of their mean daily energy from fat. None of the values within the same row were significantly different ($p < 0.05$). The percentage of cadets in each of the 0-1, 2-3, and 4-5 groups that complied with the MRDA (not more than 35% of total energy from fat) was 81%, 85%, and 87%, respectively.

Table 10. Percent of Male Cadets Obtaining Specified Percentages of Food Energy From Fat

Specified Percentages of Total Energy from Fat	Percent of Cadets		
	0-1 Study Group (n=31)	2-3 Study Group (n=42)	4-5 Study Group (n=46)
< 20	-	-	2
20.0-24.9	6	2	-
25.0-29.9	23	19	26
30.0-34.9	52	64	59
35.0-39.9	19	14	13
≥ 40	-	-	-

Saturated Fats and Cholesterol. The mean daily intakes of both monounsaturated and polyunsaturated fats of the 0-1 male cadet group were significantly lower than the 4-5 group but not the 2-3 group. Calculations based on these data show that all three male groups obtained 11% of their total mean caloric intakes from saturated fats. The 0-1 and 2-3 male groups each obtained 6%, and the 4-5 male group obtained 7% of their energy intakes from polyunsaturated fats.

AR 40-25 (1985) does not contain specific recommendations pertaining to cholesterol levels. However, the National Research Council, Food and Nutrition Board's Committee on Diet and Health (NRC, 1989) has indicated that dietary cholesterol should be less than 300 mg/day. Table 6 shows the mean daily cholesterol intakes of 376 mg, 421 mg, and 449 mg of the respective 0-1, 2-3, and 4-5 male groups all exceeded 300 mg.

Carbohydrate. Each of the three male groups derived 54% of total energy (kcal) from their mean daily carbohydrate intake. Thus, each male group met the AR 40-25 recommendation of approximately 50% to 55% of total dietary energy from carbohydrates.

Vitamins. Table 6 shows that the mean daily nutritional intake of the 0-1 male group was significantly lower in vitamin C than the 4-5 male group, but not the 2-3 male group. Ten percent of the 0-1 group had mean vitamin C intakes that were marginal (Table 8).

In spite of the high mean intakes of thiamin and riboflavin by all three male groups, 3% of the 0-1 male group had marginal mean intakes of thiamin and 6% had marginal mean intakes of riboflavin.

Mean intake of vitamin B_6, folacin, and vitamin B_{12} by each male group exceeded the MRDA; however, all groups had some individual cadets whose mean daily intakes of vitamin B_6 and folacin failed to meet the MRDA. Nineteen percent of the male cadets in the 0-1 group had low mean folacin intakes and 6% had low mean vitamin B_6 intakes; 11% of the 4-5 group also had low folacin intakes. Twenty-nine percent of the 0-1 group, 24% of the 2-3 group, and 13% of the 4-5 group had marginal mean daily intakes of folacin; 32% of the 0-1 group, 14% of the 2-3 group, and 15% of the 4-5 group had marginal mean intakes of vitamin B_6. Three percent of the male cadets in the 0-1 group had marginal mean daily intakes of vitamin B_{12}.

Vitamin A intake of the 0-1 group was significantly lower than both the 2-3 and 4-5 groups. Sixteen percent of mean individual intakes in the 0-1 group were low in vitamin A, and 26% were marginal. Ten percent and 9% of the respective 2-3 and 4-5 male groups also had marginal mean vitamin A intakes.

Minerals. The mean daily calcium intake of the 0-1 male group was significantly lower than the 4-5 male group, but not the 2-3 group. While the mean intake of all three male groups exceeded the MRDA (including the 1200 mg requirement for 18-year old cadets), 10% and 2% of the cadets in the respective 0-1 and 4-5 male groups had marginal calcium intakes when compared against the 800 mg MRDA. None of the 18-year old male cadets consumed less than 1200 mg calcium. The calcium to phosphorus ratios were: 1:1.5 for the 0-1 male cadet group and 1:1.4 for both the 2-3 and the 4-5 male groups. The mean daily phosphorus intake of the 0-1 male group was significantly lower than the other two male groups. However, the mean daily phosphorus intake of all male groups and of all cadets within each group met the MRDA for cadets aged 18 years and older.

The mean daily magnesium intake for the 0-1 male group was significantly lower than that of 4-5 male group, but not the 2-3 male group. Six percent of the 0-1 male group and 2% of the 2-3 male group had low mean daily intakes of magnesium. Twenty six percent, 12%, and 11% of the respective 0-1, 2-3, and 4-5 male group had marginal mean daily intakes of magnesium. Two percent of the 18-year olds in the 2-3 male group had magnesium intakes below the 400 mg MRDA.

Each male group and all cadets within each group had adequate mean daily intakes of iron. The mean daily zinc intakes of each male group met the MRDA; however, 6% of the 0-1 group cadets had low mean zinc intakes, and 26%, 12%, and 13% of cadets in the respective 0-1, 2-3, and 4-5 groups had marginal mean daily zinc intakes.

While the mean potassium intakes of the three male groups were all significantly different from each other (with the 0-1 male group having the lowest intake), the mean daily intake of each male group was within the estimated safe and adequate daily dietary range for potassium (1875-5625 mg) cited in AR 40-25 (1985). While the mean intakes of all male volunteers exceeded 1875 mg, the intakes of 3% of each of the 0-1 and 2-3 groups, and 9% of the 4-5 male group exceeded 5625 mg.

Calculations based on the mean sodium intakes (Table 6) determined that the mean intakes per 1000 kilocalories were 1561, 1596, and 1544 mg for the respective 0-1, 2-3, and 4-5 male groups. These intakes were all below the target for military food service systems for sodium (i.e., 1700 mg/1000 kcal). The percent of the mean daily sodium intake of each study group obtained from discretionary salt, i.e., salt added by the cadets to meals or snacks (e.g., popcorn), was 2%, 1%, and 2% for the respective 0-1, 2-3, and 4-5 male groups.

Water. The 0-1, 2-3, and 4-5 male groups' water intake as water was respectively 23%, 24%, and 17% of their mean daily dietary water intake. Thus, the average male cadet in the 0-1, 2-3, and 4-5 groups drank 680, 710, and 503 mL of water per day. Water used to reconstitute a food (e.g., cocoa, soup, instant oatmeal) was included as part of the intake of that food. The ratio of mean total water intake to mean total energy was 0.9, 0.8, and 0.8 mL of water per kcal consumed for the

respective 0-1, 2-3, and 4-5 male cadet groups. The military regulation (AR 40-25, 1985) states that during periods of light to moderate activity in a temperate climate, 1 mL of water per kcal expended is a reasonable water intake goal.

Female Groups: Assessment of Nutritional Intakes

Fifty-eight percent of the female cadets consumed three or more TRIMM meals. The majority of these cadets (60%) were from the 0-1 group; however, 39% and 65% of the respective 2-3 and 4-5 female groups also ate at least three TRIMM meals. Of the cadets in the 0-1, 2-3, and 4-5 female groups who ate at least three TRIMM meals during the study, 50%, 22%, and 9%, respectively, had mean energy intakes that were below the 2000 kcal lower end of the MRDA range for energy for females; while 27%, 56%, and 64% of the individuals eating TRIMM meals in these same respective groups had mean energy intakes that exceeded the 2314 kcal mean energy intake of all females (n=86) in the study. However, only 6% of all female cadets consuming TRIMM meals were below 1500 kcal and these cadets were in the 0-1 group only.

Table 11 provides the nutrients mean ± SD, median, and range of daily intakes (21 nutrients) for the female cadets (n=86) in the study. Comparison of the mean and median data shows that the mean value for protein is slightly skewed due to the low intakes of a few cadets, and that the mean values for all vitamins and iron are skewed due to the intakes of high potency vitamin and iron supplements by only a few cadets. The mean for alcohol (ethanol) intake is also skewed by a few high intakes.

Table 12 presents the mean nutrient intakes of the female groups. Values (mean ± SD) with different superscript letters within a row are significantly different ($p < 0.05$). Comparisons of these intakes also show that, except for vitamins, the greater the number of weekday evening meals consumed in the Cadet Mess, the higher the nutritional content of the cadets' mean nutritional intake. The intake data for vitamins and minerals computed without nutritional supplements are presented on Table 13. Without supplements, the 0-1 female group intakes of niacin, vitamin A, and phosphorus would have been significantly lower than the 2-3 and 4-5 group intakes. Also, the 0-1 group intake of riboflavin would have been lower than the 2-3 group intake, and the 0-1 group intakes of calcium and magnesium would have been lower

than the 4-5 group intakes. Without nutritional supplements, the 0-1 intakes of vitamin B_6 and folacin would not have met the MRDA. Also, without the vitamin supplements, all three of the female group intakes would have been below the MRDA for vitamin A. Even with nutritional supplements (Table 12), the 0-1 female cadet group intakes of protein, magnesium, and zinc were below the MRDA for these respective nutrients. With supplements, there were significant differences ($p < 0.05$) between the groups for energy and 12 of the nutrients evaluated (protein, fat, carbohydrate, vitamin A, calcium, phosphorous, zinc, potassium, sodium, monounsaturated fat, polyunsaturated fat, and cholesterol).

There were three instances where nutrient intakes were below the MRDA (protein, magnesium, and zinc) in the 0-1 group. The mean intakes of the other two groups met all of the MRDAs. However, comparison of the range data (Table 11) with the MRDA (Table 12) showed that, for a number of different nutrients, the minimum mean intakes reported were well below their corresponding MRDAs. Therefore, to determine the percentage of cadets within each group with mean daily intakes that were below the MRDAs, we compared the mean daily nutritional intake of each cadet with the appropriate MRDA, and determined the percent compliance with the MRDA requirements as <70% (low), 70% to 99% (marginal), and ≥100% (adequate). Table 14 presents the results of this analysis.

Table 15 presents the results of comparing the female cadets' mean intakes without nutritional supplements against the MRDA and determining the percentages within each group that were < 70%, 70%-99%, and ≥ 100% of the MRDA. Comparison of Tables 14 and 15 shows that without nutritional supplements, the 0-1 and 2-3 female groups had higher percentages of cadets with intakes that were low or marginal. For the 0-1 group, vitamin B_6, folacin, and iron were the nutrients most affected by the removal of the nutritional supplements. The percentages of cadets having adequate intakes were, respectively, 11%, 15%, and 13% less than they were with the supplements included. For the 2-3 group, the percent of cadets with adequate intakes of vitamin C, vitamin B_6, and folacin were, respectively, 13%, 9%, and 17% less than they were with supplements. The percentages of the 4-5 female cadet group's mean daily intakes that were low, marginal, and adequate when compared to the MRDAs were not altered by the removal of the supplements.

Table 11. Mean, Median, and Range of Daily Nutritional Intakes of Female Cadets (n=86)

Nutrients	Mean±SD	Median	Minimum	Maximum
Energy, kcal	2314±494	2312	604	3389
Protein, g	79±19	84	22	128
Fat, g	81±22	83	13	127
Carbohydrate, g	325±75	330	103	484
Vitamin C, mg	172±120	147	38	696
Thiamin, mg	2.8±2.8	2.0	1.0	19
Riboflavin, mg	3.0±2.3	2.5	1.2	19
Niacin, mg	30±15	26	14	107
Vitamin B_6, mg	2.6±2.1	2.2	1.0	19
Folacin, mcg	428±245	358	145	1518
Vitamin B_{12}, mcg	6.2±6.7	4.7	1.5	60
Vitamin A, IU	6248±3851	5039	1649	24119
Calcium, mg	1001±299	979	375	2030
Phosphorus, mg	1391±323	1403	415	2188
Magnesium, mg	315±82	302	147	697
Iron, mg	28±23	22	9	147
Zinc, mg	14±7	12	6	61
Potassium, mg	2791±689	2797	1347	4730
Sodium, mg	3703±907	3675	835	5790
Saturated Fat, g	28±8	29	4	49
Monounsat Fat, g	30±10	30	4	72
Polyunsat Fat, g	17±5	17	3	35
Cholesterol, mg	234±80	229	41	430
Alcohol, g	2±6	0.03	0	42

Table 12. Comparison of Mean Daily Nutritional Intakes[1] of Female Cadet Groups

Nutrients	MRDA[2]	Female Cadets' Mean Daily Nutritional Intake		
		0-1 Study Group (n=46)	2-3 Study Group (n=23)	4-5 Study Group (n=17)
Energy, kcal	2400 (2000-2800)	2125±490[a]	2456±361[b]	2638±450[b]
Protein, g	80	70±17[a]	88±13[b]	93±19[b]
Fat, g	-[3]	75±25[a]	84±18[ab]	96±13[b]
Carbohydrate, g	-	300±72[a]	345±61[ab]	365±79[b]
Dietary Fiber, g	-	16±6	18±5	18±5
Vitamin C, mg	60	167±128	180±132	176±82
Thiamin, mg	1.2	2.5±2.2	3.6±4.1	2.6±1.9
Riboflavin, mg	1.4	2.7±1.6	3.9±3.7	2.8±0.8
Niacin, mg	16	28±16	35±17	31±8
Vitamin B_6, mg	2.0	2.2±1.1	3.4±3.6	2.5±1.0
Folacin, mcg	400	413±258	467±271	415±163
Vitamin B_{12}, mcg	3.0	5.2±3.2	8.8±11.8	5.2±2.2
Vitamin A, IU	4000	4841±2538[a]	7608±4895[b]	8215±3906[b]
Calcium, mg	800-1200	904±277[a]	1064±225[ab]	1176±350[b]
Phosphorus, mg	800-1200	1272±323[a]	1481±218[b]	1592±317[b]
Magnesium, mg	300	289±85	340±65	353±71
Iron, mg	18	28±27	28±14	29±22
Zinc, mg	15	12±5[a]	16±5[b]	17±12[b]
Potassium, mg	-[4]	2533±684[a]	2955±452[b]	3267±672[b]
Sodium, mg	-[5]	3306±879[a]	3876±679[ab]	4299±931[b]
Saturated Fat, g	-	27±9	29±8	33±6
Monounsat Fat, g	-	27±9[a]	31±7[a]	38±10[b]
Polyunsat Fat, g	-[6]	15±6[a]	17±4[ab]	20±3[b]
Cholesterol, mg	-	209±81[a]	263±67[b]	263±77[ab]
Alcohol, g	-	2±8	2±4	<1

[1]Mean ± SD; values with different superscript letters within a row are significantly different ($p < 0.05$). [2]Military Recommended Dietary Allowances for females (17-50 years old). [3]No MRDA established. [4]Estimated safe and adequate daily dietary intake range is 1875-5625 mg of potassium. [5]Target for sodium for military personnel is 1700 mg per 1000 kilocalories; this equates to approximately 4100 mg for females. [6]Recommended level is at least 7 percent of kilocalories as polyunsaturated fat.

Table 13. Comparison of Mean Daily Nutritional Intakes[1] (Without Nutritional Supplements) Female Cadet Groups

Nutrients	MRDA[2]	Female Cadets' Mean Daily Nutritional Intake		
		0-1 Study Group (n=46)	2-3 Study Group (n=23)	4-5 Study Group (n=17)
Vitamin C, mg	60	122±52	141±75	159±76
Thiamin, mg	1.2	1.8±0.5	2.2±0.4	2.2±0.5
Riboflavin, mg	1.4	2.2±0.6[a]	2.6±0.6[b]	2.6±0.6[ab]
Niacin, mg	16	23±7[a]	29±6[b]	29±6[b]
Vitamin B_6, mg	2.0	1.8±0.6	2.2±0.6	2.3±0.6
Folacin, mcg	400	318±115	379±124	389±127
Vitamin B_{12}, mcg	3.0	4.0±1.8	5.0±1.9	5.0±1.7
Vitamin A, IU	4000	2039±301[a]	3057±638[b]	3356±814[b]
Calcium, mg	800-1200	889±259[a]	1036±222[ab]	1118±270[b]
Phosphorous, mg	800-1200	1269±315[a]	1475±219[b]	1590±316[b]
Magnesium, mg	300	287±75[a]	329±51[ab]	352±71[b]
Iron, mg	18	19±7	22±6	22±6
Zinc, mg	15	12±3	15±4	14±4

[1]Mean ± SD; values with different superscript letters within a row are significantly different ($p < 0.05$). [2]Military Recommended Dietary Allowances for females (17 to 50 years old) (AR 40-25, 1985).

Table 14. Percent of Female Cadets Within Each Study Group with Mean Daily Intakes at Selected[1] Levels of the Military Recommended Dietary Allowances $(MRDA)_2$

Nutrients	0-1 Study Group (n=46)			2-3 Study Group (n=23)			4-5 Study Group (n=17)		
	Percent of MRDA			Percent of MRDA			Percent of MRDA		
	<70	70-99	≥100	<70	70-99	≥100	<70	70-99	≥100
Energy	20^{a}	50	30^{x}	$-^{b}$	48	52^{xy}	$-^{b}$	29	71^{y}
Protein	20^{a}	50^{m}	30^{x}	$-^{b}$	26^{mn}	74^{y}	$-^{b}$	18^{n}	82^{y}
Vitamin C	2	9	89	4	4	91	-	6	94
Thiamin	-	4	96	-	-	100	-	-	100
Riboflavin	-	4	96	-	-	100	-	-	100
Niacin	-	19	81	-	-	100	-	-	100
Vitamin B_6	24^{a}	30	46	$-^{b}$	39	61	6^{ab}	24	71
Folacin	35	28	37	17	26	56	24	24	53
Vitamin B_{12}	9	13	78	4	4	91	6	12	82
Vitamin A	20^{a}	26	54^{x}	4^{ab}	17	78^{xy}	$-^{b}$	12	88^{y}
Calcium	9	24	67	-	13	87	-	18	82
Phosphorus	2	2	96	-	-	100	-	-	100
Magnesium	13	52^{m}	35^{x}	4	22^{n}	74^{y}	6	24^{n}	71^{xy}
Iron	11	30	59	4	17	78	-	24	76
Zinc	43^{a}	35	22^{x}	9^{b}	48	44^{xy}	18^{ab}	35	47^{y}

[1]Nutritional intake criteria was: low equals <70%, marginal equals 70%-99%, and adequate equals ≥ 100% of MRDA.

[2]MRDAs used for energy, calcium, and phosphorus were, respectively, 2400 kcal, 800 mg, and 800 mg.

NOTE: Statistical comparisons of the study groups were made for each nutrient at each selected MRDA level; percentages with different superscript letters are significantly different ($p < 0.05$); for clarity, different sets of letters were used for each MRDA level: a, b, and c for <70% MRDA; m, n, and p for 70-99% MRDA; and x, y, and z for ≥100% MRDA.

Table 15. Percent of Female Cadets Within Each Study Group with Mean Daily Intakes (Without Nutritional Supplements) at Selected[1] Levels of the Military Recommended Dietary Allowances (MRDA)[2]

Nutrients	0-1 Study Group (n=46)			2-3 Study Group (n=23)			4-5 Study Group (n=17)		
	Percent of MRDA			Percent of MRDA			Percent of MRDA		
	<70	70-99	≥100	<70	70-99	≥100	<70	70-99	≥100
Energy	20^{a}	50	30^{x}	$-^{b}$	48	52^{xy}	$-^{b}$	29	71^{y}
Protein	20^{a}	50^{m}	30^{x}	$-^{b}$	26^{mn}	74^{y}	$-^{b}$	18^{n}	82^{y}
Vitamin C	2	11	87	4	17	78	-	6	94
Thiamin	-	9	91	-	-	100	-	-	100
Riboflavin	-	9	91	-	-	100	-	-	100
Niacin	-	20^{m}	80^{x}	-	$-^{n}$	100^{y}	-	$-^{n}$	100^{y}
Vitamin B_6	33^{a}	33	35^{x}	$-^{b}$	48	52^{xy}	6^{b}	24	71^{y}
Folacin	40^{a}	37	22^{x}	17^{b}	44	39^{xy}	24^{b}	24	53^{y}
Vitamin B_{12}	9	22	70	9	4	87	6	12	82
Vitamin A	22^{a}	28	50^{x}	4^{ab}	22	74^{xy}	$-^{b}$	12	88^{y}
Calcium	9	26	65	-	17	83	-	18	82
Phosphorus	2	2	96	-	-	100	-	-	100
Magnesium	13	52^{m}	35^{x}	4	22^{n}	74^{y}	6	24^{n}	71^{y}
Iron	15^{a}	39	46^{x}	4^{b}	22	74^{y}	$-^{b}$	24	76^{y}
Zinc	44^{a}	35	22	13^{b}	52	35	18^{b}	35	47

[1]Nutritional intake criteria was: low equals <70%, marginal equals 70%-99%, and adequate equals ≥ 100% of MRDA.

[2]MRDAs used for energy, calcium, and phosphorus were, respectively, 2400 kcal, 800 mg, and 800 mg.

NOTE: Statistical comparisons of the study groups were made for each nutrient at each selected MRDA level; percentages with different superscript letters are significantly different ($p < 0.05$); for clarity, different sets of letters were used for each MRDA level: a, b, and c for <70% MRDA; m, n, and p for 70-99% MRDA; and x, y, and z for ≥100% MRDA.

Tables 13 and 15 have been included in the report to show the impact of the nutritional supplements on each female group's mean dietary intake. However, statistical comparison of the data on Table 14 for those nutrients that seemed to be most affected by nutritional supplements (vitamin B_6, folacin, vitamin $_{12}$, and iron) with the corresponding data on Table 15 for each respective study group and selected

percent of the MRDA showed that there were no significant differences due to supplements at the 0.05 level. Thus, since these nutritional supplements did contribute to the total dietary intake, discussions of the female cadets' intake data will be based on the intake data presented in Tables 12 and 14.

Energy. The mean energy intake of the 0-1 female group was significantly different from the other two female groups, which were not different from each other.

Figure 8 presents the mean daily energy intakes of the 0-1, 2-3, and 4-5 female groups. Each of the three groups consumed approximately the same amount of energy per day. Statistical comparison of the mean weekday values with separate Saturday and Sunday intakes showed no difference between the mean weekday intakes and either the Saturday or Sunday intakes for any of the three groups.

Figure 8. Mean Daily Energy Intake of Female Cadet Groups

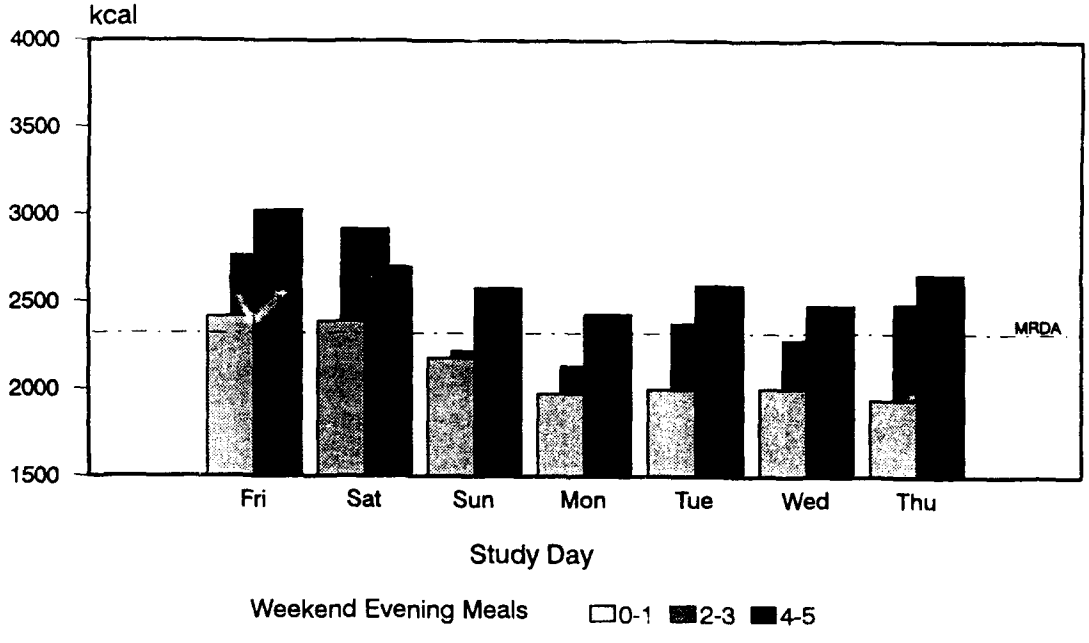
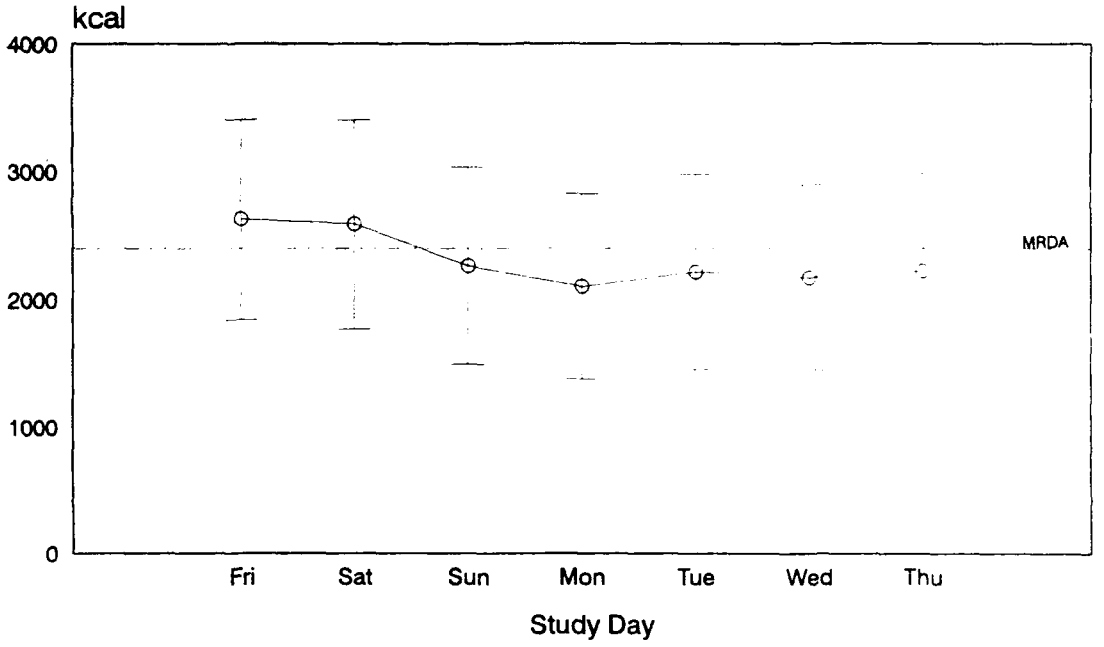


Figure 9 shows the mean daily energy intakes with standard deviations for the combined female groups. The mean weekday intake was 2270 ± 206 kcal (median = 2220 kcal) and the mean weekend intake was 2429 ± 228 kcal (median = 2429 kcal).

Figure 9. Daily Energy Intake of Female Cadets (Mean ± SD)

(n=86)

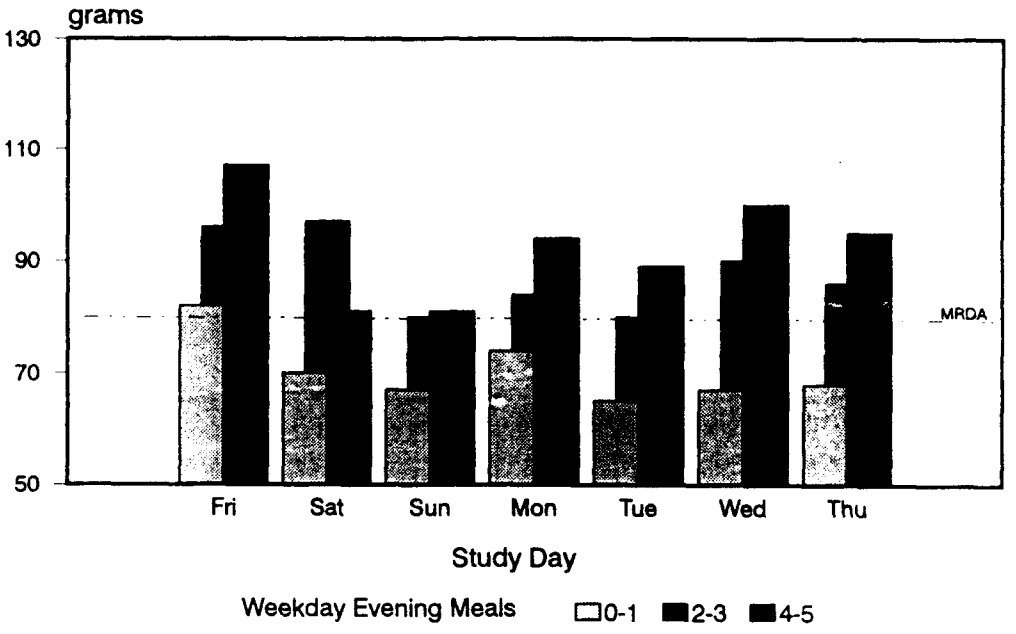


Protein. The mean daily protein intake of the 0-1 female group was significantly lower than both the 2-3 and 4-5 groups. Only the 0-1 female group had a mean protein intake less than the MRDA (Table 12). Fifty percent of this group had marginal intakes, while 20% had protein intakes < 70% MRDA (Table 14). Also, 26% and 18% of the cadets in the respective 2-3 and 4-5 groups had marginal intakes of protein.

The intake of protein provided a mean of 1.1 g, 1.5 g, and 1.5 g of protein per kg of body weight for the female cadets in the respective 0-1, 2-3, and 4-5 groups. Three percent of the female cadets in the 0-1 group had mean daily protein intakes that provided less than 0.8 g of protein per kg of body weight.

Figure 10 presents the mean protein intakes of the female groups. The mean Sunday intakes were not noticeably different from the other six days except for the 2-3 female group.

Figure 10. Mean Daily Protein Intake of Female Cadet Groups



Fat. The mean fat intake of the 0-1 female cadet group was significantly lower than the 4-5 female group, but not the 2-3 female group. Table 16 shows the percent of cadets in each female group that derived specified percentages of their mean energy from fat. None of the values within the same row were significantly different ($p < 0.05$). The combined percentages of cadets in the 0-1, 2-3, and 4-5 groups that were within the MRDA (i.e., not more than 35% of total energy from fat) were 78%, 87%, and 82%, respectively.

Table 16. Percent of Female Cadets Obtaining Specified Percentages of Food Energy From Fat

Specified Percentages of Total Energy from Fat	Percent of Female Cadets		
	0-1 Study Group (n=46)	2-3 Study Group (n=23)	4-5 Study Group (n=17)
< 20	4	-	-
20.0-24.9	4	4	-
25.0-29.9	35	44	23
30.0-34.9	35	39	59
35.0-39.9	17	13	18
≥ 40	4	-	-

Saturated Fat and Cholesterol. The mean 0-1 female group intakes of both monounsaturated and polyunsaturated fats were significantly lower than those of the 4-5 group, but not the 2-3 group; for polyunsaturated fat the 2-3 and 4-5 group intakes were not different. Calculations based on the mean daily intake data show that the three female groups each obtained 11% of their total energy intakes from saturated fats. The 0-1 and 2-3 female groups each obtained 6%, and the 4-5 female group obtained 7% of their total energy from polyunsaturated fats.

The mean cholesterol intake of the 0-1 group was significantly different from the intake of the 2-3 group. The cholesterol intake of each of the three female groups was under 300 mg per day, which is the National Research Council, Food and Nutrition Board's Committee on Diet and Health (NRC, 1989) recommendation.

Carbohydrate. The mean carbohydrate intakes of the female groups provided 56%, 56%, and 55% of the total energy intakes of the respective 0-1, 2-3, and 4-5 groups, and thus, all groups met the MRDA recommendation of 50% to 55% of total calories from carbohydrate.

Vitamins. Table 12 shows that there were no significant differences among the mean vitamin C intakes of the three female groups and that the mean vitamin C intake

of each group was at least twice the MRDA. However, in spite of the extremely high amount of vitamin C supplied by both the Regular and TRIMM menus (Tables 3 and 4) (all fruit flavored drinks served in the Cadet Mess were fortified with 60 mg of vitamin C/6 fl oz) 2% of the females in the 0-1 group and 4% in the 2-3 group had low intakes of vitamin C. Between 4% and 9% of all female groups had marginal intakes of vitamin C.

Each group's mean intake of both thiamin and riboflavin met the MRDA. None of the female cadets had low intakes of these vitamins, and only 4% of the 0-1 group had marginal intakes (Table 14).

Each group's mean folacin intake was also adequate, providing 100% of the MRDA. However, Table 14 shows that folacin was the vitamin in which the highest percentage of female cadets in each group had low mean daily dietary intakes. Thirty-five percent of the 0-1 group, 17% of the 2-3 group, and 24% of the 4-5 group had low intakes. Marginal folacin intakes of the 0-1, 2-3, and 4-5 female cadet groups were 28%, 26%, and 24%, respectively.

The mean group intakes of vitamin B_6 were all adequate; however, 24% of the female cadets in the 0-1 group had low mean intakes as did 6% of the 4-5 female group. Marginal intakes of this vitamin were 30%, 39%, and 24% for the respective 0-1, 2-3, and 4-5 groups.

All female cadet groups' mean vitamin B_{12} intakes were adequate; however, 9%, 4%, and 6% of the individual mean intakes in the respective 0-1, 2-3, and 4-5 groups were low. Marginal intakes of vitamin B_{12} were 13%, 4%, and 12% for the 0-1, 2-3, and 4-5 groups, respectively.

The mean vitamin A intake of the 0-1 group was significantly lower than the intakes of the 2-3 and 4-5 groups. Only 54% of the female cadets in the 0-1 group had adequate intakes. Twenty percent of this group had low mean intakes and 26% had marginal intakes. Four percent of the 2-3 group had low intakes, while 17% and 12% of the respective 2-3 and 4-5 female groups had marginal intakes of vitamin A.

Minerals. The mean calcium intake of the 0-1 female cadet group was significantly lower than the 4-5 group, but was not different from the 2-3 group. The mean intakes of the 0-1 group did not meet the calcium MRDA (1200 mg) for 18-year olds. Even when evaluated against the 800 mg MRDA for cadets aged 19 years and older, 9% of the cadets in the 0-1 group had low calcium intakes and 24% had marginal calcium intakes. Marginal intakes for cadets in the 2-3 and 4-5 groups were 13% and 18%, respectively. Four percent of the cadets in the 0-1 and 2-3 female cadet groups, and 6% of those in the 4-5 group were 18 years old and had calcium intakes of less than 1200 mg, the MRDA for 18-year olds. The calcium to phosphorus ratios were 1:1.4 for each of the three female cadet groups. Mean daily intakes of phosphorus met the MRDA for females, aged 18 years and older. While the intakes of the 0-1 group were significantly lower than the other two groups, when compared against the 800 mg MRDA, only the 0-1 group had cadets with low (2%) intakes. Two percent and 6% of the cadets in the respective 0-1 and 4-5 groups were 18 years old and had phosphorus intakes that were below the 1200 mg MRDA for 18-year olds.

The mean daily magnesium intake of the 0-1 female group did not meet the MRDA. Only 35% of the individual cadets in this 0-1 group had adequate mean intakes of magnesium, 13% had low intakes, and 52% had marginal intakes. Only 74% and 71% of the respective 2-3 and 4-5 groups had adequate intakes of magnesium.

Eleven percent of the female 0-1 group and 4% of the female 2-3 group had low mean daily iron intakes. Thirty percent, 17%, and 24% of the respective 0-1, 2-3, and 4-5 female groups had marginal mean daily intakes of iron.

The 0-1 group of female cadets had significantly lower zinc intakes than either of the other two female groups. Also, the mean zinc intake of the 0-1 group did not meet the MRDA; in fact, only 22% of the individual cadets in this group had mean intakes that met the MRDA. Within the respective groups of 0-1, 2-3, and 4-5, 43%, 9%, and 18% had low mean zinc intakes, while marginal intakes were 35%, 48%, and 35%.

The mean daily potassium intake of each female group was well within the safe and adequate range cited in AR 40-25 (1985). Fifteen percent of the 0-1 female cadet

group had mean potassium intakes that were less than 1875 mg, the lower limit of the MRDA estimated safe and adequate range. The minimum individual mean intake was 1347 mg of potassium (Table 11).

Calculations based on the mean sodium intakes in Table 12 show that the mean sodium intakes per 1000 kcal were 1598, 1578, and 1630 mg for the 0-1, 2-3, and 4-5 groups, respectively. These values comply with the guidelines for sodium intakes in military food service systems (i.e., 1700 mg/1000 kcal). The mean percent sodium intake of each female study group that was obtained from discretionary salt added by the cadets was 2%, 1%, and 4% for the respective 0-1, 2-3, and 4-5 female groups.

Water. Calculations based on the water intake data recorded during the study show that the 0-1, 2-3, and 4-5 female groups consumed respectively 28%, 30%, and 34% of their mean water intakes as drinking water or 622, 740, and 829 mL per day per female cadet. Water used for reconstitution of a specific food item was included as part of that food. The ratio of mean total water intake to mean total energy was 1.1, 1.0, and 0.9 mL of water per kilocalorie consumed for the respective 0-1, 2-3, and 4-5 female cadet groups. Assuming that the female cadets were expending energy equal to their energy consumption, the female water intakes complied with the AR 40-25 guidelines (1 mL of water per kcal expended) for military personnel under conditions of light to moderate activity in a temperate climate.

Male and Female Groups: Nutritional Intakes from Nutritional Supplements

Nutritional supplements reported as consumed by cadets included vitamin and mineral preparations supplied as single nutrients (e.g., vitamin C, folic acid, iron compounds, calcium compounds, and zinc), or as multiple vitamin-mineral compounds. The types and amounts of nutrients listed on the labels varied considerably and included stress formulas and other high potency preparations. A few cadets, primarily men, consumed protein and amino acid preparations and other ergogenic aids.

Table 17 shows the mean nutritional contributions of the nutritional supplements, by group. Thirteen percent, 10%, and 17% of the respective 0-1, 2-3, and 4-5 groups of male cadets took supplements. Thirty-seven percent, 35%, and

29% of the respective 0-1, 2-3, and 4-5 groups of female cadets took supplements. Nutritional supplements did not contribute more than 5% of the mean intake of any nutrient to any of the three male groups. However, certain individuals within these groups received as much as 42%, 36%, 31%, and 39% of their respective total daily intake of folacin, vitamin A, magnesium, and zinc from supplements. Among the male groups, the 0-1 group obtained the highest percentages of nutrients from nutritional supplements; from 2% to 5% of their mean vitamin intakes were from supplements. The 0-1, 2-3, and 4-5 female groups obtained, respectively, 10%, 11%, and 9% of their mean intakes of iron from nutritional supplements. In general, the 0-1 and 2-3 female groups obtained a higher percentage of their nutrients from nutritional supplements than did the 4-5 female group.

Table 18 shows the mean nutrients supplied by the nutritional supplements consumed by each class of male and female cadets. As with the male cadet groups the contributions made by nutritional supplements to the mean daily nutrient intakes of the male cadets in any class were low; none exceeded 3% for any nutrient. The First Class female cadets obtained 23% of their mean iron intake from supplements while the other three classes obtained 8% or less of their iron from supplements. The First and Second Class female cadets obtained greater percentages of their mean intakes of all vitamins, except vitamin A, from nutritional supplements than did the Third and Fourth Class female cadets; the Second and Third Class female cadets obtained equal amounts of their vitamin A from supplements.

Table 17. Percent Mean Nutrient Intakes from Nutritional Supplements by Group[1]

Nutrients	Percent Mean Daily Nutrient Intake					
	Male Cadets[2]			Female Cadets[2]		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=46)	2-3 (n=23)	4-5 (n=17)
Vitamin C	4	<1	1	9	10	7
Thiamin	4	<1	1	8	9	5
Riboflavin	4	<1	1	8	9	3
Niacin	3	<1	1	7	8	3
Vitamin B_6	5	1	1	9	10	4
Folacin	2	<1	1	10	8	2
Vitamin B_{12}	2	1	1	6	7	3
Vitamin A	4	<1	2	10	11	2
Calcium	1	<1	<1	1	2	3
Phosphorus	1	0	<1	<1	<1	<1
Magnesium	2	0	1	<1	2	0
Iron	3	<1	2	10	11	9
Zinc	3	0	1	1	3	4
Potassium	0	0	<1	<1	<1	0

[1]Energy and protein intakes from nutritional supplements were < 1% for each group.

[2]Consuming weekday evening meals in the Cadet Mess.

Table 18. Percent of Mean Nutrient Intakes from Nutritional Supplements by Academic Class[1]

Nutrients	Percent Mean Daily Nutrient Intake							
	Class - Male Cadets				Class - Female Cadets			
	1st (n=24)	2nd (n=38)	3rd (n=37)	4th (n=20)	1st (n=19)	2nd (n=16)	3rd (n=26)	4th (n=23)
Vitamin C	1	3	2	2	15	15	6	4
Thiamin	0	3	1	2	16	10	7	2
Riboflavin	0	3	1	2	15	10	5	2
Niacin	0	2	1	1	14	8	5	1
Vitamin B_6	1	3	2	2	17	11	7	2
Folacin	0	1	2	1	17	11	4	3
Vitamin B_{12}	0	3	2	2	18	12	6	3
Vitamin A	0	2	2	1	11	5	5	2
Calcium	0	1	1	1	6	1	1	1
Phosphorus	0	<1	<1	<1	<1	0	<1	<1
Magnesium	0	2	1	1	2	0	1	<1
Iron	0	2	2	1	23	6	5	8
Zinc	0	2	1	1	7	0	2	1
Potassium	0	0	<1	0	<1	0	<1	<1

[1]*Energy and protein intakes from nutritional supplements did not exceed 1% for any class.*

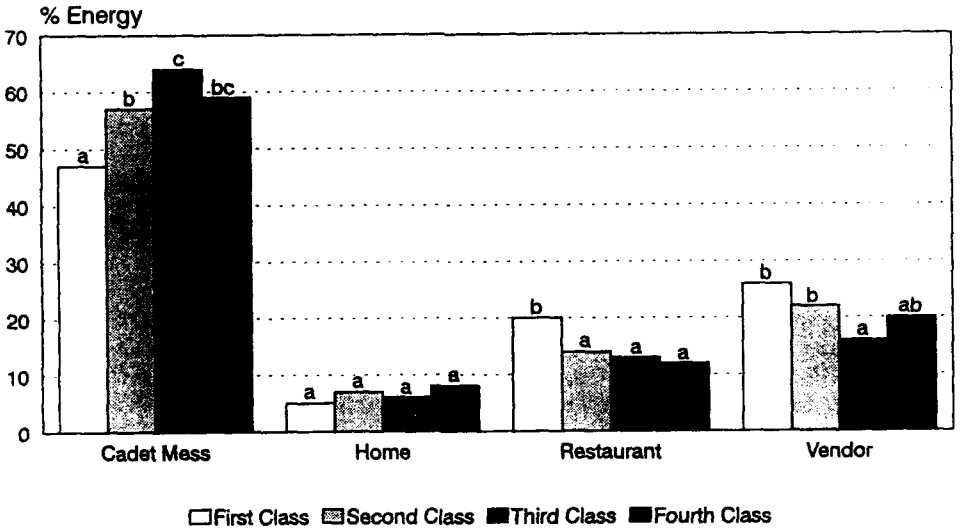
Male and Female Groups: Medications

Twenty-eight percent of the male and 50% of the female cadets took one or more medications during the study. Most of these were for relief of colds, muscle strain, and infections, and for the female cadets, birth control. None of these medications were sources of the nutrients we evaluated.

Male and Female Groups: Nutritional Intakes from Various Dietary Sources

Male cadets obtained 61% of their mean energy intakes from the Cadet Mess, 5% from home, 15% from restaurants, and 19% from vendors. Female cadets derived 53%, 9%, 14%, and 23% of their mean energy intake from the Cadet Mess, home, restaurants, and vendors, respectively. Figure 11 shows that the Cadet Mess provided 47%, 57%, 64%, and 59% of the energy consumed by the First, Second, Third, and Fourth Class cadets, respectively. These percentages are lower than those reported by Kretsch et al in 1986 for the 1979 study when 50%, 61%, 66%, and 70% of the mean energy levels reported for the respective First, Second, Third, and Fourth Classes were from the Cadet Mess.

Figure 11. Source of Mean Daily Energy Intake by Class



Bars with no letter in common within a category differ significantly ($p < 0.05$) from each other.

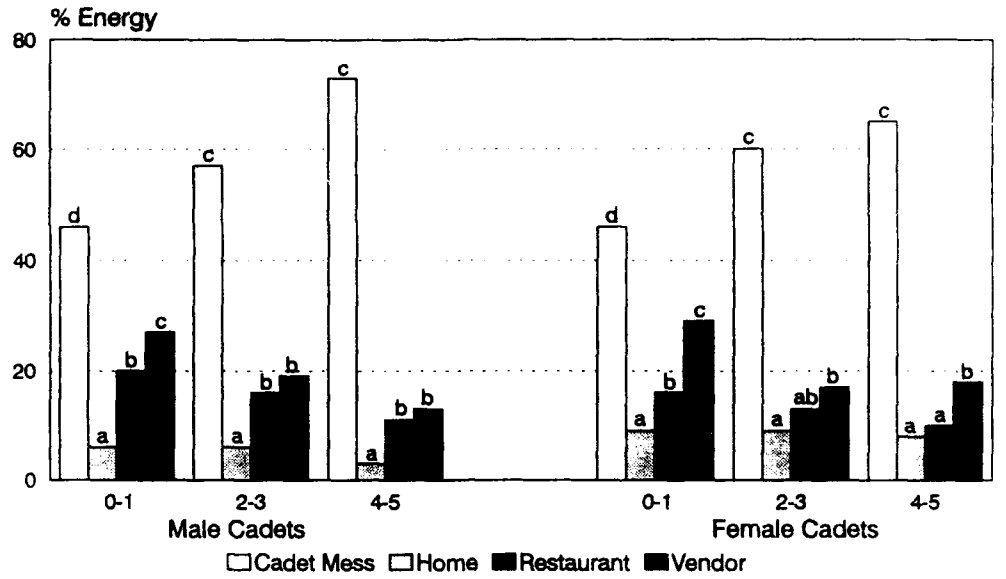
Statistical comparisons of the data summarized in Figure 11 show that the First Class cadets obtained significantly less of their mean daily energy from the Cadet

Mess than did the cadets in the other classes. The First Class cadets obtained a significantly higher percentage ($p < 0.05$) of their mean energy intake from restaurants than did the cadets in the other three classes.

Figure 12 shows that the greater the number of meals consumed in the Cadet Mess, the greater the proportion of energy furnished by mess hall food. The male and female 0-1 groups each obtained 46% of their mean energy intake from the Cadet Mess. The male and female 2-3 groups derived 58% and 60%, respectively, of their energy intake from the Cadet Mess. The 4-5 male and female groups derived 73%, and 65%, respectively, of their energy intakes from the Cadet Mess food. Statistical comparisons by category across groups showed that the 0-1 male and female cadet groups had similar energy intake patterns, i.e., they obtained the highest percentage of their mean energy intake from the Cadet Mess (as did all groups) the second highest percentages from vendors, followed by restaurants, and the lowest percentages from home, and that there were significant differences among each of the four categories (see Figure 12, bars with no letter in common within a category are significantly different [$P < 0.05$]). The intake patterns of the other groups differed from those of the 0-1 groups primarily in that the intakes from restaurants and vendors, or restaurant and home, were not different.

Statistical comparisons across groups by category (not shown on figure 12) showed that the mean percent energy intakes from the Cadet Mess of the three male groups were significantly different from each other; however the 0-1 and 2-3 male groups' intakes were not different from the respective 0-1 and 2-3 female groups' intakes. The mean percent energy intakes from the Cadet Mess of the 0-1 and 2-3 female groups were significantly different; however, the 4-5 female group's intake was not different from either of the intakes of the 2-3 male or female groups. The 0-1 male group's mean percent energy intake from restaurants was significantly different from the intakes of both of the 4-5 male and female groups; however, none of the other groups were significantly different. The 0-1 male and female groups' mean energy intakes from vendors were not different from each other; however, they were significantly different from all other male and female groups' intakes, which were not statistically different from each other at the 0.05 level.

Figure 12. Source of Mean Daily Energy Intake by Group[1]



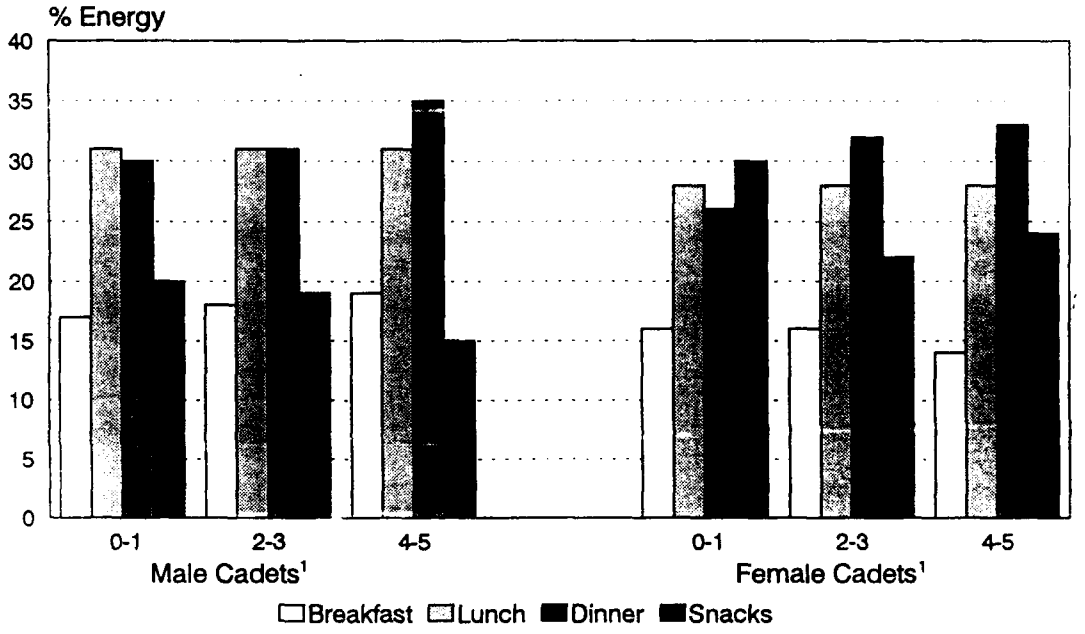
[1]Study groups based on number of weekday evening meals consumed in the Cadet Mess

Bars with no letters in common within a study group differ significantly ($p < 0.05$) from each other.

Figure 13 shows the mean percent energy obtained from meals and snacks for the groups. With three exceptions, dinners provided the highest percentages of energy (from 26% to 35%). The three exceptions were: lunch for the male 0-1 group provided the highest percentage (31%), lunch and dinner both provided the same percentages (31%) of mean daily energy for the 2-3 male group, and snacks provided the highest proportion of mean energy (30%) in the 0-1 female group. All female groups derived a greater proportion of their energy from snacks than did the male groups; however, only the 0-1 female group's intake (the highest) and the 4-5 male group's intake (the lowest) were significantly different ($p < 0.50$), both from each other and from the intakes of all other groups. The percentages of mean energy provided by snacks comprised of Cadet Mess food was 3% for the 0-1 and 4-5 male groups, 4% for the 2-3 male group, 5% for the 0-1 and 2-3 female groups, and 6% for the 4-5 female group. The mean percent of energy intake that the male and female cadets obtained from their respective breakfast and lunch meals were not statistically different at the 0.05 level. For the dinner meal, the mean percent of energy obtained by the 0-1 female group was significantly lower than the percent obtained by any other male or female group; these other groups were not significantly different. There were significant differences among the mean percent of energy intakes obtained from breakfast, lunch, and dinner. The mean percent of energy obtained from breakfast by

all groups was significantly lower than the percents obtained from either lunch or dinner. With three exceptions, the mean percent of energy obtained by each group from lunch and dinner were not statistically different; the 4-5 male and female groups and the 2-3 female groups each obtained a significantly higher percent of energy from dinner than from lunch ($p < 0.05$).

Figure 13. Mean Percent Energy Intake from Meals and Snacks

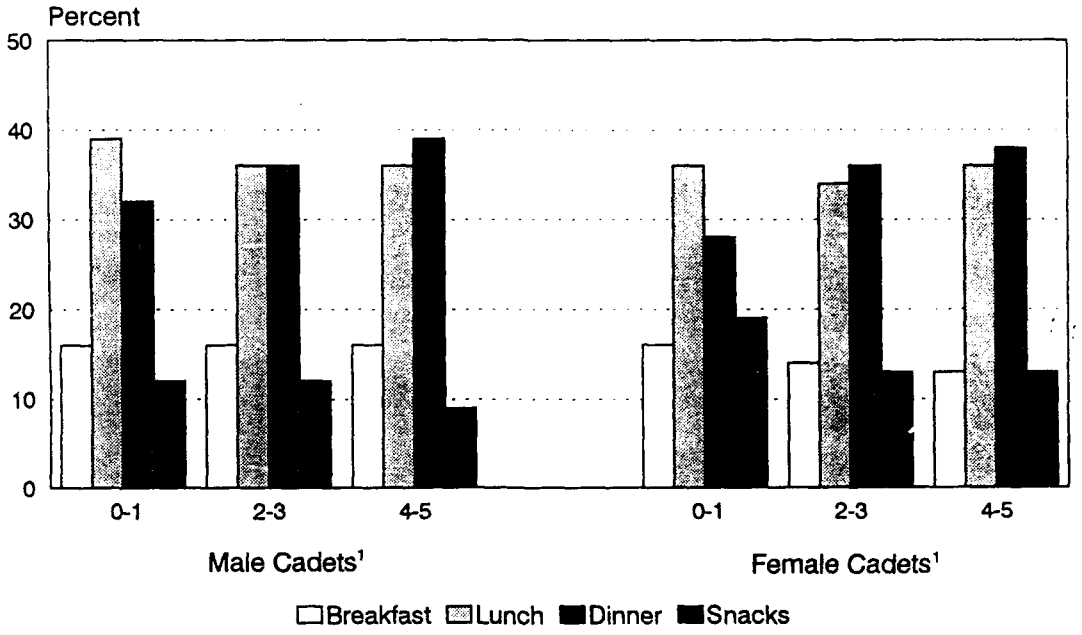


[1]Study groups based on number of meals consumed in the Cadet Mess

Figure 14 displays the mean percent of protein obtained from meals and snacks for the groups. Breakfast provided an average of 16% of the protein intake of each male group, and from 13% to 16% of the intakes of the three female groups. Lunch provided from 36% to 39% of the male groups' protein intakes, and from 34% to 36% of the female groups' intakes. Dinner provided from 32% to 39% of the male groups' protein intakes, and from 28% to 38% of the female groups' intakes. Snacks provided 9% to 12% of the male groups' and 13% to 19% of the female groups' intakes of protein. Snacks comprised of Cadet Mess food provided from 2% to 4% of the mean

protein intake of the six groups. There were no significant differences among the mean percent protein intakes that any of the six groups obtained from their breakfast and lunch meals. The mean percent intakes of protein obtained from dinner by both the male and female 0-1 groups were not different; however, the female 0-1 group's intake was significantly lower than any of the other groups and the male 0-1 group was significantly lower than the 4-5 male group. The mean percent intake of protein obtained from snacks was highest for the 0-1 female cadet group ($p < 0.50$). The mean percent protein intake obtained from snacks of the 4-5 male group was the lowest and was significantly different from the percentages obtained from snacks by both the male and female 2-3 groups. ANOVAs conducted across the data for all meals determined there were differences among the mean percentages of protein provided by breakfast, lunch, and dinner. The percentages of protein intake obtained from breakfast by all groups were significantly lower than that obtained from lunches and dinners. The 0-1 male and female groups each obtained a significantly higher percentage from lunch than from dinner; the 4-5 male group obtained a significantly higher percentage from dinner than from lunch; and the percentages that all other groups obtained from lunch and dinner were not statistically different.

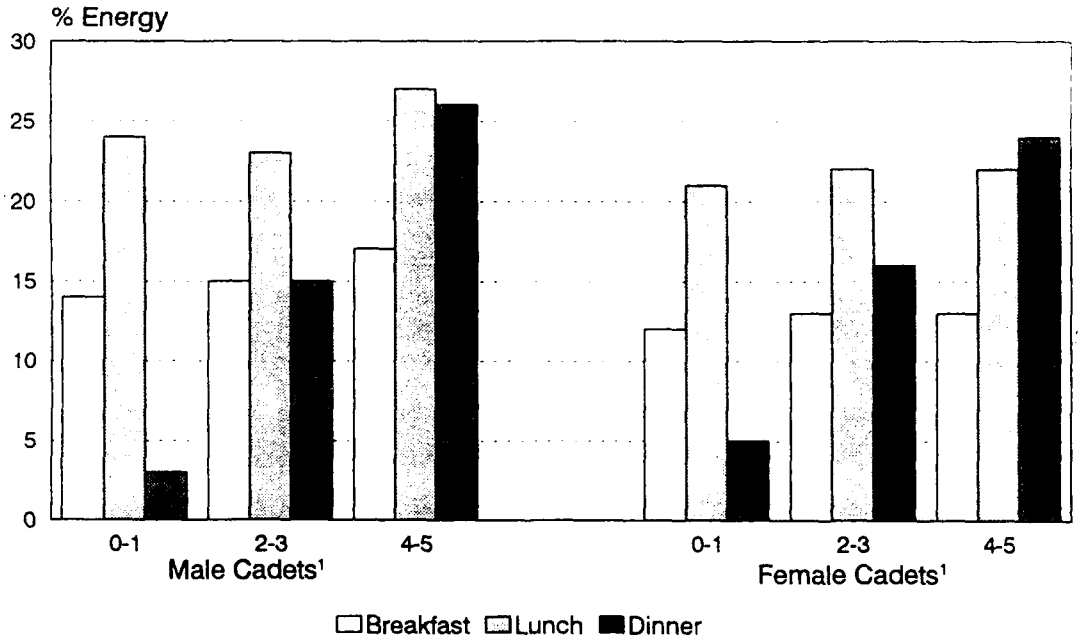
Figure 14. Percent of Mean Protein Intake from Meals and Snacks



[1]Study groups based on number of evening meals consumed in the Cadet Mess

Figures 15 displays the distribution (percentages) of the mean daily energy intake from meals consumed in the Cadet Mess for each group. All groups (except the 4-5 female group) obtained their highest mean percent of energy intake from lunch. The 4-5 female group obtained its highest percentage of energy from dinner. Statistical comparisons of the percentages of energy supplied by breakfasts, lunches, and dinners across all male and female groups determined that for both breakfast and lunch, the only significant differences were between the 4-5 male and the 0-1 female group intakes ($p < 0.05$). Within each gender, the percentage of energy obtained from the dinner meal by each of the three groups were significantly different; however, there were no significant gender differences between the respective 0-1, 2-3, and 4-5 male and female groups. When the percentages of mean energy obtained from breakfast, lunch, and dinner were compared within each group, significant differences were found among each of the three meals for both 0-1 male and female groups, and for the 4-5 female group; between breakfast and lunch, and lunch and dinner (but not breakfast and dinner) for both 2-3 male and female groups; and between breakfast and lunch, and breakfast and dinner (but not lunch and dinner) for the 4-5 male group.

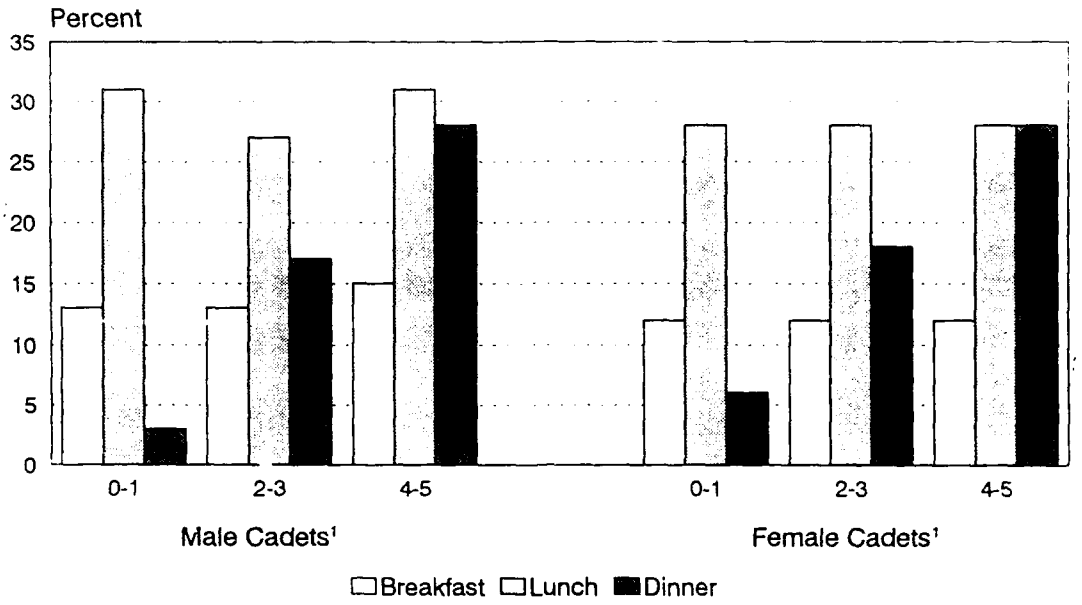
Figure 15. Percent of Mean Energy Intake from Cadet Mess Meals



[1]Study groups based on the number of weekday evening meals consumed in the Cadet Mess

Figures 16 displays the distribution (percentages) of the mean daily protein intakes from meals consumed in the Cadet Mess for each group. All groups (except the female 4-5 group) obtained the highest percentage of their mean protein intake from lunch. The female 4-5 cadet group obtained equal percentages of their protein intake at lunch and dinner. Statistical analyses conducted on meals across the percentages of protein intakes obtained from breakfasts, lunches, and dinners for both genders found no significant differences among any of the breakfast or lunch group intakes. Each of the three male and female groups' dinner protein intakes were significantly different ($p < 0.05$), but the male and female dinner intakes of the respective 0-1, 2-3, and 4-5 groups were not different. When the percentages of mean protein intakes from breakfast, lunch and dinner were compared within each group, significant differences were found among each of the three meal intakes of the 0-1 and 2-3 groups of both genders. Significant differences were found between the breakfast and lunch intakes, and the breakfast and dinner intakes (but not between the lunch and dinner intakes) of both 4-5 male and female groups.

Figure 16. Percent of Mean Protein Intake from Cadet Mess Meals



[1]Study groups based on the number of weekday evening meals consumed in the Cadet Mess

Figure 17 shows the distribution of energy from Cadet Mess meals by gender. Lunch was the biggest contributor providing 25% of the mean energy intake of the

male cadets. and 22% of the mean energy intake for the female cadets. Statistical comparison of the mean percentage of energy intake obtained from each meal by gender showed that, for each gender, the differences between the percentages of energy obtained from breakfast and lunch, and from dinner and lunch were significant ($p < 0.05$); however, there were no significant differences between the percentages obtained from breakfast and dinner. However, when the percentages of mean energy intakes of all males (n=119) and all females (n=86) were compared by meal, there were significant gender differences ($p < 0.05$) for each meal: the male intake was always higher than the female intake for the same meal.

Figure 17. Percent of Mean Energy Intake Contributed by Cadet Mess Meals by Gender

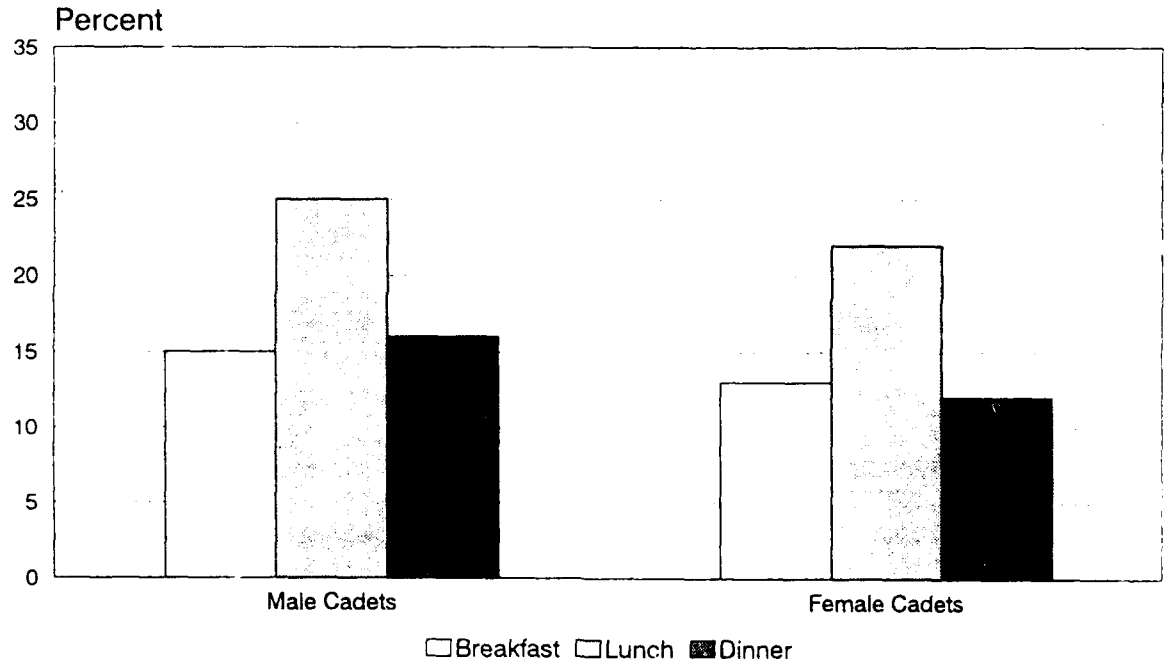
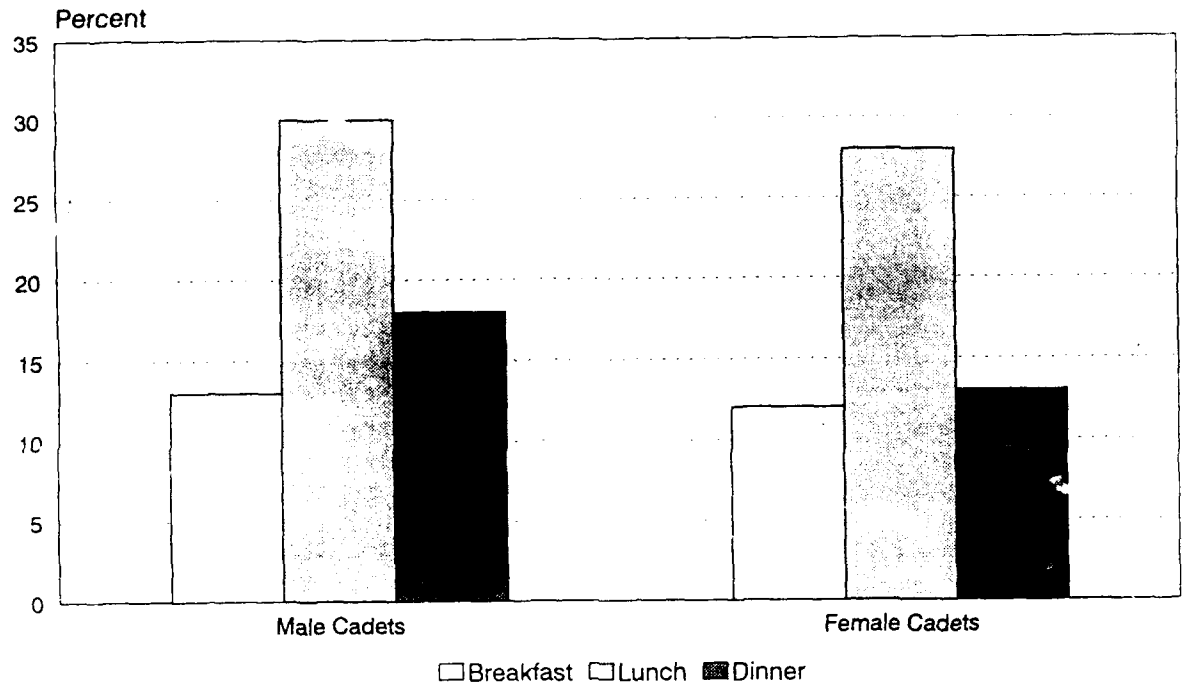


Figure 18 shows that the male cadets received 30%, and the female cadets 28% of their total protein intakes from Cadet Mess lunches. Statistical comparison of the percentage of protein intake provided by each meal by each gender showed that, for both genders, the differences between the percentages of protein supplied by breakfast and lunch, and by dinner and lunch were significant, but the difference in the percentages between breakfast and dinner was not significant. There were significant differences ($p < 0.05$) between the percentages of mean protein supplied by the dinner meals only by gender.

Figure18 . Percent of Mean Protein Intake Contributed by Cadet Mess Meals by Gender



Sources for weekday evening meals eaten away from the cadet mess for the combined male and female test population were. 16% from home, 16% from restaurants, and 68% from vendors (Appendix H).

Male and Female Groups: Nutritional Intakes from Snacks

Table 19 records the mean percent of total energy derived from snacks consumed before lunch (0500 to 1200 hours), between lunch and dinner (1200 to 1730 hours), early evening (1730 to 2200 hours), and late evening (2200 to 0500 hours). All groups received the highest percentages of their energy from snacks consumed in the early evening. Mean energy intakes from these early evening snacks ranged from 7% to 13% of the total mean energy. The data also show that all of the cadets in each of the three female groups, and in the 4-5 male group consumed some type of snack between lunch and dinner, and in the early evening.

Table 19. Mean Percent of Total Energy From Snacks Consumed by Cadet Groups by Time of Day[1]

Cadet Groups	Time (Hours)			
	0500-1200	1201-1730	1731-2200	2201-0459
Male Groups				
0-1	3 (n=22)	5 (n=29)	10 (n=29)	3 (n=23)
2-3	3 (n=31)	4 (n=38)	9 (n=41)	3 (n=35)
4-5	2 (n=33)	3 (n=46)	7 (n=46)	3 (n=35)
Female Groups				
0-1	5 (n=46)	9 (n=46)	13 (n=46)	3 (n=37)
2-3	4 (n=22)	7 (n=23)	9 (n=23)	3 (n=19)
4-5	3 (n=17)	7 (n=17)	9 (n=17)	5 (n=15)

[1]Exclusive of meal times (breakfast 0630-0700 hours, lunch 1200-1230 hours, and dinner 1730-1900 hours).

The sources of snacks that did not consist of Cadet Mess foods for the combined male and female test population were: 18% from home, 13% from restaurants, and 70% from vendors.

Comparison of Male and Female Cadets' Nutritional Intakes

The data presented in Tables 8 and 14 are summarized in Table 20 to show the incidence of risk of nutritional deficiency for male and female cadets side by side. This table combines all male cadets (n=119) and all female cadets (n=86), thus allowing for gender comparisons. The cadets were divided based upon MRDA compliance, that is, if mean daily nutrient intake was <70% MRDA, then intake was low; if intake was 70% to 99% MRDA, then intake was marginal; and if intake was ≥100% MRDA, then intake was adequate. Statistical comparisons of the data on Table 20 showed that, for all nutrients except three, the percentages of female cadets with mean intakes that met the MRDA were significantly lower than those of the male cadets; there were no gender differences for thiamin, riboflavin, and phosphorus.

Table 20. Percent of Cadets with Mean Intakes at Selected Levels of the MRDA[1]

Nutrients	% of Male Cadets (n=119)			% of Female Cadets (n=86)		
	Selected levels of the MRDA			Selected Levels of the MRDA		
	< 70%	70%-99%	≥ 100%	<70%	70%-99%	≥ 100%
Energy	2^a	28^m	71^x	10^b	45^n	44^y
Protein	$-^a$	14^m	86^x	10^b	37^n	52^y
Vitamin C	-	2	98^x	2	7	91^x
Thiamin	-	1	99	-	2	98
Riboflavin	-	2	98	-	2	98
Niacin	-	$-^m$	100^x	-	7^n	93^y
Vitamin B_6	2^a	19^m	79^x	14^b	31^n	55^y
Folacin	9^a	21	70^x	28^b	27	45^y
Vitamin B_{12}	$-^a$	1	99^x	7^a	10	83^y
Vitamin A	4^a	13	82^x	12^b	21	67^y
Calcium	$-^a$	3^m	97^x	5^b	20^n	75^y
Phosphorus	-	-	100	1	1	98
Magnesium	2^a	15^m	82^x	9^b	38^n	52^y
Iron	$-^a$	$-^m$	100^x	7^b	26^n	67^y
Zinc	2^a	16^m	82^x	29^b	38^n	33^y

[1]*Military Recommended Dietary Allowances* (AR 40-25, 1985). NOTE: Statistical comparisons were made between genders at each MRDA level; percentages with different superscript letters are significantly different ($p < 0.05$); the letters a and b were used for < 70% MRDA; m and n were used for 70-99% MRDA; and x and y were used for ≥100% MRDA.

The mean macronutrient distribution of energy for the male cadets was 15% from protein, 32% from fat, 54% from carbohydrate, and 1% from alcohol (ethanol); for the female cadets, the percentages were the same except for protein which was 14%.

The data presented in Tables 9 and 15 (percent of male and female cadets' mean intakes without nutritional supplements at selected levels of the MRDA) are summarized by gender on a side by side basis in Table 21. Statistical comparison of

Table 21. Percent of Cadets with Mean Intakes (Without Nutritional Supplements) at Selected Levels of the MRDA[1]

Nutrients	Male Cadets (n=119)			Female Cadets (n=86)		
	Selected levels of the MRDA			Selected Levels of the MRDA		
	< 70%	70%-99%	≥ 100%	<70%	70%-99%	≥ 100%
Energy	2^a	28^m	71^x	10^b	45^n	44^y
Protein	$-^a$	14^m	86^x	10^b	37^n	52^y
Vitamin C	-	2^m	98^x	2	12^n	86^y
Thiamin	-	1	99	-	5	95
Riboflavin	-	2	98	-	4	95
Niacin	-	2^m	98^x	-	10^n	90^y
Folacin	9^a	22^m	69^x	31^b	36^n	33^y
Vitamin B_6	2^a	20^m	78^x	18^b	35^n	46^y
Vitamin B_{12}	$-^a$	1^m	99^x	8^b	15^n	77^y
Vitamin A	5^a	13^m	82^x	13^b	23^n	64^y
Calcium	$-^a$	3^m	97^x	5^b	22^n	73^y
Phosphorus	-	-	100	1	1	98
Magnesium	2^a	15^m	82^x	9^b	38^n	52^y
Iron	$-^a$	$-^m$	100^x	9^b	31^n	59^y
Zinc	2^a	16^m	82^x	30^b	40^n	30^y

[1]Military Recommended Dietary Allowances (AR 40-25, 1985). NOTE: Statistical comparisons were made between genders at each MRDA level; percentages with different superscript letters are significantly different ($p < 0.05$); the letters a and b were used for < 70% MRDA; m and n were used for 70-99% MRDA; and x and y were used for ≥100% MRDA.

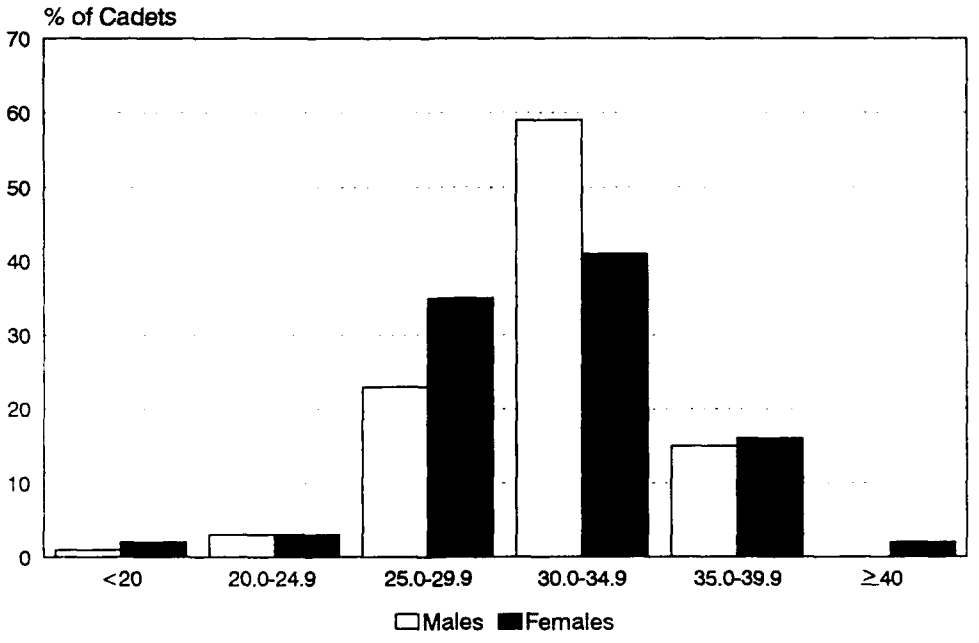
the data for male and female cadets at each selected level of the MRDA showed that, except for three nutrients, the percentages of male cadets that met the MRDA were

significantly higher than the corresponding percentages for the female cadets; the male and female values for thiamin, riboflavin, and phosphorus were not different.

Comparison of data presented in Tables 20 and 21 emphasize the importance of nutritional supplements in reducing the risk of nutritional deficiency in female cadets. Without nutritional supplements, fewer female cadets would have had adequate mean intakes of the vitamins, iron, and zinc. In fact, without supplementation, only 33% of the folacin intakes, 46% of the vitamin B_6, and 30% of the zinc intakes of the female cadets would have met the MRDA.

Figure 19 summarizes the data presented in Tables 10 and 16 by gender. Only 1% of the males and 2% of the females derived less than 20% of their total energy (kcal) from fat. Twenty-three percent of the male and 35% of the female cadets obtained between 25% to 30% percent of their energy from fat. Fifty-nine percent of the male and 41% of the female cadets obtained between 30% to 35% of their energy from fat; these are the only two values that were significantly different ($p < 0.05$). Eighty-five percent of all male and 81% of all female cadets derived less than 35% of their energy intakes from fat; however, these percentages were not statistically different.

Figure 19. Percent of Cadets Obtaining Specified Percentages of Food Energy From Fat



NUTRITIONAL INTAKE COMPARISONS BETWEEN 1979 AND 1990 STUDIES

Table 22 shows some of the similarities as well as the differences between the nutritional intakes in the 1979 and the 1990 nutrition studies.

Table 22. Comparisons Between the 1979 and 1990 West Point Nutrition Studies

Data[1]	1979 Nutrition Study		1990 Nutrition Study	
	Males (n=136)	Females (n=54)	Males (n=119)	Female (n=86)
Mean energy intake, kcal	3738	2454	3654	2314
Energy/kg of body wt, kcal	49.2	41.1	47.4	37.8
Protein/kg of body wt, g	1.6	1.5	1.7	1.3
Cadets taking nutritional supplements, %	15	50	13	35
Nutrients with mean intake < MRDA	None	Fe, Mg, Zn,Ca, Folacin	None	Protein, Zn
Macronutrient distribution, %				
Protein	13	13	15	14
Fat	38	38	32	32
Carbohydrate	46	46	54	54
Alcohol	3	3	1	1
Cadets with energy fat intake, %				
<35%	18	11	85	81
35% to 40%	50	50	15	16
40% to 45%	30	30	0	2
>45%	3	3	0	0
Mean daily cholesterol intake, mg	600	400	420	234

[1]Sodium data are not included as discretionary salt was not assessed in the 1979 study.

Comparisons of the mean intakes of specific nutrients between the 1979 and 1990 studies can only provide trends that suggest changes because during the intervening decade many changes have occurred both in the food supply and in food composition databases which would affect the validity of such a comparison. New, reformulated, and modified food products are continuously being marketed as manufacturers strive to improve acceptance, nutrition, shelf life, and stability and to

satisfy new consumer demands. Thus, one cannot be sure that even a brand name product available in 1979 is nutritionally identical to the same product available in 1990. Changes have also occurred in the USDA nutrition databases since Kretsch et al. published their report in 1985. This compounds the problem since a valid comparison of dietary intakes between studies requires that the same nutrient database be used for both studies. However, comparisons of the percentages of male and female cadets with mean daily intakes at selected levels of the MRDA between the two studies provide some insight regarding changes that may have occurred in dietary intake patterns. Tables 23 and 24 summarize these data. Both tables reflect the nutrient intakes with the nutritional supplements included. The mean nutrient intakes of the male cadets in both studies (Table 23) provided comparable proportions of the respective MRDAs for protein, calcium, phosphorous, and iron. The percentages reported for mean dietary intakes that were marginal in thiamin, niacin, and vitamin A were significantly lower in the 1990 study than in the 1979 study ($p < 0.05$).

Table 23. Comparison Between the 1979 and 1990 Nutrition Studies of Percents of Male Cadets with Mean Daily Nutritional Intake at Selected Levels of the MRDA[1,2]

Nutrients	1979 (n=136)			1990 (n=119)		
	Selected levels of the MRDA			Selected Levels of the MRDA		
	< 70%	70%-99%	≥ 100%	<70%	70%-99%	≥ 100%
Protein	1	13	86	0	14	86
Vitamin C	2	1	97	0	2	98
Thiamin	2	20	79	0	1	99
Riboflavin	0	6	94	0	2	98
Niacin	1	9	90	0	0	100
Vitamin A	6	25	69	0	13	82
Calcium	0	5	95	0	3	97
Phosphorus	0	0	100	0	0	100
Iron	0	1	99	0	0	100

[1]Military Recommended Dietary Allowances (AR 40-25, 1985).

[2]Data on folacin, magnesium, and zinc were not reported for the 1979 study because food composition data for these nutrients was limited.

The percentages of female cadets with mean daily intakes of thiamin, riboflavin, niacin, calcium, phosphorus, and iron that met the MRDA (Table 24) were significantly lower in the 1979 study than were the percentages reported for these same nutrients in the 1990 study ($p < 0.05$).

Table 24. Comparison Between the 1979 and 1990 Nutrition Studies of Percents of Female Cadets with Mean Daily Nutritional Intake at Selected Levels of the MRDA[1,2]

Nutrients	1979 (n=54)			1990 (n=86)		
	Selected levels of the MRDA			Selected Levels of the MRDA		
	< 70%	70%-99%	≥ 100%	<70%	70%-99%	≥ 100%
Protein	11	32	57	10	37	52
Vitamin C	2	4	94	2	7	91
Thiamin	6	15	80	0	2	98
Riboflavin	2	11	87	1	2	98
Niacin	7	17	76	0	7	93
Vitamin A	7	19	74	12	21	67
Calcium	11	33	56	5	20	75
Phosphorus	2	9	89	1	1	98
Iron	26	41	33	7	26	67

[1]Military Recommended Dietary Allowances (AR 40-25, 1985).
[2]Data on folacin, magnesium, and zinc were not reported for the 1979 study because food composition data for these nutrients were limited.

ANTHROPOMETRIC/BIOCHEMICAL AND NUTRITIONAL DATA COMPARISONS

Friedl et al. (1990) presented the anthropometric and biochemical results in an earlier report. We present comparisons of these measurements with nutritional intake in this report.

Cadets eating the fewest meals in the Cadet Mess were heavier (based on body mass index) and had slightly more fat by either the skinfold equation of Durnin & Womersley (men) or by the Army circumferential method (women). These higher body fat measurements remained below the upper limit in the Army standards for

men, 22%, and for women, 28% (at the time of the study) and 30% (now). Serum LDL-cholesterol was highest for the men eating most of their evening meals in the Cadet Mess (100±28 mg/dL) but this was still well below the 130 mg/dL cutoff recommended for dietary intervention. No other serum lipids were significantly different in this breakout, including total serum cholesterol (Table 25).

Table 25. Body Composition[1] and Serum Lipids[1] Compared by Study Group for Male and Female Cadets

Parameter	Number of Weekday Evening Meals		
	0-1	2-3	4-5
Male Cadets	(n=31)	(n=42)	(n=46)
Body weight, kg	78.5±10.1	75.7±9.5	75.2±7.5
BMI*, kg/m^2	25.5±2.3^a	24.2±2.0^b	24.2±1.7^b
Body fat,%$_{AR\ 600\text{-}9}$	13.1±3.4	11.7±3.0	11.7±2.6
Body fat,%$_{sknfld}$	15.4±3.6^a	13.7±2.9^b	12.9±3.0^b
Cholesterol, mg/dL	143±29	150±28	160±28
LDL-chol, mg/dL	82±24^a	89±26^{ab}	100±28^b
Female Cadets	(n=46)	(n=23)	(n=17)
Body weight, kg	62.6±4.9	60.6±6.9	61.4±6.2
BMI, kg/m2	23.0±1.7^a	22.7±1.6^a	21.4±1.7^b
Body fat,%$_{AR\ 600\text{-}9}$	27.3±3.0^a	27.1±2.5^a	24.0±3.5^b
Body fat,%$_{sknfld}$	24.4±3.8	23.4±3.2	23.0±2.6
Cholesterol, mg/dL	164±28	148±25	153±28
LDL-chol, mg/dL	94±24^a	77±21^b	87±25^{ab}

[1]Mean ± SD; values with different superscript letters within a row are significantly different ($p < 0.05$).

*BMI = body mass index.

No significant differences in body composition were detected by level of energy intake (Table 26). The cadets with the highest energy intakes were clearly not the fattest in the sample although they tended to be heavier. There was a trend for the

"fattest" cadets to have the lowest energy intakes. There was also no difference by level of fat intake.

Table 26. Body Composition Compared by Level of Energy Intake (quartiles[1] within gender)

Parameter	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
Male Cadets	(n=30)	(n=30)	(n=29)	(n=30)
Energy intake, kcal	2211-3143	3156-3538	3580-3952	3970-6094
Body weight, kg	75.5±10.2	75.6±6.1	74.9±8.4	80.1±10.7
BMI*, kg/m^2	25.1±3.4	24.5±1.9	24.3±1.9	24.3±2.1
Body fat, $\%_{AR\ 600\text{-}9}$	12.8±3.5	11.9±2.4	11.8±2.8	11.8±3.2
Body fat, $\%_{sknfld}$	14.8±3.7	13.9±2.8	13.8±3.7	12.7±2.7
Female Cadets	(n=21)	(n=21)	(n=22)	(n=22)
Energy intake, kcal	604-1993	2002-2297	2310-2603	2694-3389
Body weight, kg	60.4±6.1	60.7±6.8	63.9±5.1	62.3±4.6
BMI, kg/m^2	22.9±2.0	22.6±1.8	23.0±1.7	22.0±1.5
Body fat, $\%_{AR\ 600\text{-}9}$	27.7 ± 3.4^{a}	26.4 ± 3.0^{ab}	27.2 ± 3.2^{ab}	25.1 ± 2.9^{b}
Body fat, $\%_{sknfld}$	23.7±3.9	23.9±3.7	24.9±3.4	22.7±2.6

[1]Mean ± SD; values with different superscript letters within a row are significantly different ($p < 0.05$); comparisons by quartiles of fat intake yielded no significant difference.

*BMI = body mass index.

Serum lipids were relatively unaffected by energy intake. The only significant difference was a reduced cholesterol in men with the highest energy intakes (Table 27). In the previous table, this was the group with lowest (not significant) body fat and may correspond to a group of athletic cadets with the highest energy expenditures.

Female cadets demonstrated a nonsignificant trend of an inverse relationship between energy intake and sex hormone binding globulin (SHBG). The SHBG and insulin differences were more pronounced for the female cadets when compared on the basis of saturated fat intakes; but, there were no meaningful differences in serum lipids (Table 28).

Table 27. Serum Lipids & Hormones Compared by Level of Energy Intake (quartiles[1] within gender)

Parameter	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
Male Cadets	(n=30)	(n=30)	(n=29)	(n=30)
Energy intake, kcal	2211-3142	3156-3538	3580-3952	3970-6094
Cholesterol, mg/dL	151±30^{ac}	158±29^{ab}	161±28^{ab}	139±24^{c}
HDL-chol, mg/dL	43±9	44±11	46±8	45±8
LDL-chol, mg/dL	90±29^{ab}	97±26^{a}	98±27^{ab}	79±23^{b}
Triglycerides, mg/dL	86±42	85±83	84±35	73±23
Chol/HDL-chol ratio	3.6±1.0	3.5±0.9	3.4±0.8	3.1±0.5
Apolipoprotein AI	115±25	118±26	120±22	122±25
Apolipoprotein B	67.5±20.1	68.4±20.1	71.6±22.0	59.8±15.9
Apo AI/Apo B ratio	1.9±1.0	1.9±0.7	1.9±0.8	2.0±0.7
Insulin	13.7±3.7	13.1±3.1	12.8±2.5	11.7±2.6
DHEAS	287±118	296±131	316±117	334±165
SHBG, nmol/L	22.5±21.2	24.1±8.0	23.6±9.5	22.7 ± 8.7
Female Cadets	(n=21)	(n=21)	(n=22)	(n=22)
Energy intake, kcal	604-1993	2002-2297	2310-2603	2694-3389
Cholesterol, mg/dL	163±29	155±26	152±27	157±30
HDL-chol, mg/dL	54±11	59±12	53±8	57±14
LDL-chol, mg/dL	96±21	83±22	86±23	86±30
Triglycerides, mg/dL	76±42	69±21	66±14	73±21
Chol/HDL-chol ratio	3.0±0.5	2.7±0.5	2.8±0.5	2.8±0.7
Apolipoprotein AI	128±23	133±31	121±22	125±26
Apolipoprotein B	68.9±19.3	63.8±16.4	59.6±14.3	65.4±17.7
Apo AI/Apo B ratio	2.0±0.5	2.2±0.7	2.1±0.6	2.1±0.7
Insulin	11.2±2.9	12.4±3.3	12.4±2.4	13.2±4.2
DHEAS	228±162	169±74	242±103	193±73
SHBG, nmol/L	67.1±31.5	58.8±39.1	51.6±31.2	46.3±22.3

[1]Mean ± SD; values with different superscript letters within a row are significantly different ($p < 0.05$).

Table 28. Serum Lipids & Hormones Compared by Level of Saturated Fat Intake (quartiles[1] within gender)

Parameter	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
Male Cadets	(n=30)	(n=30)	(n=29)	(n=30)
Saturated fat intake	18-38	38-43	43-49	50-67
Cholesterol, mg/dL	148±33	154±26	155±23	151±34
HDL-chol, mg/dL	40±6[a]	47±11[b]	46±6[ab]	44±8[ab]
LDL-chol, mg/dL	89±31	90±25	93±23	91±31
Triglycerides, mg/dL	85±40	85±35	80±33	78±27
Chol/LDL-chol ratio	3.5±0.8	3.4±1.0	3.3±0.7	3.4±0.8
Apolipoprotein AI	119±27	118±24	123±23	115±23
Apolipoprotein B	66.7±19.2	65.9±18.1	67.2±19.7	68.0±23.0
Apo AI/Apo B ratio	1.9±0.7	2.0±1.0	2.0±0.8	1.8±0.6
Insulin	13.9±3.5	13.0±3.3	11.9±2.7	12.4±2.5
DHEAS	258±104	325±125	334±176	308±98
SHBG, nmol/L	24.7±21.0	21.3±9.0	23.4±8.9	24.7±13.0
Female Cadets	(n=21)	(n=21)	(n=22)	(n=22)
Saturated fat intake	4-22	22-28	29-34	34-49
Cholesterol, mg/dL	163±26	156±31	160±32	151±21
HDL-chol, mg/dL	55±10	58±12	56±14	54±9
LDL-chol, mg/dL	94±20	84±24	90±32	83±19
Triglycerides, mg/dL	79±41	65±22	70±20	69±16
Chol/LDL-chol ratio	3.0±0.5	2.7±0.5	2.8±0.6	2.8±0.5
Apolipoprotein AI	129±19	129±34	127±23	124±21
Apolipoprotein B	70.9±18.5	62.2±19.0	66.6±13.3	56.9±14.9
Apo AI/Apo B ratio	1.9±0.5	2.2±0.8	2.0±0.6	2.3±0.7
Insulin	10.8±2.9[a]	11.8±3.0[ab]	12.9±3.3[ab]	13.9±3.4[b]
DHEAS	239±154	179±90	210±90	201±93
SHBG, nmol/L	62.2±32.2	62.1±35.7	40.2±24.1	58.0±31.2

[1]Mean ± SD; values with different superscript letters within a row are significantly different ($p < 0.05$).
Note: There was no detectable effect of oral contraceptive use on serum lipids

Serum markers of iron status were not significantly affected by iron intakes (including estimates from supplements) but there was a trend for female cadets who had the lowest iron intakes to be most affected by the physiological challenge of a blood donation. In the third of female cadets with the lowest iron intakes, iron ([mean ± SD] 90 ± 45 vs. 42 ± 25; t-test, $p < 0.01$) and ferritin (23 ± 14 vs. 11 ± 9; t-test, $p < 0.01$) concentrations were halved if the cadets had given blood in the previous week (Table 29). This level of iron was below the normal range (50-150 µg/dL) and the ferritin level was typical of an iron deficiency (deficient: 0-12 ng/mL; borderline deficient: 13-20 ng/mL; normal: >20 ng/mL).

Table 29. Iron & Hematological Status Compared by Level of Iron Intake in Female Cadets (tertiles[1])

Parameter	1st Tertile (n=29)	2nd Tertile (n=26)	3rd Tertile (n=29)
Women who did not donate blood in the week prior to testing	(n=13)	(n=12)	(n=13)
Iron intake[2], mg	8.7-18.2	18.2-24.2	24.4-147.5
Serum iron, µg/dL	90±45	61±42	75±27
Serum TIBC	328±50	354±74	327±43
Serum iron saturation	29±15	18±12	23±9
Serum ferritin	23±14	12±9	19±10
Hemoglobin	12.7±0.8	12.3±9	12.7±1.1
Women who donated blood in the week prior to testing	(n=16)	(n=14)	(n=16)
Iron intake[2], mg	8.7-18.2	18.2-24.2	24.4-147.5
Serum iron	42±25	42±30	76±67
Serum TIBC	363±65	347±47	339±40
Serum iron saturation	13±10	13±11	23±20
Serum ferritin	11±9	10±6	13±9
Hemoglobin	11.7±0.7	11.9±0.6	11.8 ± 0.6

[1]Mean ± SD; values were not different within a row.
[2]Minimum and maximum values within each tertile.

DISCUSSION

The Cadet Mess Menus indicate that the USMA staff has moderated the total fat, saturated fat, cholesterol, and salt content of the food served. These menus comply with the Department of the Army Nutrition Initiatives (AR 30-1, 1988) and with the Surgeon General's recommendations on nutrition and health (DHHS, 1988). The menus also met the MRDA and the NDI guidelines. However, a meal served does not necessarily constitute a meal consumed. Although the Cadet Mess Menus were nutritionally adequate by menu analysis, only 50% of the cadets participated in the weekday evening meal.

Nutritional assessments of this magnitude have some inherent difficulties because of the wide variety of food establishments (250) available to the cadets compounded by the difficulty of procuring recipes from them. Therefore, we were forced to use the standard portion sizes included in the computerized nutrient databases for similar food items when the self-reported unit was "serving." These computerized nutrient databases were also used to determine the nutritional content of the food intakes, since it was impractical to send food samples for individual chemical and vitamin analysis. Nutrient databases are considered acceptably accurate and are commonly used in similar nutritional studies. However, since all of the USMA cadets (> 4000 cadets) were fed at one sitting, most of the hot food was prepared in large batches, portioned into 10-serving dishes, and held heated in an electric cart (food warmer) for up to two hours before serving. Thus, it must be assumed that there were some losses of the heat labile vitamins (particularly thiamin and vitamin C). While the USDA processing codes provided for reheated products were always applied to one cooked recipe in computing its nutrient content, it is not known if these estimated allowances for a nutrient loss were adequate to cover those incurred in this study. Furthermore, lack of food composition data for vitamin D, vitamin E, and iodine precluded the evaluation of the menus and intakes of these nutrients. The data on dietary fiber were not available from many food manufacturers; therefore, the dietary fiber data reported may underestimate the dietary fiber intake.

The mean nutritional intakes of male cadets in each study group were well within the MRDA. The greater the number of evening weekday meals consumed in the Cadet Mess, the higher the nutritional intake. Statistically significant ($p < 0.05$)

differences were noted for intakes of several nutrients as a function of the number of evening meals consumed in the Cadet Mess. But, this may be of little clinical consequence considering the MRDA was surpassed. All male cadets met the body fat standards, with mean body fat (12%) well below the upper limits of body fat allowed (ages <21: 20%, ages 21-27: 22% body fat). The intakes of total fat, saturated fat, cholesterol, and sodium observed in this study were not excessively high and, in fact, indicated a substantial decrease in the consumption of fat and cholesterol compared to the 1979 study.

Breaking the data into selected levels of the MRDA revealed the individuals that may have been at a higher risk of developing nutritional deficiencies. We chose to use the same levels selected by Kretsch et al. in 1979 in order to facilitate comparisons with that study. Despite the high mean nutritional intakes, some male cadets still consumed less than 70% of their nutritional requirements placing them at increased risk of nutritional deficiencies. This points out the necessity for examining individual nutrient intakes within group means.

The female cadets' mean nutritional intakes present a picture similar to that of the male cadets, except that the 0-1 group mean intake was lower than the MRDA for protein, magnesium, and zinc. Once again, statistically significant ($p < 0.05$) differences were noted among the intakes of the female groups although (with the exception already mentioned) the three study groups' mean nutritional intakes exceeded the MRDA. For some nutrients, the greater the number of evening weekday meals consumed in the Cadet Mess, the higher the nutritional intake. For others, there was no detectable pattern.

Instead of examining means, the proportion of individuals not meeting the MRDA is more revealing. The percentages of female cadets who consumed less than 70% of the MRDA were surprisingly high, and they were mainly in the group eating 0-1 weekday evening meal in the Cadet Mess. Folacin is notable in this respect; although more female cadets in the 0-1 group (35%) consumed less than 70% of the MRDA, 17% and 24% of the respective 2-3 and 4-5 groups also consumed less than 70% of the MRDA. While low intakes of folacin in pregnant females have been associated with birth defects (Scott et al., 1990), the USMA female cadets are probably not at risk for a folacin deficiency in view of the fact that the current MRDA

for folacin is twice the RDA for folacin. Revised in 1989, the current RDA for folacin is 180 mcg for nonpregnant and nonlactating females (200 mcg for males) (Recommended Dietary Allowances, 1989). If the mean intakes of the USMA cadets in the study had been evaluated against the current folacin RDA, only 5% of the female intakes would have been marginal (i.e., provided 70%-99% of the RDA). Low zinc intake, was noted in 43% of the female cadets in the 0-1 group; however, a true zinc deficiency is rarely seen in this country. Twenty-four percent of the female cadets in the 0-1 group had low intakes of vitamin B_6. Low vitamin B_6 intake is associated with anemia and could result in reduced work capacity. Only 52% percent and 75% of all female cadets in the study met the respective MRDA for magnesium and calcium. Low magnesium is associated with anorexia, muscle weakness, and irritability (Mahan & Arlin, 1989). Magnesium is also important for calcium and potassium homeostasis. A connection between dietary calcium and bone status has been demonstrated in older women, with results which suggest that high calcium intakes earlier in life result in increased bone mass in middle-aged and elderly women (Hu et al., 1993).

One third (33%) of the total study population consumed three or more TRIMM meals during the study, including 14% of male and 58% of female cadets. For the male cadets, 19%, 10%, and 15% of the respective 0-1, 2-3, and 4-5 male groups consumed TRIMM meals. This represents fewer than half of the number of men who reported that they were trying to lose weight (37%). The male cadet who commented "I would like to eat at the TRIMM tables but I just can't get enough food there," may have identified the reason for the low male participation. Male cadets eating at the TRIMM tables did not have higher weight or body fat than the other cadets.

Although 13% of female cadets slightly exceeded the standards of the Army Weight Control Program, more than four times as many female cadets ate TRIMM meals. The majority of these cadets were from the 0-1 group; however, 39% and 65% of the respective 2-3 and 4-5 female groups also ate at least three TRIMM meals. Since 86% of this 0-1 group indicated in their questionnaire responses that they were trying to lose weight, and 65% ate at the TRIMM tables, all low calorie intakes were undoubtedly deliberate. There were no differences (by t-test comparisons) in body composition, serum lipids, or iron status for cadets eating TRIMM meals compared to the remainder of female cadets. This suggests that actual body composition is not the primary determinant in a female cadet's menu selection. Some of the female cadets

involved in competitive sports commented that their food intakes were atypical because they were trying to cut their weight for a specific sporting event. While in the short term, low calorie intakes alone are not of great concern, when low energy intakes are accompanied by inadequate intakes of other essential nutrients, they must be considered as a probable cause of nutritional deficiency. Iron intake is a critical consideration because it tends to be inadequate for many women and because a deficiency has adverse consequences for physical and mental performance as well as health. The markers which are typically used and were used in this study, such as serum ferritin and hemoglobin concentrations, are relatively insensitive markers of iron deficiency. It has been suggested that other consequences, such as deficiencies in cellular immunity, can be observed before overt symptoms of anemia appear (Taylor et al., 1993). At the very least, cadets with long term mean energy intakes below 1200 kcal warrant nutritional counseling to ensure that they are not at nutritional risk.

Nine male cadets and one female cadet were authorized to eat at Heavy meal tables and 14 male and 6 female cadets were authorized to eat at Corps or Squad tables. However, three of the males cadets entitled to eat Heavy meals had mean energy intakes that were below the mean intake (3564 kcal) of all male cadets in the study. At least one of the three was deliberately trying to reduce his weight for a wrestling competition, thus the study week was probably an atypical one for him. There were no differences (by t-test comparisons) in body composition or serum lipids for male cadets actually eating Heavy meals, compared to other male cadets (with the exclusion of those eating TRIMM meals). Of the cadets authorized to eat at Corps or Squad tables, only six male and four female cadets actually had energy intakes that exceeded the mean energy intakes of all male or all female cadets. There were no differences (by t-test comparisons) in body composition or serum lipids for these ten cadets, compared to other male or female cadets (also with the exclusion of those eating TRIMM meals). This implies that the male and female cadets eating at Heavy or Corps/Squad tables were in energy balance and required the additional caloric intake: for the twelve males the average daily energy intake was 4342 kcal, or 19% greater than the average, and for the female cadets 2800 kcal, 20% greater than the average.

Eighty-five percent of the male cadets and 81% of the female cadets derived less than 35% of their energy intakes from dietary fat. Kretsch et al. (1986) reported

that only 18% of the male cadets and 11% of the female cadets consumed diets having less than 35% of kilocalories from fat, and that 30% of both the male and female cadets consumed diets that provided between 40%-45% of kilocalories from fat. The cholesterol intakes in this 1990 study were approximately 30% lower for the male cadets and 40% lower for the females than in the 1979 study.

There was a relationship between fatness (and weight) of cadets and the number of meals consumed in the Cadet Mess, but whether or not higher fat weight was directly related to alternative eating habits (i.e., eating outside of the Cadet Mess and/or skipping meals) cannot be determined from the data. Male and female cadets who ate the fewest evening meals in the Cadet Mess were heavier (when adjusted for variability in height) and fatter. The males and females taking the fewest meals in the Cadet Mess were fatter by either the skinfold equation (males) or by the Army circumference equation (females). Placed in proper perspective, this greater fatness is a minor finding because these "fat" group means (15.4% and 24.4% body fat, by skinfolds) are the values generally attributed to fit male and female means (15% and 25% body fat) (DOD, 1981). Thus, it is more meaningful to emphasize the extreme leanness of the groups eating more meals in the Cadet Mess. It would also be inappropriate to conclude that these results indicate that cadets gain fat weight as a result of excess fat and/or calories consumed outside of the Cadet Mess. The fatter cadets may have been eating fewer meals in the Cadet Mess in attempts to reduce caloric intake. This is suggested by the trend observed for cadets with the lowest calorie intakes being the "fattest."

The amount of fat in the diet is known to influence body composition and serum lipid levels, but it is not clear how rapidly this effect appears in the life cycle, or specifically, whether or not these influences of diet are readily apparent in young men and women. Fat in the diet of the cadets appears to have been reduced since the previous assessment of the Cadet Mess. Serum cholesterol levels have been reduced. This is probably not just a coincidental relationship because there is no indication that other health habits known to influence cholesterol levels have changed in the past decade. Within the current study group, there was no significant relationship between calorie or fat intake, except for a peculiar finding of a reduced LDL-cholesterol in the male cadets with the highest energy intakes. One speculation for this quirk is that this group may include many endurance athletes with high energy

expenditures which produce low body fat and reduce serum lipids. Mean values for all quartiles of energy and saturated fat intakes were all well below the 130 mg/dL value of LDL-cholesterol prescribed by the National Cholesterol Education Program as the threshold value for nutritional intervention (NCEP, 1988). The results of this study indicate that early changes which foretell lipid derangements are the only signs of high fat or high calorie intakes. These signs include primarily an increase in fasted insulin levels in the female cadets, and a trend toward a suppression of sex hormone binding globulin (SHBG) (Preziosi et al., 1993) in the female cadets with the highest saturated fat intakes. In this sample of men and women, insulin was the single best predictor (inverse relationship) of HDL-cholesterol from multiple regression analysis (Marchitelli and Friedl, 1991), and with this additional analysis of the intake data, serum insulin is, in turn, determined by the saturated fat intake in the female cadets. This connection between fasted insulin levels and saturated fat intakes has also been demonstrated in another recent study (Parker et al., 1993).

There have been several meal policy changes at USMA since this study was completed. The major changes include the substitution of four buffet lines, a soup and salad bar, and a "grab-and-go" line for the traditional "family-style" meal service at all evening dinner meals, except Thursday. On Thursday, attendance at the evening meal is again mandatory, and the traditional "family-style" meal service pattern is followed. Of course, this "family-style" meal service policy is still used for lunch and breakfast meals. Many menu changes have accompanied the meal service changes. Some of these are: the buffet lines offer a choice of two entrees (a pasta item and a meat), two vegetables, several desserts, and beverages (milk, fruit punch, and coffee); the salad bar contains lettuce and other salad greens, pickles, eggs, a variety of legumes, olives, etc., and thus enables vegetarian consumers to get adequate food intakes; and the "grab-and-go" line offers two turkey luncheon meats (with roast beef replacing one of the luncheon meats twice a month), a peanut butter and jelly mix, bread or rolls, chips or pretzels, fruit, celery and carrots sticks, a prepackaged dessert (cookie or muffin), and a 12-oz can of fruit juice or fruit punch. The cadets can have second portions of all menu items, except the entrees. The TRIMM menu served during the 1990 study is no longer available. However, since only 1% fat milk, fat-free salad dressings, and low-fat mayonnaise are now served in the Cadet Mess, cadets needing or choosing to eat a low-fat diet can make wise selections from the choices now available to them so that every table has the potential of being a diet table. The

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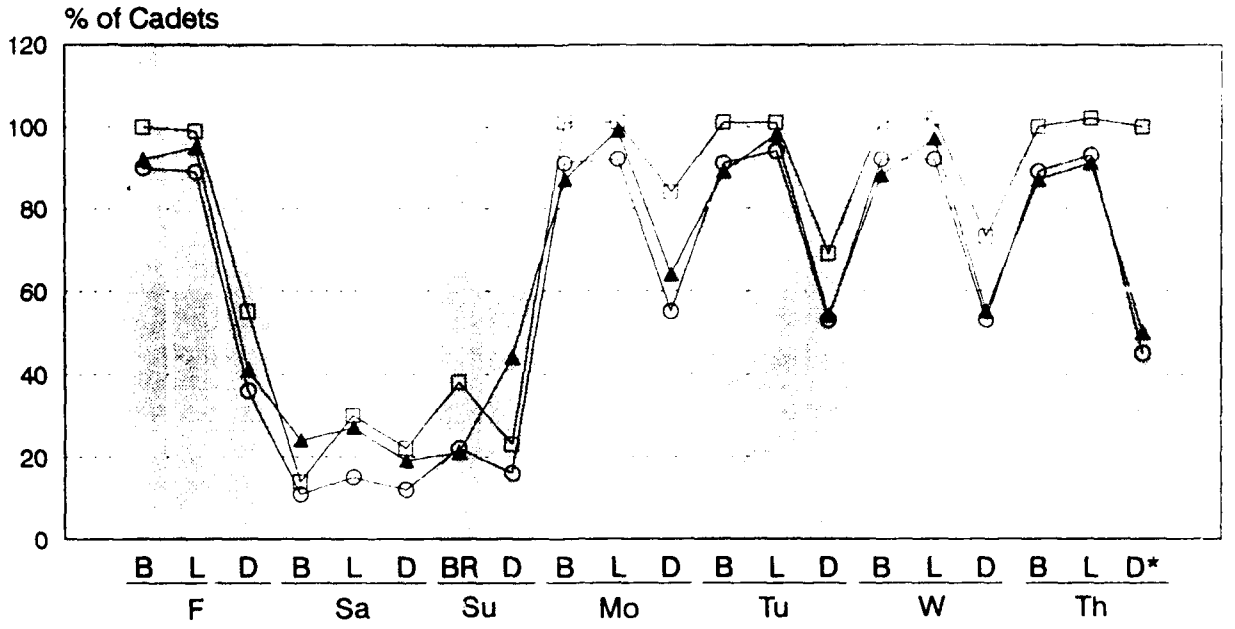
weekday evening meal changes, particularly the introduction of serving lines, have supported cooking of smaller batches of vegetables and some other foods, thus reducing the number of items that have to be prepared ahead and kept hot in food warmers. This positively affects the vitamin content of the food.

As in 1990, the cadets can review the Cadet Menu on their personal computers; however, guidelines added to the menu now give portion sizes and instructions for modifications to support an 1800-kcal dietary intake. Recently, a software package has been installed in the USMA computer which the cadets can access, put on their personal computer, and use to calculate the energy (kcal), protein, fat, and carbohydrate content of a food, meal, and daily menu. This should increase the cadets' awareness of their dietary intakes, and, along with the nutrition education and dietary consultation available to them through the USMA dietitian, should also help the cadets to assume responsibility for their own diets.

Accompanying the above changes has been a more permissive evening meal policy which allows the cadets to participate in the "grab-and-go" evening meal in gym attire. While still in the Cadet Mess dining area, the "grab-and-go" line is cordoned off from the main area. Cadets who participate in the buffet and soup and salad lines must still wear their uniforms. Before this policy, the cadets were required to wear their uniforms anytime they went to the Cadet Mess. Consequently, when the cadets were given the option of "skipping" the weekday evening meals, they did so, often to avoid getting dressed up after their afternoon physical training session.

The above described new policy implementations have provided very positive results. Figure 20 shows that when compared on a population basis, the eating pattern of the USMA cadets participating in the 1990 Nutrition Study were the same as those of the Cadet Corps in 1990. When the eating patterns of the 1993 USMA Corps population were compared to those of 1990, it was obvious that the changes made since the 1990 nutrition study have resulted in a very respectable increase in the percent of cadets that partake of the Cadet Mess weekday evening meals.

Figure 20. Eating Pattern of USMA Cadets in 1990 & 1993



* Mandatory attendance in 1993.

3 meals / day

1990 Cadet Population (N = 4374) 1990 Study Population (n = 205) 1993 Cadet Population (N = 4233)

It is fully expected that, as supported by the results of this study, the greater number of evening weekday meals consumed in the Cadet Mess, is improving the nutritional intake. With the availability at the dinner meal of a choice of vegetables, a salad bar, and fresh fruit, combined with increased meal attendance, it is likely that, since more individuals are participating in this meal, more cadets will choose to eat a healthier diet and thus more individual cadets will have mean dietary intakes that meet the MRDAs.

CONCLUSIONS

Both of the Cadet Mess menus (Regular and TRIMM) met the Nutrient Density Index guidelines and provided enough nutrients for both male and female cadets to be able to meet their Military Recommended Dietary Allowances (MRDA).

In general, the greater the number of meals consumed in the Cadet Mess, the higher the intake of energy. And, the higher the energy intake of the group, the greater the intake of other nutrients. However, while the mean nutritional intake of most groups was nutritionally adequate (i.e., $\geq$ 100% MRDA), it concealed the fact that a notable proportion of the groups had nutrient intakes considerably below (< 70%) the MRDA. This is particularly true for the 0-1 evening meal groups.

The USMA policy of authorizing those cadets who had higher energy and other nutritional requirements to eat at specially designated tables was an excellent one, since it assured that cadets heavily involved in active sports received adequate nourishment compatible with their needs.

There was a relationship between fatness (and weight) of cadets and the number of meals consumed in the Cadet Mess, with both male and female cadets who ate the fewest evening meals in the Cadet Mess being heavier (when adjusted for variability in height) and fatter. An observed trend for cadets with the lowest energy intakes being the "fattest," indicates that the fatter cadets may have been eating fewer meals in the Cadet Mess in attempts to reduce caloric intake. However, the extreme leanness of the groups eating more meals in the Cadet Mess is of greater importance.

Comparisons of the data obtained in this study with the data from the 1979 study show that the efforts of the U.S. Military Academy to reduce the total fat, saturated fat, and cholesterol content of the Cadet Mess menus were successful regarding total dietary fat intakes of both the male and female cadets. Also, since some of the cadets reported that they consumed 2% milk and other lower fat foods when eating away from the Cadet Mess, the dietary changes effected in the Cadet Mess may have encouraged these cadets to make healthier choices when eating away from the Cadet Mess. It also shows that fat-modified products (turkey meats,

margarine, salad dressings, spreads, etc.) can successfully be used in Military dining facilities to promote low-fat diets.

RECOMMENDATIONS

It is recommended that the USMA staff continue the use of the low-fat and modified-fat products, (e.g. turkey luncheon meats, reduced-fat margarine, low-fat dairy products, and low-fat salad dressings) that have enabled an appreciable reduction of total fat and cholesterol in the USMA menus, thus successfully reducing cadet dietary intakes of fat and cholesterol over the last decade. It is also recommended that the USMA staff be alert to cadets that are practicing inappropriate means of weight loss (such as skipping meals) and are therefore potentially at risk for low intakes of essential nutrients (i.e., < 70% MRDA), and initiate early intervention through appropriate dietary counseling.

It is recommended that the USMA staff examine the reason(s) that 20% of the cadets still eat their weekday evening meal in their residence or somewhere else other than the Cadet Mess. Such an examination will indicate whether their non-participation is due to some perceived deficiency in the Cadet Mess food delivery system which could be addressed or if it is due to personal decisions totally unrelated to the Cadet Mess.

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APPENDIXES

APPENDIX A

Request for Study

DEPARTMENT OF THE ARMY
UNITED STATES MILITARY ACADEMY
WEST POINT, NEW YORK 10996 -1783

REPLY TO
ATTENTION OF

MATR (30-1k) 7 October 1988

MEMORANDUM FOR: CHIEF, DIETICIAN SECTION, ATTN: DASG-DBD, OFFICE OF THE SURGEON GENERAL, 5109 LEESBURG PIKE, FALLS CHURCH, VA 22041-3258

SUBJECT: Evaluation of Cadet Food Consumption

1. Request the U.S. Army Institute of Environmental Medicine (USARIEM) schedule an evaluation of the food consumption of cadets at the United States Military Academy, West Point, similar to the evaluations performed in enlisted dining facilities during fiscal years 1987-88.

2. This evaluation should provide an assessment of the nutritional state of the Corps of Cadets and the food provided to them by the Cadet Mess, and make recommendations for any changes and improvements in menus and feeding policies. Evaluation should include both male and female cadets, and consider special feeding requirements for cadet athletes and cadets with problems meeting Army weight standards.

3. Prior to commencing the evaluation, USARIEM must gain approval of the Human Use Protocol and laboratory requirements from the West Point Director of Health Services.

4. Point of Contact is CPT Jill McCoy, Cadet Mess Dietician, AV 688-3619.

WILLIAM J. LIEPIS
COL, GS
Director of Logistics

DEPARTMENT OF THE ARMY
OFFICE OF THE SURGEON GENERAL
5109 LEESBURG PIKE
FALLS CHURCH, VA 22041-3258

REPLY TO
ATTENTION OF

17

DASG-ZB

MEMORANDUM FOR COMMANDER, UNITED STATES ARMY RESEARCH AND DEVELOPMENT COMMAND, FORT DETRICK, MD 21701-5000

SUBJECT: Evaluation of Cadet Food Consumption

1. This is in reference to your memorandum dated 7 Oct 88, subject as above.

2. I strongly support the proposed study of cadet food consumption at the United States Military Academy (USMA), West Point. Assessing the nutritional status of these future leaders will greatly contribute to the long term readiness posture of the U.S. Army. There is no doubt the diet of these young cadets is an influential factor in long term health and longevity.

3. The United States Army Research Institute of Environmental Medicine (USARIEM) has done a superb job in conducting garrison dining facility studies which have given us important feedback on the food consumption, habits, and lipid profiles of our soldiers. A study was conducted by the Letterman Army Institute of Research in 1978 at the USMA which assessed the nutritional status of the cadets. A similar study conducted by USARIEM ten years later will give The Surgeon General, as DoD Executive Agent for Nutrition, valuable comparative data from which the impact of nutrition initiatives can be evaluated, and appropriate recommendations made.

4. I look forward to your participation in this effort and your continued support of nutrition research studies.

FOR THE SURGEON GENERAL:

Robert H. Buker M.D.

ROBERT H. BUKER
Major General, MC
Deputy Surgeon General

23 Feb 89

SUMMARY SHEET

ROUTING						ROUTING					
	OFFICE	DATE	CONCUR	NON-CONCUR	SEE TAB....		OFFICE	DATE	CONCUR	NON-CONCUR	SEE TAB....
1	Dean	22Sep	T			6	SGS	22	C		
2	Commandant	22 Sep			F	7	Chief of Staff	25 Sep			
3	Garrison Cdr/DOL	6 Sep			E	8	Superintendent				
4	Chrmn, Human Rsrcs					9	OIR				
5	Cmt (COL Wolcott)	5 Sept			BWV	10					

ACTION OFFICE: OIR OFFICER/PHONE: COL Toffler/2803	SUBJECT Nutrition Assessment Study	DATE 30 Aug 89

SUMMARY

1. **Purpose:** To obtain Superintendent approval for the conduct of a Nutrition Assessment Study as described in the protocol provided by US Army Research Institute of Environmental Medicine, dated 10 August 1989 (Tab A).

2. **Background:**

a. In October 1988, the Director of Logistics requested USARIEM assess the level of nutritional health within the Corps of Cadets (Memo, MATR, Subj Evaluation of Cadet Food Consumption, dtd 7 Oct '88, Tab B). In reply, USARIEM agreed to conduct a study that would:

(1) parallel their research conducted at West Point in 1979.

(2) be part of an Army-wide VCSA initiative to improve the health of military personnel.

(3) provide important baseline data to measure progress in achieving Army nutrition objectives (Memo, SGRD-UEZ, SAB, dtd 20 Apr '89, TAB C).

b. In May 1989, the Superintendent approved (on a trial basis) optional attendance at the supper meal for AY 89-90. The Office of Institutional Research was tasked to evaluate the impact of this policy change against several criteria, including its effect on cadet nutrition.

3. **Discussion:**

a. Results of this study will provide the Surgeon General with important information concerning the nutritional well-being of cadets today versus a decade ago. These insights will be of benefit to the Army as well as USMA.

b. Data from the study will help OIR assess the nutritional impact of the optional supper policy. If there are adverse effects for individuals or for selected sub-groups (e.g. plebes, women, athletes, etc) we should be able to measure them.

c. Based upon telephonic coordination with USCC and DOL, the best time to conduct this study is during second semester AY 89-90. USARIEM accepts that time-frame and requests a three week window just prior to or immediately following Spring Leave.

DECISION OFFICE
Superintendent

- [x] APPROVED
- [x] APPROVED AS MODIFIED
- [ ] DISAPPROVED
- [ ] SEE ME

16 Sep 89

OVER

4. **Resource Impact:**

a. Approximately 240 volunteer cadets (a matched set of men and women in all four classes) will be required to participate in the study. All of these cadets will contribute approximately 7.5 hours. Half of them will be asked to devote an additional 2.5 hours. A select sub-group (16 cadets) will be involved in an additional 13 hours (Tab A, Appendix D) of data collection. The use of cadet time would be scheduled over a period of three weeks, the duration of the study, and would not conflict with academic or military duty.

b. USMA would provide logistics support (e.g. facilities and equipment). DOL would also make the Cadet Dining Facility available to USARIEM observers and data collectors.

5. **Recommendation:** That the Superintendent approve the conduct of the study at USMA during the Spring of 1990 (specific dates to be coordinated by OIR IAW USMA REG 1-1).

Encls

PATRICK A. TOFFLER
COL, IN
Director of Institutional Research

APPENDIX B

Volunteer Agreement Affidavit

VOLUNTEER AGREEMENT AFFIDAVIT

For use of this form, see AR 70-25; the proponent agency is OTSG

PRIVACY ACT OF 1974

Authority: 10 USC 3013; 44 USC 3101; and 10 USC 1071-1087

Principle Purpose: To document voluntary participation in the Clinical Investigation and Research Program. SSN and home address will be used for identification and locating purposes.

Routine Uses: The SSN and home address will be used for identification and locating purposes. Information derived from the study will be used to document the study, implementation of medical programs, adjudication of claims, and for the mandatory reporting of medical conditions as required by law. Information may be furnished to Federal, State and local agencies.

Disclosure: The furnishing of your SSN and home address is mandatory and necessary to provide identification and to contact you if future information indicates that your health may be adversely affected. Failure to provide the information may preclude your voluntary participation in the investigational study.

PART A(1) - VOLUNTEER AFFIDAVIT

Volunteer Subjects in Approved Department of the Army Research Studies

Volunteers under the provisions of AR 40-38 and AR 70-25 are authorized all necessary medical care for injury or disease which is the proximate result of their participation in such studies.

I, _____, SSN _____

having full capacity to consent and having attained my _____ birthday, do hereby volunteer/give consent as legal

representative for _____ to participate in _____

Nutritional Assessment of the U.S. Military Academy [illegible]

(Research study)

_____

under the direction of Doris E. Sherman and CPT Karl E. Friedl

conducted at West Point, New York

(Name of Institution)

The implications of my voluntary participation/consent as legal representative, duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

Doris Sherman AV 688-[illegible] Commercial (508) 651-[illegible]

Contact telephone(s): CPT Karl Friedl AV 256-4[illegible] Commercial (508) 651-[illegible]

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights/the rights of the person I represent on study related injury, I may contact

Office of Chief Counsel

at US Army Natick Research, Development and Engineering Center (508)651-[illegible]

(Name, Address and Phone Number of Hospital (Include Area Code))

I understand that I may at any time during the course of this study revoke my consent and withdraw/have the person I represent withdrawn from the study without further penalty or loss of benefits; however, I/the person I represent may be required (military volunteer) or requested (civilian volunteer) to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my/the person I represent's health and well-being. My/the person I represent's refusal to participate will involve no penalty or loss of benefits to which I am/the person I represent is otherwise entitled.

_____

PART A (2) - ASSENT VOLUNTEER AFFIDAVIT *(MINOR CHILD)*

I, _____, SSN _____ having full

capacity to consent and having attained my _____ birthday, do hereby volunteer for

_____ to participate in _____

_____

(Research Study)

_____

under the direction of _____

conducted at _____

(Name of Institution)

(Continue on Reverse)

PART A(2) - ASSENT VOLUNTEER AFFIDAVIT (*MINOR CHILD*) (Cont'd.)

The implications of my voluntary participation; the nature, duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

_____

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights I may contact

_____

at _____

(Name, Address, and Phone Number of Hospital (Include Area Code))

I understand that I may at any time during the course of this study revoke my assent and withdraw from the study without further penalty or loss of benefits; however, I may be requested to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my health and well-being. My refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

_____

PART B - TO BE COMPLETED BY INVESTIGATOR

INSTRUCTIONS FOR ELEMENTS OF INFORMED CONSENT *(Provide a detailed explanation in accordance with Appendix E, AR 40-38 or AR 70-25.)*

This study is designed to determine your nutrient intake and energy expenditure over an eight day period and to assess your potential risk of developing cardiac problems in the future. Your records will be screened to ensure that there are no medical problems (e.g., high blood pressure, diabetes, etc.) precluding selection. You will be asked to complete one questionnaire concerning your background, medical history, dietary habits, and practices. This will take approximately fifteen minutes to complete. You will also be asked to maintain a daily food diary and be interviewed for approximately twenty minutes per day to enable us to analyze your nutrient intake.

You will be weighed and measurements will be taken of your height and a series of circumferences and skinfold measurements taken. Skinfold measurements will necessitate a slight pinch of the skin, which may leave a small bruise on some individuals. A small amount of blood (about seven teaspoons) will be taken once from a vein in your arm. As is true any time blood is taken, there is a small chance of inflammation, hematoma (similar to a bruise), or infection at the site of the needle puncture. Sterile techniques will be used and the procedures meet the safety standards set up at the United States Army Research Institute of Environmental Medicine (USARIEM) for Human Research

I do ☐ do not ☐ *(check one & initial)* consent to the inclusion of this form in my outpatient medical treatment record.

SIGNATURE OF VOLUNTEER	DATE	SIGNATURE OF LEGAL GUARDIAN *(If volunteer is a minor)*
PERMANENT ADDRESS OF VOLUNTEER	TYPED NAME OF WITNESS	
	SIGNATURE OF WITNESS	DATE

Studies. A doctor from the post hospital will be standing by in the very unlikely event that treatment is required.

Your risk of developing cardiac problems will be determined by comparing your blood lipid (cholesterol) levels and your background medical information with guidelines establisned by the National Institute of Health. Your blood iron, folacin status and serum hormones will also be determined. If your results indicate that some type of treatment is required, you will be notified. The results obtained from this study are only preliminary and do not constitute a final medical diagnosis.

All data obtained about you as an individual will be considered privileged and held in confidence; you will not be identified in any presentation of the results. Complete confidentiality cannot be promised, particularly to subjects who are military personnel, because information bearing on your health may be required to be reported to appropriate medical or Command authorities, and applicable regulation "notes the possibility that the U.S. Army Medical Research and Development Command officials may inspect the records."

Participation in this study is on a voluntary basis and you may choose to withdraw at any time without penalty or loss of benefits to which you would be otherwise entitled. You will receive no direct benefits other than blood cholesterol, iron and folacin levels and the knowledge and experience you may gain from the study procedures. You may ask as many questions as you like now. If you have any further questions concerning the study or the results obtained, please contact one of the investigators for the study: Doris E. Sherman or CPT Karl E. Friedl who will be present at West Point during the study. Their permanent duty station is the U.S. Army Research Institute of Environmental Medicine, Natick, MA 01760-5007. Autovon telephone numbers are 256-5331 and 256-4847, respectively.

A second copy of this agreement is provided here for you to keep. We ask you to be conscientious in providing complete information, as your cooperation is crucial to the success of the study.

SGRD-UE-ZA (SGRD-UE-NR/26 Mar 90) (70-1s) 1st End dh/4811
SUBJECT: Amendment to Protocol "Nutrition Assessment of US Military Academy Cadets at West Point", #379

Commander, USARIEM 29 Mar 1990

FOR LTC Askew, Director, Military Nutrition Division

It has been determined that subject amendment does not increase risk to the subjects and does not compromise the value of the data; therefore, addendum to protocol HURC #379 is approved.

JOSEPH C. DENNISTON
Colonel, VC
Commanding

CF:
SGRD-HR

SGRD-UE-NR (70-9a) 26 March 1990

MEMORANDUM FOR Commander, USARIEM

SUBJECT: Amendment to Protocol "Nutrition Assessment of U.S. Military Academy Cadets at West Point" - HURC #379

1. It has been requested by the United States Military Academy that a pilot study be conducted at West Point to determine the effect of the optional meal policy on the nutritional health of the cadets. This pilot study will further define the population in HURC #379 and the following revisions will add no risk to the existing Protocol.

2. STUDY DESIGN AND SELECTION OF SUBJECTS: Three groups will be established from the cadets who volunteer to participate in the study after taking a screening questionnaire (encl 1) through the electronic mail system at the U.S. Military Academy. Group 1 will consist of cadets who eat all of their (20) meals in the cadet mess; Group 2 will be comprised of cadets who eat approximately five of their (weekend) meals away from the cadet mess; and Group 3 will consist of cadets who eat approximately 10 meals away from the cadet mess. These three groups will be further subdivided into three groups of males and three groups of females. Each of the six groups will be made up of a target of 30-33 subjects. The total number of volunteers will be determined at the time of test subject briefing; there will be no less than 180 and no more than 250 total volunteers. In addition, cadets who eat at the regular company tables in the cadet mess will be chosen rather than cadets who consume a higher or lower calorie menu. Cadets who may be subjects in other studies or receiving consultation from the dietitian in the cadet mess will be excluded. There will be a total increase of 180-250 subjects over the number of subjects stated in the original protocol. This increased number of test subjects is necessary to answer the research question regarding the optional meal policy.

3. NUTRIENT INTAKE ASSESSMENT: Data regarding salt added to food will be indicated on the food records kept by the cadets. Individual salt packets will not be provided to the cadets to track their sodium intake.

4. NUTRITIONAL STATUS ASSESSMENT AND CARDIAC RISK APPRAISAL: A fasting nonexercised (37 ml) blood sample will be drawn from an antecubital vein of each subject. In addition to the blood analyses described in the original protocol, the following analyses will be performed. Serum hormones (testosterone, 17

beta-estradiol, sex hormone binding globulin and insulin) will be analyzed by USARIEM. Since the hormones affect serum lipids, we are adding them to the analyses originally described in the protocol. They do not require an increase in the amount of blood drawn. The remaining analyses described in the protocol with the addition of HDL2-C, apolipoprotein AI and B will be performed at the Pennington Biomedical Research Center, Louisiana State University. The following body measurements have been added to the protocol and will be collected on all subjects: height, weight, body circumferences (neck, abdomen-1, abdomen-2, hips, thigh, wrist and forearm) and skinfolds (biceps, triceps, subscapular and suprailiac). A resting blood pressure and heart rate will be recorded. A near infrared device will be used as an additional measure of percentage body fat.

5. ENERGY EXPENDITURE ASSESSMENT: Energy expenditure will not be studied.

6. NUTRITION AWARENESS AND NUTRITION KNOWLEDGE ASSESSMENT: One questionnaire regarding the cadet's nutrition knowledge, eating behavior, background, and medical history will be administered. These questionnaires will be matched to subjects using only a control number, not the subject's name. The information about alcohol consumption is needed because alcohol is a potentially significant source of calories, and the information about use of oral contraceptives is required because of the effect on hormone levels. The questionnaire will be based on questions from the original protocol and from the Army Wellness Check with additional questions relating to the optional meal policy at West Point (encl 2).

7. The principal investigators for the pilot study will be Doris Sherman, AV 256-5331 and CPT Karl Friedl, AV 256-4847. The revised Volunteer Agreement Affidavit is enclosure 3.

3 Encls

ELDON W. ASKEW
LTC, MS
Director, Military Nutrition Division

APPENDIX C

West Point Cadet Mess Regular Menu

UNITED STATES MILITARY ACADEMY
WEST POINT, NEW YORK

CADET MESS MENU

BREAKFAST	LUNCH	DINNER
	FRIDAY - 30 March 1990	
Orange Juice Assorted Cereal Waffles Syrup Canadian Bacon Chilled Strawberries Fresh Fruit Bar/Yogurt Bar Margarine Coffee/Milk	Chef's Style Lasagna Italian Style Vegetables Tossed Salad Dressing Hearth Baked Italian Bread Sherbet Grape Juice/Milk	Fried Chicken Fingers BBQ/Sweet & Sour Sauces Brown Rice Green Beans Chunky Applesauce Tossed Salad/Dressing Bread/Margarine Cherry Cheese Pie Coffee/Lemonade/Milk
	SATURDAY - 31 March 1990	
Orange Juice Assorted Cereals Yogurt Bar Fresh Fruit Bar Muffins (Bran) Assorted Jellies/Honey Margarine Coffee/Milk	Turkey Noodle Soup Crackers Fishwich Tartar Sauce Macaroni & Cheese Lettuce, Tomato Round Rolls Chocolate Pudding Citrus Punch/Milk	Shepard's Pie Wide Noodles Peas & Carrots Tossed Salad Bread Margarine Lemon Sheet Cake Coffee/Grape Juice/Milk
	SUNDAY - 01 April 1990	
Orange Juice Assorted Cereals Scrambled Eggs Breakfast Steak Breaded Mushrooms	Chilled Tropical Fruit Danish Braid Assorted Jellies/Honey Yogurt Bar Margarine Coffee/Milk	Thinly Sliced Baked Ham Pineapple-Cherry Sauce Buttered Macaroni Broccoli Spears Shredded Lettuce Bread Margarine Ice Cream Sundae Coffee/Lemonade/Milk
	MONDAY - 02 April 1990	
Orange Juice Assorted Cereals Eggs MacArthur Country Fried Potatoes Yogurt Bar Fresh Fruit Bar Coffee/Milk	Chicken Fajitas Flour Tortilla Shells Picante Sauce/ Sour Cream Spanish Rice Shredded Lettuce, Diced Tomatoes, Shredded Cheese Picante Sauce/Sour Cream Sherbet Tropical Punch/Milk	Italian Style Parmigiana Spaghetti w/Marinara Sauce Italian Style Vegetables Lettuce, Cuke, Radish Salad Dressing Hearth Baked Italian Bread Margarine Applesauce Cake w/Buttercream Frosting Coffee/Grape Juice/Milk
	TUESDAY - 03 April 1990	
Orange Juice Assorted Cereals Scrambled Eggs Hashbrown Potatoes Sausage Patties Blueberry Muffins Margarine Fresh Fruit Bar Coffee/Milk	Turkey Noodle Soup Crackers BBQ Ribs McBurton BBQ Sauce Steak Fries Hobo Roll Tossed Salad Pudding Pops Hawaiian Punch/Milk	Pot Roast of Beef Vegetable Gravy Wide Noodles Green Beans Relish Tray Hearth Baked Rye Bread Margarine Orange Cake Coffee/Citrus Punch/Milk

UNITED STATES MILITARY ACADEMY
WEST POINT, NEW YORK

CADET MESS MENU

BREAKFAST	LUNCH	DINNER
	WEDNESDAY - 04 April 1990	
Orange Juice Assorted Cereal Canadian Bacon & Cheese Slice on Wh. Wheat English Muffin Country Fried Potatoes Muffin (Apple) Margarine Fresh Fruit Bar Coffee/Milk	Italian Style Meatballs Parmigiana Italian Pasta Salad Lettuce, Cucumber, Radish Tomato Salad Dressing Hobo Roll Fruited Jello Grape Juice/Milk	Chicken ala Maryland Gravy Mashed Potatoes Grits Mixed Greens Shredded Lettuce Dressing Bread/Margarine Sweet Potato Pie Coffee/Cranapple Juice/ Milk
	THURSDAY - 05 April 1990	
Orange Juice Assorted Cereals Buttermilk Hotcakes Syrup Blueberry Topping Margarine Ham Slice Fresh Fruit Bar Coffee/Milk	Corn Chowder Crackers Shaved Turkey Mozzarella Cheese Seasoned Crisscut Potatoes Lettuce, Tomato, Mayonnaise Kaiser Roll Cookies (Oatmeal Raisin, Ginger, Chocolate Chip) Apple Juice/ Milk	Chuckwagon Steak Mushroom Sauce Boiled Parslied Potatoes Whole Baby Carrots Tossed Salad Dressing Bread/Margarine Cherry Pie Coffee/Hawaiian Punch/Milk

Substitute/Supplemental spreads and condiments available at all meals: Quick (Cocoa Beverage Powder), Peanut Butter, Jam or Jelly, Catsup, Steak Sauce, Hot Sauce, Mustard, Salt, and Pepper. Additionally, Hot Cocoa Mix was available each breakfast.

APPENDIX D

West Point Cadet Mess TRIMM Menu

UNITED STATES MILITARY ACADEMY
WEST POINT, NEW YORK

CADET TRIMM MENU

BREAKFAST	LUNCH	DINNER
	FRIDAY - 30 March 1990	
Orange Juice Assorted Cereal Waffles Lite Syrup Fresh Fruit Bar Yogurt Bar Lite Margarine Coffee/Tea Skim Milk	Vegetable Lasagna Tossed Salad Lite Dressing High Fiber Bread Lite Margarine Sherbet Crystal Light Skim Milk	Baked Chicken Breast Brown Rice Green Beans Chunky Applesauce Tossed Salad Lite Dressing High Fiber Bread Lite Margarine Skim Milk
	MONDAY - 02 April 1990	
Orange Juice Assorted Cereals Ham Whole Wheat English Muffin Lite Margarine Yogurt Bar Fresh Fruit Bar Skim Milk Coffee/Tea	Chicken Fajita Flour Tortilla Mexicana Corn Spanish Rice Chopped Lettuce, Tomatoes Grapes Crystal Light Skim Milk	Trimm Style Parmigiana Spaghetti w/Marinara Sauce Lettuce, Cuke, Radish Salad Lite Dressing High Fiber Bread Lite Margarine Banana Skim Milk
	TUESDAY - 03 April 1990	
Orange Juice Assorted Cereals Trim Eggs w/Picante Sauce Breakfast Tortilla Fresh Fruit Bar Coffee/Tea Skim Milk	Turkey Noodle Soup Crackers Melted Cheese & Tomato on Hobo Roll Tossed Salad Lite Dressing/Lite Mayonnaise Pudding Pops Iced Tea/Coffee Crystal Light Skim Milk	Pot Roast of Beef Wide Noodles Green Beans Relish Tray Tossed Salad Lite Dressing High Fiber Bread Lite Margarine Chilled Pear Halves Skim Milk
	WEDNESDAY - 04 April 1990	
Orange Juice Assorted Cereals Bran Muffin Lite Margarine Fresh Fruit Bar Coffee/Tea Skim Milk	Italian Style Meatballs Onion & Pepper Sauce Hobo Roll Chopped Lettuce, Diced Tomato Salad Lite Dressing Chunky Applesauce Iced Tea/Coffee Crystal Light	Trimm Chicken ala Maryland Baked Potato Mixed Greens Tossed Salad Lite Dressing High Fiber Bread Lite Margarine Frozen Strawberries Skim Milk
	THURSDAY - 05 April 1990	
Orange Juice Assorted Cereals Buttermilk Hotcakes Lite Syrup Fresh Fruit Bar Coffee/Tea Skim Milk	Corn Chowder Shaved Turkey Trimm Potatoes (Country Fried) Lettuce, Tomato Tossed Salad Lite Dressing High Fiber Bread Angel Food Cake Iced Tea/Coffee Crystal Light Skim Milk	Chuckwagon Steak Mashed Potatoes Whole Baby Carrots Tossed Salad Lite Dressing High Fiber Bread Lite Margarine Fresh Fruit Compote Skim Milk

Substitute/supplemental spread and condiments available at each meal: Low Calorie Quick (Cocoa Beverage Powder), Spreadable Fruit Preserves, Catsup, Steak Sauce, Hot Sauce, Mustard, Salt, and Pepper. Additionally, Low Calorie Hot Cocoa Mix was available each breakfast.

APPENDIX E

Background and Medical History Questionnaire

The United States Military Academy with the U.S. Army Research Institute of Environmental Medicine are conducting a study of the nutritional health of cadets. Your answers to these questions are important to the study and will assist West Point in making decisions regarding the optional supper policy. Please use a No. 2 pencil, mark in the square completely, erase any stray markings and do not fold the questionnaire. Thank you.

DO NOT WRITE IN THIS BOX

0 1 2 3 4 5 6 7 8 9

1. What was your age (in years) at your last birthday?

17 ☐ 18 ☐ 19 ☐ 20 ☐ 21 ☐ 22 ☐ 23 ☐ 24 ☐ 25 ☐ 26 ☐ 27 ☐

2. What is your gender? ☐ Male ☐ Female

3. What class are you in at West Point?

☐ 1st class ☐ 2nd class ☐ 3rd class ☐ 4th class

4. What is your race/ethnic background?

☐ White
☐ Black
☐ Hispanic
☐ Asian/Pacific Islander
☐ American Indian/Alaskan Native
☐ Other (Please specify) _____

5. Which barracks do you live in at West Point?

☐ Lee ☐ Sherman ☐ Grant
☐ Pershing ☐ Central ☐ Scott ☐ MacArthur ☐ Eisenhower

6. In the past five years, have you been informed that your blood pressure was high?

☐ No ☐ Yes, high ☐ Yes, borderline

7. Are you now being treated for high blood pressure? ☐ Yes ☐ No

8. Have any of your close blood relatives (parent, grandparent, brother or sister) had a heart attack before age 60?

☐ Yes ☐ No ☐ Don't know

9. Have any of your close blood relatives (parent, grandparent, brother or sister) had a stroke before age 60?

☐ Yes ☐ No ☐ Don't know

10. Have any of your close blood relatives (parent, grandparent, brother or sister) had high blood pressure before age 60?

☐ Yes ☐ No ☐ Don't know

11. Have any of your close blood relatives (parent, grandparent, brother or sister) had diabetes?

☐ Yes ☐ No ☐ Don't know

12. Do you smoke cigarettes now?

☐ Yes
☐ No, I quit in the last 6 months
☐ No, I quit over 6 months ago
☐ No, I never smoked

13. How much do you smoke now?

- [ ] I don't smoke
- [ ] Less than a half a pack per day
- [ ] 1-2 packs per day
- [ ] Two or more packs per day

14. How long have you smoked?

- [ ] I don't smoke
- [ ] Less than one year
- [ ] 2-4 years
- [ ] 5-10 years
- [ ] More than 10 years

15. Do you want to stop smoking?

- [ ] I don't smoke
- [ ] I would like to quit now
- [ ] I would like to quit someday
- [ ] I don't want to quit smoking

16. How often do you smoke a pipe or cigar?

- [ ] Never
- [ ] Less than daily
- [ ] Daily

17. How often do you use smokeless tobacco such as chewing tobacco or snuff?

- [ ] Never
- [ ] Less than daily
- [ ] Daily

18. In a typical week, how many days do you have at least one drink of alcohol (beer, wine or liquor)?

- [ ] I don't drink
- [ ] 1-2 days per week
- [ ] 6-7 days per week
- [ ] not even 1 day per week
- [ ] 3-5 days per week

19. In a typical week, how many drinks do you usually drink?

- [ ] I don't drink
- [ ] 5-12 drinks per week
- [ ] 21-30 drinks per week
- [ ] 4 or less drinks per week
- [ ] 13-20 drinks per week
- [ ] 30 or more drinks per week

20. Which describes your eating habits?

- [ ] Eat three regular meals per day
- [ ] Eat two regular meals per day
- [ ] Eat one meal per day
- [ ] Eat one or two regular meals per day plus snacks
- [ ] Don't have time to eat regularly and frequently snack or eat on the run

21. How would you describe your usual weekend meal pattern?

- [ ] Eat lightly during the day, big supper
- [ ] Snack throughout the day and evening
- [ ] Skip breakfast and lunch, eat supper only
- [ ] Skip lunch, eat breakfast and supper
- [ ] Three regular meals per day
- [ ] Other _____

22. For me the largest meal of the day is usually...
- [ ] Breakfast
- [ ] Lunch
- [ ] Dinner

23. How would you describe your usual snacking pattern?
- [ ] Seldom snack
- [ ] Snack during the day only
- [ ] Snack during the evening only
- [ ] Snack during the day and evening

24. On average, how many snacks per day do you usually eat?
- [ ] 0
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] 6 or more

25. On average, how many meals per day do you eat? (DO NOT INCLUDE SNACKS.)
- [ ] 0
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] 6 or more

26. I order take out food...
- [ ] Seldom
- [ ] Once per week
- [ ] 2-3 times per week
- [ ] 4 or more times per week

27. Which one type of milk do you drink most often?
- [ ] Chocolate milk
- [ ] Whole milk
- [ ] 2% milk
- [ ] 1% milk
- [ ] Skim milk
- [ ] Don't drink milk
- [ ] Don't know

28. How much milk do you drink per day?
- [ ] Over 2 cups
- [ ] 1-2 cups
- [ ] Less than 1 cup
- [ ] Don't know

29. I consume...
- [ ] Coffee
- [ ] Decaffeinated Coffee
- [ ] Kool-Aid
- [ ] Cola
- [ ] Diet Cola
- [ ] Decaffeinated Cola
- [ ] Decaffeinated Diet Cola
- [ ] Juices
- [ ] Tea
- [ ] Iced Tea
- [ ] Water

30. Which describes your consumption of sweets (candy, cookies, pastries, etc.)?
- [ ] Eat sweets every day
- [ ] Eat sweets 5-6 times per week
- [ ] Eat sweets 3-4 times per week
- [ ] Eat sweets once or twice per week
- [ ] Never eat sweets

31. How often do you eat foods high in salt or sodium such as cold cuts, bacon, canned soups, potato chips, etc.?
- [ ] Daily or almost daily
- [ ] 3-5 days per week
- [ ] Less than 3 days per week
- [ ] Rarely or never

32. When I add salt at the table I...
- [ ] Taste the food first
- [ ] Automatically salt before tasting
- [ ] Don't add salt at all
- [ ] Other _____

33. How would you describe your use of foods like ketchup, A-1 sauce, Worcestershire sauce, soy sauce, mustard, relish, pickles,etc.?

☐ Usually add them to foods ☐ Sometimes add them to foods
☐ Rarely or never add them to foods

34. How often do you eat foods high in saturated fats such as beef, hamburger, pork, sausage, butter, whole milk, cheese, etc.?

☐ Daily or almost daily ☐ 3-5 days per week
☐ Less than 3 days per week ☐ Rarely or never

35. I eat fried foods...?

☐ Never ☐ Less than once per week ☐ Less than 3 times per week
☐ Between 3-6 times per week ☐ More than 7 times per week

36. When I'm served fatty meat I...

☐ Always trim off the fat ☐ Often trim off the fat, but not always
☐ Never trim off the fat

37. How often do you eat high fiber foods such as whole grain breads, cereals, bran, raw fruit, or raw vegetables?

☐ Daily or almost daily ☐ 3-5 days per week
☐ Less than 3 days per week ☐ Rarely or never

38. What was your weight at the beginning of the year (Sept. 89)? _____ pounds

39. What is the most you have ever weighed? _____ pounds

40. What is the least you have ever weighed in your adult life _____ pounds

41. Are you trying to gain weight? ☐ Yes ☐ No

42. Are you trying to lose weight? ☐ Yes ☐ No

43. Are you or have you ever been anorexic? ☐ Yes ☐ No ☐ Unknown

44. Are you or have you ever been bulimic? ☐ Yes ☐ No ☐ Unknown

45. Is anyone in your family more than 20 pounds overweight? ☐ Yes ☐ No

46. If yes, which family member ☐ Mother ☐ Father ☐ Brother/Sister

47. Describe your ususal pace of eating?

	B	L	D
All meals on the run	☐	☐	☐
Some meals on the run	☐	☐	☐
All meals in a relaxed manner	☐	☐	☐
Some meals in a relaxed manner	☐	☐	☐

48. Please fill in the squares for the meals you attend in the cadet mess, but DO NO EAT or EAT LESS THAN HALF of the ITEMS OFFERED at the meal.

	M	Tu	W	Th	F	Sa	Su
Breakfast	☐	☐	☐	☐	☐	☐	
Lunch	☐	☐	☐	☐	☐	☐	Brunch ☐
Dinner	☐	☐	☐	☐	☐	☐	Dinner ☐

49. Please fill in the squares for the meals you usually EAT (at least half of the items offered) in the cadet mess.

	M	Tu	W	Th	F	Sa	Su
Breakfast	☐	☐	☐	☐	☐	☐	
Lunch	☐	☐	☐	☐	☐	☐	Brunch ☐
Dinner	☐	☐	☐	☐	☐	☐	Dinner ☐

50. How often do you do at least 20 minutes of non-stop aerobic activity (vigorous exercise that greatly increases your breathing and heart rate such as running, fast walking , biking, swimming, rowing, etc.)?

☐ *Three or more times per week* ☐ 1-2 times per week
☐ Rarely or never

51. How often do you do exercises that improve muscle strength, such as pushups, situps, weight lifting, a Nautilus/Universal workout, resistance training, etc.?

☐ Three or more times per week ☐ 1-2 times per week
☐ Rarely or never

52. *Do you have a physical condition that limits or prevents you from exercising?*

☐ Yes ☐ No

53. How important do you think your body weight is to maintaining health?

☐ Very important ☐ Somewhat important ☐ Not important

54. How important do you believe food is in maintaining health?

☐ Very important ☐ Somewhat important ☐ Not important

55. On the average how many hours of sleep do you get each night?

☐ Less than 5 hours ☐ 5-6 hours ☐ 7-8hours
☐ 9 hours ☐ More than 9 hours

56. FEMALES ONLY: Do you take birth control pills?

☐ Yes ☐ No

Thank you for your cooperation.

APPENDIX F

Food Record Form

NATICK FORM 758 (O/T)
1 MAR 90

Cadet Food Record

ID # Name

Day Date

Time	Meal/ Snack	Food/Beverage Name & Description	Size of Portion	# Salt Shakes	Source (Where Obtained)	DO NOT WRITE IN THIS COLUMN

APPENDIX G

Interviewer Coding Form

INTERVIEWER'S CODING FORM
WEST POINT

ID # _____ Name_____
Day_____ Date_____

STATUS: ____of____

____Calculated ____Completed
____Checked ____Hold_____
____Rechecked ____Entered
____Verified

Dietitian ID #_____

Time onsumed	Meal	Food Code	Food/Beverage Name and Description	Portion Size	Quantity/gram wt.	NaCl	Source	Code	Comments

Do you take medication?_____ Specify_____
How often did you take it?_____

Did you sit at a Regular, Trimm, or Heavy table for meals yesterday?
Breakfast_____ Lunch_____ Dinnner_____

Is the way you ate yesterday the way you usually eat?_____
If no, why? _____

Do you consume any type of supplement (i.e. vitamin, mineral, protein)?_____

FCK FORM 761 (ONE-TIME)
PR 90

APPENDIX H

Sources of Foods Consumed by Cadets During Study

Sources of Foods Consumed at West Point Cadets During 1990 Nutrition Study

Standards:

1) Cadet Mess- Foods served at the Cadet Mess, box lunches, and other meals (e.g., for field feeding) prepared at the Cadet Mess, and any food items carried out of the Cadet Mess.

2) Home- Foods prepared and consumed in the cadet's room (i.e., coffee, Tang, etc.) foods eaten at parents or sponsor's home, and food prepared at parents' home but sent to the cadet at West Point (e.g., cookies).

3) Restaurant- Commercial food outlets which provide seating for on-site food consumption (i.e., Eisenhower Hall, Grant Hall, Officer's Club, The Thayer Hotel, Tony's, Shades, and other off-post restaurants).

4) Vendor- Commercial food outlets where seating was not provided (e.g., football concessions) or very limited, grocery stores providing ready-to-eat food, vending machines, and food served at parties or meetings.

1) Dining Hall

BBQ/picnic from Cadet Mess	West Point
Box meal from Cadet Mess	West Point
Cadet Mess	West Point
Cadet Mess- TRIMM	West Point
Dietitian	West Point
Meal in field (Mermite)	Camp Buckner[1]
Meal, Ready-to-Eat, Individual	Army issue
Taste test (4/5/90)	Cadet Mess

2) Home

Care package (Boodle)	Any
Home	Any
Homemade	Any
Superintendent's	West Point
Sponsor's house	West Point area

3) Restaurant

3rd Avenue Sports Bar/Restaurant	New York City, N.Y.
Alameda Mexican Restaurant	?
Andy's Restaurant	Highland Falls, N.Y.
Ann's Restaurant	Fredericksburg, Va.
Arbuckle's Restaurant	Fredericksburg, Va.
Arbuckles	Brighton, Mass.
Arby's	Any
Army Navy Country Club	Va.
Bar, generic	Any
Barnabee's Restaurant	?

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[1]West Point area

3) Restaurant (Continued)

Bavarian Inn	West Point area
Bennigan's	Any
Best Western	Md.
Boat House Bar	Cambridge, Mass.
Bob's Big Boy	Any
Boston Beach Club	Boston, Mass.
Boston Sail Loft Restaurant	Cambridge, Mass.
Brandywine Diner	Schenectady, N.Y.
Brother's	Highland Fall, N.Y.
Burger King	Any
Burger Barn	New Haven, Conn.
C.B. Driscoll's Restaurant	?
Cadet Restaurant	West Point
Cafe	N.Y.
Canadian Militaire Royale (CMR)	Montreal, Canada
Carlo's O'Kelly's	?
Chick-Fil-A	N.J.
Chicken's Last Stand	Highland Falls N.Y.
Chinese Restaurant	Any
City Pizza	Philadelphia, Pa.
Colonial Hotel	New Haven, Conn.
Cooking Class (Officers' Club)	West Point
Coolidge Corner Pub	Brookline, Mass.
Corrib Pub	Brighton, Mass.
Cosmo's Pizza	West Point area
Dartmouth College	Hanover, N.H.
Denny's	Any
Depot Restaurant	N.Y.
Dinardo's	Philadelphia, Pa.
Diner	Any
Dining In	West Point[2]
Domino's Pizza	Any
Donut Shop	Any
Dragon Lady	Newburgh, N.Y.
Dragon's Pizza	Philadelphia, Pa.
Dunkin Donuts	Any
Easy Street Restaurant	Hyde Park, N.Y.
Eisenhower Hall	West Point
Elby's Restaurant	Chamberburg, Pa

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[2]Although during the study the food for the Dining In was prepared by and served in the Cadet Mess, the Dining In was categorized as a Restaurant since it was not a Cadet Mess meal, but it was a special meal and could have been held at the Officer's Club or some other restaurant.

3) Restaurant (Continued)

Elmer Suds Pub	Croton Falls, N.Y.
Everett House of Pizza	Everett, Mass.
Far East Restaurant	Arlington, Va.
Fiesta Cancun	West Point area
Four Brothers Pizza	Poughkeepsie, N.Y.
Friendly's Restaurant	Any
Gettysburg College Cafeteria	Gettysburg, Pa.
Grant Hall	West Point
Ground Round	Any
Grovelli's Restaurant	Mount Kisco, N.Y.
Guido's Italian Restaurant	?
Hama Hamu	Fort Montgomery, N.Y.
Hamburger Hamlet	Georgetown, D.C.
Hardee's	Any
Hilltop Bar & Grill	Fort Montgomery, N.Y.
Holiday Inn	Any
Hotel	Any
Hotel Thayer	West Point area
House of Hunan	?
I Love NY Pizza	N.Y.
Italian Restaurant	?
Jade Aloha Restaurant	?
JB Winberies	Montclair, N.J.
Joseph's	Highland Falls, N.Y.
Keller Hospital Cafeteria	West Point
Kentucky Fried Chicken	Any
King's Garden	Highland Falls, N.Y.
Knights of Columbus	Highland Falls, N.Y.
L'Orleans Restaurant	Montreal, Canada
Lilly's Piano Bar	Boston, Mass.
Little House Chinese Restaurant	New Canaan, Conn.
Little Saskatawan Restaurant	Little Silver, N.J.
Lobo's Mexican Restaurant	Poughkeepsie, N.Y.
Long John Silver's	Any
Lord Dunsby	?
Los Lobos Mexican Restaurant	Poughkeepsie, N.Y.
Mall restaurant	Any
Mandarin Garden Chinese Restaurant	Southington, Conn.
Marshall House Restaurant	Boston, Mass.
Matt Garret's Restaurant	Boston, Mass.
McDonald's	Any
Mol Feta's Restaurant	West Point area
Mr Donut	Any
Mule Bar	West Point area
Museum of Art	Philadelphia, Pa.
Nathan's	Newark, N.J., Airport

3) Restaurant (Continued)

Naval Academy	Annapolis, Md.
Nicky's Pizzeria	?
Officer's Club	West Point
Old Oak Inn	Fort Montgomery, N.Y.
Park Restaurant	Highland Falls, N.Y.
Patio Vidal Restaurant	Canada
Penguin Cafe	New York City, N.Y.
Pentagon Restaurant	Arlington, Va.
Perkin's	Vails Gate, N.Y.
Philip's Restaurant	?
Pie Plate Restaurant	Newburgh, N.Y.
Pizza Place	Any
Pizza Hut	Any
Ponderosa	Any
Popeye's Chicken	Any
Poughkeepsie Diner	Poughkeepsie, N.Y.
Pub Restaurant	Poughkeepsie, N.Y.
Quarters 100	West Point area
Red House Chinese Restaurant	Vails Gate, N.Y.
Restaurant, NFS	Any
Richardson's Diner	Hagerstown, Md.
Rider College	Lawrenceville, N.J.
Rio Bravo Mexican Restaurant	N.Y.
Robinson's Cafe	Hagerstown, Md.
Roseview Stables Snack Shop	?
Roy Roger's	Any
Rumson Country Club	?
Rutgers University Dining Hall	New Brunswick, N.J.
Schade's	Highland Falls, N.Y.
Shoney's	Any
Ski Lodge	Pa.
Sluggo's Bar	?
Social benefit, catered	Boston, Mass.
Soldiers & Sailors Motel	New York City, N.Y.
Sports Depot Restaurant	Boston, Mass.
St. George IV Restaurant	Philadelphia, Pa.
St. George's Restaurant	Philadelphia, Pa.
Stella's Pizza	Stratford, Conn.
Subway Restaurant	?
Supreme Wok	Highland Falls, N.Y.
Taco Bell	Any
Terrance's Restaurant	New York City, N. Y.
Texas Steak House	Atlanta, Ga.
TGI Friday's	Any
Thayer Hall	West Point
Tombs	?

3) Restaurant (Continued)

Tony's	West Point area
Town 'N Country Diner	Poughkeepsie, N.Y.
Uno's	Any
Vassar College	Poughkeepsie, N.Y.
Village Smokehouse Restaurant	Brookline, Mass.
Vito's Fine Italian Cuisine	West Point area
Wedding reception	Wash. (state)
Weeping Willaby's Restaurant	?
Wendy's	Any
West Point Pizza	West Point area
Younger Brother's Restaurant	Newburgh, N.Y.

4) Vendor

Bakery	Any
Baptist Student Union	West Point
Baskin Robbin's	Any
Bistany International Foods	Boston, Mass.
Blood Drive	West Point
Boodlers	West Point
Bowling Lanes	?
Cadet Store	West Point
Catering Service	West Point
Chapel/Church	West Point area
Temple, Jewish	West Point
Chaplain's Office	West Point
Club Activity (DCA)	West Point
Coach/Athletic Department	West Point
Coffee House	West Point Area
Coffee call	West Point
Columbo Yogurt Shop	Cambridge, Mass.
Commissary	West Point
Community Club	West Point
Continental Airlines flight	Any
Convention, Exposition	Any
Dairy Queen	Any
Dance Club	Any
Dave's Cookies	?
Delicatessen	Any
Denver Airport	Denver, Colo.
Drug Store	Any
Everything Yogurt	Arlington, Va.
First Class Club	West Point
Food Mart Grocery Store	Any
Football	West Point
Freshman's Yogurt	?
Fruit Juice Stamd	Ithaca, N.Y.

4) Vendor (Continued)

General Nutrition Center	Any
Giant Supermarket	Any
Girl Scouts	Any
Grand Union	Highland Falls, N.Y.
Haagan Daz	Any
Hanscom AFB Commissary	Bedford, Mass.
Highland Falls Bakery	Highland Falls, N.Y.
I Can't Believe Its Yogurt	Any
Ice Cream Shop, NFS	Any
Ice Cream Shop	Highland Falls, N.Y.
Ice Cream Shop	West Point
Kawa Market	Philadelphia, Pa.
La Petite Bakery	Newburgh, N.Y.
Little Caesar	Any
Mahan Hall	West Point
Monkey Bar	Boston, Mass.
Movie/Cinema	Any
Mrs. Field's	Any
Naval Academy Box Lunch	Annapolis, Md.
Newark Airpost	Newark, N.J.
Orderly Room	West Point
Original Cookie Factory	Conn.
Party	Any
Piece of Cake Co.	West Point area
Popcorn Factory	Any
Prepared food, generic	Any
Price Chopper	?
Professor's Office	West Point
PX	West Point
Reception	?
Rest stop	Road/highway
Retreat	West Point area
Safeway	Any
Seattle/Tacoma Airport	Seattle, Wash.
Send A Smile	?
Seven-Eleven, AM-PM, Mini-Mart	Any
Shop Rite	Any
Snack Shop at PX	West Point
Sports Event	Any
Stadium	West Point
Steve's Ice Cream	Any
Stewart Deli Delicious	?
Store, generic	Any
Street Vendor/Concession Stand	West Point area
Sub Shop	Any
Subway Sub Shop	Annapolis, Md.

4) Vendor (Continued)

TAC's	West Point
TCBY	Any
Touch of Class	West Point area
United Airlines	Any
University of Pennsylvania Snack Shop	Philadelphia, Pa.
Unknown	Not specified
Up Skate	New Windsor, N.Y.
Vending Machine	Any
Wawa Grocery Store	Any
?(formerly, Popcorn Factory)	?

APPENDIX I

Military Recommended Dietary Allowances (MRDA) and Nutrient Density Index (NDI)

Military Recommended Dietary Allowances (MRDA) and Nutrient Density Index (NDI)

Nutrient	Unit	MRDA[1]		Nutrient Density
		Male	Female	(Nutrients/1000 kcal)
Energy[2,3]	Kcal MJ	3200 (2800-3600) 13.4 (11.7-15.1)	2400 (2000-2800) 10.0 (8.4-11.7)	
Protein[4]	gm	100	80	33
Vitamin A[5]	mcg RE (IU)	1000 (5000)	800 (4000)	333 (1667)
Vitamin D[6,7]	mcg	5-10	5-10	
Vitamin E[8]	mg TE	10	8	
Acorbic Acid	mg	60	60	25
Thiamin	mg	1.6	1.2	0.5
Riboflavin	mg	1.9	1.4	0.6
Niacin[9]	mg	21	16	6.7
Vitamin B-6	mg	2.2	2.0	0.8
Folacin	mcg	400	400	167
Vitamin B-12	mcg	3.0	3.0	1.25
Calcium[7]	mg	800-1200	800-1200	333-500
Phosphorus[7]	mg	800-1200	800-1200	333-500
Magnesium[7]	mg	350-400	300	125
Iron[7]	mg	10-18	18	6
Zinc	mg	15	15	
Iodine	mcg	150	150	
Sodium[10]	mg	5500	4100	1700

[1]MRDA for moderately active military personnel, ages 17 to 50 years, are based on the Recommended Dietary Allowances, ninth revised edition, 1980.

[2]Energy allowance ranges are estimated to reflect the requirements of 70 percent of the moderately active military population. One megajoule (MJ) equals 239 kcals.

[3]Dietary fat calories should not contribute more than 35 percent of total energy intake.

[4]Protein allowance is based on an estimated protein requirement of 0.8 gm/kilogram (kg) desirable body weight. Using the reference body weight ranges for males of 60 to 79 kg and for females of 46 to 63 kg, the protein requirement is approximately 48 to 64 grams for males and 37 to 51 grams for females. These amounts have been approximately doubled to reflect the usual protein consumption levels of Americans and to enhance diet acceptability.

[5]One microgram of retinol equivalent (mcg RE) equals 1 mcg of retinol, or 6 mcg betacarotene, or 5 international units (IU).

[6]As cholecalciferol, 10 micrograms of cholecalciferol equals 400 IU of Vitamin D.

[7]High values reflect greater Vitamin D, calcium, phosphorus, magnesium, and iron requirements for 17- to 18-year olds than for older ages.

[8]One milligram of alpha-tocopherol equivalent (mg TE) equals 1 milligram d-alpha-tocopherol.

[9]One milligram of niacin equivalent (mg TE) equals 1 milligram niacin

[10]The safe and adequate levels for daily sodium intake of 1100 to 3300 mg published in the RDA are currently impractical and unattainable within military food service systems. However, an average of 1700 milligrams of sodium per 1000 kilocalories of food served is the target for military food service systems. This level equates to a daily sodium intake of approximately 5500 milligrams for males and 4100 milligrams for females.

APPENDIX J

Questionnaire Responses

Selected Responses to Questionnaire by West Point Cadets Consuming 0 to 1, 2 to 3, or 4 to 5 Weekday Evening Meals in the Cadet Mess

Question	Percent of Group Population[1]					
	Male Cadets			Female Cadets		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=44)[2]	2-3 (n=23)	4-5 (n=17)
Average Age (in Years) at Last Birthday						
18	6	10	2	7	13	29
19	13	17	26	23	26	41
20	19	17	50	25	22	18
21	23	33	9	25	22	6
22	23	19	11	11	13	6
23	13	5	2	4	4	-
24	3	-	-	-	-	-
25	-	-	-	4	-	-
West Point Class						
1st class	29	26	9	32	17	6
2nd class	36	29	33	20	22	12
3rd class	19	24	46	25	35	41
4th class	16	21	13	23	26	41
Race/Ethnic Background						
White	84	90	85	91	78	82
Black	6	2	9	2	4	6
Hispanic	3	5	-	2	-	6
Asian/Pacific Islander	3	2	6	2	13	-
American Indian/Alaskan	-	-	-	-	-	6
Other	3	-	-	2	4	-

[1]Where n for responses to one question differs from group n the correct n is given in parenthesis above group data.
[2]Two cadets did not turn in questionnaires; therefore, n=44 was used for the 0-1 female group in lieu of n=46 for all questionnaire responses.

Selected Responses to Questionnaire by West Point Cadets Consuming 0-1, 2-3, or 4-5 Weekday Evening Meals in the Cadet Mess (cont'd)

Question	Percent of Group Population[1]					
	Male Cadets			Female Cadets		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=44)[2]	2-3 (n=23)	4-5 (n=17)
Days/Week That Have at Least One Drink of Wine, Beer, or Liquor						
I Don't Drink	19	48	37	41	65	76
Not even 1 day per week	61	38	61	50	30	24
1-2 days per week	16	14	2	7	4	-
3-5 days per week	3	-	-	2	-	-
Number of Drinks Per Typical Week	(n=29)	(n=41)				
I don't drink	24	56	37	48	70	82
4 or less drinks per week	62	34	63	39	26	18
5-12 drinks per week	7	10	-	7	4	-
13-20 drinks per week	7	-	-	2	-	-
21-30 drinks per week	-	-	-	2	-	-
30 or more drinks per week	-	-	-	2	-	-
Description of Regular Eating Habits						
Eat 3 regular meals/day	26	69	91	23	39	82
Eat 2 regular meals/day	26	19	2	30	13	12
Eat 1-2 reg meals + snacks	48	12	6	48	48	6
Description of Usual Weekend Meal Pattern						
Eat lightly during day, big supper	23	21	17	23	26	18
Snack throughout day and evening	23	10	11	27	17	18
Skip breakfast & lunch eat supper only	10	7	4	2	13	6
Skip lunch, eat breakfast & supper	13	17	9	11	4	24
Three regular meals per day	3	10	24	2	9	18
Other	29	36	35	34	30	18

[1]Where n for responses to one question differs from group n the correct n is given in parenthesis above group data.
[2]Two cadets did not turn in questionnaires; therefore, n=44 was used for the 0-1 female group in lieu of n=46 for all questionnaire responses.

Selected Responses to Questionnaire by West Point Cadets Consuming 0-1, 2-3, or 4-5 Weekday Evening Meals in the Cadet Mess (cont'd)

Question	Percent of Group Population[1]					
	Male Cadets			Female Cadets		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=44)[2]	2-3 (n=23)	4-5 (n=17)
Largest Meal of Day is Usually		(n=41)				
Breakfast	10	12	6	14	9	-
Lunch	68	56	30	77	61	41
Dinner	23	32	63	9	30	59
Description of Usual Snacking Pattern		(n=40)				
Seldom snack	23	10	26	14	13	-
Snack evenings only	52	45	35	52	56	53
Snack during the day only	-	-	-	4	4	12
Snack day and evening	26	45	39	30	26	35
Average Number of Snacks Usually Eat per Day		(n=41)		(n=43)	(n=22)	
None	13	2	13	2	-	-
One	29	37	39	19	32	29
Two	36	22	15	35	41	29
Three	13	24	6	35	18	29
Four	10	5	24	7	4	6
Five	-	5	-	-	-	-
Six	-	5	2	2	4	6
Average Number of Meals Eaten per Day		(n=41)				
One	-	-	-	2	-	-
Two	64	34	11	64	56	12
Three	36	63	85	32	44	88
Four	-	2	4	2	-	-

[1]Where n for responses to one question differs from group n the correct n is given in parenthesis above group data.
[2]Two cadets did not turn in questionnaires; therefore, n=44 was used for the 0-1 female group in lieu of n=46 for all questionnaire responses.

Selected Responses to Questionnaire by West Point Cadets Consuming 0-1, 2-3, or 4-5 Weekday Evening Meals in the Cadet Mess (cont'd)

Question	Percent of Group Population[1]					
	Male Cadets			Female Cadets		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=44)[2]	2-3 (n=23)	4-5 (n=17)
Frequency of Ordering Take Out Food	(n=41)					
Seldom	29	39	54	46	56	53
Once per week	32	42	30	25	22	24
2-3 times per week	23	20	13	27	22	24
4 or more times per week	16	-	2	2	-	-
Type of Milk Drink Most Often	(n=41)			(n=43)		(n=16)
Choclate	10	2	13	2	9	6
Whole	10	10	11	-	-	-
2 %	55	80	70	20	48	44
1%	-	-	2	2	4	6
Skim	13	7	4	66	35	44
Don't drink milk	6	-	-	9	4	-
Don't know (or not specified)	6	-	-	-	-	-
Amount of Milk Usually drink Per Day	(n=45)					
Over 2 cups	19	45	56	12	22	24
1-2 cups	52	43	38	46	30	59
Less than 1 cup	29	12	7	40	48	18
Don't know	-	-	-	2	-	-

[1]Where n for responses to one question differs from group n the correct n is given in parenthesis above group data.
[2]Two cadets did not turn in questionnaires; therefore, n=44 was used for the 0-1 female group in lieu of n=46 for all questionnaire responses.

Selected Responses to Questionnaire by West Point Cadets Consuming 0-1, 2-3, or 4-5 Weekday Evening Meals in the Cadet Mess (cont'd)

Question	Percent of Group Population[1]					
	Male Cadets			Female Cadets		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=44)[2]	2-3 (n=23)	4-5 (n=17)
Type of Beverages Consumed						
Coffee	39	26	30	37	39	29
Decaffeinated Coffee	-	-	-	-	9	-
Kool-Aid	23	26	50	13	17	24
Cola	52	64	78	15	39	47
Diet Cola	36	21	20	67	61	53
Decaffeinated Cola	-	10	6	2	4	-
Decaffeinated Diet Cola	-	2	4	2	4	12
Juices	61	83	94	56	65	76
Tea	19	29	24	46	52	47
Iced Tea	23	29	35	20	39	29
Water	90	90	100	85	96	94
Frequency of Consumption of Sweets	(n=45)					
Every day	16	21	27	23	22	35
5-6 times per week	16	26	27	20	17	24
3-4 times per week	39	33	13	39	39	18
Once or twice per week	29	17	20	18	22	18
Never eat sweets	-	2	13	-	-	6
Frequency of Consumption of Foods High in Salt or Sodium						
Daily or almost daily	13	2	6	2	13	18
3-5 days per week	29	29	22	18	13	12
Less than 3 days per week	42	48	46	46	35	65
Rarely or never	16	21	26	34	39	6

[1]Where n for responses to one question differs from group n the correct n is given in parenthesis above group data.
[2]Two cadets did not turn in questionnaires; therefore, n=44 was used for the 0-1 female group in lieu of n=46 for all questionnaire responses.

Selected Responses to Questionnaire by West Point Cadets Consuming 0-1, 2-3, or 4-5 Weekday Evening Meals in the Cadet Mess (cont'd)

Question	Percent of Group Population[1]					
	Male Cadets			Female Cadets		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=44)[2]	2-3 (n=23)	4-5 (n=17)
Salt Addition to Food						
Taste the food first	39	24	24	25	22	12
Automatically add salt before tasting	29	5	22	23	17	29
Don't add salt at all	32	69	48	48	56	53
Other	-	2	6	4	4	6
Use of Condiments (Ketchup, A-1 Sauce, Worcestershire Sauce, Soy Sauce, Mustard, Relish, Pickles, etc.)						
Usually add to foods	29	31	28	20	35	29
Sometimes add to foods	45	62	54	43	30	47
Rarely or never use	26	7	17	36	35	24
Frequency of Consumption of Food High in Saturated Fat						
Daily or almost daily	32	40	28	16	17	24
3-5 days per week	32	31	37	14	26	41
Less than 3 days per week	32	26	33	46	35	18
Rarely or never	3	2	2	25	22	18
Frequency of Consumption of Fried Foods	(n=30)					
Never	7	2	-	11	26	6
Less than once per week	7	10	15	27	-	18
Less than 3 times/week	40	33	35	41	44	29
Between 3-6 times/week	43	55	48	20	30	41
More than 7 times/week	3	-	2	-	-	6

[1]Where n for responses to one question differs from group n the correct n is given in parenthesis above group data.
[2]Two cadets did not turn in questionnaires; therefore, n=44 was used for the 0-1 female group in lieu of n=46 for all questionnaire responses.

Selected Responses to Questionnaire by West Point Cadets Consuming 0-1, 2-3, or 4-5 Weekday Evening Meals in the Cadet Mess (cont'd)

Question	Percent of Group Population[1]					
	Male Cadets			Female Cadets		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=44)[2]	2-3 (n=23)	4-5 (n=17)
Treatment of Fatty Meat						
Always trim off the fat	52	69	59	67	56	76
Often trim off fat	32	24	28	28	26	24
Never trim off fat	16	7	13	2	17	-
(Don't eat meat)	-	-	-	2	-	-
Frequency of Eating High Fiber Foods						
Daily or almost daily	48	57	67	77	91	76
3-5 days per week	29	31	24	16	9	24
Less than 3 days per week	19	10	9	7	-	-
Rarely or never	3	2	-	-		-
Trying to Gain Weight						
Yes	13	17	44	-		-
No	87	83	56	100	100	100
Trying to Lose Weight						
Yes	55	29	33	86	74	71
No	45	71	67	14	26	29

[1]Where n for responses to one question differs from group n the correct n is given in parenthesis above group data.
[2]Two cadets did not turn in questionnaires; therefore, n=44 was used for the 0-1 female group in lieu of n=46 for all questionnaire responses

Selected Responses to Questionnaire by West Point Cadets Consuming 0-1, 2-3, or 4-5 Weekday Evening Meals in the Cadet Mess (cont'd)

Question	Percent of Group Population[1]					
	Male Cadets			Female Cadets		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=44)[2]	2-3 (n=23)	4-5 (n=17)
Description of Usual Pace of Eating						
All breakfasts on the run	-	7	4	2	9	6
All lunches on the run	-	2	4	2	4	6
All dinners on the run	14	2	2	12	4	-
Some breakfasts on the run	17	12	28	9	4	25
Some lunches on the run	16	26	22	14	13	19
Some dinners on the run	18	24	22	30	26	19
All breakfasts in a relaxed manner	60	45	52	64	61	50
All lunches in a relaxed manner	64	33	48	64	52	50
All dinners in a relaxed manner	61	37	48	33	52	50
Some breakfasts in a relaxed manner	20	36	15	23	26	19
Some lunches in a relaxed manner	16	38	26	18	30	25
Some dinners in a relaxed manner	7	37	26	26	13	31
Breakfast - other	3	-	-	2	-	-
Lunch - other	3	-	-	2	-	-
Dinner - other	-	-	2		4	-

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[2]Two cadets did not turn in questionnaires; therefore, n=44 was used for the 0-1 female group in lieu of n=46 for all questionnaire responses.

Selected Responses to Questionnaire by West Point Cadets Consuming 0-1, 2-3, or 4-5 Weekday Evening Meals in the Cadet Mess (cont'd)

Question	Percent of Group Population[1]					
	Male Cadets			Female Cadets		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=44)[2]	2-3 (n=23)	4-5 (n=17)
Meals Attend in Cadet Mess But Do Not Eat or Eat < 1/2 Offered Food			(n=45)		(n=22)	
Monday - Breakfast	61	71	80	50	27	53
Monday - Lunch	94	100	100	82	82	94
Monday - Dinner	87	95	96	86	86	94
Tuesday - Breakfast	68	74	80	48	23	53
Tuesday - Lunch	94	98	93	89	82	94
Tuesday - Dinner	87	90	98	89	86	82
Wednesday - Breakfast	61	71	78	52	41	47
Wednesday - Lunch	94	100	98	77	86	94
Wednesday - Dinner	94	93	96	86	82	94
Thursday - Breakfast	68	74	78	52	27	59
Thursday - Lunch	94	98	96	84	86	94
Thursday - Dinner	84	81	93	86	82	82
Friday - Breakfast	68	71	78	54	41	59
Friday - Lunch	94	98	98	82	86	88
Friday - Dinner	87	93	98	96	82	94
Saturday - Breakfast	77	81	84	91	54	94
Saturday - Lunch	94	88	89	91	82	94
Saturday - Dinner	90	90	87	86	77	94
Sunday - Brunch	94	90	98	89	77	82
Sunday - Dinner	94	81	87	89	77	100

[1]Where n for responses to one question differs from group n the correct n is given in parenthesis above group data.
[2]Two cadets did not turn in questionnaires; therefore, n=44 was used for the 0-1 female group in lieu of n=46 for all questionnaire responses

Selected Responses to Questionnaire by West Point Cadets Consuming 0-1, 2-3, or 4-5 Weekday Evening Meals in the Cadet Mess (cont'd)

Question	Percent of Group Population[1]					
	Male Cadets			Female Cadets		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=44)[2]	2-3 (n=23)	4-5 (n=17)
Meals Attend in Cadet Mess and Usually Eat at Least Half of Items Offered			(n=45)		(n=22)	
Monday - Breakfast	39	31	20	54	68	47
Monday - Lunch	6	2	0	20	14	6
Monday - Dinner	81	17	9	86	64	12
Tuesday - Breakfast	36	29	20	54	77	47
Tuesday - Lunch	6	5	7	16	18	6
Tuesday - Dinner	77	24	7	82	54	24
Wednesday - Breakfast	39	31	20	50	64	53
Wednesday - Lunch	6	2	2	25	14	6
Wednesday - Dinner	77	26	16	84	68	6
Thursday _ Breakfast	36	31	22	52	73	47
Thursday - Lunch	3	5	7	16	14	6
Thursday - Dinner	77	36	16	86	64	29
Friday - Breakfast	32	29	22	48	59	41
Friday - Lunch	6	5	2	20	14	12
Friday - Dinner	77	31	22	80	68	18
Saturday - Breakfast	94	71	58	84	86	53
Saturday - Lunch	84	64	42	80	77	71
Saturday - Dinner	94	60	44	91	77	82
Sunday - Brunch	58	43	16	73	46	53
Sunday - Dinner	90	71	38	93	77	65

[1]Where n for responses to one question differs from group n the correct n is given in parenthesis above group data.
[2]Two cadets did not turn in questionnaires; therefore, n=44 was used for the 0-1 female group in lieu of n=46 for all questionnaire responses.

Selected Responses to Questionnaire by West Point Cadets Consuming 0-1, 2-3, or 4-5 Weekday Evening Meals in the Cadet Mess (cont'd)

Question	Percent of Group Population[1]					
	Male Cadets			Female Cadets		
	0-1 (n=31)	2-3 (n=42)	4-5 (n=46)	0-1 (n=44)[2]	2-3 (n=23)	4-5 (n=17)
Frequency of 20-min Non-Stop Aerobic Exercise						
3 or more times/week	94	83	83	96	100	82
1-2 times/week	6	14	15	2	-	12
Rarely or never	-	2	2	2	-	6
Frequency of Exercises that Improve Muscle Strength						
3 or more times per week	77	81	78	77	91	59
1-2 times per week	16	12	17	23	9	35
Rarely or never	6	7	4	-	-	6
Have Physical Condition that Limits Exercising						
Yes	6	2	4	4	4	12
No	94	98	96	96	96	88
Importance of Body Weight in Maintaining Health						
Very important	77	76	87	96	91	88
Somewhat important	23	19	13	4	9	12
Not important	-	5	-	-	-	-
Importance of Food in Maintaining Health						
Very important	74	95	89	98	96	82
Somewhat important	26	5	11	2	4	18

[1]Where n for responses to one question differs from group n the correct n is given in parenthesis above group data.
[2]Two cadets did not turn in questionnaires; therefore, n=44 was used for the 0-1 female group in lieu of n=46 for all questionnaire responses.

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