AD-A168 120 NUTRIENT INTAKE EVALUATION OF MALE AND FEMALE CADETS AT THE UNITED STATES..(U) LETTERMAN ARMY INST OF RESEARCH PRESIDIO OF SAN FRANCISCO CA M J KRETSCH ET AL. APR 86 1/1

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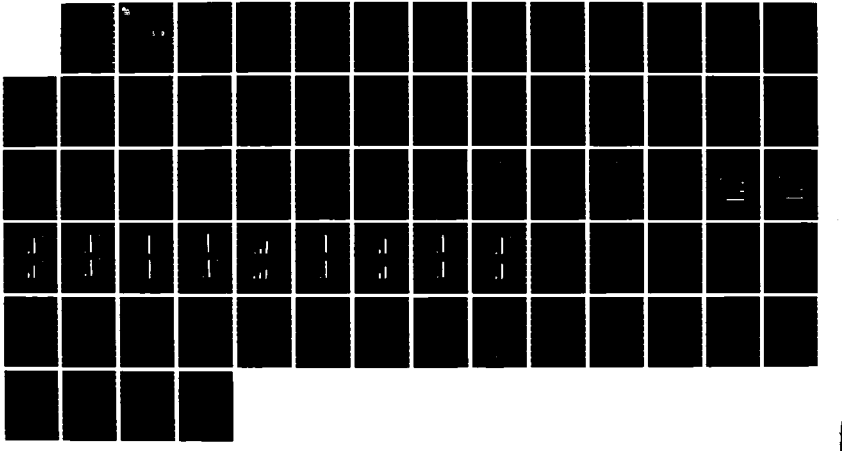

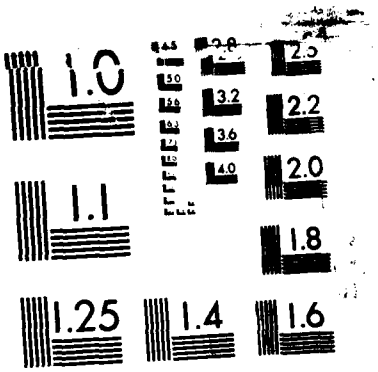

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INSTITUTE REPORT NO. 218

NUTRIENT INTAKE EVALUATION OF MALE AND FEMALE CADETS AT THE UNITED STATES MILITARY ACADEMY, WEST POINT, NEW YORK

M. J. KRETSCH, PhD
P. M. CONFORTI, MPH
and
H. E. SAUBERLICH, PhD

Report prepared by the USDA/ARS, Western Human Nutrition Research Center, Presidio of San Francisco, California 94129, for Letterman Army Institute of Research, in fulfillment of the Memorandum of Understanding signed April 4, 1980 between SEA–HN and DoD.

APRIL 1986

LETTERMAN ARMY INSTITUTE OF RESEARCH
PRESIDIO OF SAN FRANCISCO, CALIFORNIA 94129

Nutrient Intake Evaluation of Male and Female Cadets at the United States Military Academy, West Point, New York--Kretsch, Conforti, Sauberlich

Human Subjects participated in these studies after giving their free and informed voluntary consent. Investigators adhered to AR 70-25 and USAMRDC Reg 50-25 on the use of volunteers in research.

This material has been reviewed by Letterman Army Institute of Research and there is no objection to its presentation and/or publication. The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense. *(AR 360-5)*

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS *BEFORE COMPLETING FORM*
1. REPORT NUMBER LAIR Institute Report No. 218	2. GOVT ACCESSION NO. AD-A168120	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Nutrient Intake Evaluation of Male and Female Cadets at the United States Military Academy, West Point, New York	5. TYPE OF REPORT & PERIOD COVERED Final October 1979 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) M.J. Kretsch, PhD; P.M. Conforti, MPH; H.E. Sauberlich, PhD	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Nutrition Technology Division, Letterman Army Institute of Research, Presidio of San Francisco, California 94129	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Memorandum of Understanding* April 4, 1980 SEA-HN and DOD
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Medical Research and Development Command, Fort Detrick, Frederick, MD 21701	12. REPORT DATE Apr 86 13. NUMBER OF PAGES 71
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*	15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

Approved for public release: Distribution is unlimited

18. SUPPLEMENTARY NOTES

*Report prepared by USDA/ARS, Western Human Nutrition Research Center, Presidio of San Francisco, California 94129, for Letterman Army Institute of Research, in fulfillment of the Memorandum of Understanding, signed 4 April 1980 between SEA-HN and DOD.

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Military Nutrition, Military Nutrition Surveys, Military Academy, West Point, Nutrient Intake, Diet, Nutrient Density

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Nutrient intakes of male and female cadets were evaluated during the 1979-80 academic year as part of a study to determine factors contributing to weight gain in the West Point cadets. In addition, the study was the first nutritional evaluation of the cadet diet in the history of the West Point Academy. Five consecutive days of dietary data were collected from 136 males and 54 females using the diary-interview technique. Significant differences in total nutrient intake were found between sexes but not

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between classes. The mean daily energy intake was 3738 kcal for the male cadets and 2454 kcal for the female cadets. For both sexes, the average percentage of energy from protein was 13%; from fat, 38%; from carbohydrate, 46%; and from alcohol, 3%. Only 18% of the males and 11% of the females consumed less than the 35% fat calories recommended by the MRDA. Sucrose provided 14% of the daily calories in contrast to the 10% recommended by the MRDA, and dietary fiber intake was low. Overall, the cadets received adequate vitamin and mineral nutrition with the exception of iron for the female cadets. Twenty-six percent of the females had low daily iron intakes. The dining hall provided 50%, 61%, 66%, and 70% of the average daily energy intake for the First, Second, Third, and Fourth classes, respectively. There were some significant differences in nutrient density between weekday and weekend day dining hall intakes, but overall nutrient density of dining hall intake was adequate for both sexes. The exceptions were iron density on weekdays for the females and calcium density on weekdays for 17-18 year old cadets of both sexes. About 20% of the daily energy intake was from snacks. The high caloric intakes of the male and female cadets together with generally overall adequate nutrient density, resulted in a high percentage of the cadet population receiving adequate total daily vitamin and mineral nutrition. Female iron intakes were problematic but the need for iron supplementation should be determined on an individual basis. The level of calories in the cadet diet provided by fat and simple sugars should be reduced and the percentage of calories from complex carbohydrates increased. The most effective approach for correction of these nutritional inadequacies would be a combination of dining hall menu changes and nutrition education for the cadets.

ABSTRACT

Nutrient intakes of male and female cadets were evaluated during the 1979-80 academic year as part of a study to determine factors contributing to weight gain in the West Point cadets. In addition, the study was the first nutritional evaluation of the cadet diet in the history of the West Point Academy. Five consecutive days of dietary data were collected from 136 males and 54 females using the diary-interview technique. Significant differences in total nutrient intake were found between sexes but not between classes. The mean daily energy intake was 3738 kcal for the male cadets and 2454 kcal for the female cadets. For both sexes, the average percentage of energy from protein was 13%; from fat, 38%; from carbohydrate, 46%; and from alcohol, 3%. Only 18% of the males and 11% of the females consumed less than the 35% fat calories recommended by the MRDA. Sucrose provided 14% of the daily calories in contrast to the 10% recommended by the MRDA, and dietary fiber intake was low. Overall, the cadets received adequate vitamin and mineral nutrition with the exception of iron for the female cadets. Twenty-six percent of the females had low daily iron intakes. The dining hall provided 50%, 61%, 66%, and 70% of the average daily energy intake for the First, Second, Third, and Fourth classes, respectively. There were some significant differences in nutrient density between weekday and weekend day dining hall intakes, but overall nutrient density of dining hall intake was adequate for both sexes. The exceptions were iron density on weekdays for the females and calcium density on weekdays for 17-18 year old cadets of both sexes. About 20% of the daily energy intake was from snacks. The high caloric intakes of the male and female cadets together with generally overall adequate nutrient density, resulted in a high percentage of the cadet population receiving adequate total daily vitamin and mineral nutrition. Female iron intakes were problematic but the need for iron supplementation should be determined on an individual basis. The level of calories in the cadet diet provided by fat and simple sugars should be reduced and the percentage of calories from complex carbohydrates increased. The most effective approach for correction of these nutritional inadequacies would be a combination of dining hall menu changes and nutrition education for the cadets.

PREFACE

The authors wish to acknowledge the excellent support received during the USMA, West Point study from COL J. L. Anderson, Director of the Department of Physical Education (DPE); MAJ R. Massot, Officer-in-Charge, Cadet Mess; CPT M. G. Smith, DPE; and Ms. K. Glynn, Dietitian, Cadet Mess. In addition, we would like to thank the cadets from the classes of 1980, 1981, 1982, and 1983 who participated in the study. The wholehearted cooperation of the cadets greatly contributed to the success of the study.

The authors also wish to recognize the following LAIR personnel: Ms. D. Dare, Ms. J. Jensen, Ms. K. Lee, Ms. J. Lord, and Ms. N. Robinson for their outstanding efforts as interviewers, and SP5 R. Summers for his administrative assistance. In addition, the authors are indebted to Mrs. M. Thomas, Nutrition Group, NARADCOM, who provided invaluable assistance with this study, and to Mr. R. A. Nelson for data processing assistance.

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NUTRIENT INTAKE EVALUATION OF MALE AND FEMALE CADETS AT THE UNITED STATES MILITARY ACADEMY, WEST POINT, NEW YORK

The Department of Physical Education, United States Military Academy (USMA) at West Point, New York, identified a problem of weight gain developing in cadets during their academic careers. Those cadets who were found to be overweight by biannual height/weight surveys were enrolled in the Cadet Weight Control Program (CWCP), administered by the Department of Physical Education (Appendix A). During the 1978-79 academic year, 3.5% of the male cadets and 20% of the female cadets were enrolled in the CWCP. The number of cadets, particularly female cadets, participating in the CWCP was considered to be unacceptably high. This situation was of major concern to the USMA command staff and a policy was being formulated for separating from the Academy those cadets unable to maintain the required body fat standards.

The Commandant of the United States Corps of Cadets requested a study to determine factors contributing to weight gain by cadets during their academic careers. This request was forwarded from the Commandant through the Surgeon General to the Division of Nutrition Technology, Letterman Army Institute of Research (LAIR). Researchers from LAIR were sent to the West Point Academy to examine the many facets of the problem. This report presents the results from a portion of that study; the nutritional evaluation of the dietary intake of male and female cadets. This study was the first nutritional evaluation to be conducted on West Point cadets in the history of the Academy. In addition, this study is historic in that the first classes of females cadets were studied; the Class of 1980 was the first class at the Academy to include females. The evaluation of the body composition, work performance, energy expenditure, and activity patterns of male and female cadets in this study have been previously reported (1,2).

METHODS

Data Collection. Cadets were randomly selected from class rosters at West Point, informed about the study purpose and methods, and requested to volunteer for the study. It was estimated that 25 males and 25 females from each class plus 25 males and 25 females from the CWCP, would provide adequate statistical power for the study. The first 30 male and 30 female volunteers from each class served as subjects. In addition, 30 male and 30 female volunteers from the CWCP were recruited. Due to the limited number of female cadets enrolled at West Point, it was not possible to obtain 30 females from each class. In addition, less than the desired numbers of males in the 1983 class and males and females in the CWCP volunteered for the study

(Table 1). Before participating, all volunteers signed voluntary consent and privacy act statements.

Weight and height were measured on all cadets. Weight was recorded to the nearest 10 g from a triple beam balance and height to the nearest millimeter from a free standing anthropometer.

Five consecutive days (Wednesday through Sunday) of dietary data were collected from each subject utilizing a diary-interview technique developed by investigators at LAIR (3). Energy expenditure and activity pattern data, which has been previously reported (2), were collected concurrently with the dietary data. The data were collected during a three week period in October 1979.

Each subject was randomly assigned to an interviewer who had been trained in the LAIR dietary diary-interview technique. The interviewer met once with each subject before commencement of data collection and then on a daily basis, except Sundays, during the collection period. At the first dietary interview, the subjects were instructed in the procedures for recording daily food and beverage consumption on pocket-size diary cards. In addition, cadets completed a short questionnaire on habits related to dietary intake. Guidance was provided on recording the food item description, the time of eating, the source of the food or beverage, and the amount (household measures, size dimensions, package weight, etc.) of food and beverages consumed. All subjects were given a pocket-size ruler to measure foods which could not otherwise be easily quantitated such as: pieces of meat, cake, etc. Intake of water, salt, and spices were not recorded. The importance of recording information as soon as possible after eating was emphasized. At all subsequent interviews, subjects returned their completed cards to the interviewer for review and verification of portion size estimates, for clarification of unusual food items, and for assignment of each food item as a component of either a meal or snack. If an individual reported intake of nutrient supplement(s), he/she was asked to bring in the nutrient supplement bottle or label so the nutrient content of each tablet or capsule could be recorded by the interviewer.

"Family style" meals were served to the cadets at the Cadet Dining Facility. Before serving, the average portion weight was measured for all pre-portioned foods. For foods which were served in bulk, the average weight of the food in the serving dish was obtained. Each serving dish contained enough food to serve ten cadets (10 cadets were seated at each table). In addition to basic food preparation, the Dining Hall operated such industrial activities as a Meat Cutting Shop and a Bakery. Food specifications, meat cuts and grades, and exact ingredients for all breads, pastries, and desserts were obtained. Precise recipe information was obtained on all foods served in the Cadet Dining Facility. Nutrients were computed from nutrient values of the recipe ingredients. In addition, recipes and ingredient weights

were obtained for all food items purchased by cadets at local food establishments. Recipes were estimated for foods served at football tailgate parties, sponsor's homes, and other non-local restaurants.

Following data collection, each interviewer coded the dietary data of assigned subjects for computer processing and verified the correctness of the coded data. Some data coding occurred at West Point so questions could be answered while on site. Each food item was assigned a food identification number from the LAIR Nutrient Factor File (NFF) and the quantity of the food or beverage was converted from household measures to the equivalent gram weight. The NFF is a computerized file of food nutrient composition values obtained from the U.S. Department of Agriculture, other published literature, and food manufacturers. Food composition data were not available for all nutrients for all foods and therefore, calculated intakes are less accurate for some nutrients (zinc, magnesium, folacin, and vitamin B-6 and vitamin B-12).

The time of day and where the food item was consumed (source) were also coded. The sources were defined as follows:

1. Dining Hall - Foods served at the Cadet Dining Hall, box lunches prepared at the Cadet Dining Hall, and any food items carried out of the Cadet Dining Hall.

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 (i.e. cookies, etc).

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

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

Nutritional Evaluation Standards. Shown in Appendix B are the Military Recommended Dietary Allowances (MRDA) which were used to evaluate the calculated nutrient intakes. The MRDA are the nutritional standards established for the Armed Services (4), and are based on the Recommended Dietary Allowances (5). The MRDA are adapted to meet the needs of healthy military personnel of average height and weight, between the ages of 17-50 years, who are moderately active, and living in a temperate or thermally neutral environment. The recommendations contained in the MRDA differ from those in the

Recommended Dietary Allowances (RDA) for only protein. The MRDA for protein is approximately double the RDA level thereby allowing for the usual amount of protein consumed in the "average American diet." Energy allowances in the MRDA are established to meet the mean requirements of a normally distributed population and the energy range is estimated to reflect the requirements of 70% of the moderately active military population. All other nutrients for which an allowance has been set, have a margin of safety above the mean requirement included in the allowance.

In assessing the nutritional adequacy of dietary intakes, if the quantity of a nutrient consumed by particular group falls below the MRDA, some individuals in that group can be assumed to be at nutritional risk. When the proportion of individuals with low intakes in the group is large, the risk of nutritional deficiency is increased. In this report, nutrient intakes for all nutrients except energy, were termed **adequate** if consumption equalled or exceeded the standard, **marginal** if consumption was between 70% and 99% of the standard, and **low** if consumption was less than 70% of the standard.

Nutrient density (nutrients expressed per 1000 kilocalories) is often utilized as an index of dietary nutritional quality. Intakes expressed on a nutrient density basis allow for comparison of male and female intakes as well as for a determination of the degree to which dietary adequacy is a function of total calories consumed versus food choices. Nutrient density allowances were calculated by using the MRDA. The use of nutrient density allowances, however, has certain limitations. Requirements for various nutrients and, therefore, allowances which are based upon those requirements, are not always related to energy intake. For example, vitamin C, vitamin A, sodium, and potassium are essential even with a zero calorie intake. Additionally, individuals with low energy requirements will probably have higher nutrient density requirements than those with high energy needs.

Reference Groups. For comparative purposes, nutrient intake data of similarly aged (19-22 years old) males and females from the USDA Nationwide Food Consumption Survey (NFCS), conducted in 1977-78 in the 48 conterminous states, have been included in this report (6). The nutrient intake data for these reference groups was calculated from a three-day dietary record (1 weekend day and 2 weekdays). One difference between the cadets and the NFCS reference groups is their level of physical activity; the cadets performed moderate activity (2) whereas the reference groups probably performed light activity. (Activity level was not assessed in the NFCS but the general activity level of the U.S. population is light.) Activity level may affect caloric intake and therefore the overall level of nutrient intake.

Statistics. Total nutrient intake and nutrient density were computed for each subject by each source, by meal or snack, and on a daily basis. Utilizing SAS (7), a factorial analysis of variance (ANOVA) was used to test for significant effects of sex and class on total nutrient intake, nutrient density, % energy from each source, % nutrients from meals, % nutrients from snacks, and nutrients per kilogram body weight. A repeated measures ANOVA was conducted to test the effect of sex and day of the week on total nutrient intake, nutrient density, and nutrients from the dining hall. The effect of energy intake quartile on total nutrient intake and nutrient density was tested with a one-way ANOVA. A repeated measures ANOVA was used to test the effects of sex and weekday vs. weekend day on total nutrient intake and nutrient density of intake from the dining hall. Log transformations were performed before ANOVA analysis on total nutrient intake, nutrient density of intake, and nutrient intake per kilogram of body weight. A 2 x 4 factorial ANOVA was used to test the effects of sex and class on the heights and weights of the cadets. If analyses were found to be significant at $p<.01$, then variables were tested with Duncan's Multiple Comparisons procedure. Differences are indicated as significant in the text of this report if $p<0.01$.

RESULTS AND DISCUSSION

Anthropometric Data. The number of male and female cadets studied in each class and in the CWCP and their average ages, weights, and heights are shown in Table 1. There were no significant differences between classes for weight or height. Group sample size varied but the statistical programs accommodated unequal group sizes. The small number of volunteers from the CWCP precluded any statistical comparisons between CWCP cadets and the general cadet population. Some of these data are presented in the tables for interest, but are not discussed in the report.

Some, but not all, of the cadets participating in the dietary evaluation had skinfold measurements taken. Presented in Table 2, for reference purposes, is the percent body fat calculated from skinfolds for male and female cadets who participated in the body composition portion of the study during the Fall of 1979 (1). (Some of the cadets that participated in the dietary evaluation are included in these data.) Females had a significantly greater percentage of body fat than the males. In addition, there were no significant differences between cadet classes. The means for female classes exceeded the acceptable percentage of body fat (22%) allowed under the CWCP (Appendix A). Except for the class of 1983, which was only slightly over the standard, the mean percentage of body fat for the male groups was within the acceptable range (10 to 15%).

Questionnaire Data. Tables 3, 4, and 5 present the results of the questionnaire on recent dietary change, nutrient supplement usage, and frequency of salt usage at meals. Dietary change responses (Table 3) varied by class and sex. Overall, a greater percentage of the women than the men indicated that they were eating less within the last month. Since the study was conducted shortly after the commencement of Fall academic courses, "within the last month" meant a change from summer Academy dietary patterns for the First, Second and Third classes but a change from home eating patterns for the Fourth class. This may explain the higher percentage of the Fourth class males (52.6%) reporting a dietary change within the last month. This same pattern, however, was not found for the Fourth class female cadets. Nutrient supplement usage was markedly different between the sexes (Table 4); about 15% of the men compared to 50% of the women reported usage. However, supplement usage did not differ between classes. Twenty-two percent of the males and 35% of the females in the NFCS reference groups reported that they consumed nutrient supplements. Frequency of salt usage at meals (Table 5) was obtained since the calculated nutrient intakes include sodium from foods but not salt added at the table. Overall, between 40-50% of the males and females reported that they "frequently" or "always" added salt at meals. Therefore, actual sodium intake was higher than the calculated sodium intakes indicate.

Source of Average Daily Energy Intake. Figures 1 and 2 present the average daily energy intake by source (dining hall, home, restaurant, or vendor) and from meals, respectively. The dining hall provided 50%, 61%, 66%, and 70% of the average (5-day) daily energy intake for the First, Second, Third and Fourth classes, respectively. As would be expected, the dining hall was the principal provider of energy for all cadets; and meals provided the majority of energy (Figure 2). The First class received significantly less energy from the cadet dining hall and significantly more from restaurants than did the other three classes. Restaurants supplied 16% of the daily meal energy for the First class. About 20% of the daily energy intake for male and female cadets was from snacks. This level of daily energy from snacks is the same as found for the reference groups and for previously studied military populations (6,8). Although not significant, there was a trend for more energy to be obtained from snacks as cadets advanced in class. This is consistent with the increased independence and discretionary time allowed upperclass cadets (i.e. less duties and services were required of them). Restaurants and vendors were the prime providers of snack energy.

Total Daily Nutrient Intake. Presented in Tables 6 through 11 are the average (5-day) nutrient intakes from food, beverages, and nutrient supplements for male and female cadets. For nearly all nutrients, total daily intakes were significantly different between

sexes but not between classes. Therefore, the results in the tables are presented by sex but not by class. The ANOVA results are summarized in Table 12. In addition, significant effects for day of the week were found for all nutrients except riboflavin and total sugars. The reason for the day of the week effect is not known, but may be a reflection of dining hall daily menu differences.

The male and female cadet average total daily nutrient intakes are reported in Table 7. For comparison purposes, the average daily intakes of the NFCS reference groups are shown. Mean intakes for the male cadets met or exceeded the MRDA for all nutrients calculated. This also was true for the female cadets except for iron, magnesium, zinc, folacin, and calcium. Calcium intake was low for only the 17 and 18 year old females. It should be remembered, however, that the food nutrient composition data for magnesium, zinc, and folacin were limited, and therefore the calculated values for these nutrients are probably low. The average daily energy and protein intakes per kilogram of body weight are reported in Table 8. Tables 10 and 11 provide the mean, the median, selected percentiles, and the minimum and maximum total daily nutrient intakes for the males and females, respectively. There was fairly close agreement between mean and median values for most nutrients except the vitamins. Mean vitamin intakes were skewed due to the consumption of high dosage vitamin supplements by some cadets.

1. Energy. Presented in Table 6 are the average energy intakes for male and female cadets by day of the week. For both sexes, caloric intake was significantly higher on Saturdays and Thursdays and significantly lower on Wednesdays and Sundays than the other days of the week. These differences were consistent over the three week period studied. However, for the males it should be noted that there was a 500 kcal difference between the Saturday mean and median intake values; thus indicating that the data was skewed by high values. The percentage of calories from protein did not differ significantly by day of the week. However, the proportion of fat calories was highest on Thursday and the proportion of alcohol calories was highest on Saturday. These elevations most probably account for the high caloric intakes reported for those days.

The average daily energy intake was 3738 kcal for male cadets and 2454 kcal for female cadets (Table 7). Thirty-four percent of the males and 50% of the females were within the MRDA energy intake range established to be adequate for moderately active military personnel (Appendix B). Seven percent of the males were below and 59% were above the MRDA energy intake range; 22% of the females were below and 28% above the MRDA energy intake range. When energy intake was expressed on a per body weight basis (Table 8), there was a significant difference between sexes but not between classes. Males consumed an average of 49.2 kcal/kg and females an average of 41.1 kcal/kg. Whether expressed on a total or a body weight basis, the

majority of the males were consuming more energy than recommended for moderately active personnel. The daily energy intake of the West Point male cadets is very similar to the level previously reported (3705 kcal per day) for moderately-active, male, military cadets in Great Britain (9). There is no information in the literature on energy intake levels for females cadets.

There was a significant difference between males and females for total calories but not for the proportion of calories from protein, fat, carbohydrate, and alcohol. The average percentage of energy from protein was 13%; from fat, 38%; from carbohydrate, 46%; and from alcohol, 3%.

2. Protein. There was no significant difference in protein intake between classes or sexes on a total or per body weight basis. Mean protein intakes for male and female cadets exceeded the MRDA (Table 7). Eighty-six percent of the male cadets and 57% of the females cadets met or exceeded the MRDA for protein (Figure 3). Mean protein intakes per kg of body weight (Table 8), were 1.6 and 1.4 g for male and female cadets, respectively. For both sexes, about 70% of the protein intake was from animal sources and about 30% from plant sources. (It should be noted that the totals for the animal and plant protein percentages reported in Tables 7, 10, and 11, are less than 100% due to missing values in the nutrient file.)

3. Fat and Cholesterol. Table 9 shows the percentage of male and female cadets, compared to the NFCS reference group, receiving specified percentages of food energy from fat. The MRDA recommends that calories derived from fat should not exceed 35% of the total daily calories; only 18% of the males and 11% of the females had daily fat calories below this level. Eighteen percent of the NFCS males and 23% of the NFCS females consumed less than 35% of their calories as fat. About 50% of the male and female cadets consumed between 35-39% fat calories, and about 30% consumed between 40-45% of their calories as fat. Only about 3% of the cadets consumed greater than 45% fat calories; this is in contrast to 25% of the reference group.

At the time this study was conducted, the 1976 version of the MRDA was in effect. That version specified that less than 40% of daily calories should be from fat. About two-thirds of the male and female cadets received less than 40% of their energy from fat. This is a higher percentage than was found for the men and women in the USDA study (about 45%) which was conducted at about the same time.

The ratio of plant to animal fat intake was about 0.9 for male and for female cadets. Fat from fish was negligible in the diets of both sexes. (Again, missing values in the nutrient file reduces the sum of the animal, plant, and fish fat percentages in Tables 7, 10, and 11 to less than 100%.) Cholesterol intakes (600 and 400 mg/day

for males and females, respectively) were of about the same magnitude previously found in male and female Marines (8), but higher than found in the NFCS reference groups (10).

A study (11) conducted in the Spring of 1979 at the West Point Academy found, with few exceptions, that the serum lipid profiles of the female cadets were normal. However, elevated serum triglycerides were found in 20% of the male cadets studied. A small number had elevated serum total cholesterol or below normal levels of serum high density lipoprotein cholesterol. In addition, approximately 10% of the male cadets had a cholesterol risk factor slightly above average. The cholesterol risk factor is derived from the ratio of the serum total cholesterol and serum HDL cholesterol values (11).

4. Carbohydrate, Crude Fiber, and Alcohol. Carbohydrate provided about 46% of the average daily energy intake. The MRDA recommends that carbohydrates contribute between 50 to 55% of the total dietary energy and that simple, refined, and other processed sugars provide only 10% of the total energy. Total sugar consumption accounted for 21% of the mean caloric intake for male and female cadets. Sucrose alone provided 14% of the total daily energy for both sexes. The proportion of calories supplied by total sugars and sucrose is the same as found in a previously studied Marine population (8), but higher than found in the general U.S. population. In 1984, average total sugar consumption in the U.S. population was 18% and average sucrose intake was 9% of the daily mean caloric intake (12). (Total sugar and sucrose consumption for the U.S. population in 1979 was not available.) The average crude fiber intake of the American population ranges from 3 to 7 grams per day. Male and female cadets consumed 4.3 g and 3.3 g per day, respectively. This level of fiber intake is low but of the same magnitude as the levels previously measured in military populations. Alcohol consumption occurred primarily on Saturdays. Only 3% of the average energy intake for males and females was from alcohol.

5. Minerals. Ninety-five to 100% of the male cadets received adequate amounts of calcium, phosphorus, and iron in their average daily diet (Figures 4-6). However, lesser numbers of female cadets received adequate amounts of these nutrients. Twenty-six percent of the females had low iron intakes and 11% had low calcium intakes. Although mean iron intake for the females was below the MRDA, the level (16.2 mg) was higher than has been reported for other military and U.S. populations (6,8). (The MRDA acknowledges that moderately active female personnel consuming an average of 2400 kcal per day may require supplemental iron to meet the recommended 18 mg per day.) Similarly, although the mean calcium intake for females was below the 1200 mg per day level recommended for 17 and 18 year olds, the level (954 mg) was higher than found for most U.S. women (13). Only 25% of the female cadets had daily calcium intakes less

than 800 mg. A calcium to phosphorus ratio of 0.7 was found for both sexes. A ratio between 1:1 to 1.5:1 is considered nutritionally desirable.

The female cadets mean caloric intake was higher than has been found for other females studied in the military and the U.S. population. The average dietary iron and calcium densities of the female cadets, however, was not higher than the other populations. Therefore, the female cadets high caloric intake was responsible for a greater percentage of them receiving adequate iron and calcium nutrition than was found for the other populations.

In a previous study (11), some incidence of anemia was found to exist in the male and female cadets. Overt anemia was observed in only a few subjects, but a subclinical form of anemia, as revealed by low serum iron levels, low iron saturation values, and low serum ferritin levels existed in a larger segment of the population. This anemia was present in one-fourth of the female cadets studied but in a smaller proportion of the male cadets. The reason for this low iron nutriture in the male cadets is difficult to explain on a dietary basis; 99% of the males in this study received adequate dietary iron. However, heavy exercise may induce a "sports anemia" and a significant percentage of the male cadets were engaged in heavy exercise (2). It should be noted, however, that "sports anemia" is a transient phenomenon usually lasting less than one month in duration.

The average daily sodium consumption levels, not including table salt usage, was 4048 mg for male cadets and 2764 mg for female cadets (Tables 10 and 11). About 10% of the male cadets exceeded the maximum level (5500 mg per day) recommended by the MRDA. This figure would have been higher if discretionary salt had been assessed and included in the calculations. Potassium intake averaged 3652 mg and 2454 mg for male and female cadets, respectively. Ninety-five percent of the male cadets and 75% of the female cadets were within the "estimated safe and adequate range" recommended by the United States RDA for potassium (i.e. 1875-5625 mg/day). The sodium and potassium intakes of the cadets are higher than reported in the NFCS (10), but the ratio of sodium to potassium intake (i.e. 1.1) is the same. The higher intake levels are probably reflective of the cadets higher caloric intakes.

In spite of limited food nutrient composition data, the male cadets mean intake of zinc and magnesium exceeded the MRDA; this was not true for the females. The females average magnesium and zinc intakes were equal to 79% and 75% of the MRDA, respectively.

6. Vitamins. The male cadets average vitamin intakes (Tables 7 and 10) exceeded the MRDA. Except for folacin, this was also true for the females. It should be noted, however, that the

mean B-vitamin intakes of the females were exceptionally high due to the usage of high dosage vitamin supplements by some female cadets. The median B-vitamin intake values, shown in Table 11, are more reflective of the vitamin levels consumed from food by the females. These median values exceeded the MRDA for all B-vitamins except B-6 and folacin. Fewer male cadets took nutrient supplements and therefore their mean intake values were not skewed.

Daily vitamin A intakes were marginal for about 20% and low for about 6% of the cadets (Figure 7). Essentially none of the male cadets and 7% or less of the female cadets had low daily intakes of vitamin C, thiamin, riboflavin, or preformed niacin (Figures 8-11). About 50% of the male cadets met the MRDA for vitamin B-6 and folic acid and 94% for vitamin B-12, in spite of limited food nutrient composition data. In contrast, about 25% of the female cadets met the MRDA for vitamin B-6 and folacin and 72% for vitamin B-12. Even with missing nutrient values, the low percentages of male and female cadets meeting the MRDA for vitamin B-6 and folacin may be indicative of a problem of marginal B-6 and folacin nutriture. In the previously mentioned study (11), low serum folacin levels were found for 17% of the male cadets and 14% of the female cadets.

Nutrient Density Evaluation. Presented in Table 13 are the average (5-day) daily nutrient density values from food, beverages, and nutrient supplements for the male and female cadets. (For comparative purposes, nutrient density values of the NFCS reference groups are also given.) Analysis of variance yielded significant effects of day of the week, class, and sex on dietary nutrient density. Day of the week significantly affected all nutrient densities, but only some densities were affected by class and sex. The effects of class and sex on nutrient density values are summarized in Table 12.

Significant differences between sexes were found for vitamin density values (vitamin A, thiamin, riboflavin, niacin, vitamin C and folacin). Except for vitamin A, this is probably a result of the high dosage vitamin supplements used by some of the female cadets. The median intake values of the females for these B- vitamins (indicated in the Table 13 footnote) are similar in magnitude to the mean vitamin nutrient density levels of the male cadets. Therefore, if nutrient supplements had been excluded from the calculated vitamin intakes, it is unlikely that significant differences between the sexes would have occurred for the B-vitamins. The sex difference in vitamin A density appears to be unrelated to vitamin supplement usage. Fiber and iron density were also significantly different between the male and female cadets. Significant differences in the alcohol, cholesterol, riboflavin, niacin, and vitamin B-6 dietary densities were found between classes. The First class consumed significantly higher alcohol, riboflavin, niacin, and vitamin B-6 densities and the Fourth class consumed a significantly higher

cholesterol density than the other classes. The Fourth class, but not the other classes, was required to attend breakfast at the dining hall. The consumption of eggs at breakfast caused their higher cholesterol dietary density. The reason for the day of the week effect on nutrient density is not known, but most probably was caused by daily dining hall menu differences.

Mean nutrient densities of the male cadet diet met or exceeded the nutrient densities calculated from the MRDA for all nutrients except sodium, magnesium, vitamin B-6 and folacin. Since salt added at the table is not included in the calculated nutrient density, a sodium density value lower than the MRDA is desirable. The vitamin B-6, folacin, and magnesium densities in the cadet diet were only slightly below those of the MRDA. Considering the limited food nutrient composition data available for these nutrients, for all practical purposes, these nutrient densities were adequate.

Mean nutrient densities of the female cadet diet were less than those of the MRDA for iron, sodium, magnesium and zinc. In addition, mean calcium density values were not adequate for the 17 and 18 year old female cadets, and vitamin B-6 and folacin median intakes were slightly less than the MRDA. Again, the fact that food nutrient composition data was limited for magnesium, zinc, vitamin B-6, and folacin impacts on the interpretation of this data.

Nutrient density of food intake for nearly all nutrients was remarkably similar between the West Point cadets and the NFCS reference groups. The NFCS groups had higher vitamin A, vitamin B-12, protein, magnesium, and phosphorus densities than the cadets. However, the NFCS groups also consumed less total daily calories than the cadets, which may in turn affect nutrient density for some nutrients such as protein.

The mineral intake distributions of the male and female cadets were essentially the same whether expressed on a total daily or nutrient density basis (Figures 4-6). Eighty-seven to 100% of the male cadets had adequate calcium, phosphorus, and iron densities in their diets. Ninety-one percent of the female cadets had adequate phosphorus densities, 22% had low iron densities, and 9% had low calcium densities. Although about 70% of the male and female cadets had adequate total daily vitamin A intakes, 100% of the females, but only 52% of the males, had adequate vitamin A densities (Figure 7). This indicates that low caloric intake, and not food choices, caused the low and marginal total daily vitamin A intakes of female cadets. In contrast, the male cadets met the daily MRDA for vitamin A through increased caloric intake rather than through selection of vitamin A rich foods. Four percent or less of the male and female cadets consumed low vitamin C, thiamin, riboflavin, and niacin densities (Figures 8-11). However, 29% of the males consumed marginal thiamin density in their diets and 16-20% of both sexes consumed intakes with

marginal niacin density. The requirements for thiamin, riboflavin, and niacin are considered to increase with increased caloric consumption. Therefore, if those cadets that had "marginal" thiamin and niacin densities were also the cadets with lower caloric intakes, then their thiamin and niacin densities may have been adequate rather than marginal.

Nutrient density of food intake by energy intake quartile is shown in Table 14 for male cadets and in Table 15 for females cadets. Except for fat, no significant differences in nutrient density were found between energy quartiles. Male cadets in the highest energy intake quartile (4098-6325 kcal per day) had significantly higher fat density in their diet. In addition, the male cadets calcium and sodium densities decreased, although not significantly, with increasing caloric intake. Similarly, densities in the female diet of cholesterol, calcium, vitamin A, and vitamin C decreased with increased caloric consumption.

Average Caloric Intake and Nutrient Density of Food Consumed at the Cadet Dining Hall. Caloric intake and the percentage of calories from protein, fat, and carbohydrate are shown in Table 16 for food and beverages consumed at the Cadet Dining Hall. Significantly more calories were consumed by both sexes on weekdays than on weekend days at the dining hall. The percentage of calories supplied by protein did not differ significantly between weekday and weekend days, but the percentage of calories supplied by fat and carbohydrate did. Percent fat calories were significantly higher for both sexes on weekdays; averaging 41-42% fat calories.

Table 17 presents the nutrient density of food consumed by cadets at the dining hall. There were no significant differences in nutrient density values between sexes, but there was a significant difference between the densities on weekdays and weekends. Dietary fat density was higher on weekdays and carbohydrate density was higher on weekend days. The sucrose density levels were constant between weekdays and weekends. Cholesterol, calcium, phosphorus, iron, potassium, thiamin, riboflavin, and vitamin C densities were higher on weekends. The nutrient density values for intakes from the the dining hall exceeded those of the MRDA for all nutrients except iron on weekdays for the females, and calcium on the weekdays for cadets, aged 17-18 years, of both sexes. Sodium density values averaged between 1100-1200 mg per 1000 kcal. This, of course, does not include table salt usage.

CONCLUSIONS

The nutrition of male and female cadets during the 1979-80 academic year was evaluated as part of a study undertaken to assess contributory weight gain factors in USMA cadets over the course of their academic career. This study was the first nutritional

evaluation of the cadet diet in the history of the West Point Academy. In addition, this study is historic in that the first classes of female cadets were studied; the Class of 1980 was the first class at the Academy to include females.

Dietary nutritional adequacy was assessed in three ways: (1) comparison of the group's mean total daily nutrient intake from foods, beverages, and nutrient supplements with the military nutritional standards (MRDA), (2) comparison of the group's mean nutrient densities with the MRDA expressed on a per 1000 kcal basis, and (3) comparison of the mean daily nutrient intake and nutrient intake density of individuals to the MRDA, and then expression of these results as the percentage of the males and females with low, marginal, and adequate intakes. Since the mean value of a group can mask the fact that a substantial portion of the individuals within that group may have nutrient intakes far below or above the nutritional standard, examination of the distribution of individuals with low, marginal and adequate nutrient intakes within a population better identifies the nutritional adequacy of their diet.

The mean daily energy intake of the male cadets (3738 kcal; 49.2 kcal/kg) was at a level commensurate with moderate to heavy activity, whereas the females mean daily energy intake (2454 kcal; 41.1 kcal/kg) was indicative of a moderate activity level. The daily energy intake of the male cadets is remarkably similar to the level previously reported (3705 kcal per day) for moderately active, male, military cadets in Great Britain (9). (The energy intake, expenditure, and balance of the male and female cadets in relationship to anthropometric measurements will be discussed in depth in an upcoming report.)

For both sexes, the average percentage of energy from protein was 13%; from fat, 38%; from carbohydrates, 46%; and from alcohol, 3%. The level of calories provided by fat in the cadet diet should be reduced to meet the MRDA. Only 18% of the male cadets and 11% of the female cadets consumed the recommended less than 35% of calories from fat. Since the Cadet Dining Facility is the major provider of nutrition for the cadets, the daily percentage of fat calories could be reduced by decreasing the quantity of fat in dining hall meals. The percentage of calories from fat in dining hall meals was particularly high on weekdays; averaging 41%.

In addition to reducing the proportion of fat in their diets, the cadets also need to reduce the percentage of calories received from simple sugars, in particular from sucrose. Sucrose provided 14% of the total daily calories in contrast to the 10% maximum recommended by the MRDA. The quantity of sucrose provided by dining hall meals should be reduced. Complex carbohydrates should be increased to replace those calories lost by the reduction of dietary fat and sucrose. Increased complex carbohydrates will concurrently increase the dietary fiber level of the cadet diet. The fiber level reported

in this study is considerably lower than what is currently thought to be consistent with good health.

Overall, the cadets received adequate vitamin and mineral nutrition. The exception was iron intake for the female cadets. Twenty-six percent of the females had low daily iron intakes and 22% had daily intakes with low iron density. The MRDA acknowledges that moderately active female personnel consuming an average of 2400 kcal per day may require supplemental iron to meet the recommended 18 mg per day, but that supplementation should be determined on an individual basis. Hematological parameters of the West Point cadets were evaluated six months prior to this study (11). One-fourth of the females studied had evidence of subclinical anemia as revealed by low serum iron levels, low iron saturation values, and low serum ferritin levels. Therefore, iron supplementation should be considered for those female cadets with marginal iron nutriture.

Nutrient densities of intakes were similar in magnitude to those found for the reference NFCS groups and for previously studied Marines. Protein and phosphorus density values for both sexes were higher, and vitamin A density value for the male cadets was lower than reported for the NFCS reference groups. Although about 70% of the male and female cadets had adequate total daily vitamin A intakes, 100% of the females, but only 52% of the males, had intakes with adequate vitamin A density. The male cadets who met their daily MRDA for vitamin A, did so through high caloric intake rather than through selection of vitamin A rich foods. The high calorie intakes, in part resulting from the moderate to heavy activity levels of the male and female cadets, were responsible for the high percentage of the cadet population receiving adequate vitamin and mineral nutrition.

The Cadet Dining Hall Facility was the principal provider of energy for all cadets. The dining hall provided 50%, 61%, 66%, and 70% of the average daily energy intake for the First, Second, Third, and Fourth classes, respectively. The Cadet Weight Control Program, in effect at the time of the study, permitted the First, Second, and Third classes to skip breakfast at the dining facility. This, in conjunction with the greater freedoms and privileges allowed the upper cadet classes, may account for their reduced consumption of daily energy in the dining hall. The First class received significantly more energy from restaurants than did the other three classes; restaurants provided 24% of the First class's energy intake. About 20% of the daily energy intake for male and female cadets was from snacks. This level of daily energy from snacks was the same as has been found for similarly aged military and civilian populations (6,8).

There were some differences in nutrient density between weekday and weekend day dining hall intakes. However, overall nutrient

density from dining hall foods was adequate for both sexes. The exceptions were iron density on weekdays for the females and weekday calcium density for 17-18 year old cadets of both sexes. The fact that these densities were not adequate is not unexpected. The high requirements for these nutrients are difficult to meet through foods alone.

In order to correct the nutritional inadequacies found in this study, the most effective approach would be a combination of dining hall menu changes and nutrition education. Since the dining hall is the primary source of nutrition for the cadets, menu changes will change their nutrition. However, the cadets received from 30 to 50% of their daily energy intake from food sources outside of the cadet dining facility. Therefore, a nutrition education program would provide the cadets with the necessary knowledge to make nutritionally sound food choices from these outside establishments. In addition, a nutrition education program would provide knowledge that could be used by the cadets throughout their Army careers and their lives as part of a program for health maintenance.

RECOMMENDATIONS

1. Reduce the percentage of calories from fats and simple sugars and increase those from complex carbohydrates in the diets of male and female cadets.

2. Evaluate, on an individual basis, the need for iron supplementation of the female cadets.

3. Reduce the quantity of fat and simple sugars and increase the quantity of complex carbohydrates provided in meals at the Cadet Dining Facility.

4. Institute a cadet nutrition education program to provide the necessary knowledge for cadets to make nutritionally sound food choices outside of the dining hall and throughout their Army careers as part of a program for health maintenance.

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APPENDIX A. USMA Weight Control Program
APPENDIX B. Military Recommended Dietary Allowances for Selected Nutrients
APPENDIX C. Cadet Dining Hall Menus
APPENDIX D. Figures 1-11
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APPENDICES

CADET WEIGHT CONTROL PROGRAM

APPENDIX A

THE UNITED STATES CORPS OF CADETS
WEIGHT CONTROL PROGRAM

RESPONSIBILITY:

The Director, Department of Physical Education (DPE), is responsible for the administration of the USCC Weight Control Program.

IDENTIFICATION:

Cadets will undergo biannual height/weight surveys, typically held in conjunction with regularly scheduled DPE testing. Those cadets found to exceed, or be within 2% of exceeding, the maximum body weights in AR 600-9 will be required to report to DPE for a percent body fat measurement.

Additionally, cadets are required to report to DPE for a body fat measurement when:

a. Volunteering for the program.

b. Directed by an officer or another cadet in the chain of command.

PERCENT BODY FAT CALCULATION:

Percent body fat will be calculated for cadets using skinfold techniques and mathematical formulas, a relatively simple and accurate method. The normal error encountered by such measurements is taken into account in developing standards. The skinfold technique accounts for body build, muscular development, muscle tone, and bone structure. AR 600-9, Paragraph 3-4, indicates that these body parameters should be included in obesity determination.

Once the percentage of body fat is calculated, cadets will be categorized as follows:

	PERCENT BODY FAT		
CATEGORY	MALE (%)	FEMALE (%)	REMARKS
V	0-5	0-8	Very low, caution
IV	5.1-10	8.1-17	Excellent
III	10.1-15	17.1-22	Acceptable
II	15.1-16	22.1-23	High, bi-weekly weigh-ins required.
I	over 16.1	over 23.1	Mandatory Weight Control Program.

WEIGHT CONTROL PROGRAM

Cadets who are in Categories I or II are required to report to DPE Weight Control Clinic every 7-14 days to be weighed.

Cadets in Category I will be allowed a period of time to lose adipose tissue (fat) in order to achieve Category II or a higher category. Time allowed to lose fat will be equal to one week for every 0.5% body fat they exceed the body fat limits of Category II; however, the time period will not be less than two weeks. For example, a male cadet may weigh 200 pounds of which 19% is fat. Since his percent body fat is 3% over the 16% Catergory II limit, he is allowed 6 weeks to lose that 3% body fat. In this case, the 3% body fat equals 6 pounds of adipose tissue.

If a cadet has not attained the appropriate level of body fat at the end of the prescribed time period, there are two possible courses of action. At the discretion of the Director, DPE, the cadet will be recommended for dismissal, or will be granted a time extension to reach the required goal. The extension, if granted, will be no longer than one-half the originally prescribed time period. For example, the cadet described above is found to have 18% body fat at the end of the 6 weeks. He could be granted a maximum extension of 3 weeks to reach the Category II level of 16% body fat. Should the cadet still fail to reach a Category II level during the extension, the cadet may be recommended for dismissal.

Cadets who fall into Category II, or higher, and who regress into Category I two (2) or more times during any one Academic Year, may be recommended for administrative dismissal. For example, in September a female cadet may weigh 140 pounds with 24.5% body fat. She is granted 3 weeks to make the 23% Category II limit. At the end of the 3 week period she is found to have 22.5% body fat which is within the Category II limit. The cadet is then required to weigh-in at DPE biweekly. A weight gain is discovered in November, and a new resultant percent body fat measurement shows her to have 23.5% body fat. She is then allowed another period of two weeks to attain the Category II level. If she reaches the prescribed level in 2 weeks and a month later found to have 21.5% body fat, she would be released from the program. If the cadet is administered another percent body fat measurement in February as a result of a weight gain shown in a routine class height/weight survey, and found to be 24% body fat, she could be recommended for dismissal.

ADMINISTRATIVE DISMISSAL

Administrative dismissal under the Weight Control Program will be processed in accordance with Regulations for the United States Military Academy, paragraph 12.04 (proposed para 10.08, Revised Regs USMA).

MILITARY RECOMMENDED DIETARY ALLOWANCES FOR SELECTED NUTRIENTS

APPENDIX B

Military Recommended Dietary Allowances for Selected Nutrients

Nutrient	Unit	Daily Intake Level		Calculated Nutrient Density Level	
		Males	Females	Males	Females
Energy[1,2]	kcal	3200 (2800-3600)	2400 (2000-2800)	----	----
Protein	gm	100	80	31.2	33.3
Vitamin A	IU	5000	4000	1562	1667
Ascorbic Acid	mg	60	60	18.8	25.0
Thiamin	mg	1.6	1.2	0.50	0.50
Riboflavin	mg	1.9	1.4	0.60	0.60
Niacin	mgNE	21	16	6.6	6.6
Vitamin B-6	mg	2.2	2.0	0.68	0.83
Folacin	mcg	400	400	125	167
Vitamin B-12	mcg	3.0	3.0	0.94	1.25
Calcium	mg	800(1200)[3]	800(1200)[3]	250(375)[3]	333(500)[3]
Phosphorus	mg	800(1200)[3]	800(1200)[3]	250(375)[3]	333(500)[3]
Magnesium	mg	350(400)[3]	300	109(125)[3]	125
Iron	mg	10(18)[3]	18	3.1(5.6)[3]	7.5
Zinc	mg	15	15	4.7	6.25
Sodium	mg	5500[4]	4100[4]	1700	1700

[1]Energy allowance ranges are estimated to reflect the requirements of 70 percent of the moderately active military population.
[2]Dietary fat calories should not contribute more than 35 percent of total energy intake.
[3]Higher value is the requirement for 17-to-18 year olds; lower value for 19-to-50 year olds.
[4]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.

CADET DINING HALL MENUS

APPENDIX C

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UNITED STATES MILITARY ACADEMY

WEST POINT NEW YORK

Originated by Cadet Mess Staff

Approved by Cadet Mess Menu Board

CADET MESS MENU

Week Ending 7 October 1979

BREAKFAST	LUNCH	DINNER
	MONDAY 1 Oct 79	
Orange Juice Assorted Dry Cereal Pineapple Hotcakes w/Maple Syrup and Margarine Brown and Serve Sausage Raisin Bran Muffins* Assorted Jellies - Honey Coffee - Milk	Taco Shells w/Meat Filler, Taco Sauce, Chopped Onions, Shredded Lettuce, Sliced Tomatoes and Cheese Macaroni Salad Fruit Jello Grape Drink	Chilled Half Grapefruit w/Rum Syrup Roast Fresh Ham w/Pan Gravy Mashed Potatoes Green Beans Bread - Margarine Cocoanut Sheet Cake Coffee - Apple Juice - Milk
	TUESDAY 2 Oct 79	
Pineapple Juice Orange Juice* Assorted Dry Cereal Chopped Sirloin Pattie Scrambled Eggs Sugar Doughnuts Assorted Jellies - Honey Toast - Margarine Coffee - Milk	Hot Corned Beef Sandwich w/Slice of Swiss Cheese Braised Sauerkraut Shoestring Potatoes Rye Bread - Margarine Chilled Mixed Fruit - Cookies Iced Tea w/Lemon Slice	Chicken Parmigiana Spaghetti w/Marinara Sauce and Grated Cheese Tossed Green Salad w/Oil and Vinegar Dressing Italian Bread - Margarine Black Forest Tart Coffee - Orange Drink - Milk
	WEDNESDAY 3 Oct 79	
Orange Juice Assorted Dry Cereal Platter of Fried and Scrambled Eggs Hot Shaved Ham Toast - Margarine Fruit Filled Sweet Rolls Assorted Jellies - Honey Coffee - Milk	Vegetable Soup w/Crackers Grilled Hamburger Patties w/Sliced Onions and Tomato Slices Dill Pickle Spears Potato Chips Hamburger Rolls - Mayonnaise Spice Sheet Cake Chocolate and White Milk	Veal Cordon Bleu w/Wine Sauce Risi Bisi Kernel Corn Chopped Lettuce w/French Dressing Bread - Margarine Pineapple Cheese Pie Coffee - Cherry Drink - Milk
	THURSDAY 4 Oct 79	
Grape Juice Orange Juice* Assorted Dry Cereal Bacon Omelet Potato Pisces Crumb Coffee Cake Toast - Margarine Assorted Jellies - Honey Coffee - Milk	Fishwich w/Slice of Cheese, Chili Tartar Sauce and Lemon Slice Potato Salad Coleslaw Rolls - Margarine White Sheet Cake w/Melba Sauce Hawaiian Punch	Relish Tray Grilled Sirloin Steak w/Bordelaise Sauce Rissole Potatoes Carrots ala Vichy Italian Bread - Margarine Fruit Pie Coffee - Lemon Lime Drink - Milk
	FRIDAY 5 Oct 79	
Orange Juice Assorted Dry Cereal Cinnamon French Toast w/Maple Syrup and Margarine Bologna Slice Bagels w/Cream Cheese* Assorted Jellies - Honey Coffee - Milk	Beef Stew w/Fresh Garden Vegetables Wide Noodles Bread - Margarine Bowl of Fresh Fruit Ice Cream Sandwich Fruit Punch	Meatza Pizza w/Mozzarella Cheese Cheddar Fries Antipasto Salad w/Oil and Vinegar Dressing "Go Army" Cake Lemon Soda - Milk
	SATURDAY 6 Oct 79	
Melon Balls Orange Juice* Assorted Dry Cereal Scrambled Eggs Crisp Bacon Sweet Rolls Toast - Margarine Assorted Jellies - Honey Coffee - Milk	Fried Chicken Breasts w/Veloute Sauce Curried Rice Peas w/Mushrooms Bread - Margarine Butterscotch Brownies Coffee - Lemonade	Baked Virginia Ham w/Pineapple Glaze Scalloped Potatoes Green Beans Cottage Cheese Jubilee Salad Whole Wheat Bread - Margarine Ice Cream duJour Coffee - Milk Iced Tea w/Lemon Slice
BRUNCH	SUNDAY 7 Oct 79	
Orange Juice Assorted Dry Cereal Eggs MacArthur w/English Muffin Potato Cakes Coffee Ring - Fruit Compote Assorted Jellies - Honey Coffee - Chocolate and White Milk		Grilled Chopped Steak w/Onion Gravy Roast Potatoes Mixed Vegetables Tossed Green Salad w/Dressing Cottage Custard Pudding w/Rum Sauce Coffee - Milk Iced Tea w/Lemon Slice

"DUMP DUKE"

[illegible] 6-18 [illegible]

*Item for continental breakfast only

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[illegible]

UNITED STATES MILITARY ACADEMY
WEST POINT NEW YORK

Originated by Cadet Mess Staff

Approved by Cadet Mess Menu Board

CADET MESS MENU

Week Ending 14 October 1979

BREAKFAST	LUNCH	DINNER
	MONDAY 8 Oct 79	
Bowl of Strawberries Orange Juice* Assorted Dry Cereal Waffles w/Maple Syrup and Margarine Crisp Bacon Vanilla Ice Cream Sugar Doughnuts* Assorted Jellies -Honey Coffee - Hot Chocolate - Milk	Platter of Shaved Ham w/Slice of Cheese French Fried Onion Rings Sliced Tomatoes and Lettuce Leaves Rye Bread - Mayonnaise Heavenly Hash Ice Cream w/Cones Hawaiian Punch	Roast Top Sirloin of Beef w/Pan Gravy Baked Potato w/Sour Cream Broccoli Spears Bread - Margarine Marble Sheetcake Coffee - Orange Drink - Milk
	TUESDAY 9 Oct 79	
Orange Juice Assorted Dry Cereal Western Omelet Cottage Fried Potatoes Orange Muffins Toast - Margarine Assorted Jellies - Honey Coffee - Milk	Vegetable Soup w/Crackers Tunafish Salad w/Lettuce Leaves Cheese Curls Bread - Mayonnaise Butterscotch Brownies Bowl of Fresh Fruit Iced Tea w/Lemon Slice Milk	Roast Loin of Pork w/Pan Gravy Oven Brown Potatoes Garden Peas Marinated Tomato and Cucumber Salad Italian Bread - Margarine Devil's Food Cake Coffee - Lemon Lime Drink - Milk
	WEDNESDAY 10 Oct 79	
Orange Juice Assorted Dry Cereal Buttermilk Pancakes w/Maple Syrup and Margarine Brown and Serve Sausage Soft Rolls @ Assorted Jellies - Honey Coffee - Milk	Shrimp Chow Mein w/Water Chestnuts and Bamboo Shoots Steamed Rice Fried Noodles Whole Wheat Bread - Margarine Cherry Jello w/Sliced Pears Chocolate and White Milk	Breast of Chicken Kiev w/Wine Sauce Mashed Potatoes Diced Carrots and Peas Waldorf Nut Salad w/Sweet Cream Dressing Dinner Rolls - Margarine blueberry Pie ala Mode Coffee - Fruit Punch - Milk
	THURSDAY 11 Oct 79	
Grapefruit Juice Orange Juice* Assorted Dry Cereal Platter of Fried and Scrambled Eggs Ham Slice Crumb Coffee Cake Toast - Margarine Assorted Jellies - Honey Coffee - Milk	Grilled Chopped Sirloin Steak w/Beef Gravy Mashed Potatoes Mixed Vegetables Cottage Cheese w/Fruit Bread - Margarine Chocolate Ice Cream - Cookies Cherry Drink	Pizza w/Pepperoni and Mozzarella Cheese Corn Chips Caesar Salad w/Lemon Dressing "Go Army" Cake Cola - Milk
	FRIDAY 12 Oct 79	
Orange Juice Assorted Dry Cereal Country Style Scrambled Eggs Lemon Muffins Toast - Margarine Assorted Jellies - Honey Coffee - Milk	Oven Broiled Frankfurters w/Texas Sauce and Chopped Onions Shoestring Potatoes Mixed Pickles and Olives Frankfurter Rolls Bowl of Fresh Fruit Milkshake - Milk	New England Boiled Dinner w/Horseradish Sauce Boiled Potatoes Steamed Cabbage Sunset Salad Rye Bread - Margarine Apple Pie Coffee - Milk Iced Tea w/Lemon Slice
	SATURDAY 13 Oct 79	
Apple Juice - Orange Juice* Assorted Dry Cereal French Toast w/Maple Syrup and Margarine Crisp Bacon Sweet Rolls* Assorted Jellies - Honey Coffee - Milk	Platter of Fried Beef Liver w/Onion Gravy Mashed Potatoes Kernel Corn Bread - Margarine Ice Cream w/Strawberry Topping Iced Tea w/Lemon Slice	Hot Sliced Turkey Breast w/Gravy Sage Dressing Cranberry Sauce Candied Sweet Potatoes Green Beans Bread - Margarine Raisin Pound Cake Coffee - Apple Juice - Milk

"SMASH PENN STATE"

BRUNCH	SUNDAY 14 Oct 79	
Orange Juice Assorted Dry Cereal Open Toasted Metropolitan Sandwich - Scrambled Eggs French Fried Potatoes Danish Coffee Ring - Margarine Bowl of Sliced Peaches Assorted Jellies - Honey Coffee - Hot Chocolate - Milk		Baked Savory Meat Loaf w/Robert Sauce Rissole Potatoes Brussels Sprouts Pickles, Celery and Carrot Sticks Bread - Margarine Baked Apple w/Custard Sauce Coffee - Milk Iced Tea w/Lemon Slice

6-18

*Item for continental breakfast only

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UNITED STATES MILITARY ACADEMY

WEST POINT NEW YORK

Originated by Cadet Mess Staff

Approved by Cadet Mess Menu Board

CADET MESS MENU

Week Ending 21 October 1979

BREAKFAST	LUNCH	DINNER
	MONDAY 15 Oct 79	
Orange Juice Assorted Dry Cereal Chopped Sirloin Steak Fried Eggs Corn Muffins Toast - Margarine Assorted Jellies - Honey Coffee - Milk	Tomato Gumbo Soup w/Crackers Chicken Salad w/Sliced Tomatoes and Lettuce Leaves Ruffle Chips w/Onion Dip Bread - Mayonnaise Ice Cream Float	Grilled Pork Chop ala Soubise Mashed Potatoes Fordhook Lima Beans Bowl of White Seedless Grapes Whole Wheat Bread - Margarine French Nut Cake Coffee - Apple Juice - Milk
	TUESDAY 16 Oct 79	
Sliced Peaches Orange Juice* Assorted Dry Cereal Fruit Filled Crepes w/Maple Syrup and Margarine Brown and Serve Sausage Sugar Doughnuts* Assorted Jellies - Honey Coffee - Hot Chocolate - Milk	Baked German Sausage w/Sauerkraut Potato Cakes Hard Rolls - Margarine Bowl of Fresh Fruit Fig Bars Orange Drink	Cheese Ravioli w/Tomato Sauce and Grated Cheese Baked Italian Meat Loaf Chef's Salad w/Oil and Vinegar Dressing Italian Bread - Margarine Martha Washington Cake Coffee - Grape Juice - Milk
	WEDNESDAY 17 Oct 79	
Orange Juice Assorted Dry Cereal Cheese Omelet Chipped Spiced Ham Cocoanut Sweet Rolls Toast - Margarine Assorted Jellies - Honey Coffee - Milk	Mexican Chili con Carne w/Red Kidney Beans and Crackers Steamed Rice Shredded Lettuce w/Dressing Bread - Margarine Chocolate Brownies Hawaiian Punch	Platter of Fried Flounder Filets and Crabcakes w/Chili Tartar Sauce and Lemon Slice Roast Potatoes Corn on the Cob Spanish Coleslaw Bread - Margarine Peach Tart w/Topping Coffee - Lemonade - Milk
	THURSDAY 18 Oct 79	
Grape Juice - Orange Juice* Assorted Dry Cereal Cream Chipped Beef w/Sliced Eggs Potato Cakes Hard Rolls* Toast - Margarine Assorted Jellies - Honey Coffee - Milk	Yankee Bean Soup w/Crackers Grilled Ham and Cheese Sandwiches Potato Discs Dill Pickle Spears Mocha Sheet Cake Cherry Drink	Relish Tray Grilled Sirloin Steak w/Steak Gravy Baked Potato w/Sour Cream Mixed Vegetables Italian Bread - Margarine Fruit Pie Coffee - Orange Drink - Milk
	FRIDAY 19 Oct 79	
Orange Juice Assorted Dry Cereals Raisin French Toast w/Twin-Berry Syrup and Margarine Crisp Bacon Danish Coffee Ring* Assorted Jellies - Honey Coffee - Milk	Chicken Kiev w/Veloute Sauce Cranberry Sauce Hominy Grits w/Chive Butter French Style Peas Bread - Margarine Sherbet Chocolate and White Milk	Pizza w/Sausage and Mozzarella Cheese Taco Chips Antipasto Salad w/Garlic Dressing "Go Army" Cake Root Beer - Milk
	SATURDAY 20 Oct 79	
Orange Juice Assorted Dry Cereal Scrambled Eggs w Diced Ham Raisin Nut Bread Toast - Margarine Assorted Jellies - Honey Coffee - Milk	Sliced Beef ala Burgundy Buttered Noodles Dutch Green Beans Hard Rolls - Margarine Fruit Jello Coffee Iced Tea w/Lemon Slice	Fried Chopped Veal Steak w/Tomato Sauce Rice Pilaf Zucchini Chopped Lettuce w/French Dressing Whole Wheat Bread - Margarine Ice Cream Cake Coffee - USMA Punch - Milk
	"BEAT BAYLOR"	
Orange Juice Assorted Dry Cereal Eggs MacArthur w English Muffins - Tator Nuggets Fruit Compote Coffee Rolls - Margarine Assorted Jellies - Honey Coffee - Hot Chocolate - Milk	SUNDAY 21 Oct 79	Roast Beef w/Pan Gravy Mashed Potatoes Macedoine of Vegetables Pear Salad Bread - Margarine Hot Fudge Sundae Coffee - Milk Iced Tea w/Lemon Slice

Open 6-18

*Item for continental breakfast only

MENU SUBJECT TO CHANGE WITHOUT NOTICE

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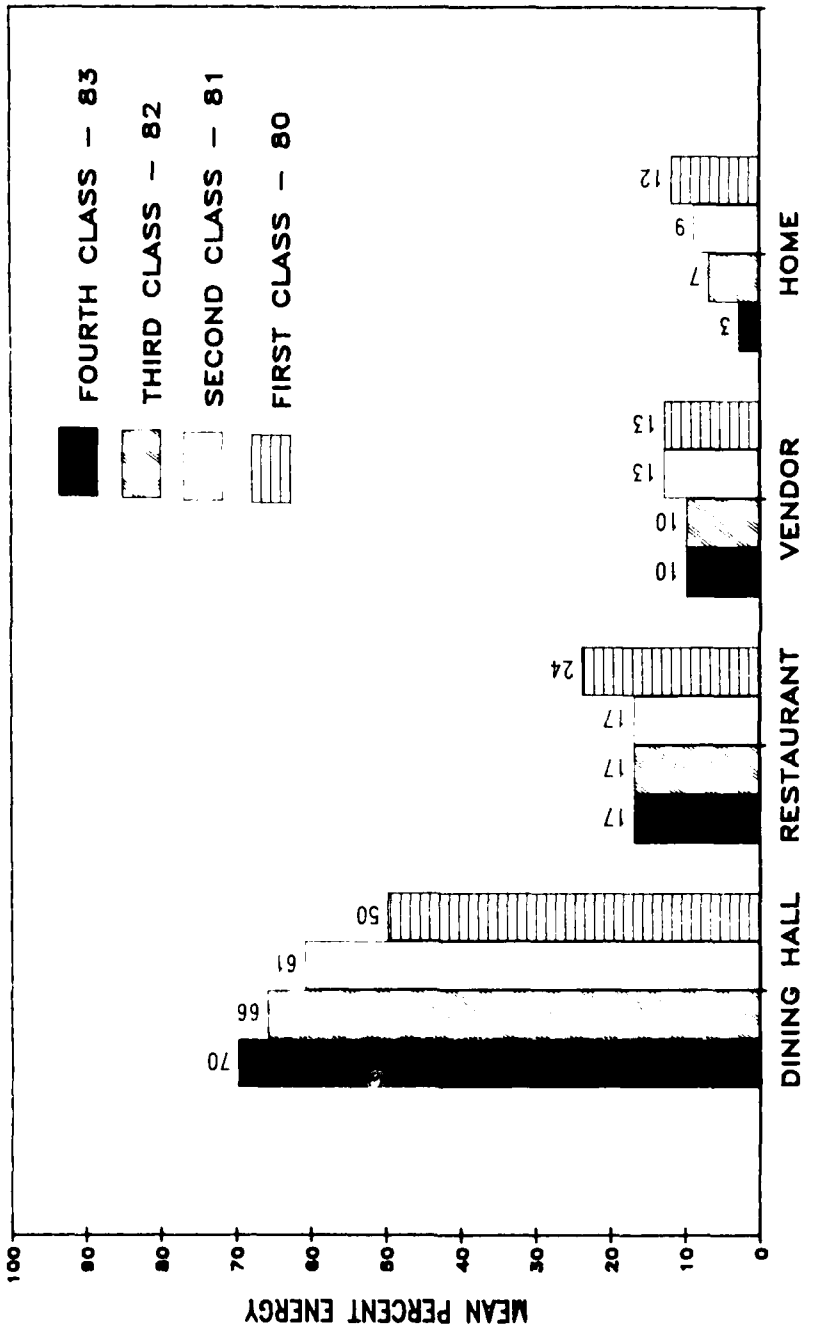


Figure 1. Source of Average Daily Energy Intake.

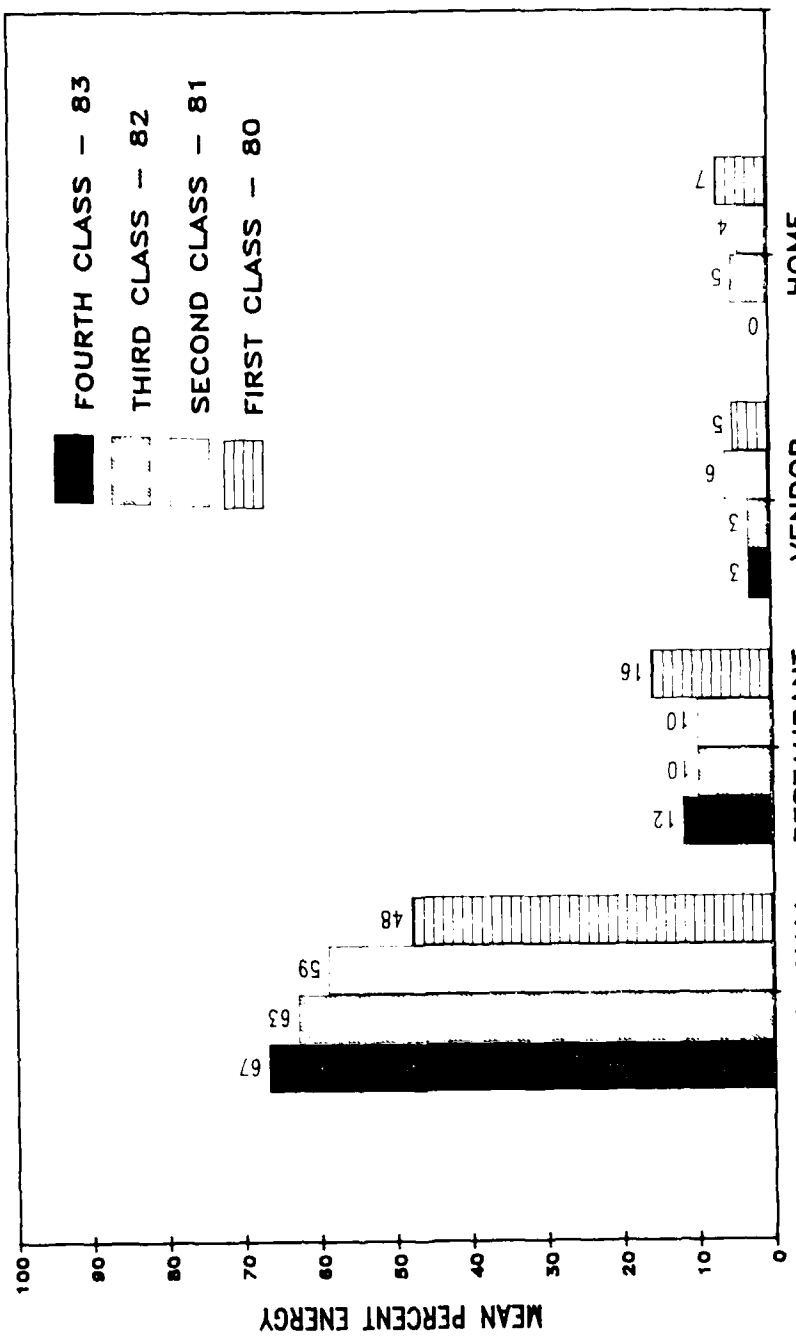


Figure 2. Source of Average Daily Energy Intake from Meals.

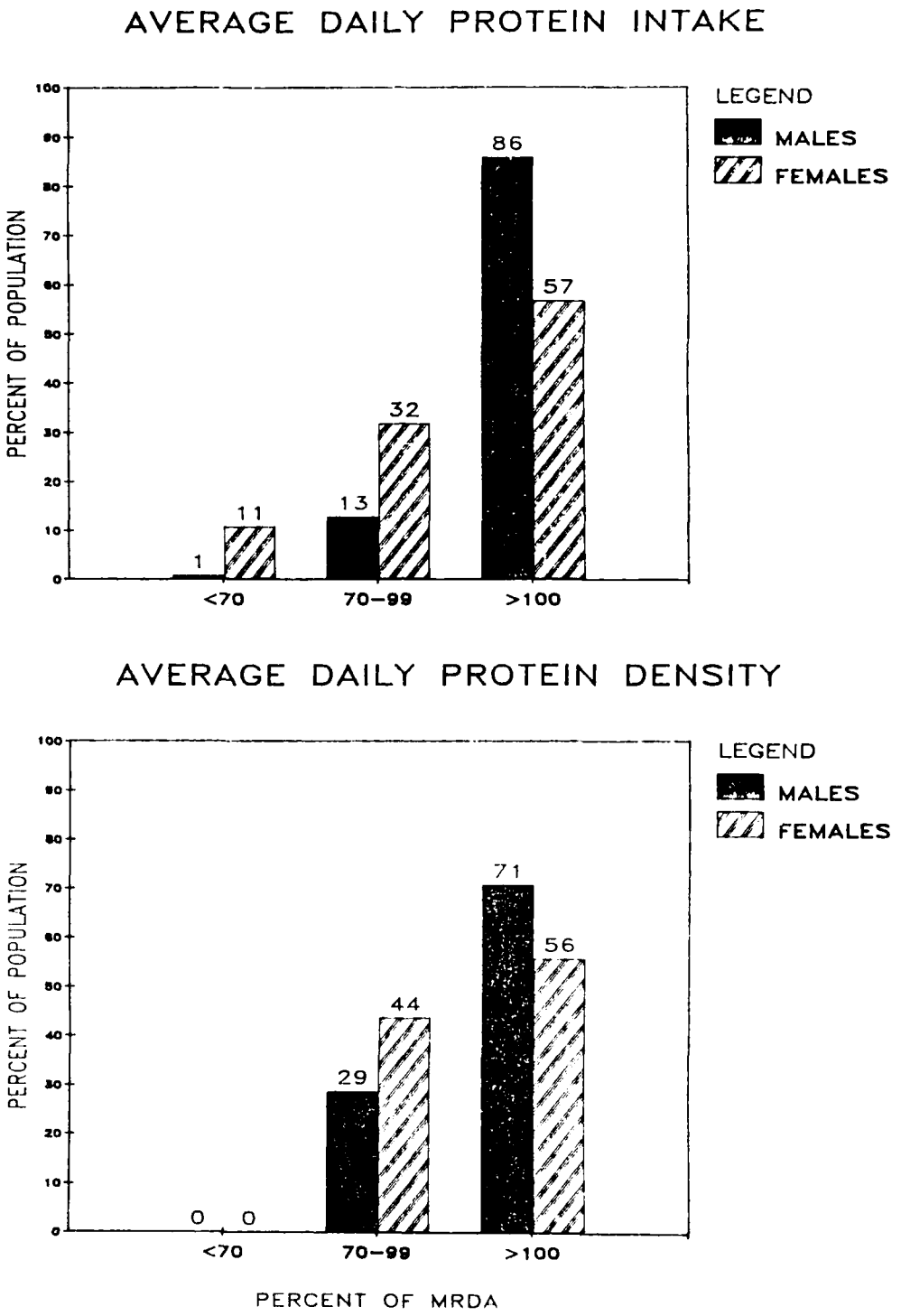


Figure 3. Intake Distribution of Average Daily Protein and Protein Density.

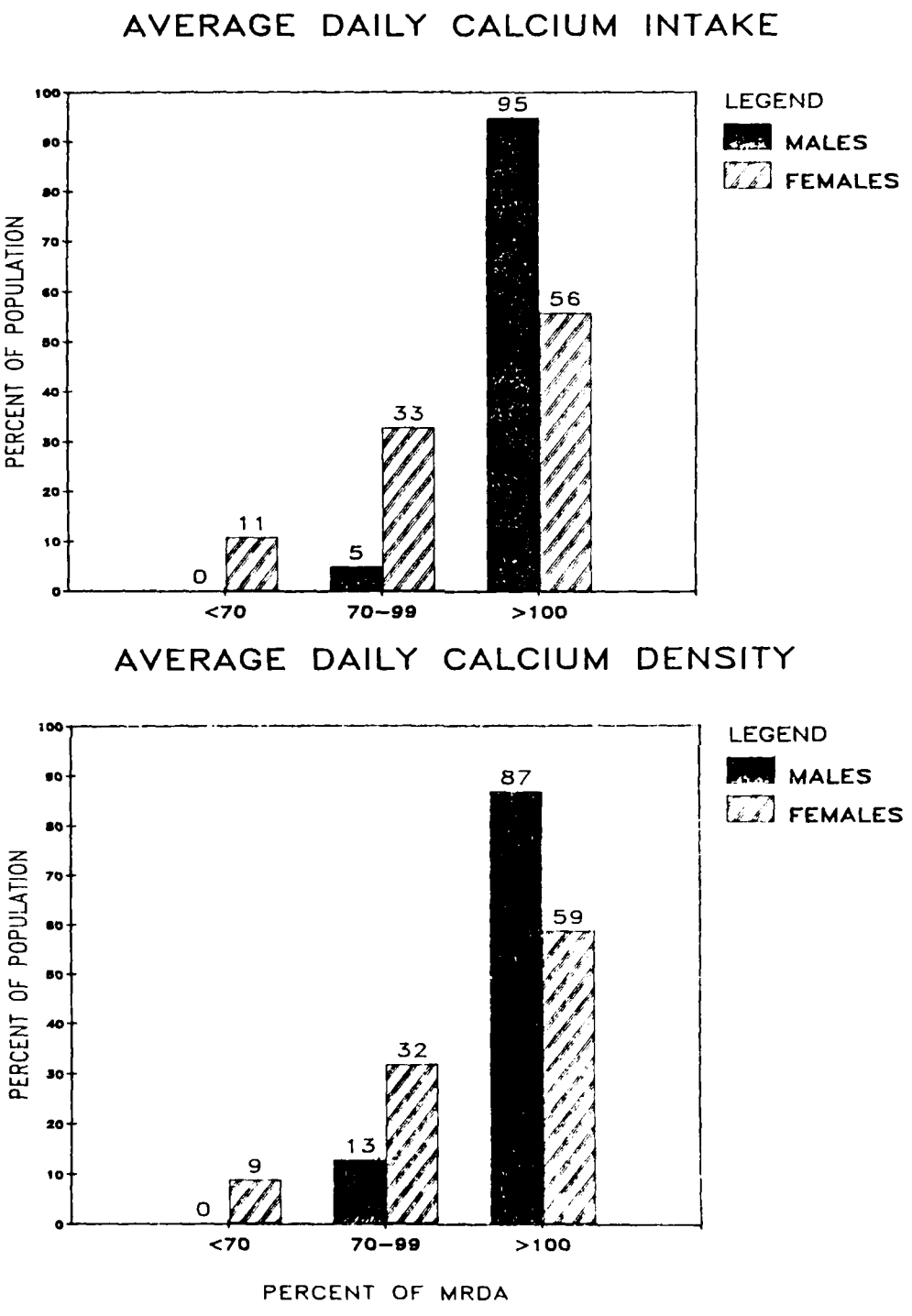


Figure 4. Intake Distribution of Average Daily Calcium and Calcium Density.

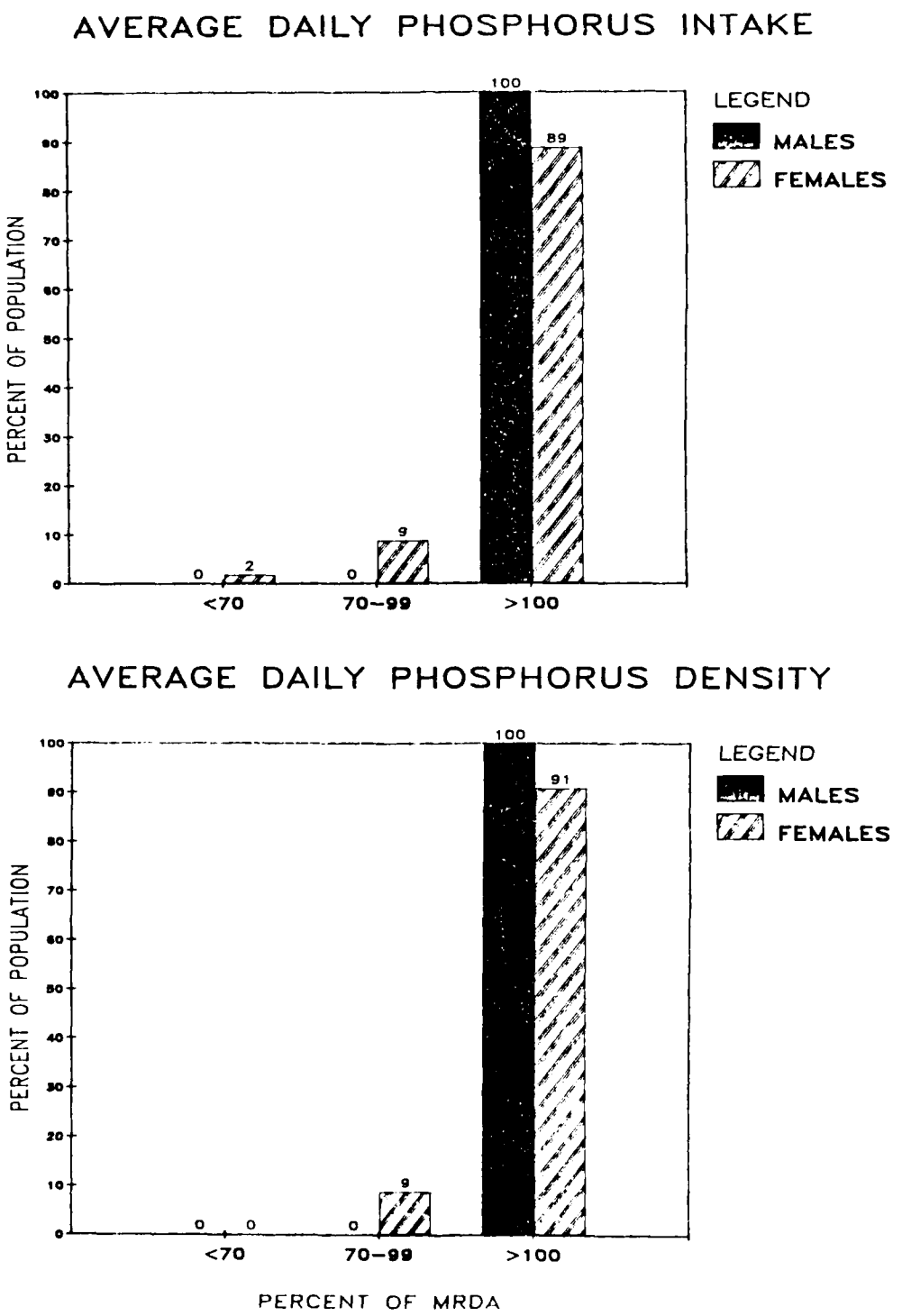


Figure 5. Intake Distribution of Average Daily Phosphorus and Phosphorus Density.

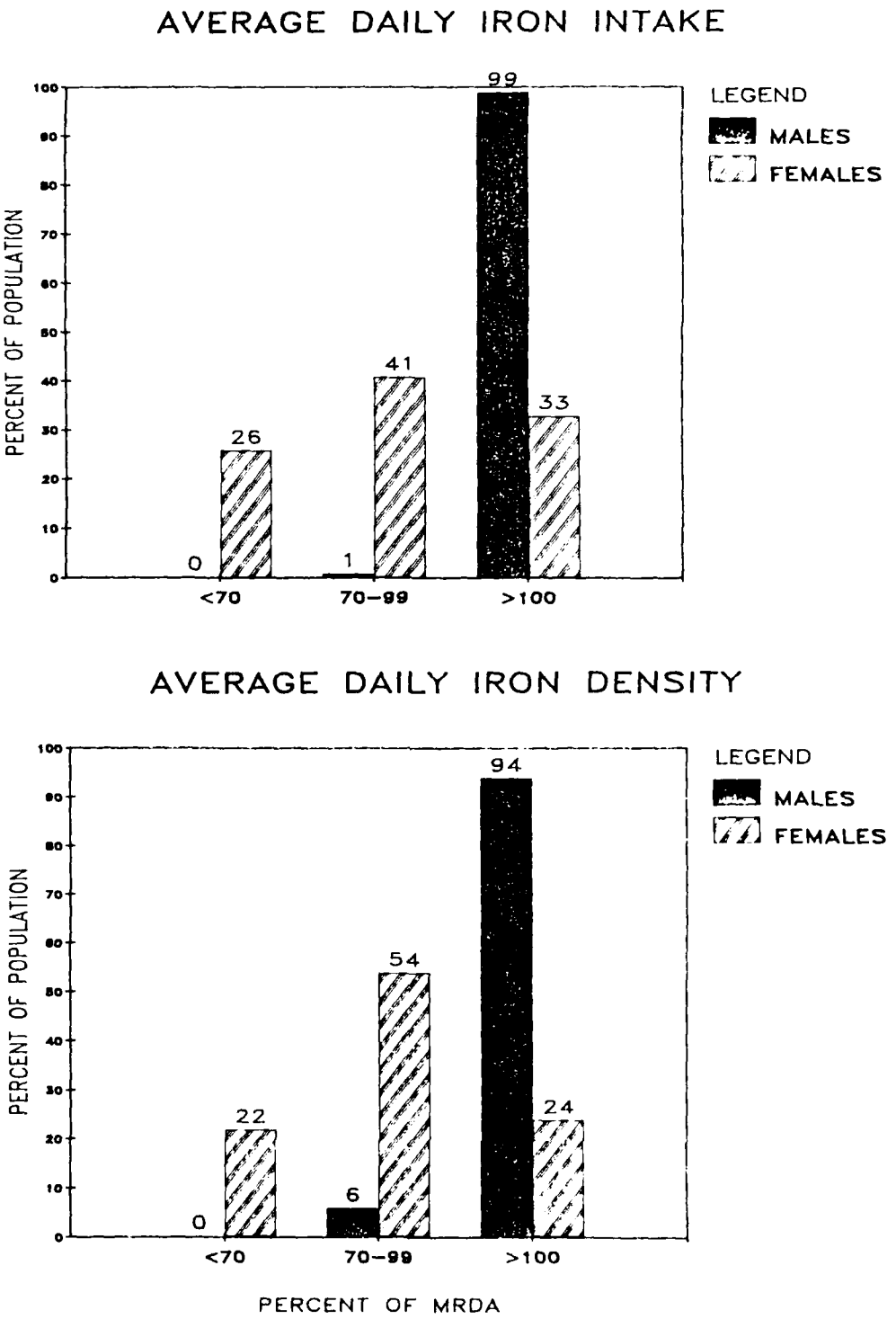


Figure 6. Intake Distribution of Average Daily Iron and Iron Density.

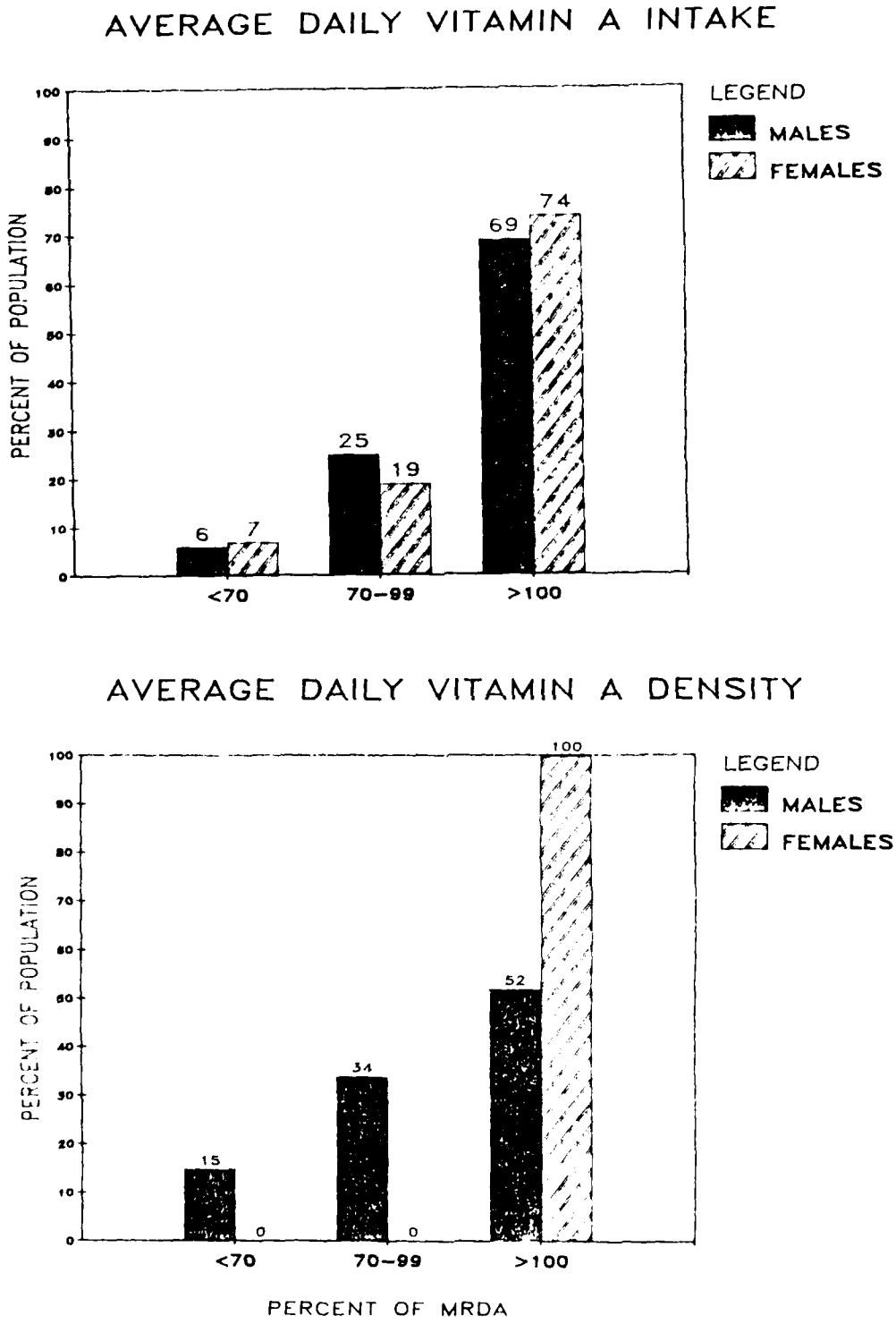


Figure 7. Intake Distribution of Average Daily Vitamin A and Vitamin A Density.

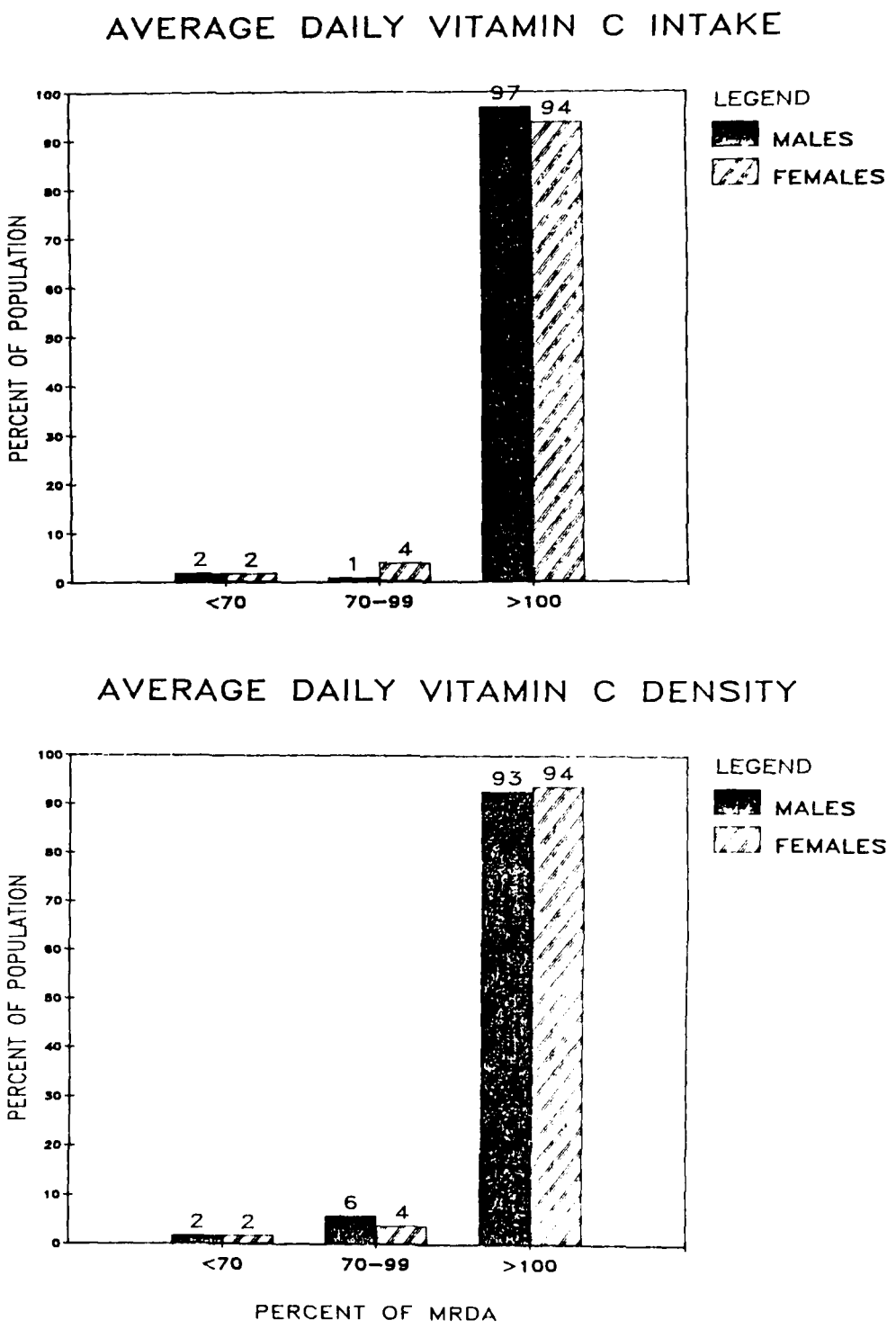


Figure 8. Intake Distribution of Average Daily Vitamin C and Vitamin C Density.

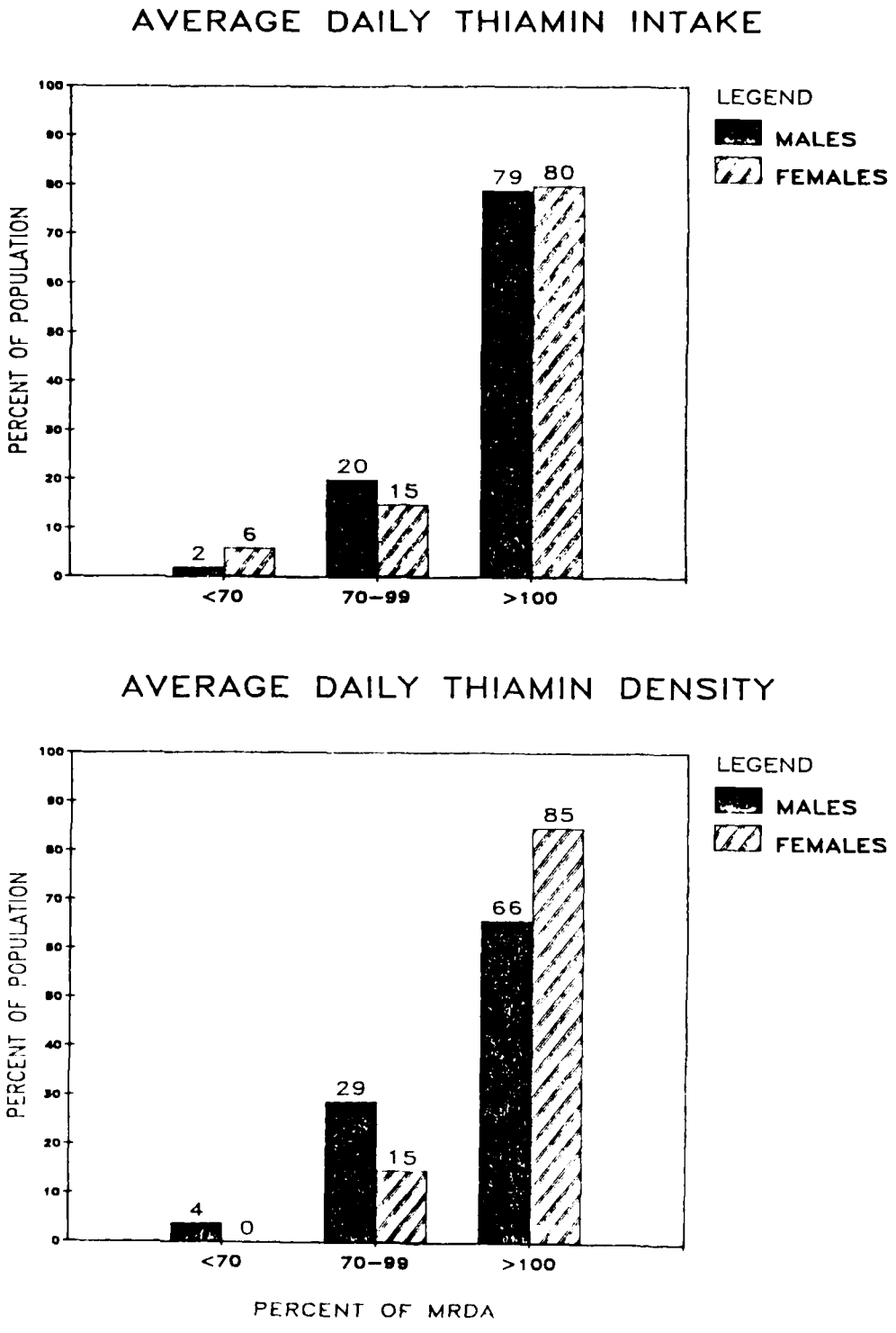


Figure 9. Intake Distribution of Average Daily Thiamin and Thiamin Density.

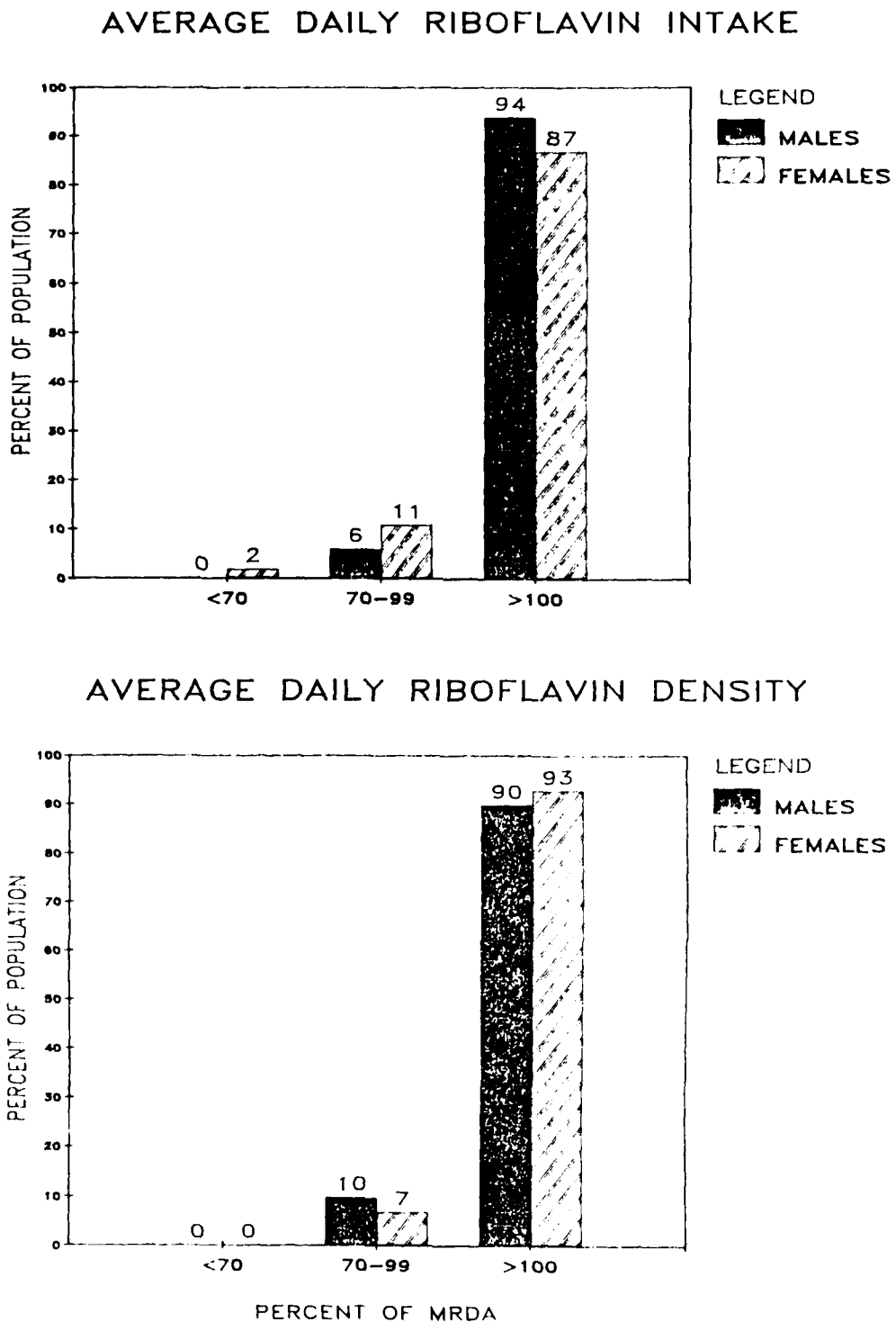
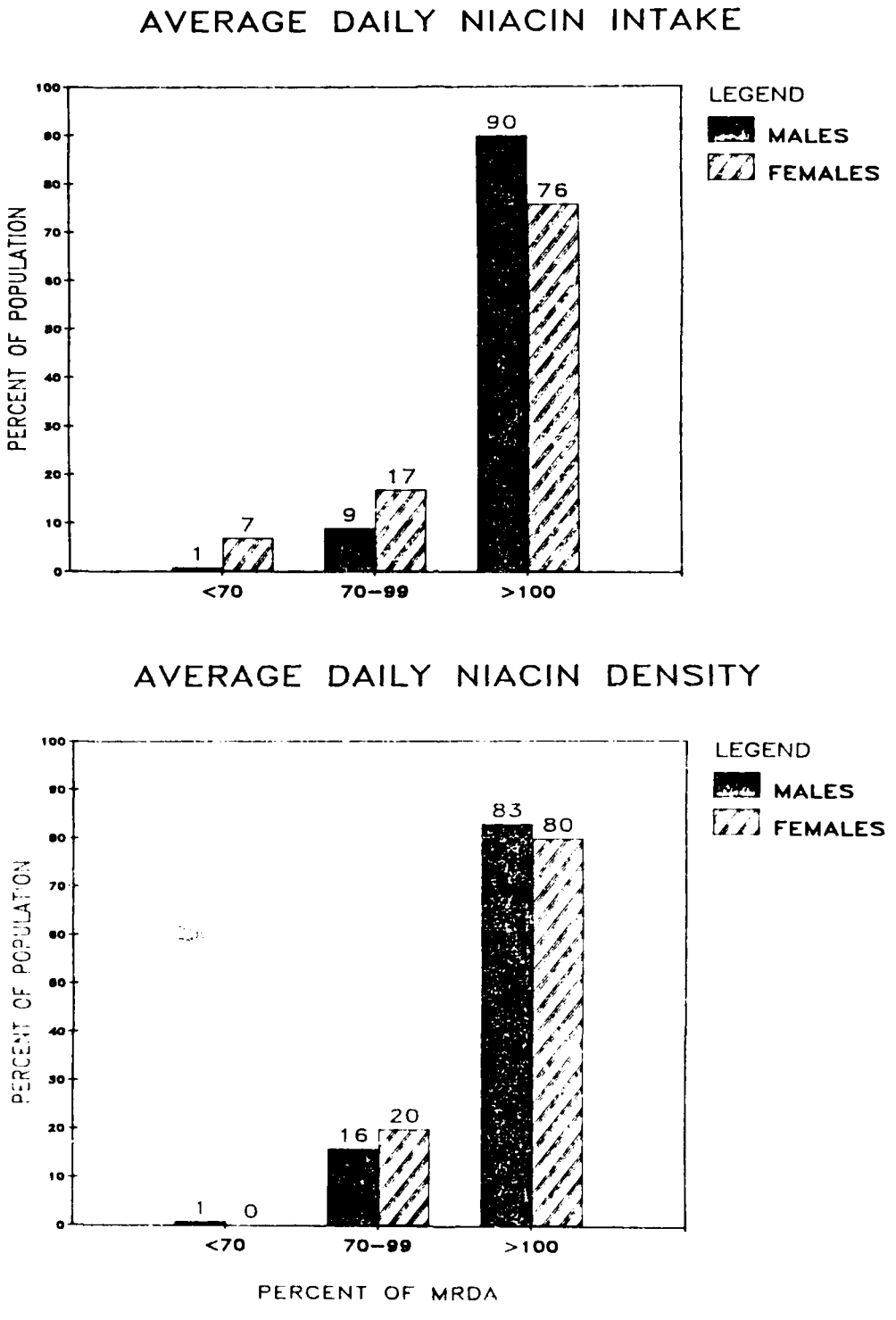


Figure 10. Intake Distribution of Average Daily Riboflavin and Riboflavin Density.



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	APPENDIX E	

TABLE 1
Age, weight, height and number of male and female cadets studied (mean ± SD)

	Number of Subjects		Age (Years)		Weight (kg)		Height (cm)	
Class*	Males	Females	Males	Females	Males	Females	Males	Females
First-'80	36	12	21.9±1.0	22.1±0.8	77.0±9.7	57.6±4.4	179.2±6.0	165.4±4.7
Second-'81	34	18	20.6±0.4	21.2±1.3	74.7±9.4	59.9±6.0	176.6±6.0	165.5±6.7
Third-'82	47	12	19.9±0.9	19.6±1.4	77.0±7.4	59.8±5.2	176.5±7.4	165.8±7.1
Fourth-'83	19	12	18.8±0.8	18.5±0.5	77.7±7.6	61.7±5.8	178.4±6.8	166.7±6.1
All Classes	136	54	20.0±1.4	20.3±1.5	76.6±9.3	59.7±6.6	176.0±18.2	165.3±5.8
CWCP Cadets	7	8	21.8±1.6	20.2±1.8	93.9±12.0	66.8±5.6	180.2±9.2	162.9±6.7

*First-'80 = First Class (Class of 1980),
Second-'81 = Second Class (Class of 1981),
Third-'82 = Third Class (Class of 1982),
Fourth-'83 = Fourth Class (Class of 1983).

TABLE 2
Percent body fat from skinfolds of cadet volunteers by class and sex (mean ± SD)

Class	MALES (%)	FEMALES (%)
First-'80	14.56 ± 3.93	23.41 ± 4.78
Second-'81	14.12 ± 2.48	22.51 ± 3.07
Third-'82	14.29 ± 2.58	23.50 ± 1.35
Fourth-'83	15.21 ± 2.57	24.64 ± 3.85

TABLE 3
Percentage of cadets with a dietary change within the last month

	No Change (%)	Eat More (%)	Eat Less (%)	Prescribed Diet* (%)
MALES:				
First-'80	75.0	8.3	11.1	5.6
Second-'81	88.2	2.9	5.9	2.9
Third-'82	66.0	4.3	27.7	2.1
Fourth-'83	47.4	31.6	21.1	0
CWCP Cadets	14.3	14.3	57.1	14.3
FEMALES:				
First-'80	75.0	0	16.7	8.3
Second-'81	50.0	11.1	38.9	0
Third-'82	58.3	8.3	33.3	0
Fourth-'83	66.7	16.7	16.7	0
CWCP Cadets	37.5	12.5	50.0	0

*Prescribed diet is defined as a diet prescribed by a doctor, dietitian, etc. It does not include self-prescribed diets.

TABLE 4
Nutrient supplement usage by cadets

	No (%)	Yes, Regularly (%)	Yes, Irregularly (%)
MALES:			
First-'80	88.9	5.6	5.6
Second-'81	85.3	8.8	5.9
Third-'82	83.0	8.5	8.5
Fourth-'83	84.2	0	15.8
CWCP Cadets	85.7	0	14.3
FEMALES:			
First-'80	50.0	25.0	25.0
Second-'81	50.0	22.2	27.8
Third-'82	50.0	8.3	41.7
Fourth-'83	50.0	33.3	16.7
CWCP Cadets	50.0	25.0	25.0

TABLE 5
Frequency of salt usage at meals by cadets

	Never (%)	Occasionally (%)	Frequently (%)	Always (%)
MALES:				
First-'80	8.3	33.3	27.8	30.6
Second-'81	11.8	44.1	20.6	23.5
Third-'82	17.0	38.3	29.8	14.9
Fourth-'83	10.5	36.8	36.8	15.8
CWCP Cadets	0	14.3	42.9	42.9
FEMALES:				
First-'80	16.7	41.7	16.7	25.0
Second-'81	11.1	38.9	16.7	33.3
Third-'82	16.7	33.3	8.3	41.7
Fourth-'83	25.0	41.7	16.7	16.7
CWCP Cadets	0	75.0	12.5	12.5

TABLE 6
Total energy intake by day of the week and sex (mean ± SD, median)

	Total Energy Intake	
	Males (kcal)	Females (kcal)
Wednesday	3484 + 1041[C] (3397)	2158 + 734[C] (2099)
Thursday	4001 + 991[A] (4012)	2613 + 733[A] (2659)
Friday	3702 + 1148[B] (3522)	2379 + 863[B] (2252)
Saturday	4245 + 1814[A] (3772)	2790 + 1030[A] (2748)
Sunday	3256 + 976[C] (3063)	2329 + 906[C] (2154)

A,B,etc. Values within a column not followed by the same superscript are significantly different at $p<0.01$.

TABLE 7
Average (5-day) total daily nutrient intake (mean ± SD)

	West Point Cadets		NPCS REFERENCE GROUP	
	Males (n=136)	Females (n=54)	Males (n=1030)	Females (n=1317)
MACRO:				
Energy (kcal)	3738 ± 726	2454 ± 551	2395	1601
Total protein (g)	125 ± 29	84 ± 24	99.0	65.4
% Animal Protein	70.8 ± 7.2	67.4 ± 9.8	—	—
% Plant Protein	27.7 ± 6.0	29.2 ± 8.1	—	—
Total fat (g)	161 ± 39	107 ± 27	110.2	72.4
% Animal Fat	48.9 ± 7.8	48.0 ± 10.2	—	—
% Plant Fat	44.3 ± 7.1	43.2 ± 9.0	—	—
% Fish Fat	0.6 ± 0.7	0.8 ± 0.9	—	—
Total Carbohydrate (g)	432 ± 85	284 ± 69	247	170.6
Total Sugars (g)	199 ± 54	133 ± 39	—	—
Sucrose (g)	127 ± 40	85 ± 27	—	—
Alcohol (g)	14 ± 18	8 ± 12	—	—
Crude Fiber (g)	4.3 ± 1.5	3.3 ± 1.2	—	—
Cholesterol (mg)	599 ± 188	403 ± 122	—	—
MINERALS:				
Calcium (mg)	1375 ± 356	954 ± 268	945	626
Phosphorus (mg)	2046 ± 421	1347 ± 317	1506	997
Iron (mg)	22.6 ± 6.6	16.2 ± 5.0	15.6	10.6
Sodium (mg)	4048 ± 913	2764 ± 675	—	—
Potassium (mg)	3652 ± 831	2454 ± 630	—	—
*Magnesium (mg)	371 ± 86	238 ± 55	286	200
*Zinc (mg)	18.1 ± 4.8	11.3 ± 3.2	—	—
VITAMINS:				
Vitamin A (IU)	6773 ± 4083	5247 ± 1947	5903	3915
Thiamin (mg)	2.51 ± 2.86	11.61 ± 69.14	1.58	1.06
Riboflavin (mg)	3.35 ± 2.78	9.29 ± 49.6	2.22	1.40
Preformed Niacin (mg)	32.9 ± 16.3	37.3 ± 93.0	23.4	15.4
Vitamin C (mg)	161 ± 76	147 ± 115	88	71
*Vitamin B-6 (mg)	2.30 ± 2.44	2.29 ± 4.22	1.77	1.19
*Folacin (mcg)	432 ± 164	339 ± 124	—	—
*Vitamin B-12 (mcg)	7.30 ± 10.22	4.65 ± 2.55	7.18	3.81

*Limited food nutrient composition information was available for this nutrient.

TABLE 8
Average (5-day) energy and protein intakes per kilogram of body weight (mean ± SD)

	Energy per kg bodyweight		Protein per kg bodyweight	
	Males	Females	Males	Females
First class-'80	49.5 ± 10.8	39.7 ± 9.9	1.6 ± 0.4	1.5 ± 0.6
Second class-'81	50.1 ± 8.5	43.0 ± 7.7	1.7 ± 0.3	1.4 ± 0.3
Third class-'82	48.1 ± 10.0	41.1 ± 9.8	1.6 ± 0.4	1.4 ± 0.3
Fourth class-'83	50.0 ± 8.5	39.9 ± 9.0	1.6 ± 0.2	1.3 ± 0.3
All classes	49.2 ± 9.6	41.1 ± 8.8	1.6 ± 0.4	1.4 ± 0.4
CWCP Cadets	37.3 ± 8.0	41.3 ± 14.4	1.3 ± 0.3	1.3 ± 0.4

TABLE 9
Individuals obtaining specified percentages of food energy from fat

Percent Fat Calories	Males		Females	
	NFCS* (n=1030)	West Point (n=136)	NFCS (n=1317)	West Point (n=54)
	- - - Percent - - -		- - - Percent - - -	
< 30%	4.9	1.5	7.6	—
30.0 - 34.9%	13.6	16.9	15.2	11.1
35.0 - 39.9%	26.0	50.0	24.3	53.7
40.0 - 44.9%	27.8	29.4	27.7	31.5
45.0 - 49.9%	19.4	2.2	15.3	3.7
≥ 50%	8.4	—	9.8	—

*USDA Nationwide Food Consumption Survey 1977-78, 48 conterminous states.

TABLE 10
Total daily nutrient intake and nutrient intake distribution of male cadets (5-day average)

	Mean	Median	Percentile 95th	75th	25th	5th	Min	Max
MACRO:								
Energy (kcal)	3738	3720	5076	4089	3217	2552	2199	6325
Total protein (g)	125	120	186	141	106	88	54	245
% Animal Protein	70.75	72.56	80.53	75.43	66.34	54.72	44.64	83.26
% Plant Protein	27.67	26.64	39.76	30.03	24.36	19.14	16.04	45.96
Total fat (g)	161	154	227	181	135	106	77	316
% Animal Fat	48.89	49.43	61.13	53.87	44.05	34.79	26.35	67.04
% Plant Fat	44.29	43.89	56.72	48.52	40.08	31.98	26.40	68.09
% Fish Fat	0.64	0.48	1.70	0.64	0.34	0.17	0.06	6.18
Total Carbohydrate (g)	432	434	611	473	381	294	220	708
Total Sugars (g)	199	193	292	235	161	115	74	394
Sucrose (g)	127	126	198	150	98	64	47	256
Alcohol (g)	14	8	54	21	0.03	0.01	0	83
Crude Fiber (g)	4.3	4.2	7.1	4.9	3.5	2.3	1.2	10.1
Cholesterol (mg)	599	565	952	692	471	319	260	1502
MINERALS:								
Calcium (mg)	1375	1345	1964	1606	1113	852	714	2819
Phosphorus (mg)	2046	2059	2788	2252	1759	1408	1110	3592
Iron (mg)	22.6	21.4	35.1	25.8	18.5	13.3	11.9	55.1
Sodium	4048	3962	5638	4537	3469	2775	1855	7535
Potassium (mg)	3652	3589	5150	4083	3059	2415	1800	6561
*Magnesium (mg)	371	364	526	430	310	233	161	715
*Zinc (mg)	18.1	17.2	27.4	19.8	14.8	12.1	9.8	37.1
VITAMINS:								
Vitamin A (IU)	6773	5897	12065	8094	4494	3323	1778	42813
Thiamin (mg)	2.51	2.05	3.84	2.47	1.71	1.26	0.96	28.75
Riboflavin (mg)	3.35	2.89	5.10	3.48	2.37	1.83	1.57	29.88
Preformed Niacin (mg)	32.9	29.8	50.8	35.8	25.0	18.7	8.7	148.1
Vitamin C (mg)	161	147	284	202	111	64	28	557
*Vitamin B-6 (mg)	2.30	1.89	4.04	2.37	1.52	1.14	0.92	27.87
*Folacin (mcg)	432	414	738	523	298	227	180	1089
*Vitamin B-12 (mcg)	7.30	5.31	17.16	7.01	4.09	2.66	2.10	108.12

*Limited food nutrient composition information was available for this nutrient. There is a greater risk of the calculated value being underestimated.

TABLE 11
Total daily nutrient intake and nutrient intake distribution of female cadets (5-day average)

	Mean	Median	Percentile 95th	75th	25th	5th	Min	Max
MACRO:								
Energy (kcal)	2454	2469	3535	2833	2124	1552	1153	3790
Total protein (g)	84	85	110	100	66	47	141	184
% Animal Protein	67.43	68.62	81.24	73.61	63.38	41.02	37.18	83.24
% Plant Protein	29.16	29.03	44.85	32.96	23.69	18.50	16.45	63.76
Total fat (g)	107	110	156	123	87	61	53	177
% Animal Fat	47.96	47.27	64.76	54.26	43.17	29.54	18.78	65.79
% Plant Fat	43.16	43.79	58.35	48.43	35.55	27.84	25.12	67.94
% Fish Fat	0.79	0.51	3.83	0.72	0.31	0.08	0.01	4.01
Total Carbohydrate (g)	284	291	423	323	231	171	129	444
Total Sugars (g)	133	133	200	166	104	70	45	215
Sucrose (g)	85	87	136	102	66	37	29	146
Alcohol (g)	8	3	43	14	0.01	0	0	49
Crude Fiber (g)	3.3	3.2	5.1	3.9	2.6	1.7	1.2	8.3
Cholesterol (mg)	403	404	619	506	297	203	167	680
MINERALS:								
Calcium (mg)	954	961	1349	1144	762	474	396	1764
Phosphorus (mg)	1347	1323	1812	1617	1092	768	603	1932
Iron (mg)	16.2	15.8	26.3	19.2	12.4	8.5	7.7	30.8
Sodium (mg)	2764	2835	3988	3201	2218	1572	1338	4310
Potassium (mg)	2454	2430	3619	2893	1916	1486	1085	3740
*Magnesium (mg)	238	241	331	273	202	146	110	387
*Zinc (mg)	11.3	11.4	16.7	13.8	8.8	5.4	5.0	18.1
VITAMINS:								
Vitamin A (IU)	5247	5017	9210	6128	3794	2404	2051	10004
Thiamin (mg)	11.62	1.69	12.13	2.05	1.23	0.82	0.74	510.03
Riboflavin (mg)	9.29	2.23	8.99	2.55	1.66	1.11	0.90	366.70
Preformed Niacin (mg)	37.3	21.9	73.3	26.7	16.2	10.7	8.4	694.0
Vitamin C (mg)	147	111	378	176	85	56	15	779
*Vitamin B-6 (mg)	2.29	1.45	7.60	2.01	1.09	0.60	0.57	30.93
*Folacin (mcg)	339	331	577	416	253	164	162	723
*Vitamin B-12 (mcg)	4.65	4.25	9.81	5.83	3.20	1.61	1.12	15.5

*Limited food nutrient composition information was available for this nutrient. There is a greater risk of the calculated value being underestimated.

TABLE 12
Two-by-four factor analysis of variance of average total daily nutrient intake and nutrient density

	Total Nutrient Intake		Nutrient Density Intake	
	Class Effect	Sex Effect	Class Effect	Sex Effect
Energy	NS	p<.0001	—	—
Total protein	NS	p<.0001	NS	NS
% Animal Protein	NS	NS	—	—
% Plant Protein	NS	NS	—	—
Total fat	NS	p<.0001	NS	NS
% Animal Fat	NS	NS	—	—
% Plant Fat	NS	NS	—	
% Fish Fat	NS	NS	—	—
Total Carbohydrate	NS	p<.0001	NS	NS
Total Sugars	NS	p<.0001	NS	NS
Sucrose	NS	p<.0001	NS	NS
Alcohol	NS	p<.0057	p<.0010	NS
Crude Fiber	NS	p<.0001	NS	p<.0003
Cholesterol	p<.0043	p<.0001	p<.0011	NS
Calcium	NS	p<.0001	NS	NS
Phosphorus	NS	p<.0001	NS	NS
Iron	NS	p<.0001	NS	p<.01
Sodium	NS	p<.0001	NS	NS
Potassium	NS	p<.0001	NS	NS
Magnesium	NS	p<.0001	NS	NS
Zinc	NS	p<.0001	NS	NS
Vitamin A	NS	p<.0012	NS	p<.001
Thiamin	NS	NS	NS	p<.0002
Riboflavin	NS	NS	p<.0015	p<.0034
Preformed Niacin	NS	p<.0009	p<.0029	p<.0068
Vitamin C	NS	NS	NS	p<.0011
Vitamin B-6	NS	p<.0059	p<.0023	NS
Folacin	NS	p<.0002	NS	p<.007
Vitamin B-12	NS	p<.0006	NS	NS

NS=Not significant at p<.01.

TABLE 13
Average (5-day) nutrient density of food intake (mean quantities/1000 kcal ± SD)

	West Point Cadets		NFCS Reference Group	
	Males (n=136)	Females (n=54)	Males (n=1030)	Females (n=1317)
MACRO:				
Protein (g)	33.5 ± 4.2	34.4 ± 7.8	41.9	41.7
Fat (g)	42.8 ± 4.0	43.6 ± 3.7	45.4	44.8
Carbohydrate (g)	116.1 ± 11.6	116.0 ± 13.1	104.0	106.7
Total Sugars (g)	53.4 ± 11.9	54.5 ± 11.8	—	—
Sucrose (g)	33.9 ± 8.6	34.5 ± 8.1	—	—
Alcohol (g)	3.8 ± 4.5	3.2 ± 4.9	—	—
Crude Fiber (g)	1.2 ± 0.3§	1.4 ± 0.4	—	—
Cholesterol (mg)	161 ± 44	166 ± 46	—	—
MINERALS:				
Calcium (mg)	371 ± 79	394 ± 95	392	397
Phosphorus (mg)	549 ± 58	552 ± 79	630	638
Iron (mg)	6.1 ± 1.5§	6.8 ± 2.2	6.6	6.8
Sodium (mg)	1088 ± 163	1133 ± 164	—	—
Potassium (mg)	978 ± 120	1002 ± 144	—	—
*Magnesium (mg)	100 ± 15	98 ± 14	120	131
*Zinc (mg)	4.8 ± 0.8	4.6 ± 1.0	—	—
VITAMINS:				
Vitamin A (IU)	1830 ± 995§	2216 ± 924	2532	2544
Thiamin (mg)	0.68 ± 0.75§	4.92 ± 29.35†	0.67	0.66
Riboflavin (mg)	0.90 ± 0.73§	3.94 ± 21.06†	0.93	0.88
Preformed Niacin (mg)	8.8 ± 4.2§	15.8 ± 39.8†	9.9	10.0
Vitamin C (mg)	44 ± 20§	61 ± 50†	38	45
*Vitamin B-6 (mg)	0.62 ± 0.64	0.96 ± 1.81†	0.75	0.75
*Folacin (mcg)	117 ± 43§	142 ± 60†	—	—
*Vitamin B-12 (mcg)	1.95 ± 2.62	1.97 ± 1.29	2.99	2.47

*Limited food nutrient composition information available for this nutrient.
§Significantly different ($p<.01$) from female value.
†Median values: thiamin, 0.61 mg; riboflavin, 0.81 mg; niacin, 8.2 mg; ascorbic acid, 49 mg; vitamin B-6, 0.52 mg; and folacin, 132 mcg.

TABLE 14
Average (5-day) nutrient density of food intake by energy intake quartile for male cadets (mean quantities/1000 kcal ± SD, median)

	Quartile 1 (2199-3216 kcal/day)	Quartile 2 (3217-3719 kcal/day)	Quartile 3 (3720-4098 kcal/day)	Quartile 4 (4089-6325 kcal/day)
MACRO:				
Protein (g)	34.9 ± 4.6 (35.2)	32.8 ± 3.6 (32.5)	32.5 ± 3.7 (32.8)	33.8 ± 4.4 (33.6)
Fat (g)	42.1 ± 4.3 (42.1)	42.7 ± 3.3 (42.5)	41.6 ± 4.0 (41.7)	44.8 ± 3.8* (44.3)
Carbohydrate (g)	117.8 ± 14.2 (115.7)	118.3 ± 8.9 (118.7)	116.6 ± 9.0 (116.0)	111.6 ± 12.7 (112.9)
Total Sugars (g)	55.2 ± 15.9 (57.2)	54.7 ± 10.2 (56.5)	52.0 ± 9.6 (52.6)	51.6 ± 10.8 (51.4)
Sucrose (g)	33.8 ± 9.8 (32.3)	35.5 ± 8.5 (36.3)	33.1 ± 7.8 (34.8)	33.3 ± 8.3 (33.4)
Crude Fiber (g)	1.2 ± 0.5 (1.2)	1.2 ± 0.2 (1.2)	1.1 ± 0.2 (1.1)	1.2 ± 0.3 (1.1)
Alcohol (g)	2.9 ± 3.9 (0.5)	3.1 ± 3.4 (2.3)	5.4 ± 5.9 (3.0)	3.7 ± 4.3 (1.7)
Cholesterol (mg)	169.2 ± 51.4 (154.6)	168.7 ± 42.1 (156.9)	144.4 ± 30.1 (137.5)	162.6 ± 45.6 (155.4)
MINERALS:				
Calcium (mg)	403 ± 78 (413)	368 ± 78 (358)	364 ± 71 (371)	351 ± 83 (341)
Phosphorus (mg)	574 ± 62 (567)	539 ± 59 (548)	545 ± 42 (537)	539 ± 62 (533)
Iron (mg)	6.3 ± 1.5 (5.9)	6.4 ± 2.0 (5.9)	5.6 ± 0.8 (5.5)	5.9 ± 1.3 (5.5)
Sodium (mg)	1123 ± 181 (1149)	1108 ± 154 (1089)	1065 ± 148 (1100)	1056 ± 163 (1056)
Potassium (mg)	1000 ± 148 (1007)	960 ± 105 (949)	968 ± 113 (982)	983 ± 110 (996)

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TABLE 14 **(Continued)**
Average (5-day) nutrient density of food intake by energy intake quartile for male cadets (mean quantities/1000 kcal ± SD, median)

	Quartile 1 (2199-3216 kcal/day)	**Quartile 2** (3217-3719 kcal/day)	**Quartile 3** (3721-4098 kcal/day)	**Quartile 4** (4089-6325 kcal/day)
VITMAINS:				
Vitamin A (IU)	2048 ± 945 (1811)	1879 ± 795 (1638)	1620 ± 539 (1504)	1772 ± 1462 (1432)
Thiamin (mg)	0.66 ± 0.24 (0.59)	0.71 ± 0.76 (0.54)	0.81 ± 1.28 (0.53)	0.53 ± 0.13 (0.50)
Riboflavin (mg)	0.90 ± 0.26 (0.83)	0.91 ± 0.58 (0.78)	1.04 ± 1.30 (0.75)	0.77 ± 0.18 (0.75)
Preformed niacin(mg)	8.9 ± 2.5 (8.8)	9.0 ± 3.5 (8.0)	9.5 ± 6.9 (7.7)	8.1 ± 1.8 (7.7)
Vitamin C (mg)	46 ± 20 (42)	45 ± 22 (42)	46 ± 22 (40)	38 ± 13 (37)

*Significantly different ($p<.01$) from Quartiles, 1, 2, and 3.

TABLE 15
Average (5-day) nutrient density of food intake by energy intake quartile for female cadets (mean quantities/1000 kcal ± SD, median)

	Quartile 1 (1153-2123 kcal/day)	Quartile 2 (2124-2468 kcal/day)	Quartile 3 (2469-2832 kcal/day)	Quartile 4 (2833-3790 kcal/day)
MACRO:				
Protein (g)	35.0 ± 6.3 (33.8)	36.3 ± 12.9 (34.1)	34.5 ± 4.3 (35.4)	31.6 ± 4.0 (32.5)
Fat (g)	42.2 ± 3.9 (41.8)	43.7 ± 4.8 (43.6)	43.9 ± 2.1 (44.1)	44.4 ± 3.6 (44.0)
Carbohydrate (g)	117.7 ± 15.7 (112.3)	117.6 ± 14.9 (119.0)	112.4 ± 10.4 (115.4)	116.2 ± 11.2 (114.0)
Total Sugars (g)	54.3 ± 14.2 (53.0)	56.9 ± 13.6 (55.8)	52.6 ± 10.9 (52.6)	54.0 ± 8.8 (53.4)
Sucrose (g)	31.4 ± 10.0 (31.6)	37.9 ± 9.4 (38.1)	33.0 ± 5.5 (35.1)	35.4 ± 5.6 (35.7)
Crude Fiber (g)	1.6 ± 0.6 (1.6)	1.4 ± 0.3 (1.4)	1.1 ± 0.2 (1.2)	1.4 ± 0.5 (1.3)
Alcohol (g)	3.4 ± 7.1 (0.01)	2.6 ± 3.3 (1.5)	3.7 ± 5.7 (1.0)	3.1 ± 2.7 (2.6)
Cholesterol (mg)	185.8 ± 58.0 (181.1)	174.4 ± 48.8 (171.2)	156.2 ± 30.3 (157.2)	149.8 ± 36.9 (149.2)
MINERALS:				
Calcium (mg)	435 ± 119 (454)	372 ± 72 (357)	403 ± 116 (404)	365 ± 47 (363)
Phosphorus (mg)	581 ± 105 (573)	529 ± 55 (532)	567 ± 85 (575)	533 ± 59 (544)
Iron (mg)	7.4 ± 2.8 (5.8)	7.0 ± 2.4 (6.2)	6.9 ± 2.1 (6.5)	5.8 ± 0.8 (5.9)
Sodium (mg)	1165 ± 182 (1177)	1134 ± 174 (1121)	1165 ± 135 (1143)	1066 ± 164 (1096)
Potassium (mg)	1051 ± 175 (1051)	954 ± 143 (977)	990 ± 137 (990)	1017 ± 114 (1002)

CONTINUED

TABLE 15 **(Continued)**
Average (5-day) nut ent density of food intake by energy intake quartile for female cadets (mean quantities/1000 kcal ± SD, median)

	Quartile 1 (1153-2123 kcal/day)	**Quartile 2** (2124-2468 kcal/day)	**Quartile 3** (2469-2832 kcal/day)	**Quartile 4** (2833-3790 kcal/day)
VITAMINS:				
Vitamin A (IU)	2742 + 1292 (2323)	2295 + 829 (2226)	2032 + 718 (1738)	1805 + 517 (1730)
Thiamin (mg)	1.30 + 1.74 (0.61)	16.28 + 57.63 (0.69)	0.75 + 0.34 (0.68)	0.78 + 0.78 (0.58)
Riboflavin (mg)	1.59 + 1.89 (0.95)	12.05 + 41.34 (0.97)	0.89 + 0.24 (0.83)	0.85 + 0.31 (0.80)
Preformed niacin(mg)	14.1 + 18.8 (8.3)	30.7 + 76.1 (10.6)	9.6 + 3.8 (8.7)	8.0 + 1.7 (7.6)
Vitamin C (mg)	75 + 49 (65)	69 + 79 (37)	50 + 22 (44)	52 + 28 (43)

TABLE 16
Weekday and weekend day Dining Hall caloric intake and caloric intake compostion (mean ± SD)

	WEEKDAY		WEEKEND DAY		SIGNIFICANT DIFFERENCE	
	Males	Females	Males	Females	Weekday & Weekend Day	Sex Effect
Energy (kcal)	3004 ± 790	1886 ± 565	1328 ± 790	726 ± 447	$p<.0001$	$p<.0001$
% Protein kcal	14.3 ± 1.8	14.5 ± 2.4	15.2 ± 3.1	14.4 ± 2.7	NS	NS
% Fat kcal	41.0 ± 4.2	41.9 ± 5.2	34.7 ± 8.7	30.6 ± 7.8	$p<.0001$	NS
% Carbohydrate kcal	45.7 ± 2.5	44.1 ± 6.6	50.5 ± 10.4	55.7 ± 10.1	$p<.0001$	NS

TABLE 17
Nutrient density of dining hall food intake on weekdays and weekend days (mean quantities/ 1000 kcal ± SD)

	WEEKDAY		WEEKEND DAY		SIGNIFICANT DIFFERENCE	
	Males	Females	Males	Females	Weekday & Weekend Day	Sex Effect
MACRO:						
Protein (g)	35.8 ± 4.3	39.4 ± 15.1	38.0 ± 7.4	36.5 ± 7.1	NS	NS
Fat (g)	46.4 ± 4.6	47.4 ± 5.4	39.3 ± 9.5	35.6 ± 8.8	p<.0001	NS
Carbohydrate (g)	112.0 ± 13.5	108.0 ± 15.8	124.8 ± 24.9	135.1 ± 25.8	p<.0001	NS
Total Sugars (g)	51.1 ± 12.8	48.9 ± 13.5	58.8 ± 25.7	64.0 ± 29.3	p<.0026	NS
Sucrose (g)	32.8 ± 9.2	30.7 ± 9.0	31.9 ± 13.7	30.3 ± 13.9	NS	NS
Alcohol (g)	0.2 ± 0.1	0.1 ± 0.7	0.0 ± 0.0	0.0 ± 0.0	NS	NS
Fiber (g)	1.3 ± 0.4	1.4 ± 0.5	1.1 ± 0.4	1.2 ± 0.5	p<.0001	NS
Cholesterol (mg)	182 ± 56	211 ± 94	243 ± 204	250 ± 193	NS	NS
MINERALS:						
Calcium (mg)	358 ± 76	383 ± 111	472 ± 206	479 ± 191	p<.0001	NS
Phosphorus (mg)	541 ± 72	569 ± 103	644 ± 159	649 ± 150	p<.0001	NS
Iron (mg)	6.1 ± 1.8	6.2 ± 2.2	7.1 ± 5.3	8.2 ± 5.4	p<.0030	NS
Sodium (mg)	1125 ± 159	1174 ± 225	1126 ± 332	1231 ± 345	NS	NS
Potassium (mg)	1046 ± 147	1086 ± 180	1325 ± 393	1351 ± 327	p<.0001	NS
VITAMINS:						
Vitamin A (IU)	2037 ± 897	2545 ± 1204	3204 ± 4506	2633 ± 1752	NS	NS
Thiamin (mg)	0.61 ± 0.20	0.63 ± 0.19	0.86 ± 0.55	1.03 ± 0.44	p<.0001	NS
Riboflavin (mg)	0.82 ± 0.23	0.85 ± 0.27	1.25 ± 0.78	1.25 ± 0.57	p<.0001	NS
Preformed Niacin(mg)	8.6 ± 2.5	9.4 ± 2.8	10.2 ± 6.6	10.6 ± 6.3	NS	NS
Vitamin C(mg)	47 ± 18	61 ± 86	85 ± 87	111 ± 79	p<.0014	NS

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Armed Forces Radiobiology Res Inst
Building 42, NNMC
Bethesda, MD 20014

Chairman, Joint Formulation Board
DOD Food RDT and ENG Program
HQ, US Marine Corps LFS-4
Washington, DC 20380

Commander
USNARADCOM
ATTN: US Navy Rep/JTS
Natick, MA 01760

Commander
US NARADCOM
ATTN: US Army Rep/JTS
Natick, MA 01760

Commander
HWDA, ODCSRDA
ATTN: DAMA-CSS-D
Washington, DC 20310

Commander
US NARADCOM
ATTN: USMC REPL
JTS, USMC DRDNA-ZF
Natick, MA 01760

Commander
US NARADCOM
ATTN: Chief, ORLSA
Natick, MA 01760

HWDA, ODCSLOG
of Staff for Logistics
ATTN: Chief, Troop Sup Div
Washington, DC 20310

Chairman, DOD Food SVC FAC
and Equip Planning Board
Office, Chief of Engineers
Forestal Building, Room 2-F
055
Washington, DC 20314

Commander
US Army TSA
ATTN: DALO-TAD
Ft. Lee, VA 22314

Commander
US NARADCOM
ATTN: Technical Director
Natick, MA 01760

Commander
US NARADCOM
Dev Command
ATTN: USAF Rep/JTS
Natick, MA 01760

END

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