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THE EFFECTS OF PROLONGED FEEDING MEAL, READY-TO-EAT (MRE) OPERATIONAL RATIONS

FINAL REPORT 1983

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The US Army Natick Research and Development Center conducted a study to evaluate the effects of prolonged feeding Meal, Ready-to-Eat (MRE) operational rations on troop effectiveness. Two combat support companies, from the 25th Infantry Division, participated in this 34-day study while they were engaged in a field training exercise at the Pohakuloa Training Area on the big Island of Hawaii. One company subsisted solely on MRE rations. The other company was fed an A ration breakfast, an MRE lunch and an A ration dinner.

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The MRE food items were highly rated by the troops but these foods were not consumed in sufficient quantity. Average daily caloric intake was 2,189 calories per day for the MRE group and 2,950 calories per day for the control group. The major consequences of the low food intakes were body weight loss and some vitamin and mineral intakes that were below recommended levels. The MRE group lost 8.1 pounds and the control group lost 4.6 pounds. Both groups had intakes of niacin and magnesium that were below recommended levels. The MRE group also consumed less riboflavin, calcium, and iron than recommended.

The other measures that were taken to evaluate the consequences of prolonged feeding the MRE did not reveal any major differences between the two companies. Questionnaires on physical symptoms, mood, morale and perceptions of leadership showed only minor differences between the two companies. The performance of the two companies did not differ on a test battery of cognitive and psychomotor tasks. Measures of nutritional status did not reveal differences between the two companies or values outside the normal range.

The low food intake of the company fed solely MRE rations did not appear to be due to dissatisfaction with the ration or to thirst-induced anorexia. Rather, the low food intake in the MRE group appears to result from several factors, including loss of appetite, absence of scheduled meals, small portion sizes of highly rated and highly consumed entree items, lack of typical breakfast foods and a limited variety of preferred beverages in the ration.

EXECUTIVE SUMMARY

Current scenarios call for troops to subsist on operational rations as their sole source of food for extended periods of time. Prior to this study it was not known whether this could be done without compromising troop effectiveness. In August/September 1983 the U.S. Army Natick Research and Development Center conducted a field study of the effects of prolonged feeding Meal, Ready-To-Eat (MRE) operational rations during an extended field training exercise (34 days) with troops from the 25th Infantry Division at the Pohakuloa Training Area on the big island of Hawaii.

The protocol for the field test was coordinated with the Office of The Surgeon General and satisfied the criteria established in concert with Training and Doctrine Command and the Quartermaster School. Two combat support companies participated in the field test. One company subsisted solely on MRE operational rations. The other company was fed an A ration breakfast, an MRE lunch and an A ration dinner. Data on food acceptability, physical symptoms, mood, morale, perceptions of leadership, food preferences, body weight, and perceptions of the MRE were collected from all the men in both companies prior to the exercise and at selected time points during the exercise. In addition, within each company 30 volunteers underwent more intensive testing, and in these individuals the following measures were taken: body weight, height, body fat, food intake, water intake, nutritional status as indexed by blood levels of selected nutrients, body fluid status as indexed by urine volume, urine osmolality and hematocrit, and cognitive and psychomotor performance. With the exception of body fat and food intake, these measures were taken prior to the exercise, and on days 11/12 and 23/24, approximately one-third and two-thirds of the way through the exercise, and on day 34, at the end of the field test. Body fat was measured prior to the exercise and at its termination. Food intake was measured three days a week throughout the exercise.

In general, the MRE items were very well received by the troops in both companies with average acceptability scores of 7.05 for the MRE group and 6.48 for the control group on a nine-point hedonic scale. The MRE group also rated the MRE higher than the control group rated comparable hot A ration meals. There was no indication of a decline in the acceptability of the MRE over the 34 days of the field test. The MRE was rated higher for lunch and dinner than it was for breakfast.

Although these high ratings indicate that the items consumed by an individual were highly acceptable to him, an examination of the consumption data for each of the food classes reveals that of the items distributed, the following percentages were actually eaten by the troops: entrees - 68%, starch items - 60%, spreads - 47%, fruits - 51%, desserts - 50%, beverages - 27% and condiments and candies - 26%.

The final questionnaire about the MRE was consistent with the acceptability data. It revealed that the troops were generally satisfied with the ration's taste, appearance, variety, and ease of preparation. Their ratings of the amount of food the ration provided were in the neutral range and more detailed questions indicated that they felt that the portion sizes of some components were too small. Responses to the questionnaire also revealed three potential areas in which the ration could be improved: (1) The troops indicated that the entree and the dehydrated fruit portion sizes were too small. (2) The MRE group indicated that they liked the ration better for lunch and dinner than for breakfast. (3) The troops overwhelmingly indicated that they wanted more variety in the beverages that were included in the ration.

Despite its high acceptability and the troops' satisfaction with the ration, the MRE was not consumed in sufficient quantity. Daily caloric intake averaged 2,189 calories for the MRE group and 2,950 for the control group. Both values are considerably below the recommended level of 3600 calories for operational rations. The MRE group showed a decline in daily caloric intake over the course of the field test, whereas daily caloric intake tended to remain stable in the control group.

The low food intake did not appear to be due to dissatisfaction with the sensory properties of the ration (taste, smell, appearance) or to thirst-induced anorexia. Water intake of the MRE group was somewhat lower than that of the control group (2657 mL/day versus 3132 mL/day), but was not low enough to produce increased reports of thirst or significant changes in the monitored indices of body fluid status (urine volume, urine osmolality, hematocrit, and hemoglobin). Rather, the low food intake in the MRE group appears to result from several factors, including loss of appetite, absence of scheduled meals, small portion-size of highly rated and consumed entree items, lack of breakfast items in the ration, and the limited variety of beverages in the ration.

The major consequences of the low food intakes were body weight loss and some vitamin and mineral intakes that were below recommended levels. The majority of troops in both companies lost weight during the 34-day field test (69 of 71 in the MRE company and 57 of 68 in the control company), but the men in the MRE company lost significantly more weight than those in the control company (8.1 pounds versus 4.6 pounds). Both groups had intakes of niacin and magnesium that were below the recommended levels, while the MRE group also had intakes of riboflavin, calcium, and iron that were below recommended levels.

The other measures that were taken to evaluate any effects of prolonged feeding the MRE or any possible effects of nutritional deficiencies that developed did not reveal any major differences between the two companies. The questionnaire data on the incidence of physical symptoms showed that the two groups showed similar profiles of complaints and discomforts during the field test, but of the 67 possible symptoms on the questionnaire, the two reported at the highest frequency were: "I feel good" and "I feel alert." There were, however, two important food-related symptoms that were reported at a higher frequency by the MRE group. The MRE company reported that they had lost their appetite and that they experienced gas pressure more frequently than the control group. The MRE company did not differ from the control company on any of the six mood scales, and both companies showed a considerable improvement in their mood scores during the field test. In a similar manner, the two companies did not differ from one another on measures of morale and perceptions of leadership. These latter ratings were positive and remained stable over the four data collection points.

The performance of the troops in the two companies did not differ on a test battery of cognitive and psychomotor tasks. The test battery included tasks which measured eye-hand coordination, speed of gross arm movements, accuracy and speed of aiming at stationary and moving targets, reaction time, memory scanning rate, short term memory capacity, speed and accuracy of coding digits into symbols, grammatical reasoning, and the speed and accuracy with which simple arithmetic problems are solved. Within the MRE company, the performance of the individuals who lost the most weight (greater than 7% body weight loss) did not differ from the performance of those who lost the least amount of weight during the field test.

Despite the low levels of food intake, nutritional status (as indexed by measures of hemoglobin, hematocrit, plasma albumin, plasma total protein, serum vitamin C, serum folate, plasma pyridoxal phosphate, serum retinol, and serum zinc) did not reveal significant differences between the two companies or values that were outside the normal range. Plasma albumin and total protein were consistent with adequate protein status. Values for serum Vitamin C were normal throughout the field trial. Values for retinol were at the upper range of normal levels. Serum folate values fell during the field test in both companies, but in neither company did this value fall below normal limits. Plasma pyridoxal phosphate concentrations remained unchanged during the field test in the control company, but rose above normal levels in the MRE company. Serum zinc remained within normal limits in both companies. With the one exception that troops fed solely the MRE lost more weight than troops fed two hot meals daily, the data on selected blood constituents indicate that nutritional status was not compromised by subsistence on the MRE for 34 days.

PREFACE

The present study was conducted by the Behavioral Sciences Division of the Science and Advanced Technology Laboratory at Natick R&D Center. A study of this scope and complexity is not completed successfully without the support and cooperation of many individuals. At the Center we were fortunate to have the full support and encouragement of both the Commanding Officer, BG James Hayes, and the Technical Director, Dr. Robert Byrne, who gave us the mandate to do a complete and thorough study of the effects of prolonged feeding of operational rations. We hope our effort fulfilled this forward looking mandate. Dr. Hamed M. El-Bisi, our laboratory director, backed their support with his own enthusiasm and drive. We were also fortunate in receiving support and guidance on a continuing basis from the Office of The Surgeon General. MG Garrison Rapmund and his able nutrition staff officer, LTC David Schnakenberg provided timely counsel and support in regard to nutritional assessment and the medical monitoring of this study. At the 25th Infantry we encountered only a "can do" attitude that emanated from their commanding general, MG William Schneider, and spread through his staff, to the brigade commander of the participating troops, COL Cooper and to the test subjects themselves. We would particularly like to express our appreciation to CW4 James Sifford, the 25th Infantry Division's project officer for this study and his assistant SFC Robert LoPresto. Their experience in military food service and their ability to meet commitments in a timely and efficient manner made this study a reality. CPT Sae Tuia served as our capable liaison with the brigade. The commanding officers of the two participating companies CPT Ronald Benton and CPT Kevin Shea, led by example and by ability. The first sergeants of the two participating companies Jim Cacoulidis and S. Fauaa made our test plan a reality. The participating troops were always where they told us they would be at the appointed hour, even if the appointed hour was breakfast at 0330 hrs. Finally we cannot over-emphasize the level of cooperation and good spirit that characterized the men of the 1/21st Combat Support Company and the 1/35th Combat Support Company. Without their cheerful willingness to be probed, poked and questioned, the information contained in this report, which provides the basis for future combat field feeding regimens and a data base for improving operational rations of the future, would not exist.

Personnel from University of Hawaii participated in this study under contract DAAK-83-C-0052. They were responsible for collecting data on nutrient intakes, nutritional status and hydration which appears in Chapters 4 and 7 of this report. They were ably assisted by G. Carey, K.W. Chan, R. Cunningham, M. Hennessey, and R. Worthley in computer analysis; J. Davis, W. Kuhlmeyer, A. Lerma, and A. Yamamoto in data collection. In addition to the authors of this report a number of Natick personnel were involved in conducting this study including Barbara L. Bell, Dr. Barbara Edelman-Lewis, Joanne Moy, Charlene Slamin and Robert L. Swain. We gratefully acknowledge their support.

Project Officer for the US Natick R&D Center was Dr. Edward Hirsch. The study was performed under Project Number 1L162724AH99.

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THE EFFECTS OF PROLONGED FEEDING

MEAL, READY-TO-EAT (MRE) OPERATIONAL RATIONS

CHAPTER 1

INTRODUCTION

Current military scenarios call for troops to subsist on operational rations for extended periods of time. It is currently not known whether this can be accomplished without compromising troop effectiveness. Current policy on duration of use of combat rations advises that the Meal Combat Individual (MCI) ration should not be used as the sole source of food for more than 10 consecutive days.

In the near future the existing stocks of MCIs will be depleted and the Meal, Ready-to-Eat (MRE) will be the Army's operational ration. There are reports indicating that this ration is acceptable to troops over a 7-day period and that it is preferred to the MCI.[1,2] The ration is formulated to meet the nutrient requirements of young adult males. The central unanswered question is whether this ration is sufficiently palatable and provides enough variety to sustain adequate levels of nutrient intake when it is the sole source of sustenance for periods of 30 to 60 days.

The MRE is composed of 30 food items, two beverages, a cream substitute, assorted candies, condiments and a gravy base (see Appendix A). These components are divided into 12 menus with repetition of some items other than entrees across the 12 menus. The components are contained in a flexible retort pouch and can be eaten hot or cold. Seven of the food items are meant to be rehydrated, but they can be eaten without adding water. Three MRE pouches provide 3600 calories and meet the known requirements for all nutrients.

The limited number of foods in the 12 menus in conjunction with the fact that, on the average, each meal will be repeated every four days raises the possibility that food monotony will develop when this ration is fed as the sole food source over an extended period of time. Some investigators have found that both food intake and food acceptability decline when limited menus are offered.[3,4,5,6] In addition to the possibility of a food monotony effect, the study investigated whether some components of the MRE were not sufficiently palatable to the soldier to be consumed. The rejection of some components of the ration may lead to inadequate energy intake, consumption of a nutritionally imbalanced diet or inadequate vitamin and mineral intakes, due to the patterns of diet fortification and food selection.

The present experiment was designed to evaluate the effects of prolonged feeding the MRE to troops engaged in an extended (34 days) field training exercise. Given the nutritional quality of the MRE and the possibility of food monotony developing, the acceptability and the consumption of the MRE were regarded as the primary measures. Accordingly, the most frequent and intensive measurements focused on these variables. In addition, a series of measures were taken to assess any possible harmful consequences of consuming this diet or of not eating sufficient amounts of it or of choosing foods from the ration in such a manner that inadequate amounts of specific vitamins or minerals were consumed. These secondary measures included: mood, morale, cognitive performance, psychomotor performance, physical symptoms, body weight, body fat and nutritional status as indexed by the circulating levels of selected blood constituents. In addition, water intake and body fluid status were measured to provide a basis for evaluating whether thirst and/or dehydration contributed to or caused inadequate food intake if this outcome developed.

CHAPTER 2

GENERAL METHOD

Overview

The design and execution of this field study on the effects of prolonged feeding of MRE combat rations were guided by two general considerations. First, we regarded the acceptability and consumption of the MRE as the primary measures and any possible changes in troop performance, morale or general well-being as results of low acceptability and inadequate consumption. Accordingly, the most frequent and intensive measures focused on food acceptability and consumption. Second, we designed the study to model as closely as possible the manner in which troops actually eat in the field. For this reason the troops were not in the field solely to be tested. They were there for training. The training program enabled the test to simulate the rigor of combat and also kept the troops sufficiently busy so that what they were eating was not the major focus of their day. In some instances the training schedule led to minor departures from the initial test plan. These changes were not serious and did not compromise the study. Departures from the initial test plan consisted entirely of schedule changes so that some measures were taken at approximately equal intervals rather than at exact intervals.

Three other consequences of our attempt at creating a test that attempted to model how troops feed in the field were the decisions to: a) allow troops to trade food items, b) to distribute the 12 menus in the MRE randomly and c) to provide the troops with hot sauce for their food. The first two decisions clearly mimic the manner in which troops feed in the field. In the instance of the hot sauce we also felt that by providing this item we would reduce the likelihood of having the troops bring outside sources of food into the field (a practice strictly forbidden). The design of the field test was coordinated closely with the command group of the participating troops so as not to interfere with the actual training mission of the field exercise. The testing schedule was set up around the training requirement, and in some cases the training mission dictated when and what type of measures could be taken.

Design

Two combat support companies from the 2nd Brigade of the 25th Infantry Division participated in the test. The experimental company, 1/35th CSC, subsisted for 34 days on the MRE as their sole source of food. The control company, the 1/21st CSC, was fed a hot A ration breakfast, an MRE lunch and a hot A ration dinner. The MRE company was issued three MRE meals at the beginning of each day and was free to consume the components during the course of the day as time permitted. The control company was fed their hot breakfast and dinner meals at scheduled times. The actual times of eating for the control company varied from day to day. On some days the troops were fed the hot meals in the area of a mess tent, whereas on other days the hot meal was brought in mermite containers to the location where the troops were training. On the days that the control company was training in the general vicinity of the mess tent, beverages including coffee, fruit juice and milk were available at nonmeal times. The control company was given its MRE meal after breakfast and was free to consume it during the remainder of the day. In all other ways the two companies were equivalent and were tested in the same manner and at the same frequency.

Test Subjects

All the troops from both companies participated in the test including the NCOs and the officers. Within each company a subsample of 30 men volunteered to undergo more intensive testing (urine and blood analyses, food and water intake, cognitive and psychomotor performance testing). The daily level of physical activity of a typical soldier in a combat support company is best characterized as moderate. The majority of troops spend their day in a vehicle and typically do not engage in extended running or movement on foot.

Test Site

Baseline testing took place at Schofield Barracks, Oahu, where the 25th Infantry Division is based. The field test took place at the Pohakuloa Training Area (PTA) during August/September 1983. The elevation at PTA is approximately 6,000 feet. The terrain is rugged, dry and dusty except for heavy morning mist at elevations higher than base camp. The climate is warm (70-85°F) during the day and cool at night (40-60°F). The site is remote from towns, thereby minimizing the availability of outside sources of food. Subjects remained in the field exercise area except for the three mornings when the volunteers in each company came to the base camp. On these mornings physiological and psychological data were collected.

Procedure

Ten days prior to the start of the field test, data on food preferences, self-reports of physical symptoms, mood, morale, perceptions of leaders and body weight were gathered from all the men in both companies. These measures, with the exception of body weight, were repeated three times during the field test at approximately equal intervals (T1 = days 11/12, T2 = days 23/24 and T3 = days 33/34) with the two companies tested on successive days. In addition, on these same days, within each company the volunteers underwent additional testing and on these individuals the following measures were taken: body weight, skinfold thickness at several sites, nutritional status as indexed by blood levels of selected constituents, body fluid status as indexed by urine volume, urine osmolality, hematocrit and hemoglobin, and cognitive and psychomotor performance. Height was also measured in the volunteers prior to the study so that percent body fat could be computed from the height, weight and skinfold thickness measures using the standard Army Medical Department (AMEDD) procedure.

Food intake, water intake and food acceptability were measured in the 30 volunteers in each company during four test periods. The four test periods consisted of days 8-9-10 (Period A), 15-16-17 (Period B), 21-22-23 (Period C) and 31-32 (Period D). Food acceptability data were also collected from another 15-30 men in each company at each meal on the days that consumption and acceptability data were collected from the volunteers.

Table 1 shows the testing schedule for both the entire group and for the 30 volunteers who were studied more intensively. Detailed descriptions of the tests employed and the methods used to gather the data and to analyze it are described in detail in each of the following chapters of this report.

TABLE 1. Testing Schedule for Prolonged Feeding of Meal, Ready-To-Eat (MRE) Rations.

MEASURES	FREQUENCY	WHEN	SAMPLE
1 - Food-related Measures			
a. Food preference	4X	Baseline, T_1,T_2,T_3	100 %
b. Food acceptability	11 days	Periods A,B,C,D	100 %
c. Food and water consumption	11 days	Periods A,B,C,D,	Volunteers
2 - Nutritional Status			
a. Body weight	4X 2X	Baseline, T_1,T_2,T_3 Baseline, T_3	Volunteers Nonvolunteers
b. Anthropometry height, skinfold thickness	2X	Baseline, T_3	Volunteers
c. Body fluid status	4X	Baseline, T_1,T_2,T_3	Volunteers
d. Blood constituents	4X	Baseline, T_1,T_2,T_3	Volunteers
3 - Clinical Symptoms			
a. Symptoms checklist	4X	Baseline, T_1,T_2,T_3	100%
b. Weekly availability of physician			
4 - Psychological Tests			
a. Cognitive & Psychomotor Performance	4X	Baseline, T_1,T_2,T_3	Volunteers
b. Mood	4X	Baseline, T_1,T_2,T_3	100%
c. Morale & Perceptions of Leadership	4X	Baseline, T_1,T_2,T_3	100%

CHAPTER 3

BODY WEIGHT AND PHYSICAL SYMPTOMS

Summary

Troops fed the MRE as their sole source of food lost more weight (average = 8.1 pounds) than the company fed an A ration breakfast, an MRE lunch and an A ration dinner (4.6 pounds). The questionnaire data on the incidence of physical symptoms revealed that the two groups presented similar profiles of complaints and discomforts during the field test. There were, however, two important food-related symptoms that were reported at a higher frequency by the MRE group. The MRE subjects reported that they had lost their appetite and that they experienced gas pressure more frequently than the control subjects. The self-report data also clearly indicated that the MRE subjects felt good and that they were not debilitated in any sense.

1. Introduction

In evaluating a ration two of the more fundamental criteria that should be addressed concern whether the troops are able to maintain their body weight and whether the ration makes them sick or uncomfortable in any manner. Illness or discomfort or the appearance of physical symptoms could result from eating the ration or from not consuming it in sufficient quantity to meet nutritional needs. This chapter examines changes in body weight and reports of physical symptoms in troops fed the MRE as their sole source of food for 34 days and in troops fed hot meals for breakfast and dinner and an MRE for lunch.

2. Method

Body Weight

The protocol called for body weight to be measured in all men in the MRE company and all the men in the control company prior to the start of the field training exercise and at its termination. In addition to measures at these time points, body weight was determined for the 30 volunteers in both companies on days 11/12 and 23/24, approximately one third and two thirds through the 34 day test. This information allowed us to compute the rate of weight change in those individuals who were tested more intensively. Weight was measured indoors by two individuals using leveled balances (model 230 Health O Meter, Continental Scale Corporation, Bridgeview, IL) resting on a hard floor and protected from air currents. Foot and headgear and any heavy pocket contents were removed and weight was read to the nearest 0.25 lb (and later converted to the nearest 0.1 kg). The balances were calibrated with 5 kg weights before each use.

Physical Symptoms

The physical symptoms checklist developed by the United States Army Research Institute of Environmental Medicine (USARIEM) was administered to all the men in both companies prior to the exercise and on days 11/12, 23/24 and 34 (Appendix

B). The number of troops who were tested at all four time periods was 59 in the MRE company and 34 in the control company. The loss of subjects occurred for a number of reasons including: improperly filled out forms, emergency leave, troops who joined the company in the field late or who were not part of the company at the start of the test, troops who were on a special assignment on the test day and troops who were on sick call. Only the data from troops who were present and handed in correctly filled out forms were used in the analysis of the physical symptoms data.

3. Results and Discussion

Weight Loss

The vast majority of troops in both companies lost weight during the 34-day exercise. In the MRE group 69 out of 71 soldiers who were weighed at the beginning and end of the exercise lost weight. In the control company 57 out of 68 troops lost weight. The maximum weight loss in the MRE company was 18.75 pounds and in the control company the maximum was 14.5 pounds. The average weight loss in the company fed solely MREs was 8.1 pounds and in the control company weight loss averaged 4.6 pounds. Analysis of variance of the weight loss data revealed that the group difference in absolute weight loss was highly significant ($\underline{F}(1,132) = 21.23$, $\underline{p} < 0.001$).

An examination of the weight-loss data with an individual's status as a volunteer for more intensive testing or as a nonvolunteer revealed that within both companies the volunteers lost more weight ($\underline{F}(1,132) = 5.60$, $p < 0.05$). This effect was more pronounced in the MRE company as indicated by a significant statistical interaction between diet and volunteer status ($F(1,132) = 3.90$, $p < 0.05$) in the analysis of variance (see Table 2).

TABLE 2. Absolute Weight Loss (Pounds).

	MRE	CONTROL
	$\bar{X}$	$\bar{X}$
Volunteers	10.36	4.72
Nonvolunteers	6.80	4.41

One problem with an analysis of absolute weight loss is that there were initial differences in the body weights of the four groups. Prior to the exercise, the volunteers in the MRE group weighed significantly more than the MRE nonvolunteers (volunteers = 173.73, nonvolunteers = 163.46, ($\underline{t}(68) = 2.02$, $p < 0.05$). In the control company the initial difference in body weight was much smaller and was not statistically significant (volunteers = 169.86, nonvolunteers = 168.38). In both companies there was some pressure exerted by the company commander to induce the troops with weight control problems to volunteer for more intensive testing during the study. Apparently the company commanders believed that the more intensive testing would increase the level of surveillance and limit any nonissued food these soldiers could obtain. Their perception of the situation was not correct; all the troops in both companies were monitored and limited to issued food, but the commanders' influence produced groups that were not identical in terms of initial body weight. However, it should be re-emphasized that the initial starting weight of the MRE group (168.6 lbs) did not differ from that of the control group (166.8 lbs) and the overall influence of diet on weight loss is significant.

In order to circumvent interpretive difficulties, the body weight data were also analyzed using percent body weight loss as the dependent measure (Table 3). The analysis of variance of the relative weight loss data revealed the same pattern of results as the absolute weight loss data, except some of the effects were marginally significant rather than clearly significant by standard statistical critical (alpha = 0.05). The MRE company lost a greater percentage of their initial body weight ($F(1,132) = 24.31$, $p < 0.001$) but on this measure an individual's volunteer status had only a marginally significant effect ($F(1,132) = 3.85$, $p = 0.052$). Similarly, the statistical interaction between diet and volunteer status was marginally significant ($F(1,132) = 3.21$, $p = 0.075$). These analyses show that even after correcting for differences in initial body weight the company fed MREs lost more weight than the control group, volunteers lost more weight than nonvolunteers and the effect of being a volunteer was more pronounced in the MRE company.

TABLE 3. Percent Body Weight Loss.

	MRE	CONTROL
	$\bar{X}$	$\bar{X}$
Volunteers	5.8%	2.6%
Nonvolunteers	4.1%	2.5%

Why did the volunteers lose more weight than the nonvolunteers and presumably show more of a reduction in their caloric intake? In this instance we think that the initial difference in the composition of the groups is responsible. Recall the the MRE volunteers were the heaviest group at the beginning of the study. The correlation between initial body weight and absolute weight loss when computed for all the men in both companies was $r = -0.491$ ($p < 0.01$). The heaviest troops lost the most weight during the field test. This correlation becomes even more striking when computed for the volunteers in each company. This correlation was $r = -0.659$ ($p < 0.01$) for the volunteers in the MRE company and was $r = -0.634$ ($p < 0.01$) for the volunteers in the control company.

Rate of Weight Loss

Figure 1 shows that the rate of weight loss in both companies was sharpest during the first 12 days in the field. During this period the MRE volunteers lost 3.4% of their initial body weight and the control volunteers lost 1.3%. During the second 11 day period the MRE volunteers lost another 1.0% and the control volunteers 0.9%. Finally, during the last 11-day period the MRE

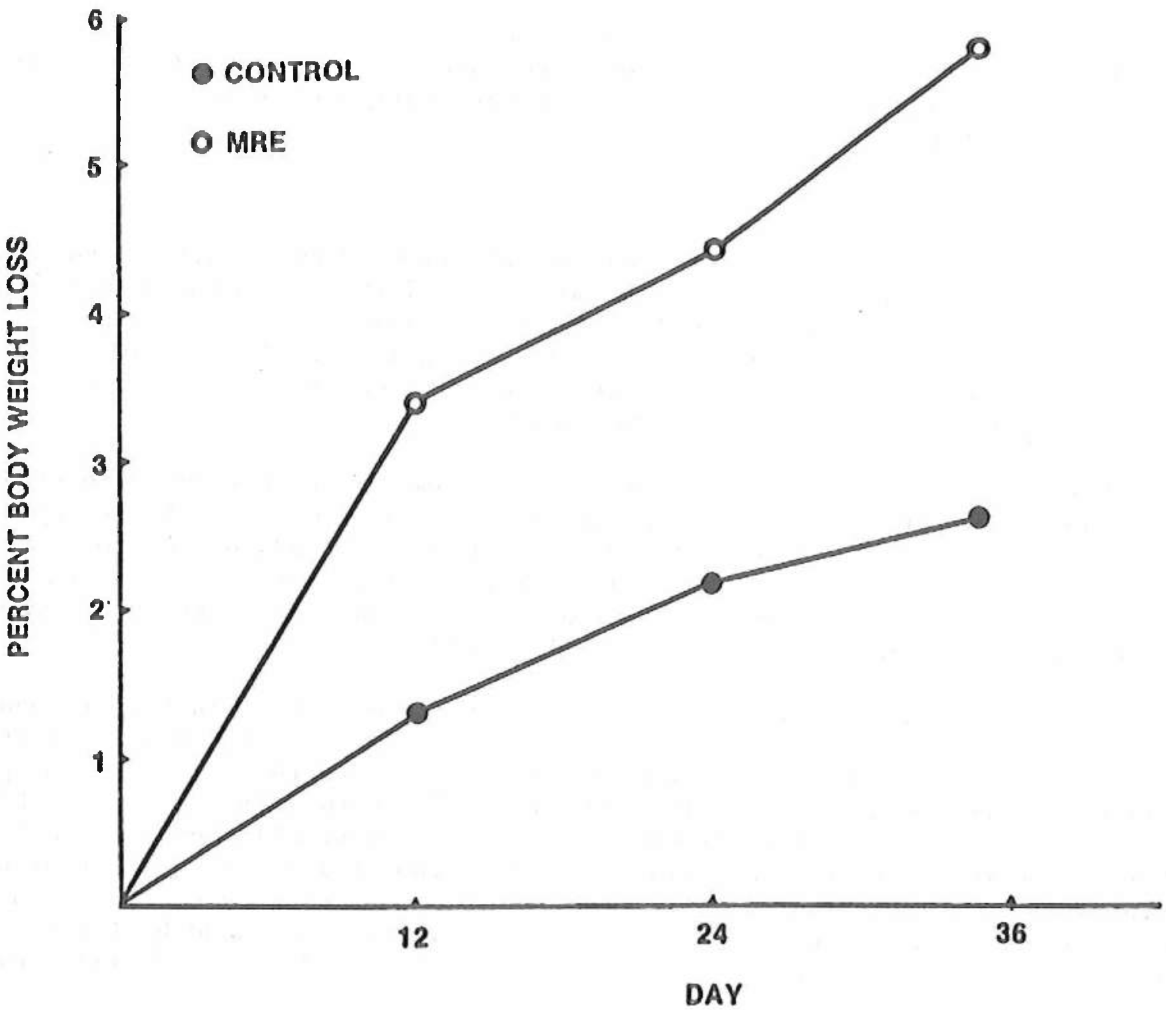

Figure 1. Mean Percent Body Weight Loss By MRE Group And Control Group.

volunteers lost another 1.4% and the control volunteers 0.4% of their initial body weight. It appears that weight loss was quickly approaching an asymptote in the control group but was still continuing to decline at a rate of slightly more than 1% per 12 day period in the MRE group.

In summary, the troops fed the MRE as their sole source of food and the troops fed an A ration breakfast, MRE Lunch, and an A ration dinner both lost weight during the 34 days. The troops fed the MRE lost more weight and at a faster rate than the control group. The magnitudes and rates of weight loss were entirely commensurate with levels of daily caloric intake in the volunteers of both companies (see Chapter 4).

It is clear that the MRE group lost more weight than the control group and this weight loss was due to inadequate food intake (see Chapter 4). Was subsistence on the MRE also associated with other bodily discomforts and increased reports of physical symptoms?

Physical Symptoms

Two analyses of the physical symptoms checklist were attempted and rejected. The scaled values of the 67 symptoms were rejected as the dependent measure because the data were badly skewed. Instead, a binary measure, the presence/or absence of a specific symptom, was used in all analyses. Also a factor analysis of the 67 symptoms did not yield clear groups of symptoms. Analyses were therefore performed on each of 67 symptoms.

Linear and quadratic codings of the four time points were used to create variables that would reflect trends over time in the incidence of the reported symptoms. Differences in these trends between the MRE and the control group were assessed by means of t-tests. T-tests were also used to compare the average percentage of troops in each company who reported a particular symptom during the three measurement points in the field.

Table 4 lists each symptom and the percentage of troops in each company who reported this symptom during the baseline measurement at Schofield Barracks and the average percentage who reported this symptom at the three measurement points during the field test (days 11/12, 23/24 and 34). Casual inspection of this table gives the overall impression that these were basically healthy troops whose discomforts in the field did not differ dramatically from the baseline level at Schofield Barracks. This impression is supported by decreases in the level of many symptoms during the troops' time in the field and by the fact that 77% of the troops in both companies reported that they "felt good" (item 67).

A closer statistical examination of these data revealed a small number of cases, 6 out of 65 possible symptoms, on which the percentage of troops in the two companies reporting the presence of the symptom differed significantly. There was a somewhat larger set of symptoms for which the two companies showed significantly different trends over the four measurement points. Table 5 lists each symptom that showed a significant group difference in the average frequency, the linear component of the trend, or the quadratic component of the trend. For these differences to be meaningful within the design and context of this study, the next column indicates whether the frequency was significantly higher than the baseline level; and the last column indicates whether the

TABLE 4. Percentage of Troops Reporting Symptoms.

SYMPTOM	BASELINE MRE (N = 59) $\bar{X}$ ± SEM	BASELINE CONTROL (N = 34) $\bar{X}$ ± SEM	FIELD TEST MRE (N = 59) $\bar{X}$ ± SEM	FIELD TEST CONTROL (N = 34) $\bar{X}$ ± SEM
1 Lightheaded	22.0 ± 5.4	38.2 ± 8.5	26.5 ± 4.2	20.6 ± 5.3
2 Headache	39.0 ± 6.4*	17.6 ± 6.6	22.6 ± 4.0	13.7 ± 4.2
3 Sinus pressure	20.3 ± 5.3	20.6 ± 7.0	47.5 ± 4.8*	29.5 ± 6.4
4 Dizzy	13.6 ± 4.5	20.6 ± 7.0	19.2 ± 3.6	12.8 ± 4.0
5 Faint	8.5 ± 3.7	8.8 ± 4.9	11.3 ± 2.9	3.9 ± 2.3
6 Vision is dim	15.3 ± 4.7	23.5 ± 7.4	12.4 ± 3.6	12.8 ± 4.9
7 Coordination is off	18.6 ± 5.1	26.5 ± 7.7	20.7 ± 4.6	16.7 ± 4.5
8 Short of breath	10.2 ± 4.0	5.9 ± 4.1	16.1 ± 3.7**	35.3 ± 6.4
9 Hard to breathe	11.9 ± 4.2	5.9 ± 4.1	13.0 ± 3.5	18.6 ± 5.1
10 Hurts to breathe	8.5 ± 3.7	2.9 ± 2.9	4.0 ± 1.6	7.8 ± 3.7
11 Heart is beating fast	17.0 ± 4.9	8.8 ± 4.9	7.3 ± 2.4	11.8 ± 4.2
12 Heart is pounding	10.2 ± 4.0	5.9 ± 4.1	11.3 ± 3.1	6.1 ± 3.1
13 Chest pains	10.2 ± 4.0	14.7 ± 6.2	6.2 ± 2.1	12.8 ± 4.9
14 Chest pressure	10.2 ± 4.0	14.7 ± 6.2	3.5 ± 1.6	11.8 ± 4.9
15 Hands shaking	17.0 ± 4.9*	35.3 ± 8.3	17.0 ± 4.0	23.5 ± 6.4
16 Muscle cramps	18.6 ± 5.1	21.2 ± 7.2	15.3 ± 3.3	10.8 ± 4.2
17 Stomach cramps	11.9 ± 4.2	14.7 ± 6.2	7.5 ± 2.2	9.8 ± 4.1
18 Muscles tight	45.8 ± 6.5	44.1 ± 8.6	26.4 ± 4.3	25.5 ± 6.8
19 Weak	35.6 ± 6.3	29.4 ± 7.9	32.2 ± 4.6	23.5 ± 5.7
20 Legs or feet ache	32.2 ± 6.1	38.2 ± 8.5	14.7 ± 3.1	19.6 ± 4.7
21 Hands, arms, shoulders ache	37.9 ± 6.4*	14.7 ± 6.2	15.5 ± 3.1	22.6 ± 6.1
22 Back aches	42.4 ± 6.5**	12.1 ± 5.8	32.2 ± 4.7	29.4 ± 5.9
23 Stomach aches	8.5 ± 3.7	14.7 ± 6.2	5.7 ± 1.8	8.8 ± 4.1
24 Nauseous	6.8 ± 3.3	14.7 ± 6.2	7.9 ± 2.0	9.8 ± 3.0
25 Gas pressure	10.2 ± 4.0	12.7 ± 6.6	40.1 ± 5.4	25.5 ± 6.1
26 Diarrhea	1.7 ± 1.7	8.8 ± 4.9	5.8 ± 2.3	4.9 ± 2.1
27 Constipated	0.0 ± 0.0	0.0 ± 0.0	11.3 ± 3.2	6.9 ± 2.7
28 Urinate more	8.5 ± 3.7	8.8 ± 4.9	16.4 ± 3.7	13.7 ± 4.7
29 Urinate less	12.1 ± 4.3	5.9 ± 4.1	14.9 ± 2.9**	4.0 ± 1.9
30 Feel warm	39.0 ± 6.4	26.5 ± 7.7	24.9 ± 4.5	16.7 ± 3.5

TABLE 4. Percentage of Troops Reporting Symptoms. (Cont'd)

SYMPTOM	BASELINE MRE (N = 59)		BASELINE CONTROL (N = 34)		FIELD TEST MRE (N = 59)		FIELD TEST CONTROL (N = 34)	
	$\bar{X}$	SEM	$\bar{X}$	SEM	$\bar{X}$	SEM	$\bar{X}$	SEM
31 Feverish	15.8	± 4.9	8.8	± 4.9	9.6	± 2.1	4.9	± 2.1
32 Feet sweaty	27.6	± 5.9	20.6	± 7.0	13.0	± 3.2	20.6	± 5.8
33 Sweating all over	19.0	± 5.2	8.8	± 4.9	4.0	± 1.6	2.9	± 1.6
34 Hands cold	1.7	± 1.7	2.9	± 2.9	28.2	± 4.4**	52.9	± 5.3
35 Feet cold	0.0	± 0.0	8.8	± 4.9	32.2	± 4.4**	50.0	± 5.1
36 Feel chilly	1.7	± 1.7	2.9	± 2.9	31.1	± 4.0	39.4	± 6.2
37 Shivering	0.0	± 0.0	2.9	± 2.9	7.9	± 2.0	10.8	± 3.9
38 Parts of body numb	10.5	± 4.1	14.7	± 6.2	9.0	± 2.7	15.7	± 4.5
39 Skin burning or itching	10.3	± 4.0	14.7	± 6.2	4.6	± 5.7	5.9	± 2.2
40 Eyes irritated	19.3	± 5.3	29.4	± 7.9	22.0	± 4.3	23.2	± 5.7
41 Vision blurry	13.8	± 4.6	11.8	± 5.6	11.9	± 3.5	12.8	± 4.2
42 Ears blocked up	5.2	± 2.9	11.8	± 5.6	14.7	± 3.5	10.8	± 3.9
43 Ears ache	5.2	± 2.9	8.8	± 4.9	6.2	± 2.3	7.8	± 3.7
44 Can't hear well	15.5	± 4.8	17.7	± 6.6	15.8	± 4.0	14.1	± 4.6
45 Ears are ringing	6.9	± 3.4	5.9	± 4.1	16.4	± 3.9	10.8	± 3.6
46 Noses stuffed up	20.7	± 5.4	20.6	± 7.0	49.2	± 4.4	38.2	± 6.3
47 Runny nose	5.2	± 2.9	5.9	± 4.1	48.6	± 4.5	47.5	± 6.7
48 Nose bleeds	0.0	± 0.0	0.0	± 0.0	6.2	± 2.1	2.9	± 2.2
49 Mouth dry	24.1	± 5.7	26.5	± 7.7	15.5	± 2.9	11.1	± 4.3
50 Throat is sore	22.4	± 5.5	14.7	± 6.2	20.7	± 3.7	20.6	± 4.5
51 Coughing	25.9	± 5.8	17.7	± 6.6	35.6	± 4.5	28.4	± 6.2
52 Lost my appetite	18.8	± 5.2	11.8	± 5.6	30.3	± 4.7**	6.9	± 3.4
53 Feel sick	13.8	± 4.6	17.7	± 6.6	13.2	± 2.6	5.9	± 2.6
54 Hungover	20.7	± 5.4	21.2	± 7.2	17.2	± 1.0	19.6	± 1.4
55 Thirsty	60.3	± 6.5	47.1	± 8.7	32.2	± 4.3**	12.8	± 4.0
56 Tired	70.7	± 6.0*	44.1	± 8.6	40.4	± 4.8	35.3	± 6.7
57 Sleepy	62.1	± 6.4	47.1	± 8.7	35.1	± 4.7	33.3	± 6.1
58 Couldn't sleep	37.9	± 6.4	38.2	± 8.5	38.7	± 4.8	25.3	± 5.6
59 Concentration is off	32.8	± 6.2	32.4	± 8.1	24.4	± 4.5	19.6	± 5.5
60 More forgetful	19.0	± 5.2	29.4	± 7.9	23.8	± 4.6	16.7	± 4.9
61 Worried or nervous	33.3	± 6.3	35.3	± 8.3	16.4	± 3.6	20.6	± 5.6

TABLE 4. Percentage of Troops Reporting Symptoms. (Cont'd)

SYMPTOM	BASELINE				FIELD TEST			
	MRE (N = 59)		CONTROL (N = 34)		MRE (N = 59)		CONTROL (N = 34)	
	$\bar{X}$	SEM	$\bar{X}$	SEM	$\bar{X}$	SEM	$\bar{X}$	SEM
62 Feel irritable	29.3	± 6.0	25.0	± 7.8	22.0	± 4.7	24.5	± 6.2
63 Restless	37.9	± 6.4	23.5	± 7.4	29.2	± 4.6	26.5	± 5.9
64 Bored	59.6	± 6.6	55.8	± 8.6	40.1	± 5.0	48.0	± 6.6
65 Depressed	42.1	± 6.6	23.5	± 7.4	30.2	± 4.5	34.3	± 6.6
66 Alert	70.7	± 6.0	85.3	± 6.2	69.8	± 3.8	76.5	± 5.4
67 Feel good	77.6	± 5.5	88.2	± 5.6	77.4	± 3.9	77.5	± 5.4

Asterisks indicate significant differences between the groups for the baseline measure or for the average of the three data collection points in the field.

* $p < 0.05$

** $p < 0.01$

symptom can reasonably be related to the quantity of food consumption. To further clarify these differences, the upper half of the table lists the symptoms that were reported more frequently by the MRE group when the absolute difference was significant. In addition, the upper portion of this table lists cases where the trend differed between the groups, and the MRE group showed an increase in the incidence of the symptom relative to the control group, or was increasing at a faster rate, or was decreasing at a slower rate. The lower half of the table presents the same information for those symptoms where the control group showed higher levels of the symptom.

Examination of the upper portion of Table 5 reveals that there are only two symptoms which differed between the groups and also met the criteria that their level in the field was higher than the baseline and that they were food-related. Symptoms that satisfied these conjoint criteria included: "I have gas pressure", and "I have lost my appetite." In regard to the increased incidence of "I have gas pressure", it should be noted that the control company also showed a significant increase in the frequency with which they reported this symptom.

The other three food-related symptoms which appear in the upper half of Table 4 "I have diarrhea," "I have to urinate less" and "I am thirsty" are more difficult to interpret. The symptom "I have diarrhea" appears on this list because there was a significant difference in the linear component of the trend between the two groups over time. Both groups showed a small increase in the frequency with which they reported this symptom at the first data collection point in the field relative to their own baseline level. The MRE group continued to report this symptom at approximately the same frequency at the last two measurement points whereas the control group showed a sharp decline in the incidence of this symptom at these latter points. Similarly, the important food-related symptom "I am thirsty" appears on this list because the MRE group reported it at a higher frequency than the control group during the field test. The frequency in the field was lower than the baseline at Schofield Barracks and both groups showed a decreasing trend in the frequency with which they reported this symptom at the three data collection points in the field. A similar pattern exists for the symptom "I have to urinate less." The MRE group reported this symptom significantly more frequently in the field than the control group but the frequency did not differ from their baseline level of reporting at Schofield Barracks. This self-report data is consistent with the monitored physiological indices of body fluid status (see Chapter 8). The MRE group consumed less fluid, had lower urine volumes and higher urine concentrations than the control group. Although all these differences are consistent with modest dehydration, the group differences were not statistically reliable. In addition, measures of hematocrit and hemoglobin failed to differentiate between the two groups.

Several of the other symptoms that appear in the upper portion of Table 5 ("I am lightheaded," "I feel faint," "My coordination is off" and "I am more forgetful") are possibly food-related in the sense that insufficient caloric intake could underlie this cluster. However, it should also be noted that the group differences in these four symptoms are relatively small and it is the differential pattern over time which differed between the groups.

TABLE 5. Symptoms that Differed between the MRE and Control Group.

SYMPTOM	GROUP DIFFERENCE IN FIELD SIGNIFICANT	LINEAR COMPONENT OF TREND SIGNIFICANT	QUADRATIC COMPONENT OF TREND SIGNIFICANT	FIELD FREQUENCY HIGHER THAN BASELINE	FOOD-RELATED
A. MRE HIGHER THAN CONTROL					
1 Lightheaded	No	*	No	No	?
3 Sinus pressure	*	No	**	Yes	No
5 Faint	No	No	**	No	?
7 Coordination is off	No	No	*	No	?
22 Back aches	No	No	*	No	No
25 Gas pressure	No	No	*	Yes	Yes
26 Diarrhea	No	*	No	No	Yes
29 Urinate less	**	No	No	No	Yes
31 Feverish	No	*	No	No	No
47 Runny Nose	No	*	**	Yes	No
52 Lost my appetite	**	No	*	Yes	Yes
55 Thirsty	**	No	No	No	Yes
60 More forgetful	No	*	No	No	?
B. CONTROL HIGHER THAN MRE					
8 Short of breath	**	No	*	Yes	No
9 Hard to breathe	No	No	**	Yes	No
15 Hands shaking	No	No	*	No	No
21 Hands, arms, shoulders ache	No	No	*	No	No
34 Hands cold	**	No	No	Yes	No
35 Feet cold	**	No	No	Yes	No
41 Vision blurry	No	No	*	No	No
64 Bored	No	*	No	No	No

* $p < 0.05$
** $p < 0.01$

The other symptoms which appear in the upper portion of Table 5 ("I have sinus pressure," "My back aches," "I feel feverish" and "I have a runny nose") may represent a minor infection that was more prevalent in the MRE company.

The most striking aspect of the lower portion of Table 5 in regard to the issues of interest in the present study is the complete absence of any symptoms which are even remotely related to food. In general, the control company showed two clusters of symptoms at higher levels than the MRE company. One cluster ("I am short of breath" and "It's hard to breathe") are altitude-related. The second cluster ("My hands are shaking," "My hands are cold," and "My feet are cold") are temperature-related. The higher incidence or the differential pattern of reporting these altitude and temperature related symptoms over time in the control group are consistent with the fact that during the field test the control company was operating at a somewhat higher and cooler elevation. The other three symptoms in the lower portion of Table 5 ("My hands, arms or shoulders ache," "My vision is blurry," and "I am bored") are not easily classified or interpreted. In regard to these three symptoms it should be noted that the group differences were relatively small and it was the pattern over time that differed between the two groups.

In summary, the physical symptoms data suggest that there were minor differences between the two companies in terms of the frequency with which they displayed symptoms related to food. The two most important differences in this area are the fact that the MRE company reported that they had lost their appetite and that they experienced gas pressure more frequently than the control group. However, these self-report data also clearly indicate that the MRE troops were not debilitated in any sense and that they felt good.

Chapter 4

FOOD, WATER, AND NUTRIENT INTAKES

Summary

This chapter provides detailed information on food, water, and nutrient intakes as well as a comparison of two dietary data collection methods, one that relies on estimations made by the subject, and one based upon weighings made by the University of Hawaii field team.

The mean daily intakes of energy, and carbohydrate and fat, which are major sources of energy, were noticeably insufficient (below 80 percent of the Surgeon General's nutritional standards for operational rations (NSOR)) in the experimental group. For the majority of the minerals the intake was extremely low. There was a downward trend with time over the four measurement periods with little day-to-day fluctuations. The control group consumed the MRE-A ration combination in sufficient quantities (at or above 80 percent NSOR). There was no visible trend over time, but there were considerable day-to-day fluctuations in nutrient intakes. In general there were highly significant differences in energy and nutrient intakes between the two groups.

For MRE meals, the results from the estimated and weighed methods of data collection correlated highly and there were essentially no significant differences between means obtained by these two methods. For A ration meals, the results from the two methods did not correlate highly and there were significant differences between the results obtained by the two methods. The estimated method can be used to measure nutrient intake from MRE rations with a high degree of accuracy.

Tabulation of individual food items eaten in the MRE ration provided an estimate of actual acceptance or, conversely, food waste. In the experimental group, consumption exceeded 50% of those items distributed in the entree, starch and spread classes only, whereas in the control group consumption of all items in the entree, starch, spread, fruit and dessert classes did not fall below 54%.

1. Introduction

The central question in this experiment is whether troops fed the MRE as their sole source of food find it sufficiently palatable and varied to consume it in sufficient quantity over an extended period of time. The data considered in Chapter 3 revealed that troops fed the MRE as their sole source of food lost more weight than troops fed a hot breakfast and dinner and an MRE for lunch. The weight loss in both groups clearly suggests that energy intake was insufficient. This chapter will examine in detail food intake during this study to determine whether the weight loss can be attributed to low levels of energy intake.

A secondary issue is whether the troops chose their food from the MRE in a manner that led to inadequate levels of intake of specific nutrients, minerals, or vitamins. This chapter will also examine this issue.

One possible explanation for low levels of caloric intake is that the troops were thirsty and thirst-induced anorexia underlies the low food intakes that developed. This issue is addressed in this chapter by providing information on water intake during the field test and is more fully considered in Chapter 7 where information on body fluid measures is presented.

Collecting direct measures of food intake in troops actively engaged in training during a field exercise is difficult, time-consuming and very labor intensive. In an effort to establish a simple, less time-consuming, measure of food intake under field conditions, the present study compared a simple food estimation technique to direct weighed measures of intake in the participating troops.

2. Method

Test Subjects

The 2nd Brigade of the 25th Infantry Division provided two units -- 1-21st Combat Support Company selected as the control group, and 1-35th Combat Support Company, selected as the experimental group. The control group subsisted on a daily A-MRE-A ration cycle while the experimental group subsisted on the MRE ration solely for all three meals. Within each company, a subsample of 30 volunteers was monitored for food and water consumption, on three consecutive days per week, except for the final week with only two consecutive monitoring days. In the experimental group, two subjects dropped out midway in the test for reasons unrelated to the study and one subject did not participate due to an emergency, resulting in a subsample of 27 volunteers. The four test periods, comprising days 8-9-10, 15-16-17, 21-22-23, and 31-32 were designated as Periods A, B, C, and D. (These periods do not correspond to Periods 1 through 4 designated under physiological data collection.)

Test Meals

The control group ate freshly prepared hot meals or A-ration breakfasts and dinners together as a group, served on paper plates from a field kitchen at specified times, whereas the MRE lunch, which was distributed after breakfast, did not have a predetermined eating time and place.

The experimental group received three MRE menu packs in the morning and ate all meals under relatively unstructured conditions. Each of 12 MRE menu packs contained the equivalent of a dinner and was eaten for breakfast as well as lunch and dinner.

Subjects were allowed to give away, receive, or trade items and to save items from one meal to eat later in order to simulate actual field eating conditions. In addition, the experimental group was allowed to use a "hot sauce" freely for which no records were taken.

Data Collection

Two methods for measuring food consumption were tested simultaneously. The estimated method relied on estimations made by the subject, and the weighed method based upon weighings made by the University of Hawaii (UH) field team (evaluators).

The term "serving weight" refers to the weight in grams of one serving of an item, e.g. an entree, beverage, starch. The serving weights of MRE ration items were standardized by the manufacturer in each menu pack, whereas in the A ration serving weights were controlled by serving instruments but varied with individual servers. For the latter, five separate weighings were made in the field and the average weight was designated as the serving weight of that item for that meal.

Battery-operated electronic, top-loading Ohaus balances were used and checked daily with standard weights to 0.01 gram.

As an estimated method subjects were instructed to check a list of food items eaten and to circle the amounts, as servings or fractions of servings eaten (to the nearest one-fourth of a serving) on cards distributed with each meal. The cards were returned in small plastic bags with the leftover food (and wrappers if MRE rations) in another plastic bag, properly identified. The product of the serving weight and the amount, as servings or fractions of servings eaten is the estimated consumption.

As a weighed method, UH evaluators recorded weights of leftover food, each weighing checked by a second person. The difference between the serving weight and the leftover weight is the actual consumption. In the control group the evaluators recorded the number of servings taken when subjects were served. The beverages left over from A-ration meals were measured in the field in graduated cylinders whereas leftover solids were measured after each meal at the PTA base camp. The MRE ration leftovers from lunch were collected by the company personnel and weighed with the evening meal. In the experimental group all leftovers were collected by the company personnel. Once or twice a day, a pick-up was made by UH evaluators and weighings made at the base camp the same day, or refrigerated overnight.

Some finer details of the methods for collecting dietary data are noted: First, the weighed method was defined as determining foods eaten (1) by calculating the difference between food taken and returned and (2) by a followup with subjects when there were unaccounted-for items. In the control group this involved visual food monitoring at the eating site for A ration meals but not for MRE ration meals, and a followup as they gathered twice a day at the field kitchen, thus providing access to all subjects. In the experimental group, there was seldom any visual observation of meal consumption and very little followup with subjects. There was limited access to subjects due to the tactical situations, and it was not possible most of the time to followup on unaccounted-for items.

Second, the weighed method for MRE meals called for the presence of the empty food wrapper or for a wrapper with uneaten food in it for that item to be classified as eaten. The absence of either the wrapper or the food was recorded as missing data (usually because the subject saved the food to eat later or gave it away). Therefore, unless an item was returned or the researcher verbally confirmed that the subject gave it away (in which case it would be recorded as not eaten), the item was recorded as missing data. Every attempt was made to account for each food item distributed in the MRE pouches in the data collection effort. One possible consequence of this rigorous requirement for an item to be counted as eaten is that actual consumption could have exceeded measured consumption. This could have occurred if an individual ate the food item, threw away the wrapper and either failed to record it on a food collection card or forgot that he ate it when probed by the data collector.

A third method, which took information from both estimated and weighed methods, was designated the combined data collection method and was calculated by the computer. Essentially, the combined method identified items at each meal not common to both the estimated method list and the weighed method list and added them to the items on the list generated by both methods.

Water intake was monitored by asking subjects to record the number of one-quart canteens of water consumed over 24 hours of each test day. Measuring of canteen water consumption by the UH field team was not feasible since canteen water is used for purposes other than drinking, e.g., brushing teeth.

Nutrient Composition. A nutrient factor file for the MRE ration items was supplied by the U.S. Army Natick Research and Development Center (Appendix A). The Office of The Surgeon General provided the Letterman Army Institute of Research (LAIR) nutrient factor file for A ration foods. The nutritive values of 25 items not on that list were either calculated from ingredients/components or obtained from other sources.[7,8,9,10,11,12,13]

Nutrient Standards for Operational Rations were supplied by the Office of The Surgeon General (Appendix C).

3. Results and Discussion

Overall, mean daily nutrient intakes by the control group were higher than intakes by the experimental group with exceptions of thiamin and pyridoxine (Table 6). The level of energy intake, and intakes of carbohydrate, fat, and protein, which provide the energy, were insufficient to meet NSOR recommendations in both experimental and control groups, with the exception of protein intake in the latter (Table 7). Mineral requirements were adequately met in the control group with the exception of magnesium, but were not adequately met in the experimental group with the exception of phosphorus. Vitamin intakes were remarkably high in both groups with the exception of riboflavin and niacin in the experimental group. Total water intake was adequate in the two groups. Generally there were highly significant differences in the level of intake between the two groups with the exception of the intakes of sodium and vitamin A. Consumption trends over time were statistically different with the intakes of the experimental group decreasing whereas the intakes of the control group remained relatively flat. A discussion of each table follows.

Table 6 provides mean daily intakes of energy and nutrients over the entire period. Differences in energy and nutrient intakes between groups were assessed with 2 (groups) x 11 (days) repeated measures analysis of variance. For all nutrients except two, significant differences were found at less than 0.0015 level of significance; sodium and vitamin A levels were not significantly different between the two groups. The mean daily intakes of the control group were higher than intakes by the experimental group but the exceptions, thiamin and pyridoxine (vitamin B) levels, although lower in the control group, still met over 100% of the NSOR (Table 7).

The mean daily intake of energy and nutrients expressed as percentage of NSOR provides another measure of examining differences between groups (Table 7). In the experimental group, the percentage of NSOR met ranged from 55% to 244% and in the control group from 74% to 257%. Intakes fell below 80% (an arbitrary figure addressed below) as follows:

Experimental group:

fat, 61%	iron 67%
carbohydrate, 56%	magnesium, 55%
energy, 61%	niacin, 77%
calcium, 72%	

Control group:

carbohydrate, 74%	magnesium, 74%

It should be noted that the MRE ration meals did not supply an average of 1/3 NSOR magnesium per meal, whereas 1/3 NSOR of other nutrients were supplied.

The frequency distribution of subjects within four intervals of mean daily intake expressed as percent NSOR provides another approach to looking at differences between the two groups (Table 8). The intervals 1/3, 2/3, and 3/3 were selected to correspond to the three meals per day eating pattern; other intervals may be appropriate as well. Intakes of 68 to 100% and above 100% occurred considerably more frequently in the control group than in the experimental group. The same individuals had very high intakes ($>$ 100%) of most nutrients, subjects E3, C28, C7, etc., or very low intakes of several nutrients, subject E6 (Table 9). Twenty-five out of 30 subjects in the control group had intakes that met over 68% NSOR for all or nearly all nutrients in contrast to 5 out of 27 subjects in the experimental group. Intakes of nutrients in both absolute units and in percent NSOR for individual subjects are in Appendix D.

TABLE 6. Mean Daily Intake of Energy and Nutrients (Combined Method): Entire Field Trial.

Energy and Nutrients	Experimental Group	Control Group	F*	P
Protein, g	81	114	48.34	0.0001
Fat, g	97	134	27.70	0.0001
Carbohydrate, g	247	325	14.56	0.0003
Energy, kcal	2189	2950	23.51	0.0001
Calcium, mg	579	1199	102.70	0.0001
Phosphorus, mg	1298	1868	37.59	0.0001
Iron, mg	12	19	69.23	0.0001
Sodium, mg	4744	4920	0.37	0.5439
Potassium, mg	2046	3747	114.99	0.0001
Magnesium, mg	220	297	28.55	0.0001
Vitamin A, IU	6837	7013	0.08	0.7799
Ascorbic acid, mg	106	154	17.72	0.0001
Thiamin, mg	4.4	3.0	22.36	0.0001
Riboflavin, mg	1.8	2.6	50.38	0.0001
Niacin, mg	18.4	23.7	23.08	0.0001
Pyridoxine, mg	3.3	2.3	11.34	0.0014
Total food, g	719	2291	476.42	0.0001
Total food, dry wt., g	445	625	31.02	0.0001
H_2O from food, g	274	1666	701.34	0.0001
H_2O from canteen, g	2383	1462	34.40	0.0001
Total H_2O, g	2657	3132	8.23	0.0058

*Analysis of variance.

TABLE 7. Mean Daily Intake of Energy and Nutrients (Combined Method) Expressed as Percentage of Nutritional Standards for Operational Rations.*

NSOR[1]	Experimental Group	Control Group
Protein, 100 g	81	114
Fat, 160 g (max)	61	84
Carbohydrate, 440 g	56	74
Energy, 3600 kcal	61	82
Calcium, 800 g	72	150
Phosphorus, 800 mg	162	234
Iron, 18 mg	67	106
Sodium, 5000-7000 mg	68-95	70-98
Potassium, 1875-5625 mg	36-109	67-200
Magnesium, 400 mg	55	74
Vitamin A, 3333 IU	205	210
Ascorbic acid, 60 mg	177	257
Thiamin, 1.8 mg	244	167
Riboflavin, 2.2 mg	82	118
Niacin, 24 mg or NE	77	99
Pyridoxine, 2.2 mg	150	104

*Nutritional Standards for Operational Rations, Office of The Surgeon General of the United States.

TABLE 8. Distribution of Subjects Consuming Different Levels of Nutrients Expressed as Percentage of Nutritional Standards for Operational Rations.

	Experimental Group					Control Group				
Energy and	Frequency in Percent NSOR Interval					Frequency in Percent NSOR Interval				
Nutrients	<33	34-67	68-100	>100	range	<33	34-67	68-100	>100	range
Protein	0	6	17	4	40-111	0	1	2	27	54-138
Fat	2	17	7	1	23-113	0	2	26	2	36-105
Carbohydrate	2	20	4	1	21-116	1	6	22	1	27-106
Energy	1	18	7	1	24-114	0	3	26	1	33-109
Calcium	1	12	11	3	25-137	0	1	1	28	39-204
Phosphorus	0	1	3	23	60-288	0	0	1	29	93-286
Iron	0	12	14	1	35-110	0	1	6	23	53-140
Sodium	0	6	18	3	38-114	0	3	25	2	36-141
Potassium	1	20	6	0	24-87	0	2	14	14	66-125
Magnesium	1	20	6	0	22-96	0	5	25	0	41-93
Vitamin A	0	3	2	22	60-438	0	0	1	29	79-291
Vitamin C	1	2	2	22	29-401	0	0	0	30	139-368
Thiamin	0	0	1	26	82-470	0	0	2	28	74-237
Riboflavin	0	6	17	4	36-133	0	1	2	27	44-143
Niacin	0	10	14	3	38-112	0	2	12	16	64-131
Pyridoxine	0	2	4	21	42-308	0	3	10	17	46-167

TABLE 9. Distribution of Sixteen Nutrients Consumed by Each Volunteer as a Percentage of Nutritional Standards for Operational Rations.

	Experimental Group: Frequency in Percent NSOR Interval			
Subject	<33	34-67	68-100	>100
E1	0	7	4	5
2	0	9	2	5
3	0	0	2	14
4	-	-	-	-
5	0	9	5	2
6	7	8	1	0
7	1	13	1	1
8	0	5	6	5
9	0	3	8	5
10	0	5	7	4
11	0	7	4	5
12	0	0	7	9
13	0	0	0	0
14	0	9	2	5
15	0	5	6	5
16	0	4	7	5
17	0	0	7	9
18	0	3	8	5
19	0	6	5	5
20	1	10	4	1
21	-	-	-	-
22	0	5	6	5
23	0	6	5	5
24	0	7	4	5
25	0	1	9	6
26	0	11	3	2
27	0	9	2	5
28	0	11	0	5
29	0	2	9	5
30	0	0	9	7
Total	9	155	133	135

	Control Group: Frequency in Percent NSOR Interval			
Subject	<33	34-67	68-100	>100
C1	0	5	6	5
2	0	6	7	3
3	0	1	4	11
4	1	11	3	1
5	0	0	8	8
6	0	0	5	11
7	0	0	4	12
8	0	0	5	11
9	0	3	6	7
10	0	0	9	7
11	0	1	4	11
12	0	0	5	11
13	0	0	7	9
14	0	0	7	9
15	0	0	5	11
16	0	0	7	9
17	0	0	5	11
18	0	0	6	10
19	0	0	5	11
20	0	0	7	9
21	0	2	7	7
22	0	0	7	9
23	0	0	8	8
24	0	1	7	8
25	0	0	6	10
26	0	0	6	10
27	0	0	5	11
28	0	0	2	14
29	0	0	6	10
30	0	0	6	10
Total	1	30	175	274

Insufficient energy intakes for the physical activity expended resulted in weight losses of 10.36 and 4.72 pounds (4.7 and 2.1 kg) in the experimental and control groups respectively. The low intakes are also possibly related to the cluster of physical symptoms -- lightheadedness, feeling faint, coordination off, and forgetfulness reported in Chapter 3. The relationship between diet and selected physiological parameters are reported in Chapter 7.

The nutritional standards for operational rations (NSOR) set forth by the Office of The Surgeon General prescribe minimum amounts of nutrients that must be present in a one-day ration at the time of consumption (unless the nutrients are shown as a range or maximum level). If one were to interpret these standards to be for the manufacturer and/or to be recommended intakes (as opposed to minimum requirements), a somewhat lower intake may be adequate to sustain the troops. A conservative estimate that 80% NSOR can sustain soldiers is extracted from weight loss reported in Chapter 3, namely that weight loss was approaching an asymptote in the control group during the last period when caloric intake was 80% NSOR. If intakes are examined from this interpretation, inadequate nutrient intakes were less pronounced.

Figures 2-20 show consumption trends over time for each of the measured nutrients and Figures 21-23 present this same information for each of the four dietary periods. There were significant differences between groups in the mean daily intake of most nutrients. No significant differences were seen in certain nutrients examined by periods:

Sept. 2-4: sodium, vitamin A, carbohydrate
Sept. 9-11: sodium, vitamin A, vitamin C, niacin, total water
Sept. 15-17: sodium, vitamin A, thiamin, pyridoxine, total water
Sept. 25-26: sodium, vitamin A, vitamin C
All periods: sodium, vitamin A

In the experimental group, intakes of all macronutrients, minerals except phosphorus, and vitamins decreased. In the control group, intakes of macronutrients fluctuated but the overall trend was a slight increase in intake over time with the exception of protein. Note that the only nutrient intake above the recommended level in either group was the control group protein intake. The mineral intake in the control group remained essentially constant except the iron and phosphorus, which decreased but still remained above the recommended levels. The general trend in vitamin intake was a slight decrease in the control group.

The very high intake of most of the vitamins is attributed in part to fortification of selected MRE ration items--cocoa beverage powder with vitamin C and thiamin; coffee with vitamin C; crackers with thiamin, riboflavin, niacin and pyridoxine (vitamin B_6)--and relatively high frequency of consumption (64% of the crackers and 50% of the cocoa distributed were consumed (Table 10), which accounts for the high intakes. All vitamins except riboflavin and niacin in the experimental group were well above NSOR.

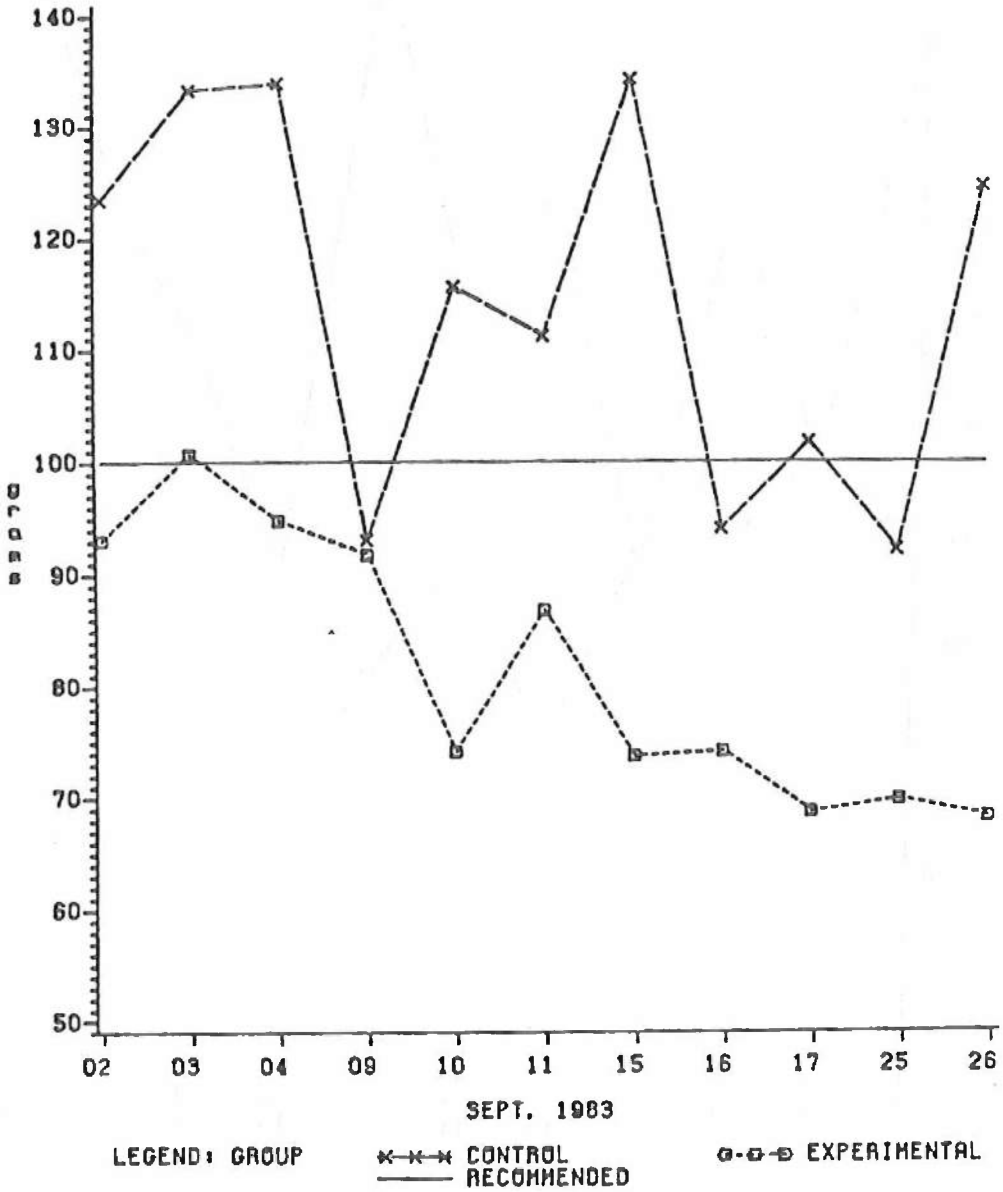

Figure 2. Mean Daily Protein Intake for MRE Group and Control Group Using Combined Method.

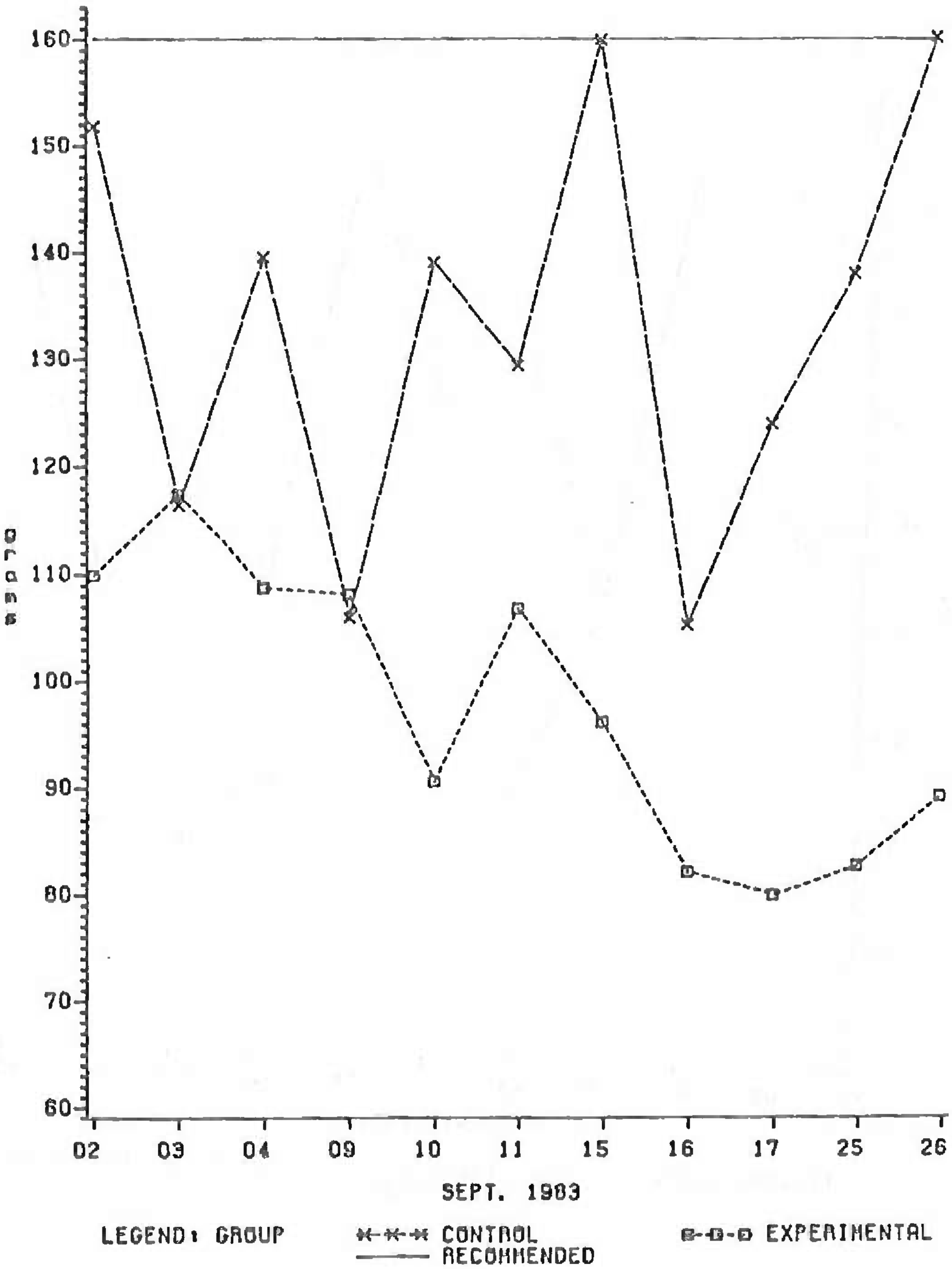

Figure 3. Mean Daily Fat Intake for MRE Group and Control Group Using Combined Method.

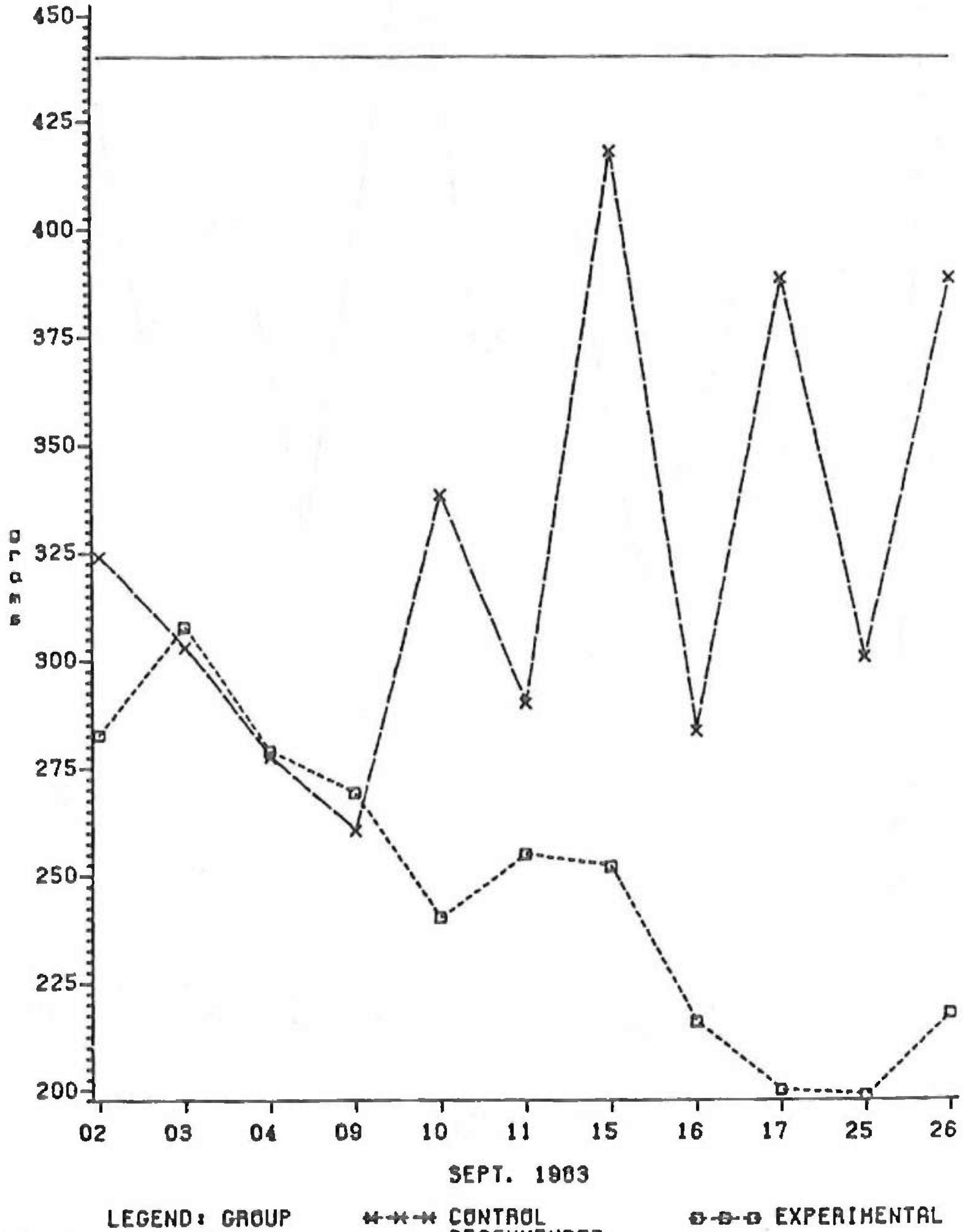

Figure 4. <u>Mean Daily Carbohydrate Intake for MRE Group and Control Group Using Combined Method.</u>

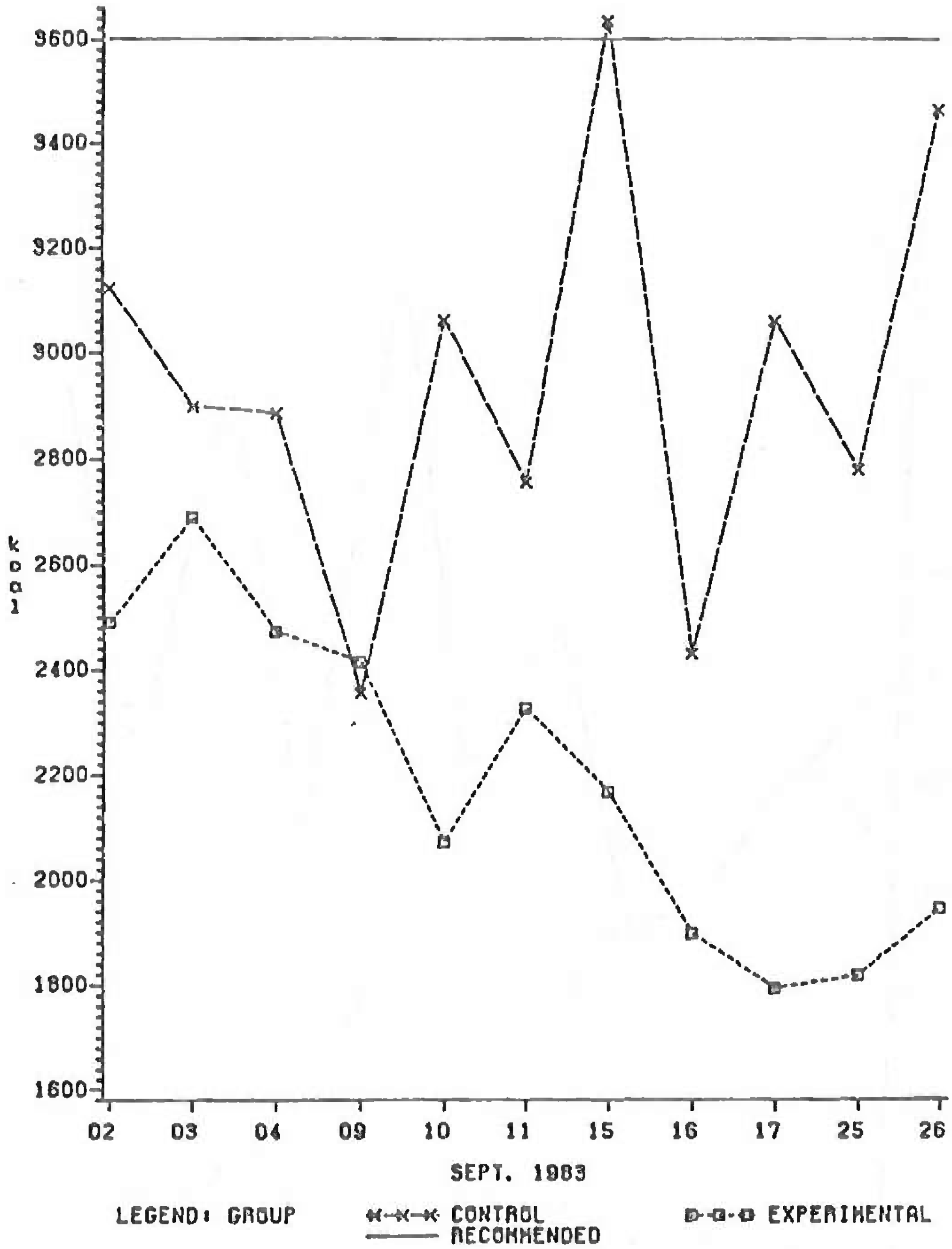

Figure 5. Mean Daily Caloric Intake for MRE Group and Control Group Using Combined Method.

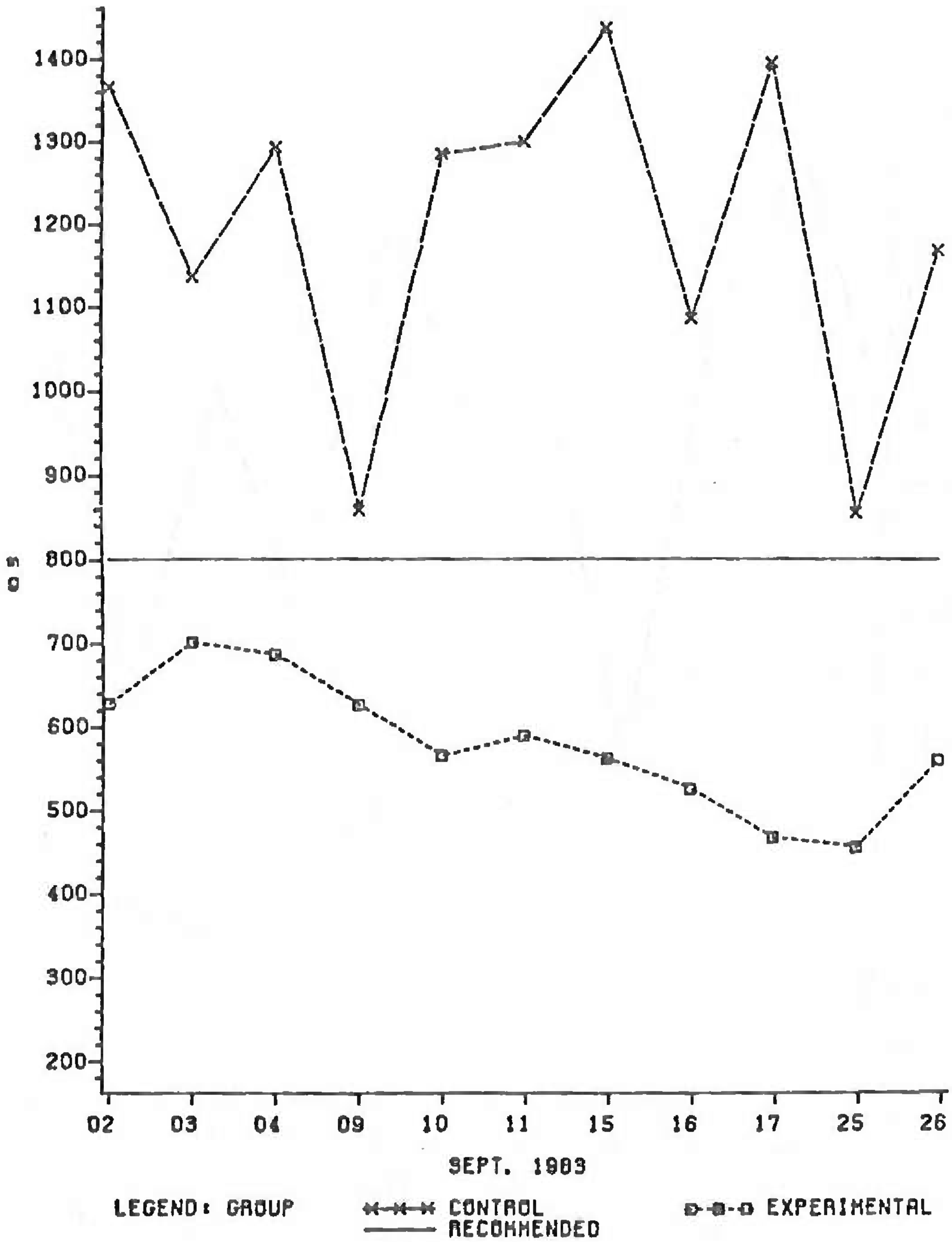

Figure 6. Mean Daily Calcium Intake for MRE Group and Control Group Using Combined Method.

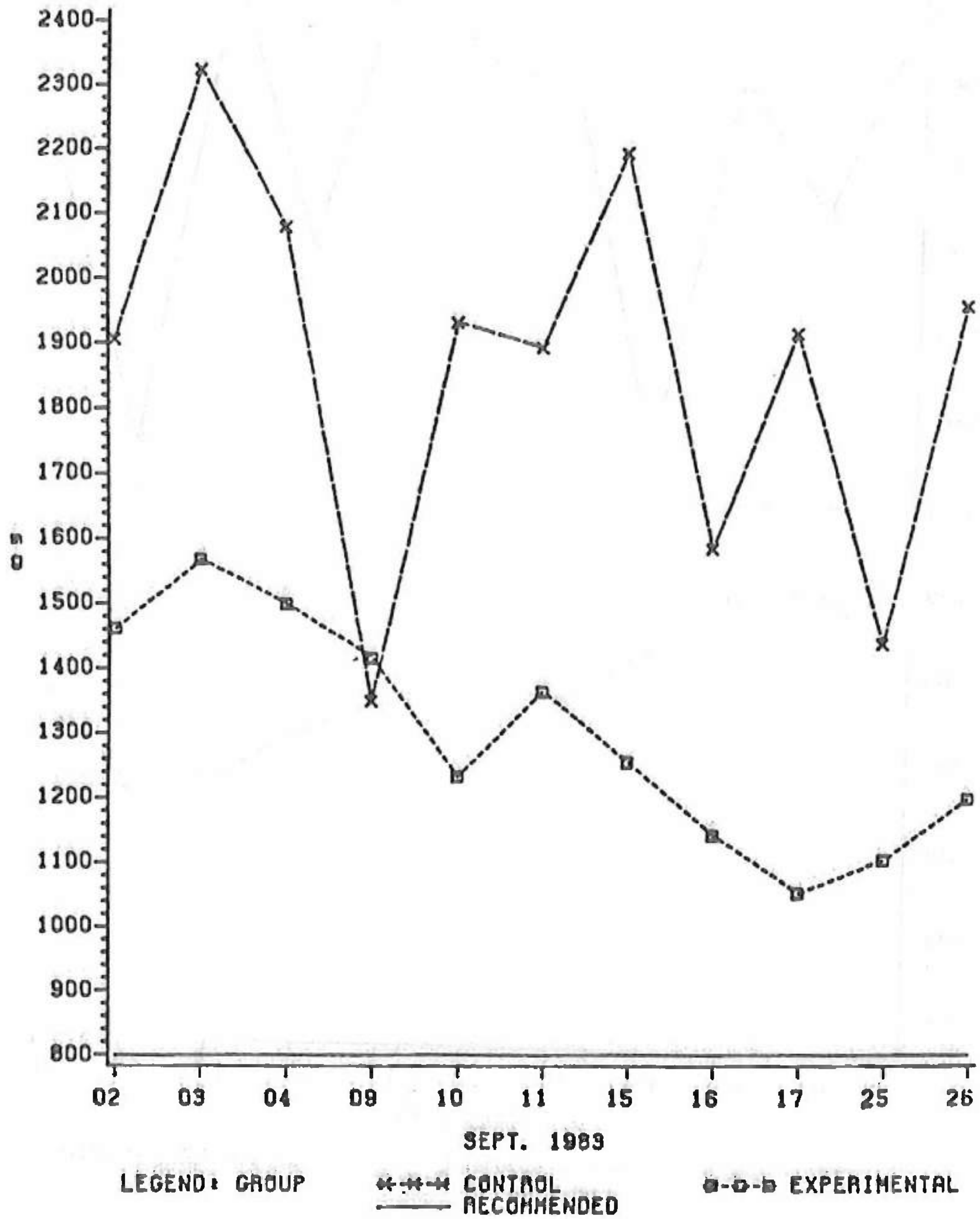

Figure 7. Mean Daily Phosphorus Intake for MRE Group and Control Group Using Combined Method.

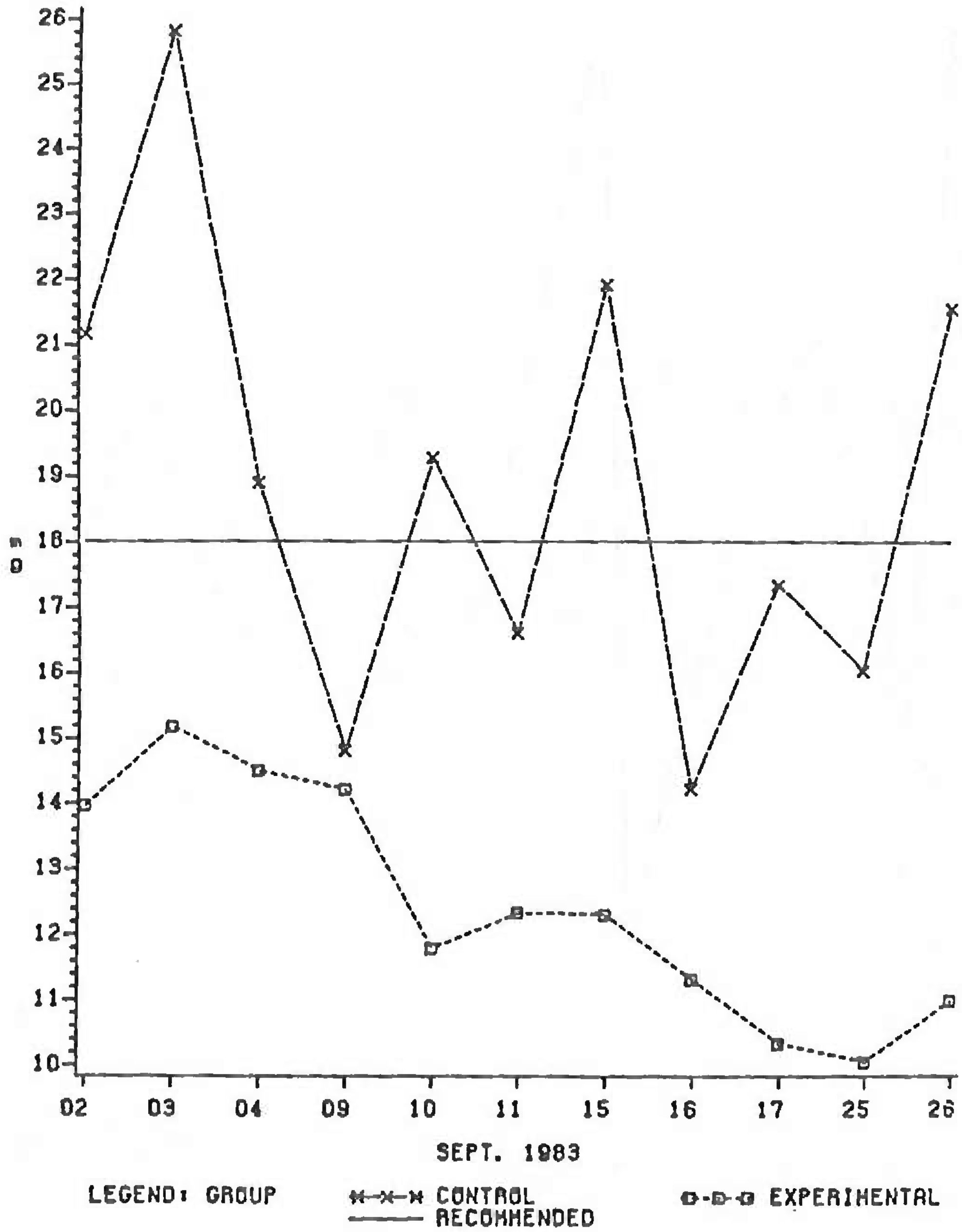

Figure 8. Mean Daily Iron Intake for MRE Group and Control Group Using Combined Method.

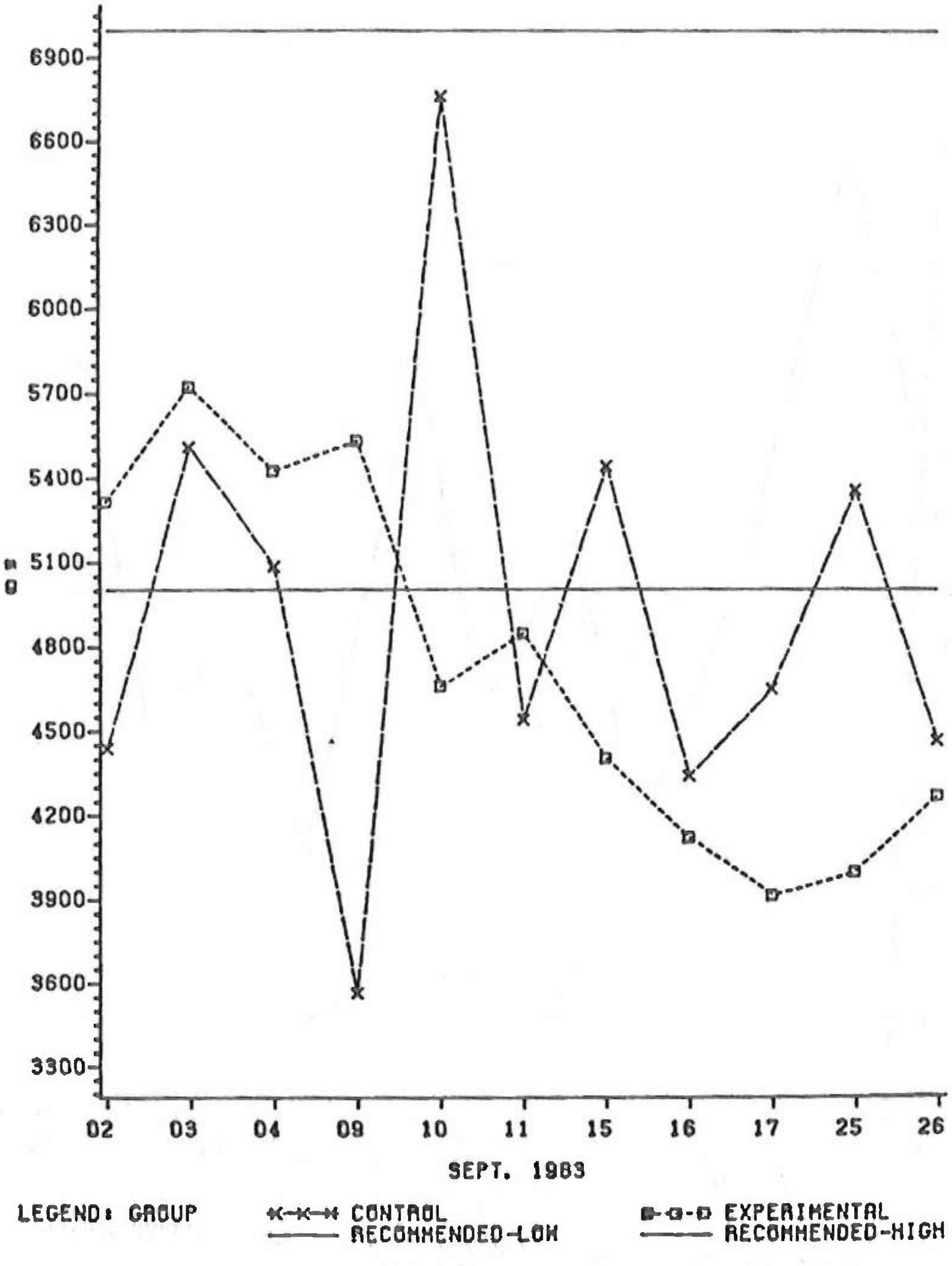

Figure 9. Mean Daily Sodium Intake for MRE Group and Control Group Using Combined Method.

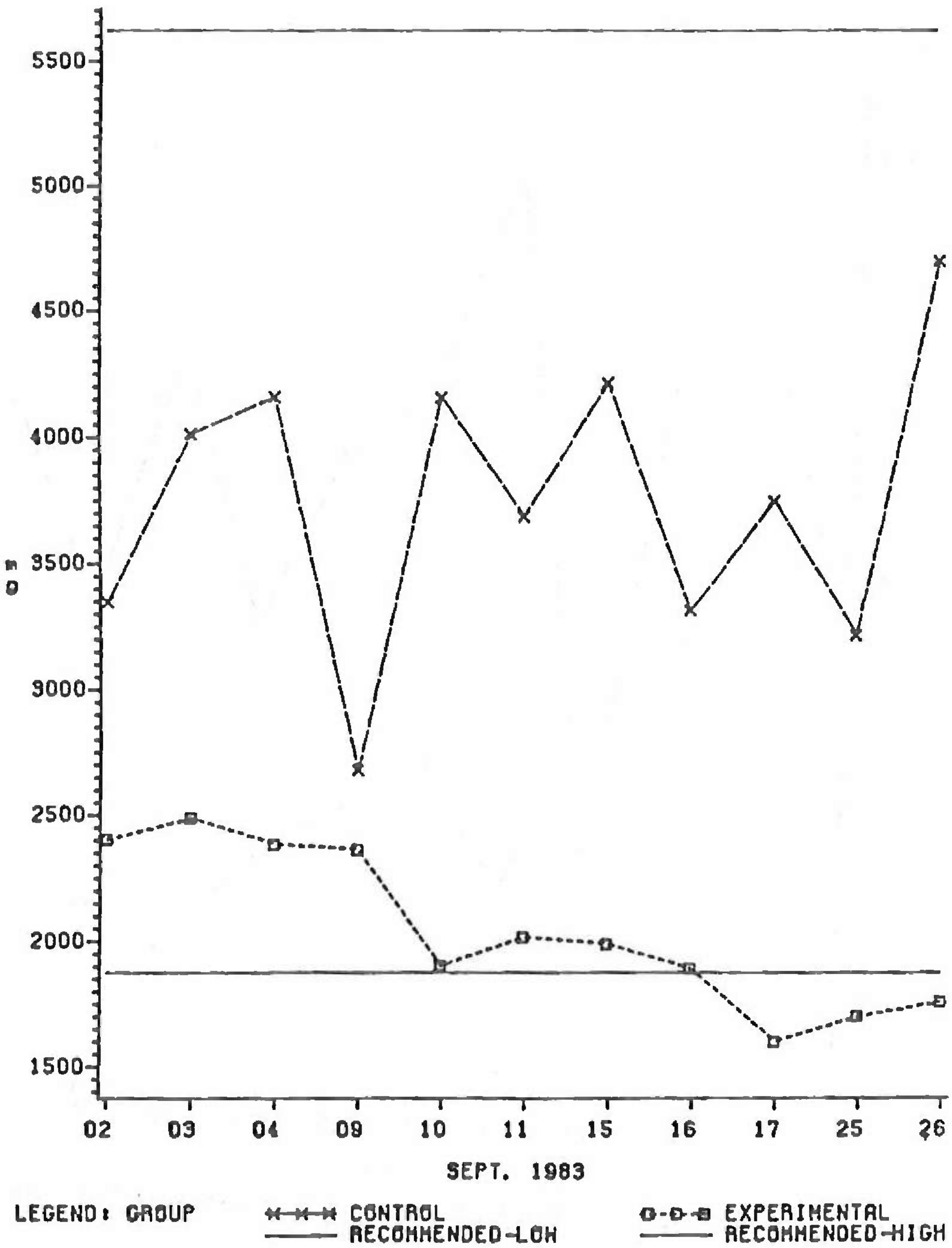

Figure 10. Mean Daily Potassium Intake for MRE Group and Control Group Using Combined Method.

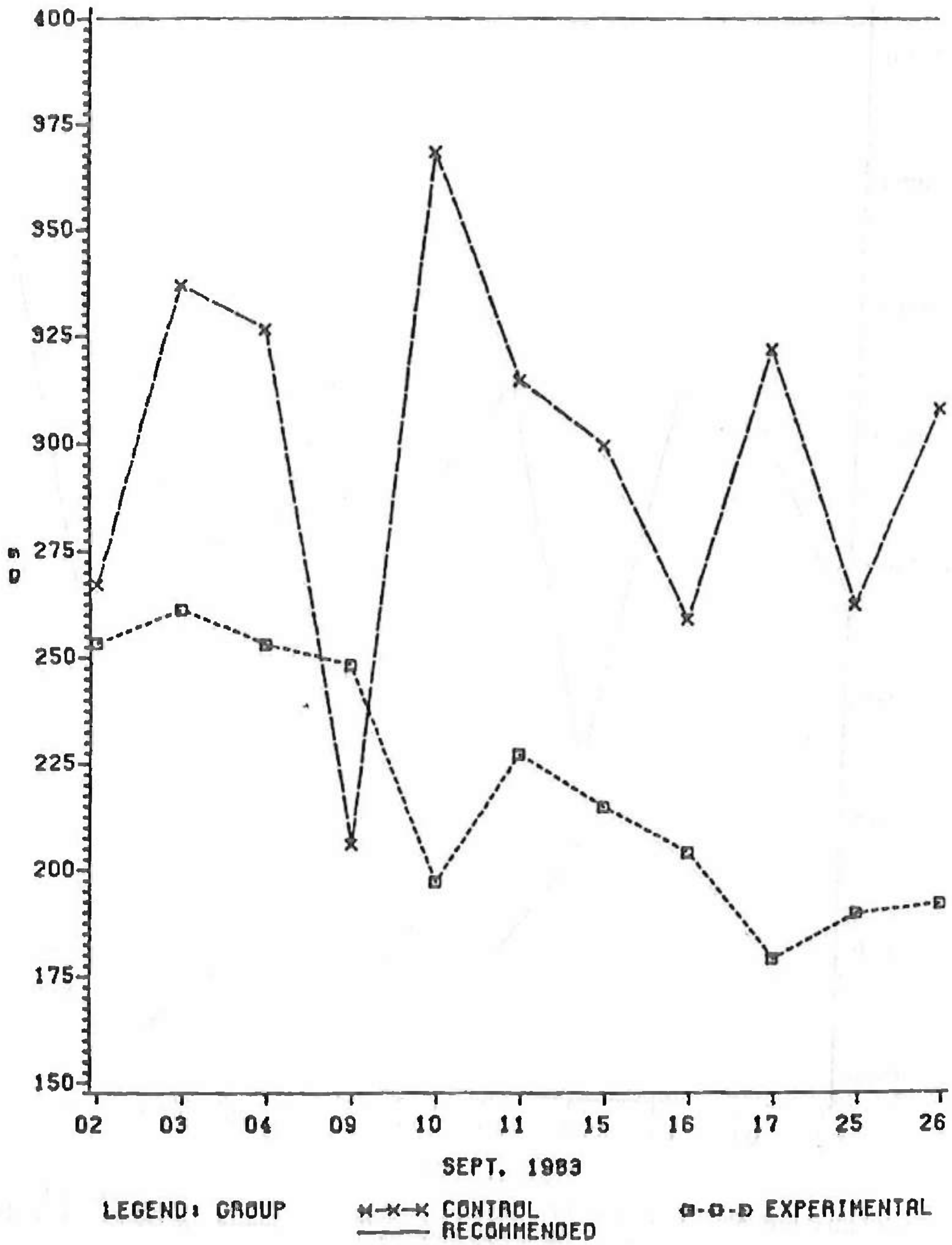

Figure 11. Mean Daily Magnesium Intake for MRE Group and Control Group Using Combined Method.

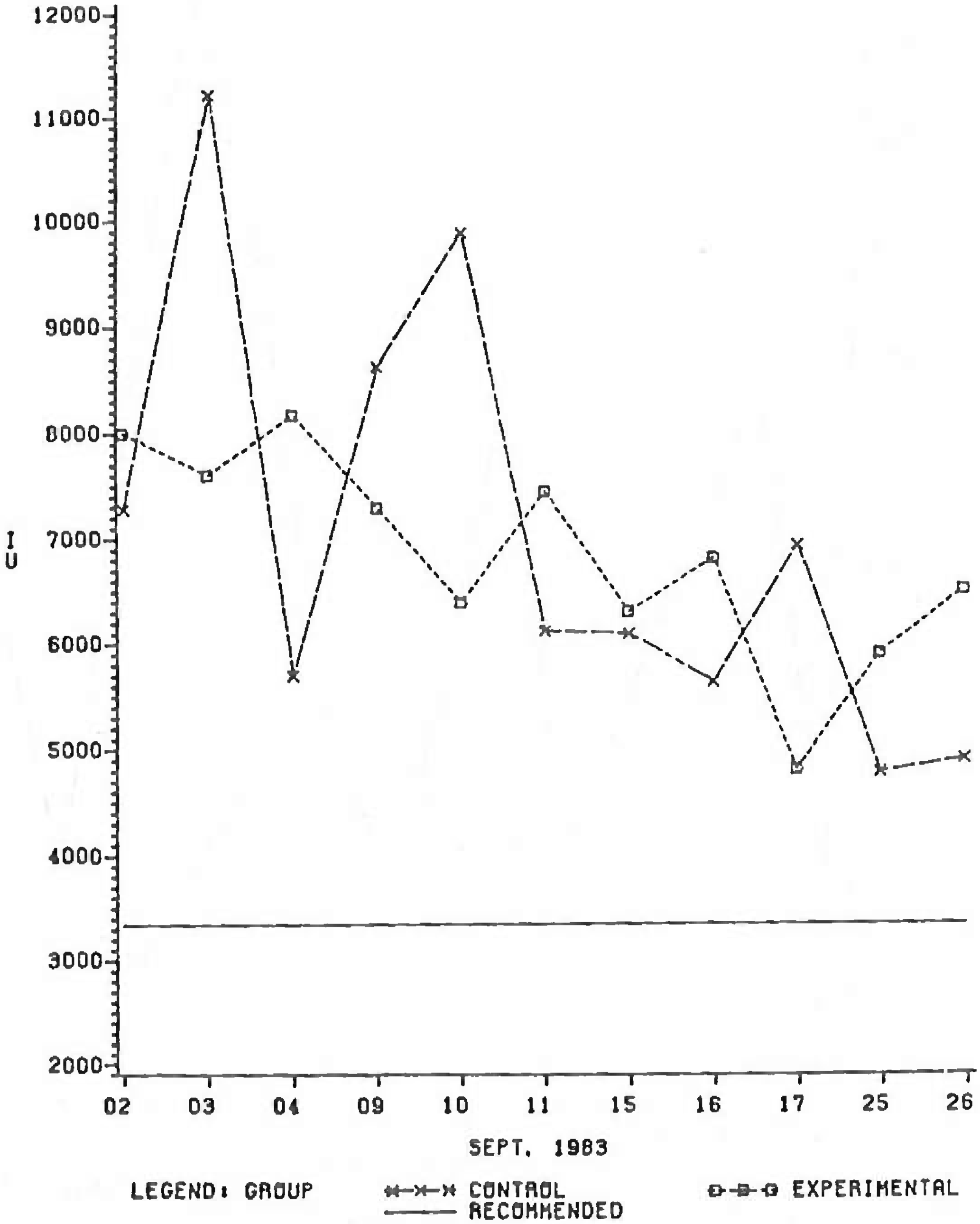

Figure 12. Mean Daily Intake of Total Vitamin A for MRE Group and Control Group Using Combined Method.

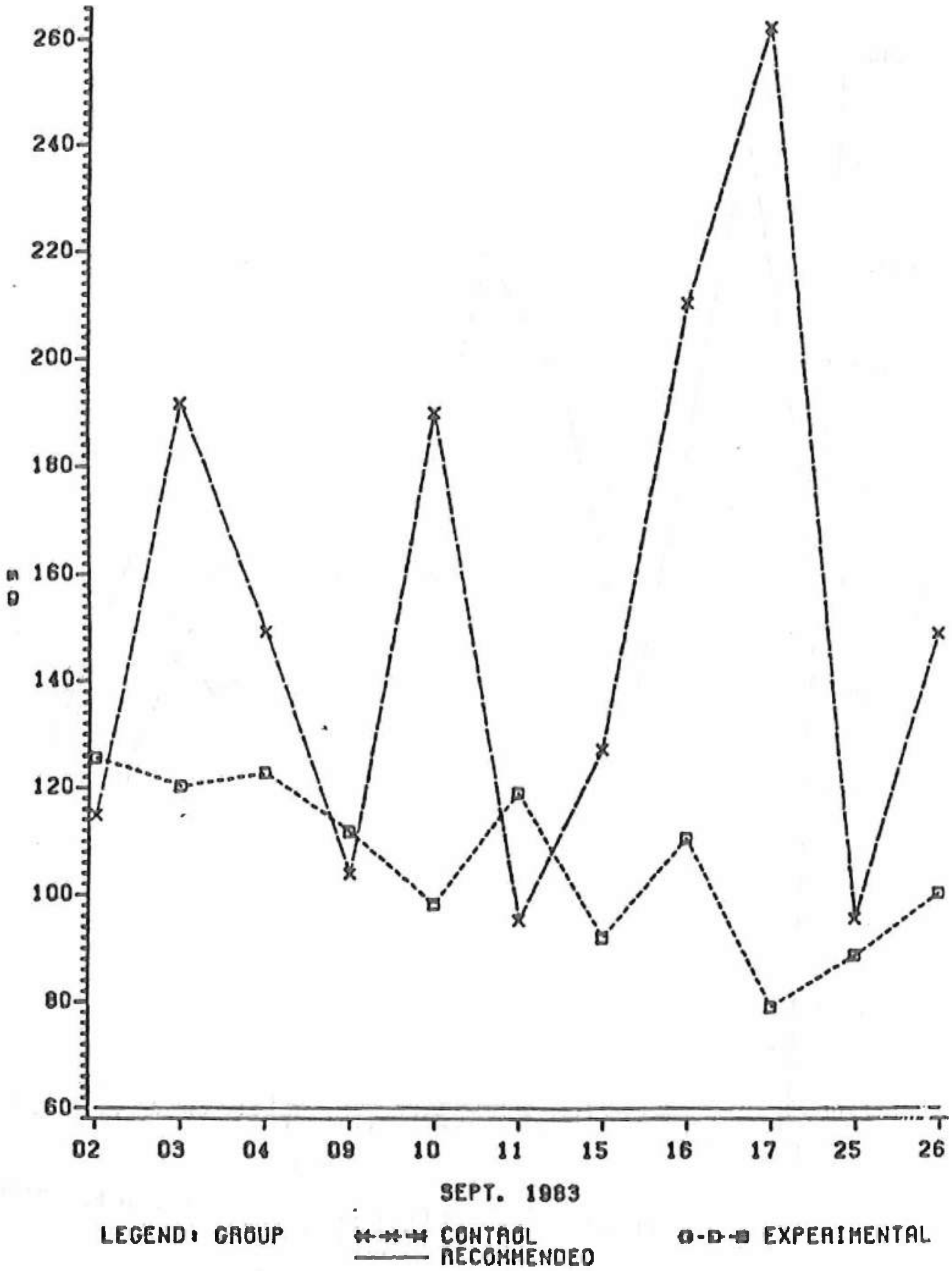

Figure 13. Mean Daily Intake of Vitamin C for MRE Group and Control Group Using Combined Method.

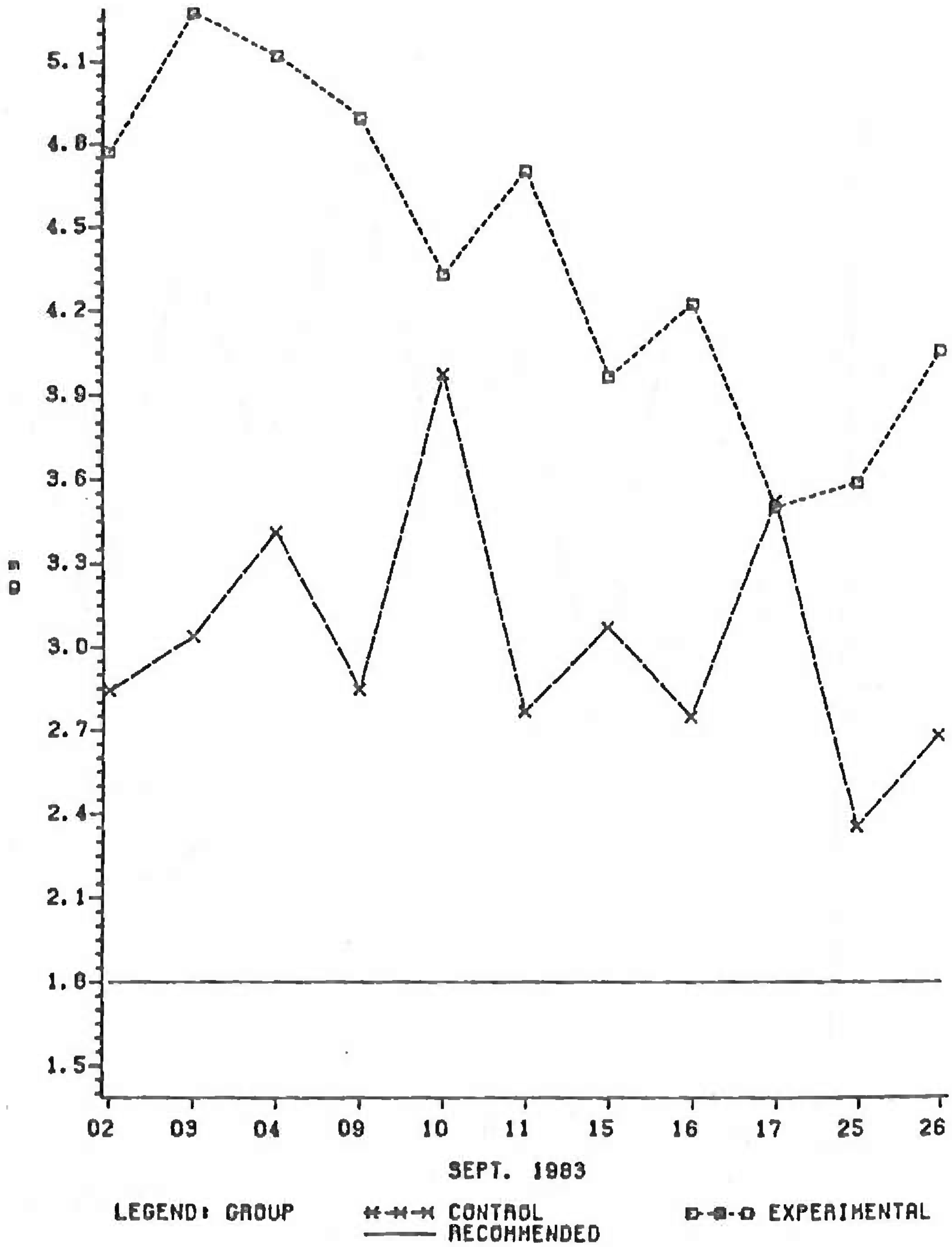

Figure 14. Mean Daily Thiamin Intake for MRE Group and Control Group Using Combined Method.

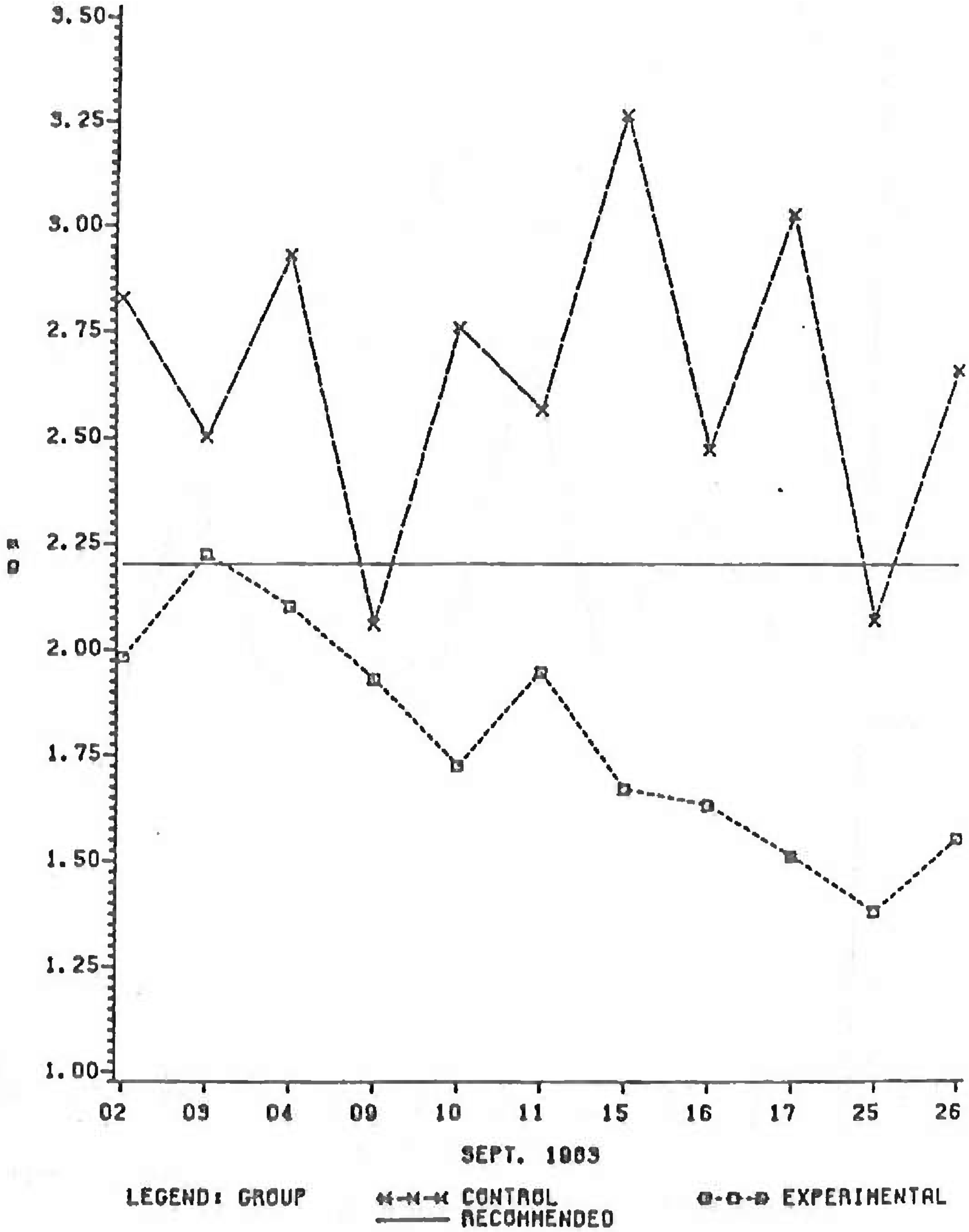

Figure 15. Mean Daily Intake of Riboflavin for MRE Group and Control Group Using Combined Method.

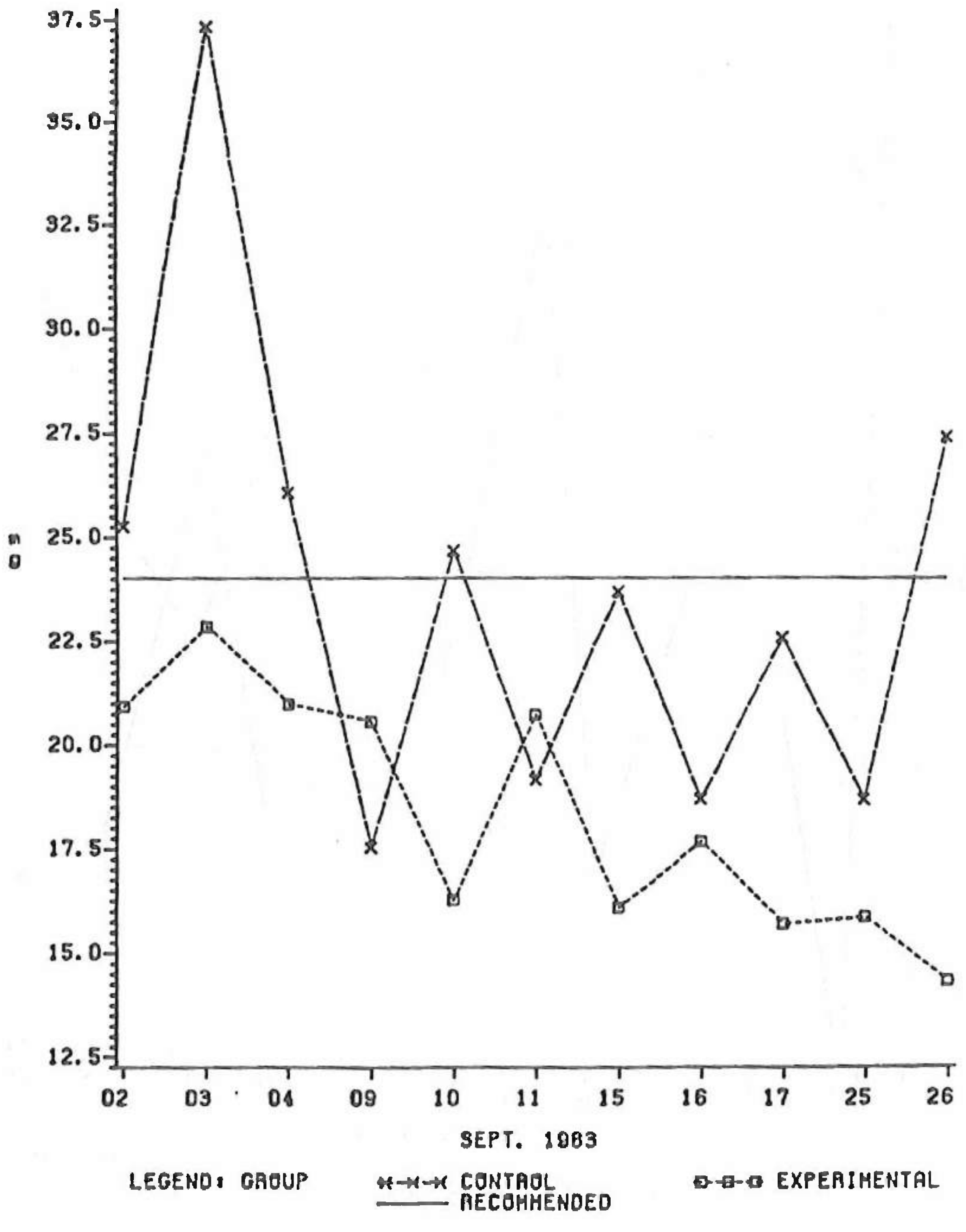

Figure 16. Mean Daily Intake of Niacin for MRE Group and Control Group Using Combined Method.

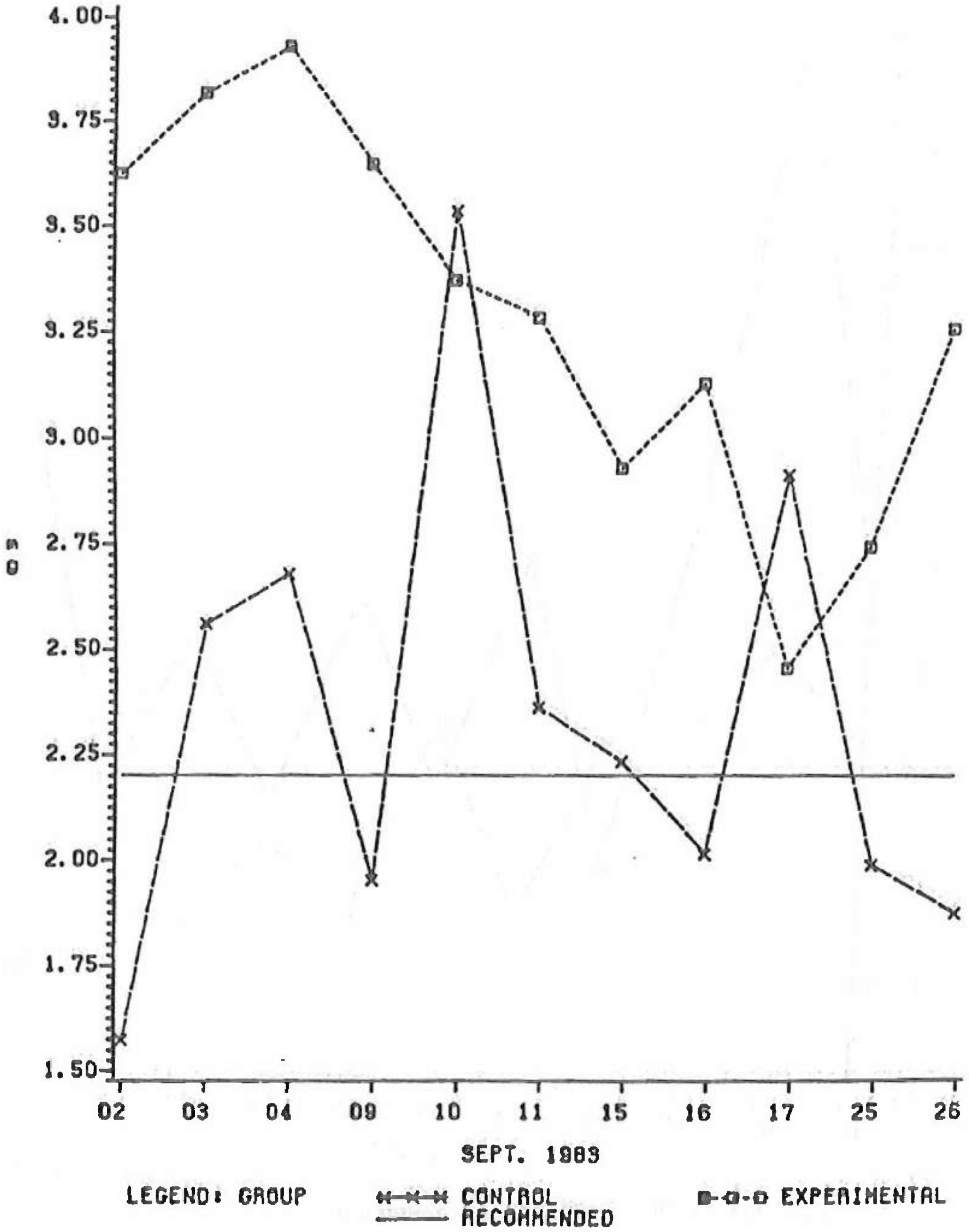

Figure 17. Mean Daily Intake of Pyridoxine for MRE Group and Control Group Using Combined Method.

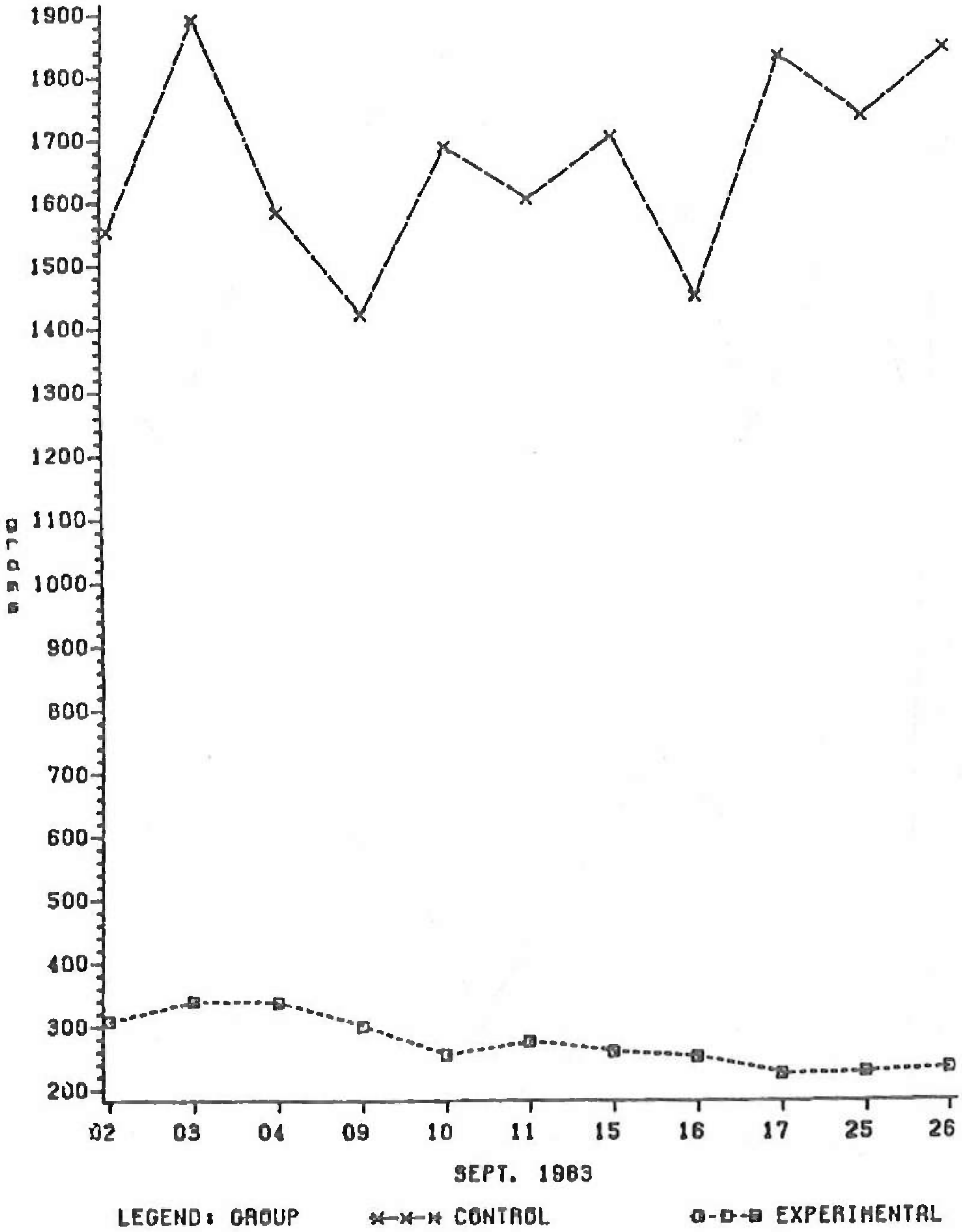

Figure 18. Mean Daily Intake of Water Derived from Food for MRE Group and Control Group Using Combined Method.

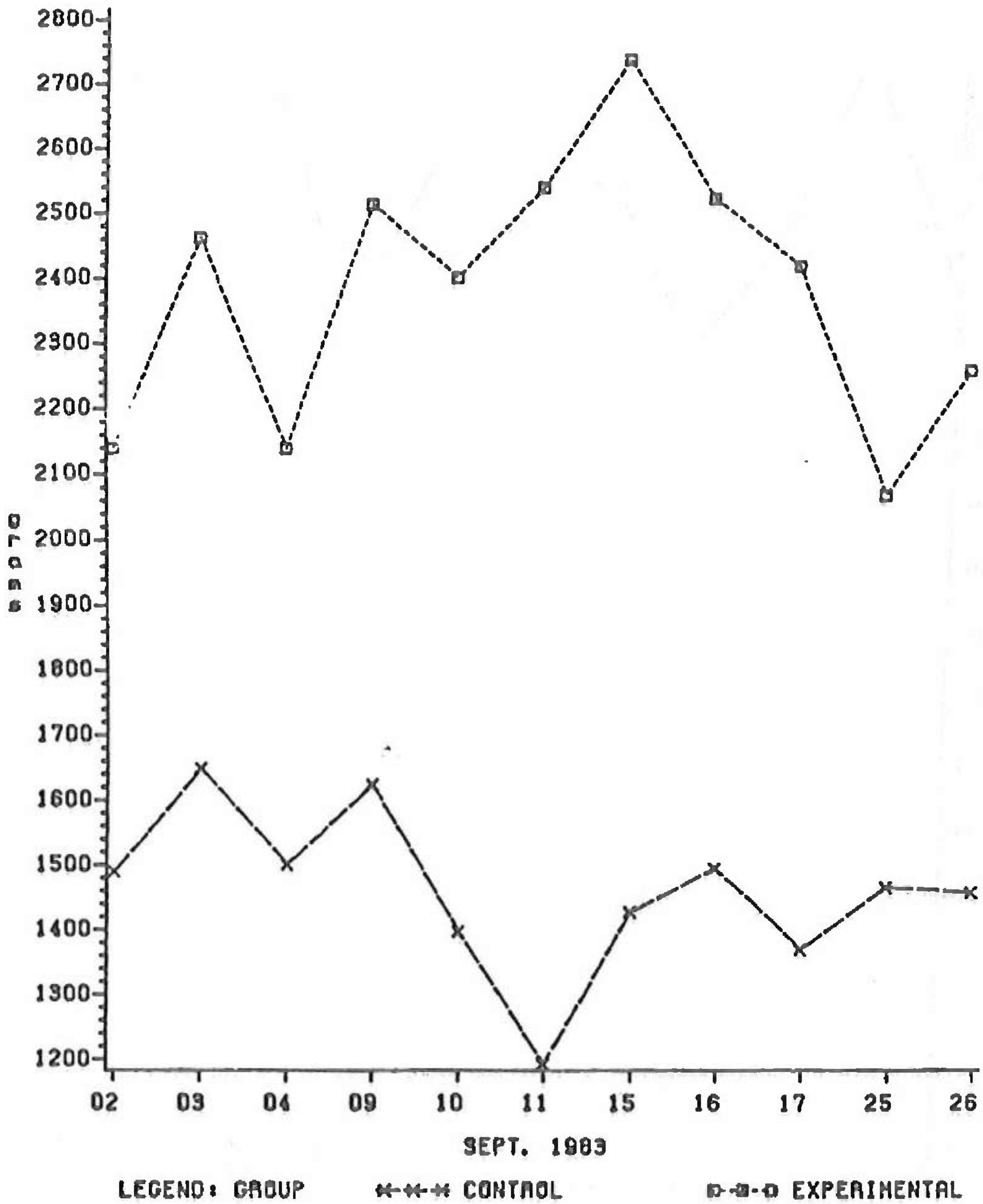

Figure 19. Mean Daily Intake Of Water From Canteen for MRE Group and Control Group Using Combined Method.

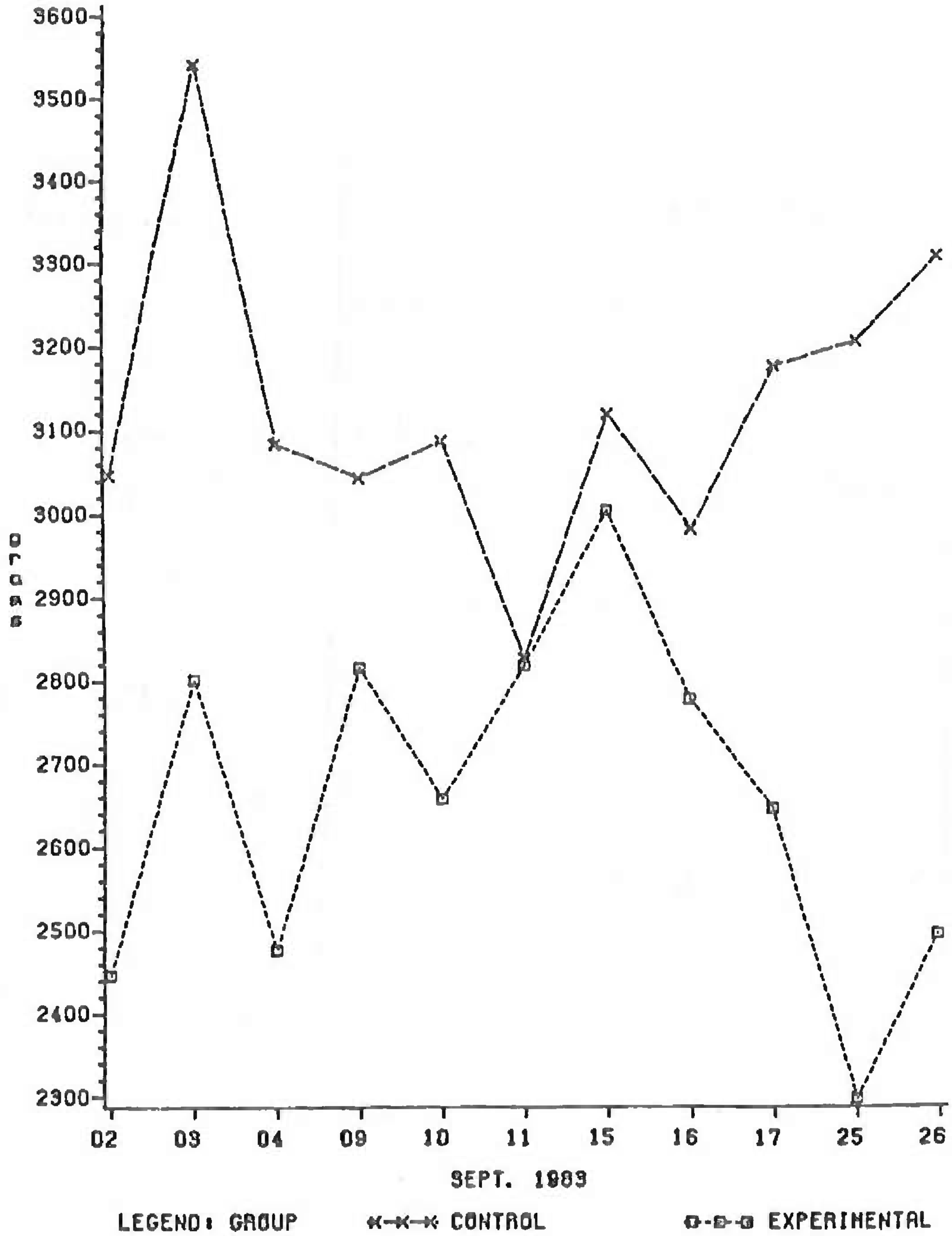

Figure 20. Mean Daily Total Intake Of Water for MRE Group and Control Group Using Combined Method.

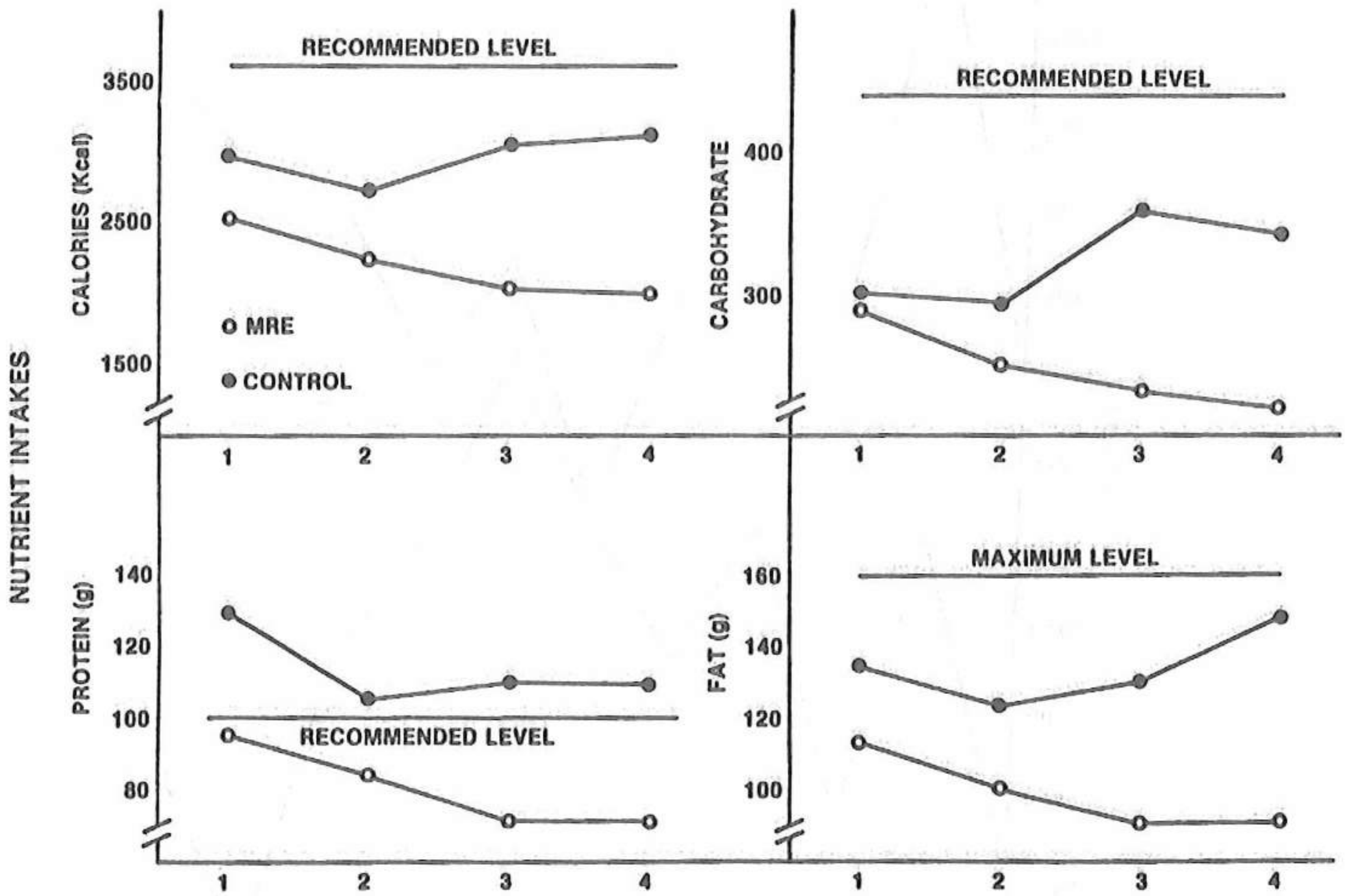

Figure 21. Mean Daily Macronutrient Intakes for Each Dietary Period for MRE Group and Control Group Using Combined Method.

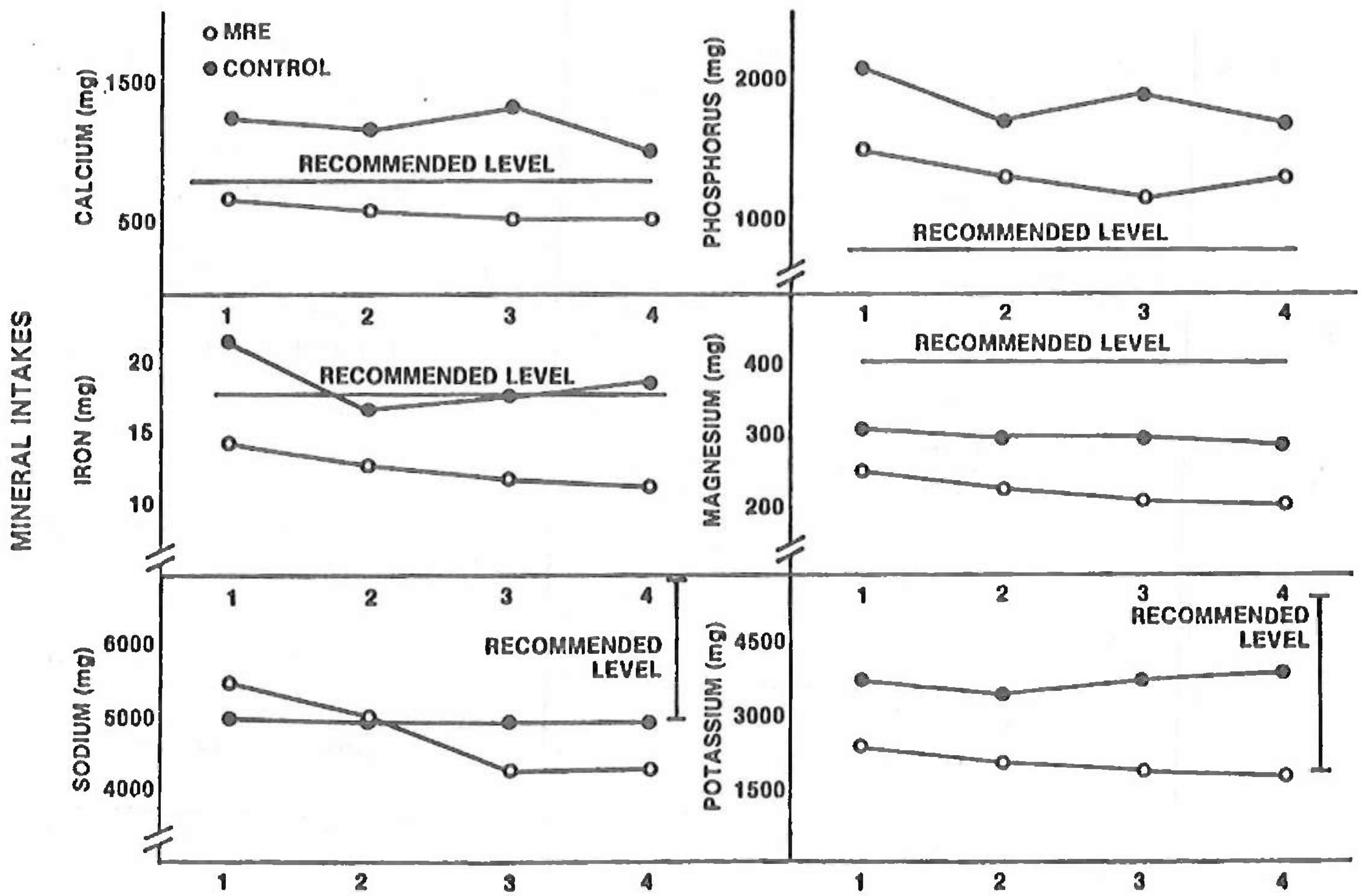

Figure 22. Mean Daily Mineral Intakes for Each Dietary Period for MRE Group and Control Group Using Combined Method.

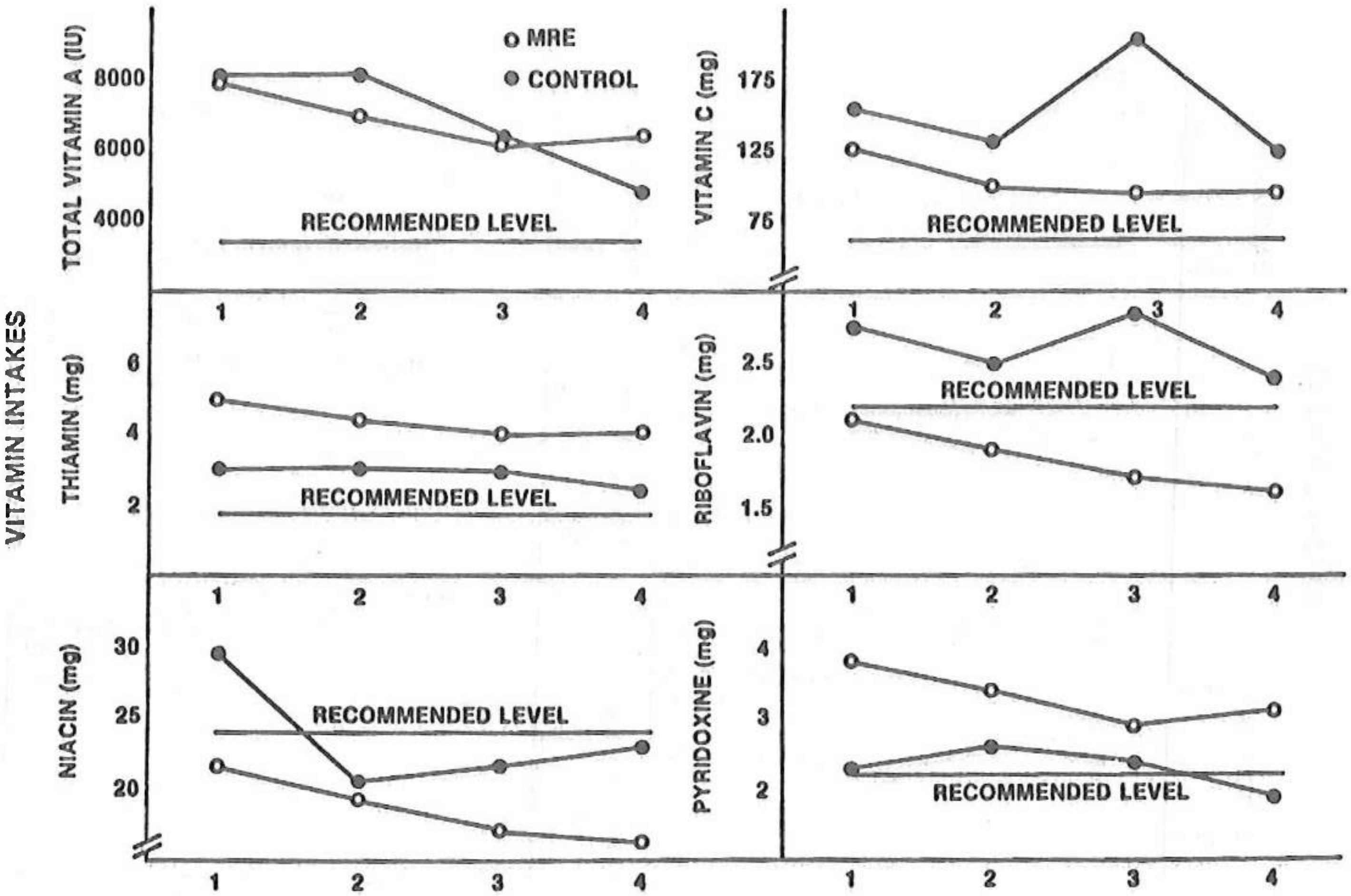

Figure 23. Mean Daily Vitamin Intakes for Each Dietary Period for MRE Group and Control Group Using Combined Method.

TABLE 10. Consumption of MRE Food Items by MRE Group and Control Grouping Using the Estimated Method.

EXPERIMENTAL GROUP

Food Item*	No. Of Items Distributed	Items Eaten**, ***	
		No.	Percent
ENTREE			
Beef W/Barbeque Sauce	74	42	58
Beef W/Gravy	74	55	74
Beef W/Spiced Sauce	74	35	47
Beef Patties	74	53	72
Beef Stew	74	49	66
Chicken Ala King	74	52	70
Frankfurters	74	52	70
Ham/Chicken Loaf	74	45	61
Ham Slices	74	61	82
Meatballs W/Barbeque Sauce	74	67	91
Pork Sausage Patties	74	45	61
Turkey W/Gravy	74	58	78
STARCH			
Crackers (12)	891	572	64
Bean W/Tomato Sauce (3)	223	139	62
Potato Patty (2)	148	78	53
SPREAD			
Cheese (5)	371	207	56
Jelly (3)	223	113	51
Peanut Butter (4)	297	105	35
FRUIT			
Applesauce	74	45	61
Mixed Fruits	74	34	46
Peaches (2)	148	77	52
Strawberries (2)	148	66	45

TABLE 10. Consumption of MRE Food Items by MRE Group and Control Grouping Using the Estimated Method. (Cont'd)

EXPERIMENTAL GROUP

Food Item*	No. Of Items Distributed	Items Eaten**, *** No.	Percent
DESSERT			
Brownie (2)	148	74	50
Cherry Nut Cake	74	58	78
Chocolate-Covered Cookie (3)	223	114	51
Fruitcake	74	38	51
Maple Nut Cake	74	49	66
Orange Nut Roll	74	34	43
Pineapple Nut Cake	74	30	41
Chocolate Nut Cake	74	30	41
BEVERAGE			
Cocoa Powder (7)	520	275	53
Coffee (12)	891	91	10
Cream Substitute (12)	891	222	25
Sugar (12)	891	225	25
OTHER			
Catsup (3)	223	25	11
Gravy Base	74	24	32
Candy (All Kinds) (4)	297	94	32
(Chocolate Fudge)	74	34	43
(Chocolate Toffee) (2)	148	45	30
(Vanilla Fudge)	74	15	20
TOTAL	8383	3435	41

*Numbers 2 through 12 in parenthesis following an item, designate the number of times an item appeared in a case containing 12 menu packs, each with a different entree.

**See text for discussion of items not listed as eaten, e.g. gave away, saved for later, ate less than half, returned unopened.

***Items were classified as eaten if one half or more were eaten.

TABLE 10. Consumption of MRE Food Items by MRE Group and Control Grouping Using the Estimated Method. (Cont'd)

CONTROL GROUP

Food Item*	No. Of Items Distributed	Items Eaten**, ***	
		No.	Percent
ENTREE			
Beef W/Barbeque Sauce	28	22	79
Beef W/Gravy	28	22	79
Beef W/Spiced Sauce	28	24	86
Beef Patties	28	23	82
Beef Stew	28	19	68
Chicken Ala King	28	20	71
Frankfurters	28	20	71
Ham/Chicken Loaf	28	27	96
Ham Slices	28	24	86
Meatballs W/Barbeque Sauce	28	23	82
Pork Sausage Patties	28	21	75
Turkey W/Gravy	28	19	68
STARCH			
Crackers (12)	330	229	69
Bean W/Tomato Sauce (3)	82	56	68
Potato Patty (2)	55	30	54
SPREAD			
Cheese (5)	138	99	72
Jelly (3)	82	45	55
Peanut Butter (4)	110	67	61
FRUIT			
Applesauce	28	21	75
Mixed Fruits	28	20	71
Peaches (2)	55	47	85
Strawberries (2)	55	48	87

TABLE 10. Consumption of MRE Food Items by MRE Group and Control Grouping Using the Estimated Method. (Cont'd)

CONTROL GROUP

Food Item*	No. Of Items Distributed	Items Eaten**, ***	
		No.	Percent
DESSERT			
Brownie (2)	55	48	87
Cherry Nut Cake	28	18	64
Chocolate-Covered Cookie (3)	82	56	68
Fruitcake	28	18	64
Maple Nut Cake	28	20	71
Orange Nut Roll	28	18	64
Pineapple Nut Cake	28	26	93
Chocolate Nut Cake	28	27	96
BEVERAGE			
Cocoa Powder (7)	192	66	34
Coffee (12)	330	27	8
Cream Substitute (12)	330	29	9
Sugar (12)	330	27	8
OTHER			
Catsup (3)	82	6	7
Gravy Base	28	5	18
Candy (All Kinds) (4)	111	45	40
(Chocolate Fudge)	28	11	39
(Chocolate Toffee) (2)	55	24	44
(Vanilla Fudge)	28	10	36
TOTAL	3337	1364	41

*Numbers 2 through 12 in parenthesis following an item, designate the number of times an item appeared in a case containing 12 menu packs, each with a different entree.

**See text for discussion of items not listed as eaten, e.g. gave away, saved for later, ate less than half, returned unopened.

***Items were classified as eaten if one half or more were eaten.

The day-to-day fluctuations in intake are shown in Figures 2 through 20. There are considerably larger and more frequent fluctuations in the intakes of the control group than in the experimental group. (It is interesting to note that the highest intake of carbohydrate coincides with the only day that rice was served, and in Hawaii it is generally known that rice is a very highly consumed carbohydrate food.)

Although mean daily intake of water by both groups was adequate, 2.7 and 3.1 liters by the experimental and control groups respectively, the food-water and canteen water ratios were 1:9 and 1:1 in the two groups. It is striking that the MRE group, which derived far less water from their food and had less access to additional beverages than the control group, consumed almost twice as much water from their canteens than the control group (2383 mL vs. 1462 mL).

Table 11 presents intakes (both in absolute units and in percent) by the estimated and weighed methods from which the combined method values were derived.

Overall, the estimated method produced slightly higher levels of intake than the weighed method in the experimental group but this was less apparent in the control group. As expected, the combined method (Table 1 and Appendix D) produced results that were higher than the other two methods.

Comparison of Weighed and Estimated Methods for Assessing Food Intake

The estimated and weighed methods of determining the mean daily intake of MRE food items used by the experimental group produced results that were highly correlated on all four days (September 3, 10, 16, 26, shown in tables 12-15), with a trend towards better correlation as the exercise progressed. These correlations were significant at the 0.05 level in all cases and at the 0.0001 level in most cases.

The paired t-tests showed that there was no significant difference between the means for the two methods at the 0.05 level with the exception of beverages on September 10.

The correlation coefficients between the weighed and estimated methods for measuring daily intake were generally much lower for the A ration food items consumed by the control group than they were for the MRE items consumed by both groups (Table 16, 17, 18, and 19). On the four days examined, the correlation coefficients between the weighed and the estimated methods of determining consumption for each of the food classes ranged from -0.07 (spreads on September 16) to 0.99 (spreads on September 10). The magnitude of these correlations did not appear to change in a systematic manner as the study progressed.

The control group also showed a high degree of data correlation between the estimated and weighed methods of determining mean daily intake while subsisting on MRE rations, with the exception of fruits on September 3, beverages on September 10, 16, and 26, and spreads on September 16. These correlations were all significant at the 0.05 level except for the two above mentioned instances.

TABLE 11. Estimated and Weighed Mean Daily Intake of Energy and Nutrients for the MRE Group and Control Group Expressed as a Percentage of Nutritional Standards for Operational Rations (NSOR).

MRE GROUP

ENERGY AND NUTRIENTS Percent NSOR	TYPE ESTIMATED Mean Intake	WEIGHED Mean Intake
Protein, g	76.0	74.3
Protein, % NSOR	76.0	74.3
Fat, g	86.0	83.3
Fat, % NSOR	53.8	52.1
Carbohydrates, g	215.3	211.1
Carbohydrates, % NSOR	48.9	48.0
Calories	1939.0	1891.1
Calories, % NSOR	53.9	52.5
Calcium, mg	531.6	517.8
Calcium, % NSOR	66.4	64.7
Phosphorus, mg	1171.7	1140.1
Phosphorus, % NSOR	146.5	142.5
Iron, mg	11.3	11.2
Iron, % NSOR	63.0	62.3
Sodium, mg	4298.2	4342.9
Sodium, % NSOR	71.6	72.4
Potassium, mg	1858.7	1851.2
Potassium, % NSOR	49.6	49.4
Magnesium, mg	194.6	193.7
Magnesium, % NSOR	48.6	48.4
Total Vit. A, IU	6369.0	6005.5
Total Vit. A, % NSOR	191.1	180.2
Vit. C, mg	99.1	92.2
Vit. C, % NSOR	165.1	153.6

TABLE 11. Estimated and Weighed Mean Daily Intake of Energy and Nutrients for The MRE Group and Control Group Expressed as a Percentage of Nutritional Standards for Operational Rations (NSOR). (Cont'd)

MRE GROUP

ENERGY AND NUTRIENTS Percent NSOR	TYPE ESTIMATED Mean Intake	WEIGHED Mean Intake
Thiamin, mg	4.1	4.0
Thiamin, % NSOR	229.8	220.4
Riboflavin, mg	1.7	1.6
Riboflavin, % NSOR	75.6	73.6
Niacin, mg	17.3	16.7
Niacin, % NSOR	72.0	69.7
Pyridoxine, mg	3.1	3.0
Pyridoxine, % NSOR	140.9	135.2
Total Food, g	649.6	639.7
Total Food, Dry Wt	394.5	385.9
Water From Food, g	255.1	253.8
Water From Canteen, g	2382.6	-
Total Water, g	2630.5	-

TABLE 11. Estimated and Weighed Mean Daily Intake of Energy and Nutrients for the MRE Group and Control Group Expressed as a Percentage of Nutritional Standards for Operational Rations (NSOR). (Cont'd)

CONTROL GROUP

ENERGY AND NUTRIENTS Percent NSOR	TYPE ESTIMATED Mean Intake	WEIGHED Mean Intake
Protein, g	105.5	104.4
Protein, % NSOR	105.5	104.4
Fat, g	119.2	116.5
Fat, % NSOR	74.5	72.8
Carbohydrates, g	266.1	281.8
Carbohydrates, % NSOR	60.5	64.0
Calories	2559.9	2588.0
Calories, % NSOR	71.1	71.9
Calcium, mg	1054.4	1074.7
Calcium, % NSOR	131.8	134.3
Phosphorus, mg	1675.0	1669.0
Phosphorus, % NSOR	209.4	208.6
Iron, mg	16.7	17.0
Iron, % NSOR	92.6	94.4
Sodium, mg	3897.5	4327.8
Sodium, % NSOR	65.0	72.1
Potassium, mg	3251.0	3374.8
Potassium, % NSOR	86.7	90.0
Magnesium, mg	252.8	263.5
Magnesium, % NSOR	63.2	65.9
Total Vit. A, IU	5968.5	6073.2
Total Vit. A, % NSOR	179.1	182.2
Vit. C, mg	130.3	128.3
Vit. C, % NSOR	217.1	213.9

TABLE 11. Estimated and Weighed Mean Daily Intake of Energy and Nutrients for the MRE Group and Control Group Expressed as a Percentage of Nutritional Standards for Operational Rations (NSOR). (Cont'd)

CONTROL GROUP

ENERGY AND NUTRIENTS Percent NSOR	TYPE ESTIMATED Mean Intake	 WEIGHED Mean Intake
Thiamin, mg	2.7	2.6
Thiamin, % NSOR	150.4	144.2
Riboflavin, mg	2.4	2.4
Riboflavin, % NSOR	109.1	108.1
Niacin, mg	22.0	21.4
Niacin, % NSOR	91.8	89.3
Pyridoxine, mg	2.0	2.0
Pyridoxine, % NSOR	92.5	89.2
Total Food, g	1951.4	2029.4
Total Food, Dry Wt	536.1	526.1
Water From Food, g	1415.3	1503.2
Water From Canteen, g	1418.1	---
Total Water, g	2793.4	---

TABLE 12. Estimated and Weighed Mean Intake of MRE Food Items by Food Class On September 3, 1983 In The MRE Food Group.

Food Items	n	Estimated Method grams	Weighed Method grams	t	p	r	p
MRE Ration							
entrees	27	298.56	309.52	-0.85	0.40	0.76	0.0001
starches	26	178.38	213.58	-1.73	0.10	0.68	.0001
spreads	20	79.64	79.65	0.00	1.00	0.79	.0001
fruits	15	72.00	66.67	1.76	0.10	0.99	.0001
desserts	23	147.80	141.65	0.70	0.49	0.80	.0001
beverages	20	68.09	65.15	0.46	0.65	0.70	.0007

TABLE 13. Estimated and Weighed Mean Intake of MRE Food Items by Food Class on September 10, 1983 in the MRE Group.

Food Items	n	Estimated Method grams	Weighed Method grams	t	p	r	p
MRE Ration							
entrees	26	242.20	236.12	1.11	0.28	0.97	0.0001
starches	26	161.23	168.15	-0.80	0.43	0.91	.0001
spreads	22	59.93	57.59	0.49	0.63	0.54	.0102
fruits	15	56.33	56.33	--	--	1.00	.0000
desserts	18	129.44	129.44	0.00	1.00	0.74	.0004
beverages	17	80.38	56.18	2.27	0.04	0.68	.0029

TABLE 14. Estimated and Weighed Mean Intake of MRE Food Items by Food Class on September 16, 1983 in the MRE Group.

Food Items	n	Estimated Method grams	Weighed Method grams	t	p	r	p
MRE Ration							
entrees	22	274.86	274.18	0.08	0.94	0.97	0.0001
starches	24	165.08	172.75	-1.17	0.25	0.96	.0001
spreads	19	71.20	73.42	-0.36	0.72	0.90	.0001
fruits	10	68.50	70.00	-1.00	0.34	1.00	.0001
desserts	17	119.24	108.65	1.72	0.10	0.92	.0001
beverages	16	80.50	78.81	0.19	0.85	0.89	.0001

TABLE 15. Estimated and Weighed Intake of MRE Food Items by Food Class on September 26, 1983 in the MRE Group.

Food Items	n	Estimated Method grams	Weighed Method grams	t	p	r	p
MRE Ration							
entrees	23	230.04	230.04	0.00	1.00	0.95	0.0001
starches	24	178.04	163.12	1.38	0.18	0.80	.0001
spreads	21	72.10	72.10	0.00	1.00	0.96	.0001
fruits	7	25.71	23.57	1.00	0.36	0.94	.0014
desserts	19	122.32	122.16	0.03	0.98	0.94	.0001
beverages	13	88.35	88.69	-0.04	0.97	0.88	.0001

NOTE: The first p-value in the table is associated with the paired t-test for no difference between estimated and weighed mean daily intake, while the second p-value is associated with a test for no correlation between the two methods.

TABLE 16. Estimated and Weighed Mean Intake of MRE and A Ration Food Items by Food Class on September 3, 1983 in the Control Group.

Food Items	n	Estimated Method grams	Weighed Method grams	t	p	r	p
A-Ration							
entrees	30	309.23	281.09	1.90	0.07	0.34	0.0690
starches	29	369.42	230.48	5.27	0.0001	0.54	.0026
fruits and vegetables	22	399.36	361.72	1.02	0.32	0.55	.0084
beverages	30	788.98	670.63	1.15	0.26	0.13	.4837
condiments	23	95.83	129.61	−2.36	0.03	0.52	.0106
MRE Ration							
entrees	29	122.43	122.07	0.23	0.82	0.98	0.0001
starches	28	70.02	71.64	−1.06	0.30	0.99	.0001
spreads	24	34.24	33.75	0.36	0.72	0.95	.0001
fruits	9	33.72	18.22	0.76	0.47	−0.17	.6684
desserts	25	78.84	77.24	0.84	0.41	0.92	.0001
beverages	6	52.67	56.50	−1.56	0.18	0.98	.0007

TABLE 17. Estimated and Weighed Mean Intake of MRE and A Ration Food Items by Food Class on September 10, 1983 in the Control Group.

Food Items	n	Estimated Method grams	Weighed Method grams	t	p	r	p
A-Ration							
entrees	30	330.07	375.74	-2.37	0.02	0.73	0.0001
starches	30	227.03	317.04	-5.37	.0001	0.73	.0001
spreads	5	28.80	28.00	1.00	0.37	0.99	.0009
fruits and vegetables	27	222.08	258.33	-3.44	0.002	0.93	.0001
desserts	14	52.26	51.19	1.00	0.34	0.98	.0001
beverages	29	819.24	955.55	-1.01	0.32	0.36	.0583
condiments	16	28.94	34.51	-2.16	0.047	0.69	.0028
MRE Ration							
entrees	29	123.40	123.00	0.27	0.79	0.98	0.0001
starches	25	65.76	64.64	0.16	0.87	0.77	.0001
spreads	17	38.01	35.18	0.96	0.35	0.70	.0018
fruits	16	29.38	29.38	–	–	1.00	.0001
desserts	20	82.35	75.70	0.97	0.34	0.82	.0001
beverages	9	49.89	16.00	2.87	0.02	0.40	.2822

TABLE 18. Estimated and Weighed Mean Intake of MRE and A Ration Food Items by Food Class on September 16, 1983 in the Control Group.

Food Items	n	Estimated Method grams	Weighed Method grams	t	p	r	p
A-Ration							
entrees	30	281.90	292.51	-1.26	0.22	0.84	0.0001
starches	30	191.09	253.33	-4.09	0.0003	0.56	.0012
spreads	6	24.00	39.00	-1.00	0.36	-0.07	.9004
fruits and vegetables	29	293.39	282.51	0.62	0.54	0.86	.0001
beverages	29	685.69	817.97	-3.77	0.0008	0.71	.0001
condiments	20	19.10	29.81	-3.15	0.005	0.41	.0725
MRE Ration							
entrees	18	100.14	92.50	1.01	0.33	0.86	0.0001
starches	14	71.71	68.29	0.71	0.49	0.95	.0001
spreads	9	44.44	34.89	1.51	0.17	-0.07	.8602
fruits	9	15.00	15.00	-	-	1.00	.0001
desserts	14	80.43	77.29	1.00	0.34	0.83	.0002
beverages	8	29.00	19.50	1.28	0.24	0.57	.1401

TABLE 19. Estimated and Weighed Mean Intake of MRE and A Ration Food Items by Food Class on September 26, 1983 in the Control Group.

Food Items	n	Estimated Method grams	Weighed Method grams	t	p	r	p
A-Ration							
entrees	29	331.26	294.79	2.28	0.03	0.63	0.0003
starches	29	325.79	311.55	0.99	0.33	0.81	.0001
fruits and vegetables	26	232.80	289.75	-2.85	0.009	0.76	.0001
desserts	23	57.00	141.60	-7.43	0.0001	0.32	.1391
beverages	29	1140.31	1273.66	-3.12	0.004	0.93	.0001
condiments	22	40.36	44.73	-2.19	0.04	0.89	.0001
MRE Ration							
entrees	15	145.07	133.33	0.57	0.58	0.59	0.0206
starches	15	62.57	61.60	1.44	0.17	1.00	.0001
spreads	11	36.75	35.18	1.00	0.34	0.94	.0001
fruits	8	15.00	13.13	1.00	0.35	1.00	.0001
desserts	12	71.58	71.58	-	-	1.00	.0001
beverages	5	47.00	38.60	.97	.39	.59	.2900

See note Table 6.

The paired t-tests showed that there were significant differences between the means of the A ration at the 0.05 level in approximately half of the food items, which probably contributed to the poorer correlations with the A ration. There was no significant difference between the means of the MRE ration with the exception of beverages of September 10.

For the A rations, the estimated method tended to underestimate the intake, as judged by the weighed data, with two of the four significant differences having lower estimated means than weighed means. Overall, 5 of the 24 comparisons between estimated and weighed methods showed the estimated to be lower.

For the MRE rations, 12 of 24 items in the experimental group and 19 of 24 in the control group had estimated means higher than weighed means. Most of these were not significantly higher however (only beverages on September 10).

Tables 20-25 show the correlation of nutrient intake data based on food consumed as determined by the estimated method and weighed method. Where the correlations are low, the test subjects had difficulty in estimating the quantity of food that they consumed.

Correlations were not calculated for the condiment and candy food classes of the MRE ration because of missing data (test subjects failed to report estimated data) and the fact that there was low frequency of appearance of condiments (catsup 3/12 and gravy base 1/12) and candies (4/12) in the 12 MRE menus.

The results indicate that it was more difficult to estimate the nutrient intake from A ration meals than from a standard operational field ration like the MRE. This could have been anticipated because of the standard portion size of the operational ration components and the tendency of the soldiers to consume all or none of the operational ration component.

The entree and fruit food classes showed exceptionally high correlations in the MRE ration for all days with the exception of September 26 for the control group. This was the last day of the exercise for the control group and many of them opted not to eat their MRE meal that day, but instead to take it home with them. This lowered the number of observations and adversely affected the correlations. All of the other food classes had relatively high correlations with only the beverage class showing a slightly lower overall correlation. This was due in part to the fact that many of the soldiers tended to save their cocoa and coffee and to drink them at some time other than meal time. This caused difficulty in reporting beverages which were consumed between meals.

There is no pattern or trend discernible in the data to indicate that any specific nutrient was more difficult to estimate than another. The estimate depended on the concentration of the nutrient in the particular food class and the difficulty associated with estimating the food class. For example, beverages, which the soldiers had some difficulty in estimating, were fortified with vitamin C, and this was reflected in the slightly lower correlation of vitamin C in beverages.

TABLE 20. Correlation Coefficients for Nutrient Intakes from Beverages between Weighed and Estimated Methods.

Energy and Nutrients	Experimental Group MRE ration September, 1983				Control Group MRE ration meal September, 1983				Control Group A ration meal September, 1983			
	3	10	16	26	3	10	16	26	3	10	16	26
Water	0.71	0.68	0.90	0.88	1.00	0.45	0.58	0.51	0.13	0.36	0.72	0.94
Protein	.72	.70	.91	.88	1.00	.45	.60	.00	.65	.48	.81	.83
Fat	.72	.70	.91	.88	1.00	.45	.60	.42	.66	.47	.81	.82
Carbohydrate	.70	.67	.88	.88	.97	.40	.57	.64	.34	.55	.77	.87
Calorie	.70	.68	.89	.88	.98	.41	.57	.58	.53	.50	.79	.83
Calcium	.72	.70	.91	.88	1.00	.45	.60	.41	.65	.47	.81	.82
Phosphorus	.71	.68	.90	.88	.99	.45	.57	.53	.64	.47	.80	.82
Iron	.70	.67	.89	.88	.98	.43	.56	.60	.52	.28	.85	.91
Sodium	.71	.69	.90	.88	1.00	.45	.59	.45	.73	.43	.81	.82
Potassium	.71	.68	.90	.88	.99	.45	.57	.52	.43	.43	.78	.86
Magnesium	.72	.70	.91	.88	1.00	.45	.60	.00	.48	.36	.74	.87
Vitamin A	.72	.70	.91	.88	1.00	.45	.60	.00	.68	.44	.81	.90
Vitamin C	.66	.69	.89	.88	.98	.33	.54	.00	.69	.41	.81	1.00
Thiamin	.72	.70	.91	.88	1.00	.45	.60	.00	.66	.49	.81	.89
Riboflavin	.68	.68	.89	.88	.99	.35	.54	.53	.63	.53	.81	.82
Niacin	.66	.31	.77	.90	.90	.99	.99	.00	.33	.50	.91	.94
Pyridoxine	.72	.70	.91	.88	1.00	.45	.60	.00	.63	.50	.77	.78

TABLE 21. Correlation Coefficients for Nutrient Intakes from Desserts between Weighed and Estimated Methods.

	Experimental Group MRE ration September, 1983				Control Group MRE ration meal September, 1983				Control Group A ration meal September, 1983			
Energy and Nutrients	3	10	16	26	3	10	16	26	3*	10	16**	26
Water	0.82	0.85	0.88	0.97	0.89	0.87	0.93	1.00		0.97		0.32
Protein	.76	.67	.91	.90	.97	.82	.55	1.00		.99		.32
Fat	.74	.59	.91	.88	.99	.83	.55	1.00		1.00		.32
Carbohydrate	.80	.78	.91	.95	.92	.81	.84	1.00		.99		.32
Calorie	.78	.69	.92	.92	.95	.82	.71	1.00		.99		.32
Calcium	.75	.68	.86	.92	.99	.68	.73	1.00		.99		.32
Phosphorus	.76	.73	.91	.92	.91	.87	.76	1.00		.99		.32
Iron	.75	.75	.92	.92	.88	.82	.79	1.00		.99		.32
Sodium	.86	.77	.93	.97	.97	.86	.88	1.00		.97		.32
Potassium	.60	.68	.88	.77	.93	.77	.38	1.00		.99		.32
Magnesium	.59	.58	.80	.71	.99	.82	.51	1.00		.99		.32
Vitamin A	.84	.95	.91	.90	.99	.90	1.00	1.00		1.00		.32
Vitamin C	.80	.98	.78	.94	.80	.99	1.00	1.00		.98		**
Thiamin	.86	.70	.82	.86	.93	.96	1.00	1.00		1.00		.32
Riboflavin	.76	.81	.83	.88	.92	.88	.99	1.00		1.00		.32
Niacin	.71	.72	.91	.87	.97	.73	.23	1.00		.99		.32
Pyridoxine	.55	.76	.91	.74	.91	.72	.58	1.00		1.00		**

* No dessert given on September 3.

** All values are identical for one of the variables.

TABLE 22. Correlation Coefficients for Nutrient Intakes from Entrees between Weighed and Estimated Methods.

Energy and Nutrients	Experimental Group MRE ration September, 1983				Control Group MRE ration meal September, 1983				Control Group A ration meal September, 1983			
	3	10	16	26	3	10	16	26	3	10	16	26
Water	0.79	0.98	0.97	0.95	0.99	0.98	0.92	0.55	0.29	0.72	0.83	0.63
Protein	.82	.95	.96	.94	.94	.99	.89	.76	.46	.77	.84	.58
Fat	.90	1.00	.95	.96	.99	1.00	.19	.70	.33	.79	.83	.73
Carbohydrate	.93	.98	.96	.97	.98	.99	.99	.78	.51	.66	.85	.58
Calorie	.82	.98	.96	.95	.96	.99	.52	.67	.41	.77	.83	.65
Calcium	.78	.98	.97	.98	.98	.99	.84	.70	.26	.86	.72	.82
Phosphorus	.81	.97	.96	.96	.93	.99	.93	.83	.46	.85	.81	.60
Iron	.85	.98	.94	.91	.95	.98	.71	.67	.48	.77	.84	.65
Sodium	.85	.99	.98	.96	.98	.99	.62	.74	.31	.72	.85	.71
Potassium	.86	.98	.94	.96	.95	.99	.88	.78	.46	.72	.86	.59
Magnesium	.80	.95	.96	.95	.93	.98	.92	.70	.45	.69	.84	.96
Vitamin A	.76	1.00	.99	.80	.99	.99	.45	.77	.53	.65	.80	.70
Vitamin C	.99	1.00	.64	.97	.85	1.00	.67	.95	.55	.63	.86	.55
Thiamin	.97	1.00	.99	1.00	.99	1.00	.98	.96	.35	.76	.86	.92
Riboflavin	.85	.95	.98	.96	.98	.99	.90	.75	.30	.86	.80	.78
Niacin	.79	.93	.97	.97	.97	1.00	.87	.84	.55	.69	.86	.54
Pyridoxine	.78	.96	.94	.93	.91	.98	.95	.64	.45	.76	.86	.72

TABLE 23. Correlation Coefficients for Nutrient Intakes from Fruits and Vegetables between Weighed and Estimated Methods.

Energy and Nutrients	Experimental Group MRE ration September, 1983				Control Group MRE ration meal September, 1983				Control Group A ration meal September, 1983			
	3	10	16	26	3	10	16	26	3	10	16	26
Water	0.99	1.00	1.00	0.96	1.00	1.00	1.00	-0.30	0.55	0.92	0.86	0.76
Protein	.84	1.00	.98	.99	.98	1.00	1.00	.17	.51	.84	.71	.70
Fat	.84	1.00	.80	1.00	.67	1.00	1.00	.99	.46	.44	.68	.66
Carbohydrate	.93	1.00	.97	.94	.46	1.00	1.00	.53	.58	.99	.85	.77
Calorie	.92	1.00	.97	.94	.44	1.00	1.00	.24	.59	.98	.85	.77
Calcium	.89	1.00	.84	.98	.99	1.00	1.00	.99	.47	.69	.67	.81
Phosphorus	.82	1.00	.92	.98	.94	1.00	1.00	.74	.52	.88	.76	.74
Iron	.98	1.00	.99	.96	.89	1.00	1.00	.61	.55	.84	.84	.72
Sodium	.97	1.00	1.00	.93	.35	1.00	1.00	.50	.57	.37	.67	.63
Potassium	.84	1.00	.95	.97	.96	1.00	1.00	.19	.55	.95	.83	.83
Magnesium	.86	1.00	.89	.97	.92	1.00	1.00	.90	.56	.95	.82	.81
Vitamin A	.89	1.00	1.00	.98	.97	1.00	1.00	.40	.48	.33	.65	.74
Vitamin C	.90	1.00	.89	1.00	.99	1.00	1.00	1.00	.56	.99	.75	.85
Thiamin	.95	1.00	.98	.87	.99	1.00	1.00	.84	.51	.91	.73	.76
Riboflavin	.96	1.00	.86	.87	.91	1.00	1.00	1.00	.49	.81	.69	.80
Niacin	.89	1.00	.98	.91	.32	1.00	1.00	.50	.51	.85	.75	.72
Pyridoxine	.94	1.00	.95	.91	.96	1.00	1.00	.93	.46	.59	.68	.82

TABLE 24. Correlation Coefficients for Nutrient Intakes from Spreads between Weighed and Estimated Methods.

	Experimental Group				Control Group							
	MRE ration				MRE ration meal				A ration meal*			
Energy and	September, 1983				September, 1983				September, 1983			
Nutrients	3	10	16	26	3	10	16	26	3	10	16	26
Water	0.85	0.73	0.88	0.91	0.95	0.80	1.00	0.82		0.99	0.07	
Protein	.79	.87	.92	.98	.88	.81	.45	.85				
Fat	.83	.82	.87	.97	.90	.85	.44	.98				
Carbohydrate	.82	.71	.96	1.00	.93	.95	.94	.92				
Calorie	.79	.72	.92	.98	.92	.74	.15	.87				
Calcium	.89	.85	.90	.93	1.00	.85	.99	.85				
Phosphorus	.87	.82	.85	.95	.96	.87	.77	.93				
Iron	.81	.74	.89	.97	.92	.78	.19	.92				
Sodium	.88	.84	.87	.94	.98	.86	.91	.89				
Potassium	.80	.99	.97	1.00	.90	.78	.60	.76				
Magnesium	.80	.99	.97	1.00	.90	.79	.60	.77				
Vitamin A	.86	.82	.85	.96	.93	.87	.58	.96				
Vitamin C	.85	.81	.85	.96	.92	.86	.51	.96				
Thiamin	.87	.82	.85	.96	.95	.88	.70	.95				
Riboflavin	.87	.83	.86	.95	.96	.87	.79	.93				
Niacin	.82	.99	.97	1.00	.90	.79	.63	.76				
Pyridoxine	.90	.86	.90	.93	1.00	.85	1.00	.84				

* There were too few observations to calculate most correlation coefficients.

TABLE 25. Correlation Coefficients for Nutrient Intakes from Starches between Weighed and Estimated Methods.

Energy and Nutrients	Experimental Group MRE ration September, 1983				Control Group MRE ration meal September, 1983				Control Group A ration meal September, 1983			
	3	10	16	26	3	10	16	26	3	10	16	26
Water	0.73	0.94	0.95	0.82	1.00	0.87	1.00	1.00	0.44	0.62	0.61	0.83
Protein	.69	.89	.96	.80	.98	.72	.92	1.00	.69	.70	.49	.76
Fat	.65	.86	.96	.93	.97	.52	.61	.98	.55	.87	.73	.77
Carbohydrate	.65	.85	.95	.84	.95	.46	.69	1.00	.70	.80	.52	.80
Calorie	.60	.85	.95	.85	.95	.33	.60	.99	.69	.82	.55	.78
Calcium	.71	.83	.95	.84	.93	.54	.66	1.00	.64	.66	.60	.65
Phosphorus	.68	.92	.96	.80	.99	.78	.96	1.00	.64	.64	.55	.75
Iron	.69	.90	.96	.80	.99	.74	.93	1.00	.73	.68	.49	.79
Sodium	.59	.86	.96	.85	.97	.41	.67	.99	.62	.73	.64	.74
Potassium	.67	.94	.95	.82	1.00	.82	.97	1.00	.57	.63	.76	.76
Magnesium	.70	.94	.96	.80	1.00	.84	.99	1.00	.68	.53	.56	.79
Vitamin A	.73	.94	.95	.82	1.00	.87	1.00	1.00	.61	.33	.84	.67
Vitamin C	.64	.93	.96	.92	1.00	.81	.83	.99	.63	.75	.82	.67
Thiamin	.80	.79	.93	.90	.86	.67	.49	1.00	.71	.74	.43	.74
Riboflavin	.79	.78	.93	.90	.86	.65	.47	1.00	.66	.68	.48	.72
Niacin	.72	.82	.95	.86	.92	.52	.59	1.00	.74	.74	.54	.81
Pyridoxine	.72	.80	.94	.88	.90	.48	.44	1.00	.63	.57	.78	.89

On a day-to-day basis, the experimental group subjects were rather consistent in their ability to estimate nutrient intake from the MRE ration that they consumed. If there is any trend detectable at all, it is probably a slight increase in accuracy as the test progressed, probably based on the learning curve. The control group started out at a high degree of accuracy in estimating nutrient intake from the MRE ration meals, but this ability declined as the test progressed in certain food groups, i.e., spreads, starches, beverages and desserts. The ability of the control group to estimate nutrient intake from the A ration meals was not very high at the beginning but showed a slight improvement over time as the test progressed.

MRE Food Items Consumed

In Table 10 the MRE food items consumed are tabulated and the percentage of each item eaten provides an estimate of actual food acceptance or conversely food waste. Overall, 41% of all MRE items dispensed were consumed by the experimental group and the control group. In the experimental group, consumption of every item except one (beef with spiced sauce) in the entree and starch classes exceeded 50% of the items distributed, and as a class, consumption of spread, fruit and dessert approached 50%. In the control group, consumption of items in the entree, starch, spread, fruit and dessert classes did not fall below 54% Ideally, if items not eaten were returned, this would provide accurate waste figures. Instead, items were often "saved for later" and the final disposition is unknown.

Sources of Error and Limitations of Method

In the data collection, the evaluators' accessibility to subjects, dictated by the military command, was different betwen the two groups, there being greater accessiblity to the control group. Climatic and terrain conditions and therefore the physical exertion required were not identical. The serving size of some A ration items could not be completely controlled under the conditions of this study and certain self-serve items like tossed green salad were highly variable.

In the data analysis, the nutrient factor files lacked complete food composition data, more so in A ration items than MRE ration items. Consequently missing nutritive values were set to zero. The applicablity of nutrient values from the Letterman Army Institute of Research (LAIR) nutrient factor file may or may not represent the composition of the items as actually eaten and is a limitation in all studies unless samples of the diet under study are analyzed in the laboratory. And finally, all food intake missing data were set to zero. Therefore, the intake values are the lowest or most conservative measure of nutrient intake.

Conclusions

The test ration was not consumed by the experimental group in sufficient quantities to meet 80% of the nutritional standards for operational rations. The mean daily intake of energy, and the carbohydrate and fat, which are major sources of energy, were especially low. The majority of the mineral intakes were extremely low and the sodium level remained below the maximum range. The majority of the vitamin intakes were exceptionally high and riboflavin and niacin were near 80%. There was a downward trend with time over the four measurement periods, with little day to day fluctuations.

In contrast, the control group consumed the MRE-A ration combination in quantities that met 80% of NSOR. The intake levels of carbohydrate and magnesium at 74% NSOR were somewhat low. There was no visible trend over time but considerable day to day fluctuations. In general the differences in nutrient intake between the experimental and control groups were highly significant.

For MRE meals, the food intake data obtained by the estimated and weighed methods of data collection correlated highly and there were essentially no significant differences between means obtained by these two methods. For A ration meal items, the data obtained from the two methods showed a much lower degree of correlation than for MRE items and there were significant differences between the results obtained by the two methods. It was more difficult to estimate nutrient intake from A ration meals than from MRE ration meals.

Among food classes in MRE rations, the entree and fruit classes showed exceptionally high correlations and the beverage class the lowest correlations. There were slightly higher correlations as the test progressed and no pattern to indicate that any specific nutrient was more difficult to estimate than another. In conclusion, the estimated method can be used to measure nutrient intake from MRE rations with a high degree of accuracy as long as adequate instructions are provided and followed.

The distribution of individual items eaten in the MRE ration provided an estimate of actual acceptance or conversely food waste. In the experimental group, consumption of almost all items in only the entree and starch classes exceeded 50% of the number dispensed. In the control group, all items in the entree, starch, spread, fruit and dessert classes did not fall below 54%.

CHAPTER 5

FOOD ACCEPTABILITY AND FOOD PREFERENCE

Summary

In general, the MRE was very well received by the troops in both companies with average acceptability scores of 7.05 for the MRE group and 6.48 for the control group on a nine point hedonic scale. The MRE group also rated the MRE higher than the control group rated comparable hot A ration meals. There was no indication of a decline in the acceptability of the MRE over the 34 days of the field test. The MRE was rated higher for lunch and dinner than it was for breakfast. The acceptability ratings of the MRE did not discriminate between the individuals in the MRE group who lost the most weight from those who lost the least. The food preference data suggest that troops subsisting on the MRE would like freshly prepared food as indicated by somewhat higher scores for these items on the preference survey than the control group.

1. Introduction

The central issue in this study is whether the MRE is sufficiently acceptable to troops who are fed this ration as their sole source of food so that enough food is consumed on a daily basis to maintain health and effective performance. The MRE consists of 12 menus composed of 44 food components (excluding assorted candies and beverages). Some of the 44 components are repeated in each of the 12 menus. On a daily basis, three MREs, which provide 3600 calories, are given to each soldier. On average, each menu is repeated every four days with some components being repeated more frequently. With this frequency of repetition, there is the very real possibility that food monotony will occur and that acceptability and intake will decline over time.[3,4,5,6] In addition to the possibility of a food monotony effect, it is possible that some components of the MRE are not sufficiently palatable to the soldier and will not be consumed. The rejection of some components of the ration may lead to inadequate energy intake, consumption of a nutritionally imbalanced diet or inadequate vitamin and mineral intakes due to the patterns of diet fortification and food selection.

The analysis of the nutrient intake data in Chapter 4 revealed that the MRE was not consumed in sufficient quantity by troops fed this ration as their sole source of food. The level of intake resulted in energy, macronutrient and mineral intakes that were below recommended levels. Vitamin intake was at or slightly below recommended levels due to the patterns of vitamin fortification and food selection. It would appear that the major problem to be accounted for concerns the overall low level of food intake rather than rejection of specific items. Does low food acceptability of the ration underlie the low intake or is another class of factors responsible? This chapter will examine how the individual MRE items were rated by the troops and how their food preferences varied over time in attempt to explain the low intake.

2. Method

In order to determine the acceptability of the MRE components, troops in both companies were asked to fill out a food acceptability questionnaire at each meal on three consecutive days during each week of the field test (Appendix E - MRE form, Appendix F - A ration form for breakfast, Appendix G - A ration form for dinner). In order to be able to relate this measure to actual food consumption, this information was collected from the 30 volunteers in each company on the same days that food intake data were collected from these individuals. In addition, another 15-20 men in each company were asked to provide food acceptability ratings at each of these meals. These individuals were randomly selected as they completed their meal.

Beyond providing information on the acceptability of each of the MRE components and any changes in their ratings over time, the acceptability data can be used to address several other important questions including: 1 - Is the MRE equally acceptable to troops as breakfast, lunch and dinner? 2 - How does the acceptability of the MRE compare to A rations under field conditions? 3 - How do troops whose sole source of food is the MRE rate this ration compared to troops who only eat the MRE for lunch? 4 - Can food acceptability ratings be used to predict weight loss during an extended field training exercise? Each of these issues will be addressed.

All the troops were also asked to fill out a 100-item food preference survey (Appendix H) prior to the exercise and on days 11/12, 23/24 and 34 of the field test. In keeping with the standard usage of the terms, acceptability and preference, the acceptability measure refers to the hedonic rating in response to eating the food whereas preference refers to the hedonic rating in response to the food name.[14,15] Of the 100 food names used in the present preference survey, 25% were from the MRE menu, 25% were from the A ration menu, 25% were high preference items that neither company was eating and 25% were low preference items that neither company was eating. The high and low preference items that were not being eaten were drawn from the Armed Forces Food Preference Survey.[15] The response to this survey allowed us to examine whether there was a change in preference for foods that were not being consumed and whether such a change was influenced by the diet an individual was currently eating. If the foods that were not currently being consumed increased in preference it would suggest dissatisfaction with the current diet. Similarly, changes in preference for foods that were currently being eaten would provide additional insight into a possible food monotony effect.

3. Results and Discussion

Food Acceptability Ratings of MRE Items

Table 26 shows the average acceptability ratings given to each of the MRE items on the 9-point hedonic scale (1=extremely bad, 9=extremely good). The ratings in this table are the averages for each company over the entire study. Group differences in acceptability ratings were assessed with t-tests.

TABLE 26. Acceptability Ratings of MRE Items.

Item	MRE Company	Control Company	
Beef w/BBQ Sauce	6.70	6.66	N.S.
Beef w/Gravy	7.13	5.91	***
Beef w/Spiced Sauce	6.43	6.98	N.S.
Beef Patty	6.77	6.04	*
Beef Stew	7.43	7.00	*
Chicken A La King	6.82	6.31	N.S.
Frankfurters	6.96	6.19	*
Ham Slices	7.51	7.41	N.S.
Ham and Chicken Loaf	7.05	5.83	***
Meatballs w/BBQ Sauce	6.82	6.84	N.S.
Pork Sausage Patty	7.05	5.48	***
Turkey w/Gravy	7.90	6.72	***
Crackers	7.34	6.84	***
Potato Patty	6.20	5.84	N.S.
Beans w/Tomato Sauce	7.14	6.77	*
Brownie	5.89	6.39	N.S.
Cherry Nutcake	7.01	7.03	N.S.
Chocolate Covered Cookie	7.47	7.51	N.S.
Chocolate Nutcake	7.79	8.00	N.S.
Fruitcake	5.88	6.21	N.S.
Maple Nutcake	7.03	6.33	*
Orange Nutroll	5.66	5.53	N.S.
Pineapple Nutcake	6.59	6.23	N.S.
Cheese Spread	7.40	7.02	**
Jelly	7.46	6.92	***
Peanut Butter	6.41	6.80	*
Applesauce	7.68	7.70	N.S.
Mixed Fruits	7.03	6.73	N.S.
Peaches	6.87	6.06	***
Strawberries	7.88	7.54	N.S.

*$p < 0.05$
**$p < 0.01$
***$p < 0.001$

There are two striking features of the data shown in Table 26. First, the troops in both companies rated all the items in the ration above 5, the neutral point of the 9-point scale, and many items, particularly the entrees and the dehydrated fruits, were rated above 7 by the MRE group, indicating that they viewed these items as falling between moderately good and very good. The second notable feature of the data displayed in this table is that the MRE items were rated more highly by the troops who subsisted on this ration than by the troops who only consumed the MRE for lunch. Averaged across all items, the MRE group assigned a rating of 7.05 to the ration whereas the control group's rating was 6.48 ($F(1,2178) = 45.65$, $p < 0.001$). At the level of individual items, Table 26 shows that with one exception (peanut butter), any statistically significant differences in the ratings of individual MRE items resulted from higher ratings of the items by the MRE group. Overall, this table clearly indicates that the MRE was well received by the troops in both companies and that individuals who consumed the MRE as their sole source of food rated it more highly than troops who only ate the MRE for lunch.

Changes in Food Acceptability Over Time

Common experience and several research reports lead to the expectation that continuous feeding of the MRE over an extended period of time would produce a food monotony effect that would be reflected in a decline in food acceptability and a reduction in food intake.[3,5,6] Research on food monotony has not been entirely successful in defining the boundary conditions for this effect. At one extreme, Hashim and Van Itallie (1965) have reported that feeding a single liquid diet to obese subjects leads to a marked reduction in energy intake and large weight losses.[3] With more varied menus that provided either six distinct meals divided into two alternate daily menus[6] or 41 different foods grouped into four menus,[5] a decline in acceptability and consumption is observed. When food variety is expanded to a three day menu cycle these food monotony effects largely disappear.[4] The MRE, which provides 12 different menus with some repetition of items across days falls into the range where food monotony effects might be expected to occur. The likelihood of a food monotony effect is increased for those food items in the MRE that are least acceptable and for those individuals who find the ration lowest in acceptability.[5,6] The food intake data showed a decline over time for the MRE group that is consistent with a food monotony effect.

To examine changes in food acceptability over time, the individual items in the MRE ration were grouped into food classes and the ratings of each food class for each company were analyzed over the five weeks of the study with a 2(groups) X 5(weeks) analysis of variance. The comparison between the two companies also addresses to the issue of food monotony. The MRE company was eating these foods three times as often as the control company, and if a decline in acceptability occurred it should be evident in this group sooner and should be more pronounced. We grouped the MRE items into food classes for purposes of this analysis and intended to examine individual food items within each class only if there was a significant decline in acceptability for that food class as a whole.

Figure 24 shows the patterns of acceptability ratings over the course of the study for the food classes in which there were at least 4 items in the ration. Entrees comprised the largest (12 items) food class in the ration and the upper panel of this figure shows that they were rated more favorably by the MRE group ($F(1,2159) = 45.65$, $p < 0.001$) than by the control group. The two groups also showed different trends over time in their acceptability ratings of the entrees as revealed by a significant interaction between groups and weeks in the analysis of variance ($F(4,2159) = 3.72$, $p < 0.01$). The ratings of the MRE group improved from week one to week two and then remained relatively constant whereas the entree ratings of the control group were very similar through the first three weeks and then showed a small decline. The middle panel of this figure shows the dessert ratings. The overall ratings between the two groups did not differ but the trend in their ratings over time did ($F(4,2136) = 4.57$, $p < 0.001$). The dessert ratings of the MRE group improved gradually through the first three weeks and then remained relatively constant. The control group showed a small drop from the first week to the second and this was followed by gradually improving ratings.

The lower panel of this figure shows overall higher ratings of the dehydrated fruits by the MRE group ($F(1,422) = 3.98$, $p < 0.05$). Although the ratings appear to improve slightly over time, neither the effect of weeks nor the interaction between weeks and groups was statistically significant. Overall, this figure shows the complete absence of a decline in food acceptability over time in the group fed the MRE as their sole source of food. Food monotony as indexed by food acceptability ratings did not occur on this 12-menu ration. It appears that the MRE is sufficiently varied and sufficiently palatable to the troops to sustain high food acceptability ratings over this extended period of time. Another factor which probably contributes to both the high ratings and the improvement in these ratings over time in the group fed only MREs is that at the beginning of the study this ration was novel to the troops. They did not have favorite items or preferred ways of preparing them. Within a relatively short period of time, individuals developed unique methods for combining and preparing different components of the ration and after the field test, the participating company prepared an MRE cookbook. The cookbook both reveals their ingenuity and is another indication of the high level of motivation in these troops that we noted in Chapter 3.

Acceptability of the MRE for Breakfast, Lunch, and Dinner

An operational ration is meant to be fed for all three meals and for snacks as time permits. The 12 menus in the MRE are equivalent in terms of the kinds of items they provide and their nutritional properties. The question arises as to whether troops find them equally acceptable at different times of the day. Figure 25 shows the average ratings of all components of the MRE when they are eaten for breakfast, lunch or dinner. The ratings of the hot A ration meals consumed by the control group for breakfast and dinner are included in the analysis and the figure as a referent. The lunch ratings for the control group in this figure are for MRE meals. A two-way analysis of variance was used to test for the effect of meal type (breakfast, lunch or dinner) on food acceptability ratings of the troops fed only MREs or A

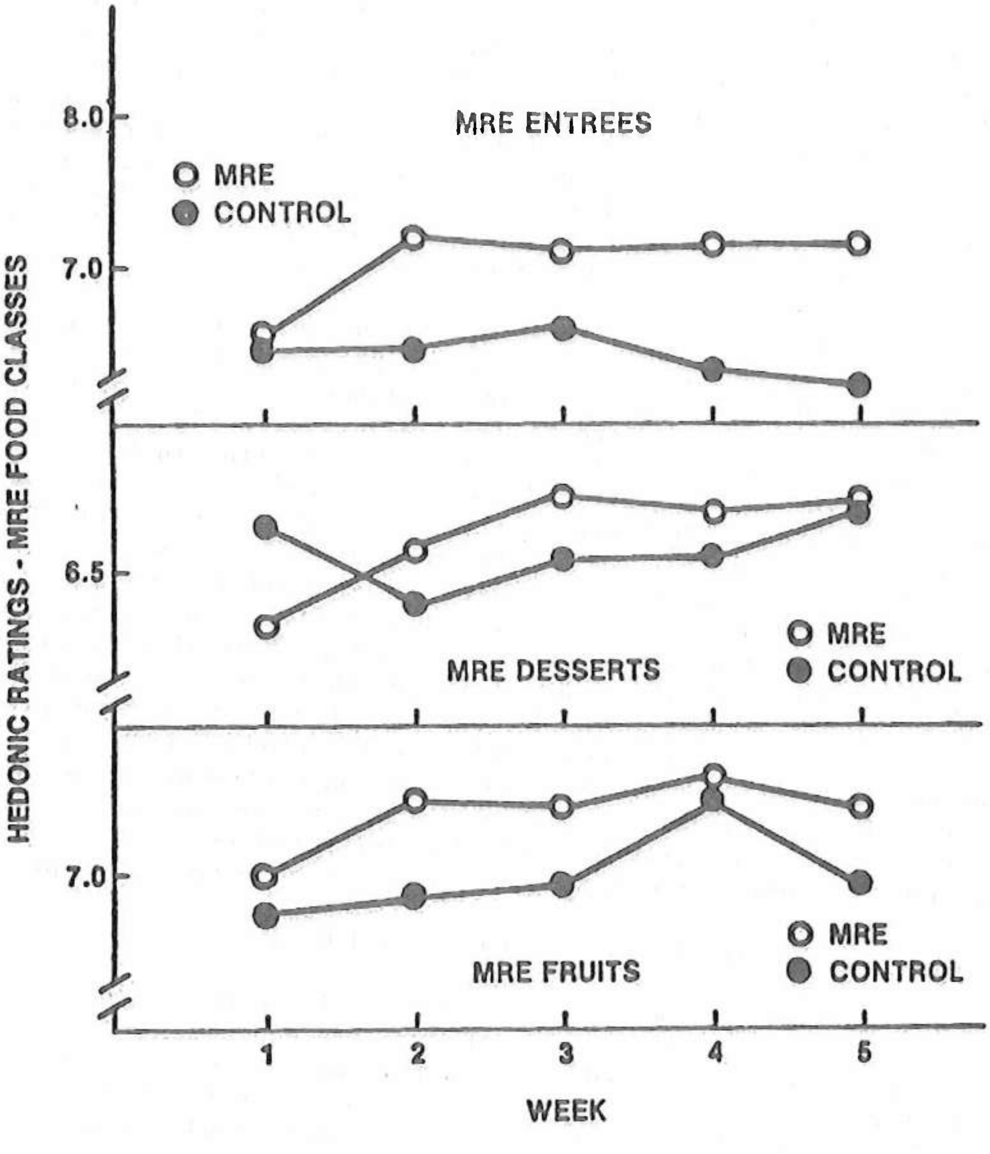

Figure 24. Mean Hedonic Rating of MRE Food Classes by MRE and Control Group During Each Week of Prolonged Feeding Test.

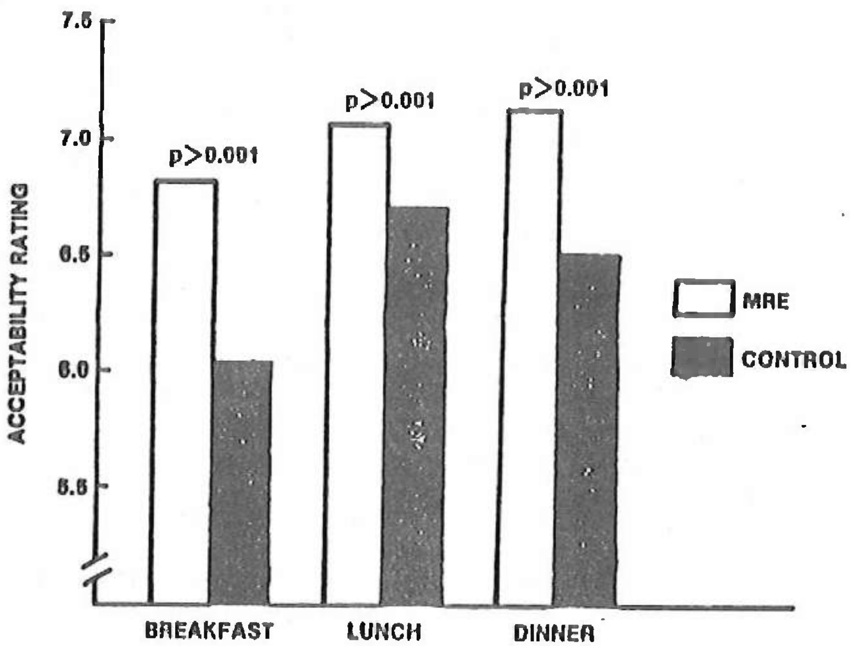

Figure 25. Mean Acceptability Ratings of Items Fed in Breakfast, Lunch and Dinner Meals to MRE and Control Group.

rations for breakfast and dinner and a MRE lunch. This analysis revealed that the MRE group rated their food as more acceptable than the control group ($F(1,3594) = 120.26$, $p < 0.001$) and the ratings of both groups were influenced by whether the meal was breakfast, lunch or dinner ($F(2,3594) = 26.38$, $p < 0.001$). Post hoc analysis revealed that for both groups, breakfast was rated lower than lunch or dinner ($p < 0.05$), which did not differ from one another.

The most surprising aspect of these data is that the group eating solely MREs rated their food higher at every meal than the group consuming hot breakfasts and dinners and an MRE lunch. There are many possible interpretations for this unexpected finding. We favor an explanation which emphasizes that the two groups were applying different internal standards for their ratings. The MRE group was probably rating their food in relation to other operational rations they had consumed whereas the control group was mentally comparing the steak or roast beef or scrambled eggs they were fed to these foods prepared and served under more ideal conditions. If this interpretation is correct, it is clear that the MRE compares favorably to other operational rations whereas the hot meals prepared and served under field conditions do not fare as well. This explanation still does not account for why the MRE group rated the MRE lunch more highly than the control group did. In the case of lunch, two additional factors may be operative. As previously mentioned, the MRE group developed novel ways of preparing this ration during the course of the study. They were also more likely to heat it and to rehydrate the dehydrated components (see Chapter 6). This extra effort would appear to enhance the product and lead to higher acceptability ratings. In addition, our impression was that the MRE company perceived the study as a challenge and may have responded to all aspects of the testing situation in a more positive manner than the control group.

The lower rating of the breakfast meal is consistent with our finding that the troops reported that they did not like the MRE as much for breakfast as they did for lunch or dinner (see Chapter 6). There are no traditional breakfast items in the MRE and this may contribute to the lower ratings. In conducting the study, we frequently noticed that the troops would have a hot beverage, crackers and cheese or peanut butter or cake for the breakfast meal and save the entree and other components for later in the day. In this manner, they rendered the MRE more like a light breakfast but may have inadvertently consumed fewer calories that were never compensated for during the rest of the day. In the case of the control group, the lower rating of the hot breakfast meal suggests that the quality of this meal was further from their internalized standard for a hot breakfast than the hot dinner meal was, and this led to a lower rating of this meal. It is important to note, however, that none of the ratings were in a range that would be regarded as a problem.

Comparison of MRE to A Ration Meals by Food Class

In addressing the issue of the acceptability of the MRE as breakfast, lunch and dinner, it became apparent that MRE meals received higher ratings than hot A ration meals. Although this unexpected finding is open to several interpretations, we sought to make the comparison of foods from these two rations more equitable by grouping the foods into the same food classes. Accordingly, both the MRE items and the A ration items were grouped into food classes in which there were at least four different items. The limited items in the MRE restricted these comparisons to entrees, desserts and fruits. There were simply too few items in the other food classes in the MRE to make more direct comparisons of this nature. Table 27 shows the average acceptability ratings of entrees, desserts (cakes, cookies) and fruits (dehydrated in the MRE vs. fresh or canned in A ration) in the two rations. In every case, the differences in acceptability were small, but the MRE food class was rated more highly than those from the A ration menu.

These data show that in both an absolute sense and relative to A rations, the MRE was rated very highly by troops who subsisted on this ration as their sole source of food.

TABLE 27. Acceptability Ratings of Comparable Items from MRE Ration and A Rations.

	MRE	A Ration
Entrees	7.05	6.48 **
Desserts	6.73	6.45 **
Fruits	7.44	7.23 *

*$p < 0.05$

**$p < 0.01$

Relationship Between Food Acceptability and Body Weight Loss

The acceptability data that have been presented in this report indicate that the MRE is highly acceptable to troops who subsist on this ration for an extended period of time. This high level of acceptability over time leads to the expectation that food consumption and body weight should not be adversely affected by prolonged feeding the MRE. Chapter 3 reports that the MRE company lost significantly more weight during the course of this study than the control group and Chapter 4 indicates that the MRE company was consuming 2189 calories per day whereas the control group was consuming 2950 calories per day. Is there a dissociation between an individual's rating of a food and how much he consumes of it or are there other reasons for the high acceptability of the MRE and the low caloric intake of this ration? As a first approximation to addressing this question, the 30 volunteers in the MRE company were grouped into two categories, a low weight loss group who lost less than 5% of their initial body weight and a high weight loss group who lost more than 7% of their initial body weight. Table 28 shows the acceptability ratings of the individual MRE items when the 30 volunteers from this company are grouped in this manner. Unfortunately, this

TABLE 28. Acceptability Ratings for MRE Items by High and Low Weight Loss Subjects in MRE Group.

Item	Low Weight Loss	High Weight Loss
Beef w/BBQ Sauce	5.85	6.15
Beef w/Gravy	6.71	7.23
Beef w/Spiced Sauce	6.51	5.71
Beef Patties	7.31	6.47
Beef Stew	6.76	8.35 ***
Chicken A La King	7.00	6.80
Frankfurters	5.57	7.22 *
Ham Slices	6.96	7.62
Ham/Chicken Loaf	6.92	7.36
Meatballs w/BBQ Sauce	6.12	7.44 *
Pork Sausage Patties	7.05	5.53 *
Turkey w/Gravy	7.45	8.05
Crackers	7.16	7.81
Potato Patty	6.63	6.58
Beans w/Tomato Sauce	6.60	6.56
Brownie	6.34	6.46
Cherry Nutcake	7.31	7.54
Chocolate Covered Cookie	7.13	6.20 *
Chocolate Nutcake	7.16	8.00
Fruitcake	6.00	6.40
Maple Nutcake	7.00	6.72
Orange Nutroll	5.73	6.30
Pineapple Nutcake	6.69	7.18
Cheese Spread	7.22	7.14
Jelly	6.54	7.62 **
Peanut Butter	6.41	6.97
Applesauce	7.53	5.83 **
Mixed Fruits	6.73	6.60
Peaches	7.17	4.93
Strawberries	8.00	7.91

*$p < 0.05$

**$p < 0.01$

***$p < 0.001$

breakdown does not provide any additional insight into the relationship between food acceptability ratings and weight loss. There were eight food items whose ratings differed significantly between the two groups. Five of these items were rated higher by the low weight loss group and three were rated higher by the high weight loss group. With the data considered in this analysis, it is possible for the individuals to find the MRE items they ate highly acceptable, but there may be many MRE items they rejected and these items would not show up in the acceptability ratings, which are based solely on the foods that were eaten.

Food Preferences

Figure 26 shows the food preference ratings for the four categories of food over the course of the study. The upper panel of this figure shows that the preference ratings for the 25 foods from the MRE menu were almost identical for the two groups and did not show any statistically significant changes over time. The lower three panels of this figure show very similar differences between the groups and patterns over time for the freshly prepared foods not being consumed by the MRE group. In each case, the MRE group showed a significant increase in preference rating for the foods at the first data collection point in the field (T2), but after this initial increase, there was no further change. The preference ratings of the control group tended to remain flat over the course of the study for the foods they were eating (control items) and for similar foods (high or low preference) drawn from the Armed Forces Food Preference Survey.[15] The increased preference ratings of the three categories of freshly prepared food (control items, high preference items and low preference items) by the MRE group suggests that they regarded these foods as different from what they were eating and as desirable. The control group, on the other hand, did not show any change in stated preference for foods they were not eating (high and low preference items from Armed Forces Food Preference Survey) suggesting that they perceived these foods as similar to what they were consuming on a daily basis and not more desirable as the study progressed. These observations provide weak evidence for the idea that the MRE group was finding the continuous regime of operational rations less than optimal and freshly prepared foods became more attractive to them.

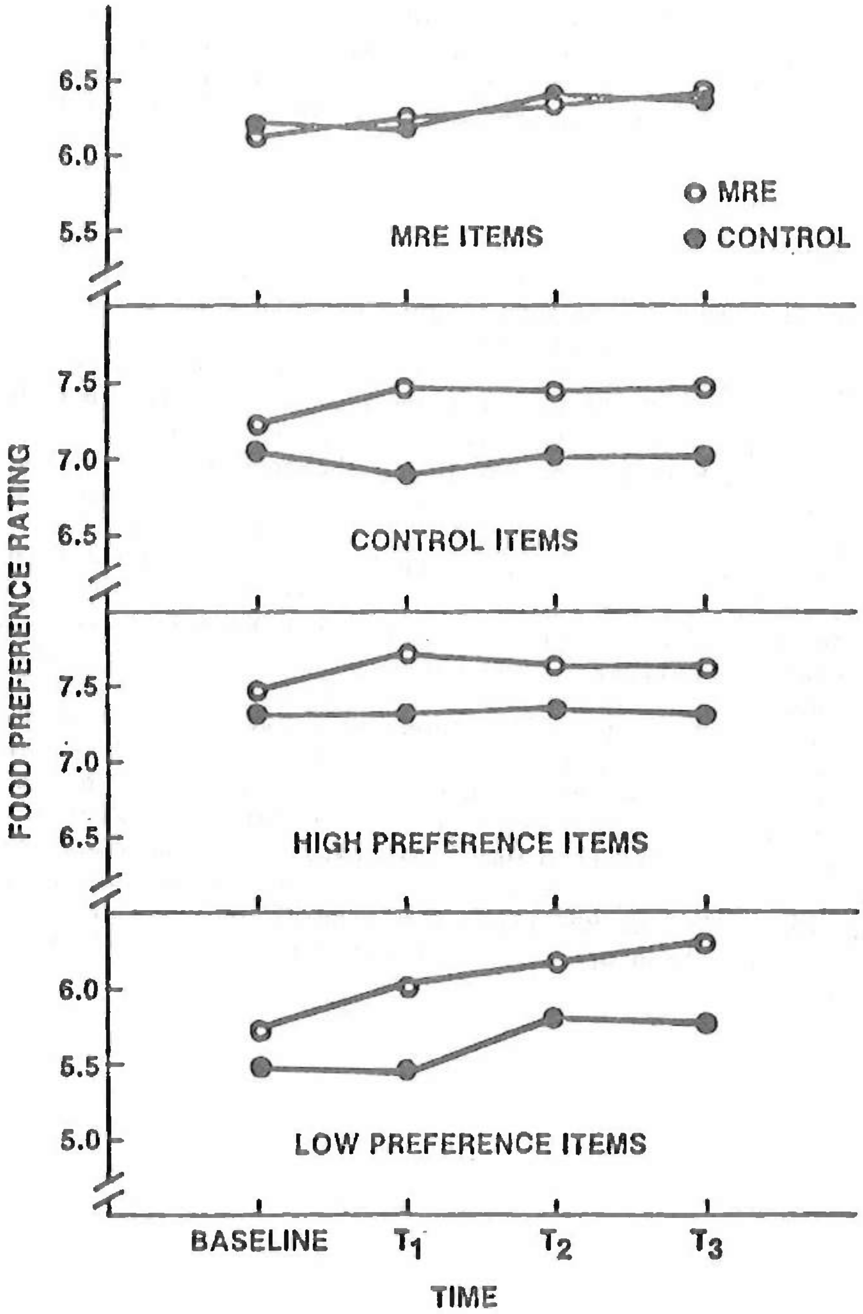

Figure 26. Mean Preference Rating Given to Different Types of Food Items by MRE and Control Group.

CHAPTER 6

TROOP OPINIONS OF THE RATION

Summary

In general the ration was well received by the troops. Differences between the two companies tended to be minor. The troops were generally satisfied with the ration's taste, appearance, variety, and ease of preparation. Their ratings of the amount of food it provided were in the neutral range and more detailed questions indicated that they felt that the portion size of some components were too small. Responses to the questionnaire also revealed three potential areas in which the ration could be improved: (1) The troops indicated that the entree and the dehydrated fruit portion sizes were too small. (2) The MRE group indicated that they liked the ration better for lunch and dinner than for breakfast. (3) The troops overwhelmingly indicated that they wanted more variety in the beverages that were included in the ration. The MRE group also indicated that they did not consume the ration at designated meal times. These factors may underlie the greater weight loss in the MRE company during the field test in comparison to the control group.

These findings, combined with other information from the field, have led to a plan to improve the MRE. The MRE is being redesigned to (1) increase the entree sizes, eliminate certain ration components and redesign other ration components, (2) introduce new breakfast items to increase breakfast acceptability and consumption, and (3) introduce a variety of beverages.

1. Introduction

The food acceptability data considered in the previous chapter did not provide a basis for explaining the relatively low food intakes that were observed during this field test. A questionnaire which was designed to obtain information about how the troops regarded the ration may provide more insight into this question or a basis for changing the ration so that consumption is improved.

Responses to the questionnaire (see Appendix I) provide both descriptive information about the ration and the interesting comparison between individuals who consumed it as their sole source of food for 34 days (the MRE group) and individuals who only ate the MRE for lunch (the control group). In addition, there were 30 volunteers in each group who participated in more intensive testing during the training exercise and whose answers can be compared with those from nonvolunteers. This questionnaire was administered to all the men in both companies on the last day of the field test.

2. Results and Discussion

Ratings of Five Ration Attributes

One section of the questionnaire (see Appendix I, Question 13) asked for ratings of five attributes of the MRE: the taste of the food, the appearance of the food, the amount of the food, the meal-to-meal variety, and the ease of preparing the MRE. The response scale ranged from 1 (Very Dissatisfied) to 7 (Very Satisfied). On this scale, a value of 4 represents the midpoint (Neither Satisfied nor Dissatisfied), and any rating above 4 is in the positive direction. The average ratings by the two dietary groups are shown in the upper portion of Table 29. Taste, appearance, meal-to-meal variety, and ease of preparation are rated above 4 by both groups ($p < 0.001$, t-test), which indicates that these aspects of the MRE were satisfactory to the troops. However, the amount of food in the MRE was rated lower than the other aspects, with the average ratings falling close to the scale midpoint. Thus, while troops did not consider the amount of food dissatisfactory, this characteristic is clearly the least satisfactory of the five aspects rated.

Both dietary groups rated the MRE similarly on the five aspects. Only on the question of ease of preparation do the two groups differ significantly ($F(1,167) = 5.4$, $p < 0.05$).* The MRE group, which had considerably more experience with the ration than the control group, was less satisfied with the ease of preparing it than the control group. However, even the MRE group's rating of 5.2 is above the midpoint of the scale, indicating that preparation is not perceived to be a problem.

The lower portion of Table 29 compares the average ratings of the same five aspects of the ration when the participants are classified as either volunteers, who underwent more intensive testing, or as nonvolunteers. Each average is based on data from both dietary groups. Volunteers gave significantly higher ratings (F-tests) than the nonvolunteers to all but one aspect of the MRE -- the amount of food. This finding is likely to reflect differences between the groups in their attitude towards the study. There was much more frequent contact between test personnel and the volunteers than the nonvolunteers, and more attention was paid to collecting data from these individuals. For these reasons, volunteers may have acquired a more positive attitude towards the study and the ration than the nonvolunteers. At the same time, volunteers may have felt that positive ratings were expected of them and may have consequently biased their ratings. However, while differences of this nature are of considerable interest to the social psychologist, they are of tangential importance to the present report, in which we are concerned with troops' opinions of the MRE and how these opinions differ between dietary groups.

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*STATISTICAL NOTE: Unless otherwise noted, F-ratio tests are based on a two-way analyses of variance, with diet and volunteer status as factors. The effect of unequal cell sizes was controlled either by applying equal cell weights or by using the least-squares approach.

TABLE 29. Mean Ratings of Satisfaction with Five Aspects of the MRE.

(7-pt. Scale, 1 = Very Dissatisfied)

	MRE GROUP (N=90)	CONTROL GROUP (N=81)
TASTE OF FOOD	5.5	5.3
APPEARANCE OF FOOD	5.4	5.2
AMOUNT OF FOOD	4.0	3.6
MEAL-TO-MEAL VARIETY	5.1	4.9
EASE OF PREPARATION	5.2	5.8*

	VOLUNTEERS (N=56)	NON-VOLUNTEERS (N=115)
TASTE OF FOOD	5.8	5.2***
APPEARANCE OF FOOD	5.8	5.0***
AMOUNT OF FOOD	4.0	3.7
MEAL-TO-MEAL VARIETY	5.4	4.7**
EASE OF PREPARATION	5.9	5.3*

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

Additional questions on the survey explored three of these dimensions in more detail (amount of food, variety, and ease of preparation), while the sensory dimensions of the food (taste and appearance) are explored in detail in the food acceptability questionnaires.

Ratings of Portion Size

Question 17 on the survey asked the troops to rate the portion sizes of six classes of MRE components. The response scale ranged from 1 (Portion Much Too Small) to 7 (Portion Much Too Large). The average ratings by each dietary group are shown in Table 30. All averages fall below 4 ($p < 0.001$, t-test), which represents a satisfactory portion size. Thus, both dietary groups judged the portions in the MRE to be too small. The ratings from both groups are highly similar, except for the ratings of the portion size of drinks ($F(1,173) = 3.7$, $p = 0.055$), which was less satisfactory to the MRE group. Of the six classes of MRE components, the entree portions and the portions of dehydrated fruit were rated less satisfactory by both groups than the other portion sizes. The reason for the group difference in ratings of drinks may reflect other aspects of the test situation rather than satisfaction with beverage portion size per se. During the field test, there were many days on which the control group was in the general vicinity of the mess tent. On those days they had access to juice, milk, and coffee at non-meal times. Similarly, the range of beverages available to this group at meals (milk, juices, tea, and coffee) was broader than those available to the MRE group who were restricted to water, coffee, and cocoa. It is possible that these factors influenced how beverage portion size of the MRE was rated by the two groups. Overall, it is clear from Table 30 that portion sizes are an aspect of the MRE ration that do not satisfy the user, with the problem being most pronounced for the entrees and the fruits.

Ratings of Variety in the MRE

Question 16 asked the troops to rate the variety of seven classes of MRE components. A four-point scale was used, ranging from 1 (Variety Not Enough) to 4 (Should Be Much More Variety). The mean ratings by each dietary group are listed in Table 31 and indicate that both dietary groups want at least somewhat more variety in each class of components. Furthermore, for both groups drinks was the item most in need of greater variety. However, the MRE group, subsisting solely on the MRE with water, coffee, and cocoa as the only beverages, experienced a greater need for additional drinks than the control group ($F(1,151) = 10.5$, $p < 0.01$).

The dietary groups also differed in their ratings of the variety among accessory items, such as spices and condiments ($F(1,151) = 7.0$, $p < 0.01$). The MRE group wanted more variety in this category than the control group. Prior to the exercise, the decision was made to provide hot sauce to the MRE group. It is not a component of the MRE. We made the decision to provide hot sauce in an effort to limit other nonissued food during the test. Our reasoning was that it would be futile to attempt to prohibit hot sauce in the field, and if hot sauce were smuggled into the field other food items would soon follow.

TABLE 30. Mean Ratings of the Portion Size of Six Classes of MRE Components.

(7-pt. Scale, 1 = Portion Much Too Small)

	MRE GROUP (N=90)	CONTROL GROUP (N=87)
ENTREES	2.7	2.4
SIDE DISHES (STARCH, VEGETABLE)	3.4	3.2
DESSERTS	3.4	3.1
FRUIT (DEHYDRATED)	2.6	2.5
SUPPLEMENTARY ITEMS (e.g., CHEESE SPREAD)	3.4	3.3
DRINKS	2.9	3.3 *

* p = 0.055

TABLE 31. Mean Ratings of Meal-to-Meal Variety for Seven Classes of MRE Components.

(4-pt. Scale, 1 = Variety Not Enough)

	MRE GROUP (N=82)	CONTROL GROUP (N=73)
ENTREES	2.4	2.6
SIDE DISHES (STARCH, VEGETABLE)	2.5	2.6
DESSERTS	2.3	2.7
FRUIT	2.5	2.7
SUPPLEMENTARY ITEMS (E.G., CHEESE SPREAD)	2.4	2.5
ACCESSORY ITEMS (E.G, PEPPER, HOT SAUCE)	3.0	2.5*
DRINKS	3.5	3.0*

* $p < 0.01$

We believe that this approach was successful. The MRE group's ratings of the variety among accessory items indicates the importance the MRE group placed on the availability of items such as hot sauce.

The differences between dietary groups in the ratings of variety may reflect differences in the degree to which the two groups supplemented their diet with privately purchased (nonissued) food. Question 35 asked respondents if they had eaten any such foods. Only one member of the MRE group indicated that he had, whereas 30 (35%) of the control group indicated they had supplemented their diet at least once during the field test. The most frequent of these non-issued items were sodas, juices, and a variety of desserts.

In summary, the ratings of variety in Table 31 indicate that both dietary groups think that greater variety is needed, especially among drinks. Differences between the groups in their ratings of variety resulted from differences in their diets, but may also have been the result of differences in the amount of nonissued food that was eaten.

Ease of Preparing the MRE

Table 29 revealed that the MRE group was less satisfied with the overall ease of preparing the MRE than the control group. More detailed information on how the two groups rated this aspect of the MRE is available from answers to Question 27. Table 32 shows how satisfied the two groups were with four steps involved in preparing the MRE. The response scale ranged from 1=Very Easy to 7=Very Difficult. None of the steps involved in preparing the MRE represent a real problem to the two groups. Opening the outer bag (pouch) was rated more difficult by the MRE group than by the controls. However, further analysis reveals that this difference between groups exists only among non-volunteers, where the mean ratings were 4.4 and 2.9 for MRE and control groups respectively. Among volunteers, the two groups gave the same rating (3.6). The reason for this discrepancy is not clear.

Questions 19 and 22 explored reasons for not heating and not rehydrating components of the MRE. Overall, the MRE group was more likely to rehydrate the dehydrated components than the control group. In the MRE group, 70% of the respondents reported always rehydrating their dehydrated components, whereas in the control group only 40% reported doing so (chi-square = 14.0, 1 df, $p < 0.001$). Similarly, the MRE group was more likely to heat the entree than the control group. Eighteen percent of the MRE group, but only 7% of the control group reported always heating the entree (chi-square = 3.5, 1 df, $p = 0.06$). This indicates that the MRE group, which ate MRE's three times a day, more fully prepared the ration than the control group. Heating and rehydrating tend to make the ration components taste better, and the MRE group appears to have taken greater advantage of these methods of enhancing the ration than the control group.

Questions 19 and 22 provided respondents with a list of reasons for not heating or rehydrating their ration components. Table 33 shows the frequency and the percentage of respondents mentioning each of the seven reasons for not heating the entree. Since no differences between dietary groups were evident, results are presented for the combined sample. Of the seven reasons, the two most frequent reasons mentioned for not heating the entree were the absence of appropriate equipment (52% mention) and the lack of time to heat an entree (51%). Heat tabs were in short supply during this exercise, and troops often resorted to heating entrees by laying them in the sun or placing them on the hoods of their vehicles. A follow-up question asked which of the listed reasons was the single most important reason for not heating an entree. Forty percent (40%) of the respondents indicated that the lack of equipment was the only or most important reason for not heating an entree, only 28% identified the lack of time as most important. In addition, the mild climate made heating the entree less important than it would have been in colder weather.

Table 34 shows the frequency with which different reasons for not rehydrating a dehydrated component were mentioned. Lack of time was mentioned most frequently (13%). The lack of available water for rehydration was mentioned by only 8%, indicating that water supply was not a problem for rehydration.

Overall, the results presented in this section suggest that preparing the ration did not present any significant problems to either group.

Ratings of the MRE When Eaten for Breakfast, Lunch and Dinner

The MRE does not presently contain specific breakfast foods. For this reason, the MRE group was asked (Question 9) to separately rate how much they liked eating the MRE for the three meals. The average ratings (N=89) were 3.8, 5.2, and 5.2 for breakfast, lunch, and dinner respectively, on a scale where 1 = Dislike Very Much and 7 = Like Very Much. These averages differ significantly ($F(2,174) = 39.7$, $p < 0.001$). Ratings of lunch and dinner do not differ ($t(88) = 0.2$, $p > 0.8$), but breakfast was rated lower than the average of lunch and dinner ($t(88) = 7.6$, $p < 0.001$). The ratings demonstrate that the MRE is not liked equally for all meals. This finding is identical to the acceptability data on the MRE when eaten for breakfast, lunch or dinner (see chapter 5).

Reported Hunger During the Exercise

Respondents were asked (Question 14) how hungry they felt between meals during the first and last week of the exercise. The response scale ranged from 1 (Not At All Hungry) to 4 (Very Hungry). The average ratings are presented in Table 35, where the results have been broken down by dietary group and volunteer status. In interpreting these data, it is important to bear in mind that the ratings are based on recollections of how hungry the troops felt at these time points. All groups reported being at least somewhat hungry during the first week of the test. The control group, however, reported being nearly as hungry during the last as the first week, whereas the

TABLE 32. Mean Ratings of Ease of Preparing the MRE.

(7-pt. Scale, 1 = Very Easy)

	MRE GROUP (N=88)	CONTROL GROUP (N=76)
OPENING OUTER BAG	4.2	3.2*
OPENING INDIVIDUAL PACKETS	2.5	2.2
HEATING ENTREE	3.6	3.4
REHYDRATING DRY COMPONENTS	2.5	2.3

* $p < 0.01$

TABLE 33. Reasons for Not Heating Entree in MRE.

	FREQUENCY OF MENTION	% MENTION (N=172)
NO EQUIPMENT FOR HEATING	90	52
NOT ENOUGH TIME TO HEAT	87	51
TOO MUCH TROUBLE TO HEAT	49	28
NOT ENOUGH WATER AVAILABLE FOR HEATING	40	23
OTHER REASONS	18	10
ENTREES TASTED BETTER COLD	10	6
ENTREES HAD BETTER TEXTURE COLD	6	3

TABLE 34. Reasons for Not Rehydrating MRE Components.

	FREQUENCY OF MENTION	% MENTION (N=163)
NOT ENOUGH TIME TO MIX WITH WATER	22	13
TOO MUCH TROUBLE TO MIX WITH WATER	20	12
OTHER REASONS	19	12
DEHYDRATED FOODS TASTE BETTER DRY	19	12
NOT ENOUGH WATER AVAILABLE FOR MIXING	13	8
DEHYDRATED FOODS HAVE BETTER TEXTURE DRY	9	6

TABLE 35. Mean Ratings of Hunger Felt Between Meals.

(4-pt. Scale, 1 = Not At All Hungry)

VOLUNTEERS:

	FIRST WEEK	LAST WEEK
MRE GROUP (N=27)	2.2	1.7
CONTROL GROUP (N=28)	2.5	2.5

NONVOLUNTEERS:

	FIRST WEEK	LAST WEEK
MRE GROUP (N=62)	2.8	2.5
CONTROL GROUP (N=55)	2.4	2.3

MRE group felt less hungry during the last than the first week (interaction $F(1,168) = 4.1$, $p < 0.05$). This marked difference between the dietary groups is consistent with our previous finding on the Environmental Symptoms Questionnaire (see Chapter 3) that the MRE group responded with increasing frequency to the item "I have lost my appetite" over the course of the exercise, whereas the control group did not. The ratings of hunger felt at the beginning and the end of the exercise reflect a similar difference between the two groups.

Characteristics of the MRE in Relation to Body Weight Loss

The MRE group lost significantly more weight during the course of the field test than the control group. The present survey sheds some light on a potentially contributing factor to the weight loss. Question 10 asked the respondents to indicate when they tended to eat their combat ration: at designated meal times, throughout the day as time permitted, or both. The results are shown in Table 36. Only 8% of the MRE group reported eating the MRE at designated meal times, whereas 22% of the control group reported doing so (chi-square = 7.9, 2 df, $p < 0.05$). This result suggests that the control group, which ate its A ration breakfast and dinner at regular meal times, tended to eat lunch (the MRE) at regular times also. Thus, the control group more readily adopted a three-meal-a-day pattern of consumption than the MRE group. The absence of any temporal structure in eating among the MRE group may have contributed to their greater weight loss.

Comments on Different Aspects of the MRE

The troops were given an opportunity to comment on what foods or drinks they would like added to the MRE (see Questions 33 and 34). Table 37 shows the distribution of responses in the beverage category, combined over both groups. Over half (55%) of the respondents mentioned Kool-Aid as a desirable addition. The MRE group mentioned Kool-Aid more frequently (66%) than the control group (43%). This result is consistent with the finding reported earlier that the MRE group wanted a greater variety of drinks than the control group. Overall, Table 37 indicates a clear desire for additional beverages.

Among foods to be added, no clear response pattern emerged. No single food item was mentioned by more than 3% of the total sample. A new entree was mentioned by 12%, a new dessert by 9%.

Table 38 lists the MRE items that respondents mentioned they would like dropped from the ration. No single item stands out as particularly unpopular. It was noted that the proportion of troops wanting the beef or pork patty dropped was higher in the control group than in the MRE group. During the exercise, the MRE group developed innovative ways of combining these dehydrated components with other items (for example, soup base or dehydrated potato patty), thereby possibly enhancing the taste of the beef and pork patty. Also, it was noted in an earlier section of this chapter that the MRE group more consistently rehydrated their dehydrated components than the control group, adding to the popularity of the dehydrated items.

TABLE 36. Times at Which MRE Rations Were Consumed.

	MRE GROUP (N=89)		CONTROL GROUP (N=81)	
	FREQUENCY	% MENTION	FREQUENCY	% MENTION
AT DESIGNATED MEAL TIMES	7	8	18	22
THROUGHOUT THE DAY AS TIME PERMITTED	38	43	24	30
BOTH OF THE ABOVE	44	49	39	48

TABLE 37. Drinks Respondents Would Like Added to the MRE. (MRE and Control Groups)

	FREQUENCY OF MENTION	% MENTION (N=179)
KOOL-AID	98	55
TEA	32	18
FRUIT JUICE	14	8
EVAPORATED MILK	11	6
TANG	7	4
COCOA (MORE)	7	4
LEMONADE	5	3

TABLE 38. MRE Components Respondents Would Like Dropped. (MRE and Control Groups)

	FREQUENCY OF MENTION	% MENTION (N=179)
PORK PATTY	19	11
BEEF W/SPICE SAUCE	18	10
CHICKEN A LA KING	18	10
POTATO PATTY	17	9
HAM/CHICKEN LOAF	17	9
BEEF PATTY	16	9
BEANS	15	8
ORANGE NUT ROLL	12	7
BEEF W/BBQ SAUCE	12	7
FRUITCAKE	10	6
FRANKFURTERS	8	4
MEATBALLS W/BBQ SAUCE	8	4
BEEF W/GRAVY	5	3
PEACHES	5	3

Respondents were also asked to comment on any other aspect of the MRE (Question 37). Only 77 out of 179 respondents provided any comments. The most frequent comment (mentioned by 16% of the total sample) was that the MRE was better than C rations (MCIs). Approximately 10% made generally positive comments about the MRE. The response proportions for other comments were less than 5%.

Ranking of Suggested Improvements to the MRE

Towards the end of the survey (Question 36), the troops were asked to rank order the importance of five hypothetical changes to the MRE. Table 39 shows the average rank for each proposed change, along with the relative importance of that change as indicated by its rank among the list of five. Both dietary groups considered making the entree portion larger the most important change. This is consistent with the finding that the size of the entree portion was among the least satisfactory of the MRE components.

The rank ordering of the proposed changes is the same for both groups, if one excludes the proposed inclusion of breakfast items. This change is ranked higher by the MRE group than by the control group. Since the MRE group ate MREs for breakfast and the control group did not, the MRE group is more qualified to judge the importance of this change. Ratings of breakfast by the MRE group suggest that eating the MRE for breakfast is less satisfying than eating it for lunch or dinner. The response to the present question underscores the importance to the MRE group of additional breakfast items in the MRE menu.

It should be noted that adding drinks was not among the five proposed changes that respondents rated in Question 36. Other results of this survey, however, have pointed to a perceived lack of variety in this area, suggesting that such a change would be welcomed.

TABLE 39. Mean Rank of Five Proposed Changes to the MRE.

(1 = Most Important Change)

	MRE GROUP (N=88)		CONTROL GROUP (N=87)	
	MEAN	RANK	MEAN	RANK
BETTER TASTE	3.5	4	3.0	3
LARGER ENTREE PORTIONS	2.3	1	2.2	1
INCREASED VARIETY	2.7	3	2.5	2
INCLUSION OF BREAKFAST ITEMS	2.4	2	3.3	4
EASIER PREPARATION	4.1	5	3.9	5

CHAPTER 7

BODY MEASUREMENTS, HYDRATION, AND BLOOD NUTRIENTS

Summary

The effects of MRE operational rations upon selected body dimensions, urine, and blood components were measured prior to and during a 34-day field trial. Comparisons were made between men in an experimental company (subsisting solely on MRE rations) and a control company (fed freshly prepared A rations morning and evening), and within each group of men over the duration of the trial. Body heights were comparable and unchanged in both companies. Body weights were not significantly different between both companies before the start of the field trial. Weights decreased during the trial. At the end of the trial, men in the experimental company weighed, on the average, 1.7 kg (3.74 lb) less than men in the control company. On both an absolute and percentage basis, the men of the experimental company lost significantly more weight than did men of the control company. The percentage of body fat was higher among volunteers in the experimental company than in the control company initially. The percentages of body fat declined in both companies during the field trials. The decline was greater in the experimental company; at the end of the trial the percentage of body fat was comparable in both companies. It would seem that there was a tendency for more weight and more fat to be lost by troops subsisting on the operational ration than by troops having access twice a day to hot meals. However, body dimensions and percentages of fat were comparable in both groups at the end of the trial.

Urine volumes tended to be somewhat lower, and concentrations (osmolalities) higher in the experimental company, but most differences were not significant. Analysis of the urinary data did not provide evidence of dehydration among troops in either company. In most instances, analysis of blood constituents did not demonstrate significant differences between volunteer troops of the two companies, or any values outside of accepted normal or usual ranges. Hemoglobin and hematocrit values rose during the field trial in accordance with expected changes when men are taken from near sea level to a higher elevation. Plasma albumin and total protein values in both companies were consistent with adequate protein and energy status. Values for serum vitamin C were normal throughout the field trial. Values for retinol (vitamin A) in serum were at the upper range of normal values in barracks and in the field. Serum folate values fell during the trial in both companies. Plasma vitamin B_6 coenzyme activity rose above normal during the field trial in the experimental company but not in the control company. Serum zinc levels and plasma alkaline phosphatase activity remained within normal limits in both companies. The experimental company experienced lower serum zinc concentrations and higher urinary zinc losses than the control company. The data indicate that zinc status was normal in both companies, but that increased urinary zinc excretion accompanied increased loss of weight in volunteers of the experimental company.

With the exception that troops subsisting solely on the MRE combat ration tended to lose body weight more rapidly than troops fed two hot meals daily, the above information indicates that consumption of the MRE ration maintained nutritional status as well or better than consumption of a diet containing two hot meals prepared in field kitchens (A ration) and one meal consisting of MRE packets. Loss of weight occurs when expenditures of energy exceed intakes. One would need to explore energy expenditures as well as dietary energy intakes in order to assess properly the value of MRE rations for maintaining body weight of operational troops.

1. Introduction

The low levels of food intake observed in the troops fed solely operational rations could result from a variety of causes. One factor that is frequently associated with anorexia in both the laboratory and the field is dehydration. This chapter examines several indices of body fluid status in an effort to examine whether thirst and dehydration contributed to the low levels of food intake.

Thus far in this report several factors that may have contributed to the low levels of food intake in troops fed only MRE operational rations have been considered. The major question that has to be addressed is whether these low levels of nutrient intakes had a negative impact on troop well-being, nutritional status, and performance capacity. Chapter 3 revealed that the troops fed the MRE lost more weight than the control group fed an A ration breakfast, an MRE for lunch, and an A ration dinner, but they were not sick and did not show any major differences in the frequency with which they reported experiencing physical symptoms or discomfort relative to the control group. This chapter examines the changes in body weight, body fat, and nutritional status that occurred during the field test in an effort to detect any harmful consequences of the low food intakes that were observed.

2. Methods

Body measurements

Height was measured by one individual using a wooden headpiece made to slide along an aluminum meter stick affixed to the wall and adjusted to vertical with a carpenter's level. Footgear was removed and height was read to the nearest 0.1 cm. Weight was measured indoors by two individuals using leveled balances (model 230 Health O Meter, Continental Scale Corporation, Bridgview, IL) resting on a hard floor and protected from air currents. Foot and headgear and any heavy pocket contents were removed and weight was read to the nearest 0.25 lb (and later converted to the nearest 0.1 kg). The balances were calibrated with 5-kg weights before each use. Body fat was computed from skinfold thicknesses measured at four sites according to the Memorandum for Army Dietitians and Physical Therapists, dated 30 January 1983 (Appendix J). Skinfold thickness was measured with a factory-calibrated Harpenden caliper (British Indicators, Ltd., St. Albans, Herts, England) to the nearest 0.1 mm on the right side of the body. Measurements were taken in triplicate at the biceps, triceps, subscapular skinfold and suprailiac skinfold by one individual.

Percent body fat was computed from the sum of four mean values according to the age of the soldier with use of tables supplied by Durnin and Womersley (1974).[16]

Urine

Twenty-four hour urine samples were collected in two-liter plastic refrigerator bottles without preservative and refrigerated for no longer than 8 hours, after which they were mixed by shaking and the volume measured to the nearest mL. Aliquots of urine were next poured into plastic culture tubes and kept in a freezer for analysis.

Blood

Antecubital vein blood was collected by Army medical personnel in sterile evacuated tubes (Vacutainer, Becton-Dickinson Company, Rutherford, New Jersey) by means of multiple sample needles. Six tubes were filled at each bleeding as follows: Four 10-mL tubes for preparation of serum, one 7-mL tube containing ethylenediamine tetraacetic acid (EDTA) for preparation of plasma and one 4-mL tube containing EDTA for collection of uncoagulated, uncentrifuged whole blood. Serum for determination of ascorbic acid, folate, and zinc was poured into plastic culture tubes and frozen. These tubes were shipped frozen on dry ice to the laboratory and kept in a freezer for analysis. Serum for determination of albumin, total protein and retinol were wrapped in aluminum foil and kept refrigerated until analysis. Plasma for determination of pyridoxal phosphate was kept in tubes wrapped in aluminum foil and kept frozen until analysis. Whole blood was kept refrigerated until analyzed. No chemicals were used to protect serum ascorbic acid from oxidation during shipment to the laboratory.

Analyses

Urine was analyzed for osmolality and its content of creatinine and zinc. Osmolality was determined within two days after arrival of urine to the laboratory by means of a freezing point osmometer (Model 3DII, Advanced Instruments, Inc., Needham Heights, MA). Determinations were done in duplicate with aliquots of 0.25 mL of urine. Creatinine was determined using the Jaffee reaction as modified for use with the Technicon Auto Analyzer II (Technicon Instruments Corporation, Tarrytown, NY).

Urine samples with osmolality below 500 mOsm/kg and creatinine below 0.75 mg/mL were considered invalid, and were dropped from further consideration. Ten such samples were dropped from the experimental (MRE) group and 17 from the control group. Note that in the absence of large swings in the amount of meat consumed, the hourly excretion of creatinine in urine is relatively steady (creatinine arises both from the diet and from muscle metabolism), and it depends on the amount of an individual's lean body tissue. When the daily urine volume is within normal limits, a very low concentration of creatinine means that the total amount of creatinine in the urine must be low, and this in turn is likely only if the sample represents less than a full day's collection. The justification for dropping these samples was that their low osmolality and creatinine concentrations, together with their normal volumes suggested the possibility that the sample volumes represented less than a full

24 hours' collection but had been supplemented by adding water or that the samples had come from soldiers who had imbibed alcoholic beverages during the collection day.

Zinc was analyzed in undiluted urine with a double beam atomic absorption spectrophotometer (Model 303, Perkin-Elmer Corporation, Norwalk, CT). Absorption was read at 211.2 nm and displayed on a recorder. Precautions were taken to minimize contamination with environmental zinc as follows: (1) plastic bottles used for urine collection were rinsed three times with zinc-free distilled water, and random checks showed no contamination; (2) all glassware and plastic ware used for analyses was soaked in 1 N HCl, rinsed in 1% (w/v) EDTA solution and then rinsed three times with zinc-free distilled water; and (3) test tubes used for analyses were randomly checked and found to be free of contamination. Eight new tubes were checked initially (of 240 to be used), and another three tubes were checked during four days used for the analyses.

Additional precautions were taken for analysis of serum zinc: (1) Vacutainers used for blood collection were checked for zinc contamination and found to contribute no detectable zinc; and (2) the Vacutainers used for preparation of serum for zinc analysis were not inverted after blood was drawn, in order to prevent contact of blood with the rubber stoppers (known to be a source of zinc contamination). Samples of 0.5 mL of serum were diluted threefold prior to analysis. Diluted serum was analyzed for zinc using the same technique as for urine (described above).

All other analyses of whole blood, blood plasma, and blood serum were made by Bio-Science Laboratories at the Hawaii Branch in Honolulu (hematocrit, hemoglobin, serum albumin, serum total protein) or at the main laboratory in Van Nuys, California (alkaline phosphatase, ascorbic acid, folate, pyridoxal phosphate, retinol). The methods used were based on the following procedures:

Hematocrit was measured after centrifugation with use of micro hematocrit tubes. Hemoglobin was determined by the cyanmethemoglobin method.[17] Serum total protein was determined by the biuret reaction.[18] Total globulins were then determined by reading the purple color developed by reacting them with glyoxylic acid under acid conditions,[19] and the serum albumin determined by difference. Serum alkaline phosphatase was measured at 37°C, with use of paranitrophenylphosphate as the substrate.[20] Serum total ascorbic acid was measured by oxidation and coupling to 2,4-dinitrophenyl-hydrazine.[21] Serum folate was determined by radioimmunoassay, with use of ^{125}I-labeled pteroylmonoglutamic acid competing with N^5 - mtheyltetrahydrofolic acid in the sample for binding to beta-lactoglubulin .[22] Plasma pyridoxal 5'-phosphate was determined after incubation with tyrosine decarboxylase apoenzyme and L-tyrosine-1-^{14}C; enzyme activity was quantitated by counting the radiocarbon released by decarboxylation in a scintillation spectrometer.[23] Serum retinol was determined by reacting extracted material (in petroleum ether) with dichloropropanol; values were corrected for the presence of carotene in the serum.[24] Detailed methodology is given in Appendix K.

3. Results and Discussion

Statistical comparisons were made by means of analysis of variance and, where F values were significant at $p < 0.005$, by Scheffe's tests at alpha = 0.05, with use of programs available from the Statistical Analysis System (SAS), SAS Institute, Inc., Cary, NC 27511.

Body Measurements

Body heights did not differ significantly between companies and did not change with time (Table 40). Body weight was obtained for 71 men in the MRE company and 68 men in the control company at the initiation (Period 1) and completion (Period 4) of the study. The initial body weights of volunteers and nonvolunteers were not significantly different. When the initial body weights were compared between all 71 men in the MRE company and 68 men in the control company, they did not differ significantly (76.0 kg and 77.0 kg, respectively). At the end of the field trial, at period 4, the weights had, on the average, decreased, and the body weights in the MRE company were significantly lower ($F = 3.93$, $p < 0.05$) than those in the control company (72.3 kg compared to 74.0 kg,) (Table 41). A very large majority of the men in both companies lost weight during the field trial. In the MRE company 69 of 71 men lost weight. Two individuals gained, 0.1 and 0.2 kg, respectively. In the control company, of 68 men 57 lost weight, two men had no weight change, and nine gained weight. Average weight losses in kg and average percentage weight losses were calculated for each company (Table 42). The maximum weight loss in the MRE company was 8.9 kg (19.5 lb) and in the control company 6.6 kg (14.5 lb). Weight losses were highest among the MRE volunteers and next highest among MRE nonvolunteers, while the losses in the control company were smaller. The weight loss was significantly greater among MRE volunteers than MRE nonvolunteers ($p < .05$ by Scheffe's test). Men in the MRE company lost significantly more weight than those in the control company (3.7 kg compared to 2.1 kg).

Since the MRE volunteers had initially higher body weights than the control volunteers, it was decided to investigate losses of body weight as a percentage of the initial weights. This analysis showed that, regardless of volunteer status, the men in the MRE company lost a significantly greater percentage of their initial weight than did men of the control company (4.7% compared to 2.6%). Data on dietary intakes of energy by the volunteers of the MRE and control companies provide insight as to why weight losses occurred and why they were greater in the MRE company. The intakes (full information shown in Chapter 4) in both companies were below the nutritional standards for operational rations (NSOR) provided by the Surgeon General, 3,600 kcal/day. Over the entire period of the field trial, energy intakes of MRE volunteers averaged 2,189 kcal/day (60 percent of NSOR), while those of control volunteers averaged 2,950 kcal/day (82 percent of NSOR).

TABLE 40. Mean Body Height (cm).

Period 1	N	Mean ± SEM	F*	p
MRE	27	176.2 ± 1.1		
Control	30	177.2 ± 2.2	0.39	0.536
Period 4				
MRE	27	176.3 ± 1.1		
Control	30	177.2 ± 1.2	0.31	0.580

*Comparison is between MRE and control groups.

TABLE 41. Mean Body Weight (kg).

	N	Mean ± SEM	F*	p
Period 1				
MRE volunteers	27	79.0 ± 1.9		
nonvolunteers	44	74.1 ± 1.3		
combined	71	76.0 ± 1.1		
CONTROL volunteers	30	77.3 ± 1.6		
nonvolunteers	38	76.9 ± 1.3		
combined	68	77.0 ± 1.0	0.52	0.473
Period 4				
MRE volunteers	27	74.3 ± 1.6		
nonvolunteers	44	71.1 ± 1.2		
combined	71	72.3 ± 1.0		
CONTROL volunteers	30	75.2 ± 1.4		
nonvolunteers	38	74.8 ± 1.2		
combined	68	75.0 ± 0.9	3.93	0.049

*Comparison is between groups for volunteers and nonvolunteers combined.

TABLE 42. Mean Body Weight Loss (kg and percent).

Kg	N	Mean ± SEM	F*	p
MRE volunteers	27	4.70 ± 0.47		
nonvolunteers	44	3.04 ± 0.28		
combined	71	3.67 ± 0.25		
CONTROL volunteers	30	2.11 ± 0.42		
nonvolunteers	38	2.07 ± 0.37		
combined	68	2.09 ± 0.27	18.57	0.0001
Percent				
MRE volunteers	27	5.78 ± 0.54		
nonvolunteers	44	4.00 ± 0.36		
combined	71	4.68 ± 0.30		
CONTROL volunteers	30	2.57 ± 0.49		
nonvolunteers	38	2.61 ± 0.45		
combined	68	2.59 ± 0.33	21.74	0.0001

*Comparison is between groups for volunteers and nonvolunteers combined.

The initial differences in body weight between MRE and control volunteers corresponded to differences in the percentage of body fat prior to the trial (Table 43). The percentage of body fat in MRE volunteers in barracks was significantly higher than that of control volunteers. The volunteers of both companies lost body fat faster than lean body mass, so that their percentages of body fat at the end of the field trial were significantly lower than at the start (both groups combined).

The decrease from 18.0 to 15.3 in the percentage of body fat in MRE volunteers was significant ($F = 3.28$, $p < 0.05$). The smaller decrease from 15.3 to 14.2 percent body fat among control volunteers was not significant. When the volunteers of both companies were compared with each other at the end of the field trial, they showed no significant differences in percentage of body fat.

Urine Volume and Concentration

The volume and concentration of urine (Tables 44 and 45) are indicators of the state of body hydration. Urine volumes were somewhat higher on the average in the control company than in the MRE company, and in the final test period the differences became significant. In the field, the average daily urine volumes

TABLE 43. Mean Percent Body Fat.

Period 1	N	Mean ± SEM	F	p
MRE	27	18.0 ± 0.86		
Control	30	15.3 ± 0.81	5.22*	0.026
Period 4				
MRE	27	15.3 ± 0.70		
Control	30	14.2 ± 0.84	0.97*	0.330
			2.70**	0.046

*Comparison is between MRE and control groups in same period.

**Comparison is between periods, both groups combined.

TABLE 44. Mean Twenty-Four-Hour Urine Volume (mL).

	N	Mean ± SEM	F*	p
Period 1				
MRE	24	811.7 ± 49.2		
Control	22	861.8 ± 88.7	0.26	0.616
Period 2				
MRE	29	937.2 ± 59.4		
Control	28	1,054 ± 58.2	1.98	0.165
Period 3				
MRE	25	848.4 ± 94.6		
Control	26	941.5 ± 75.0	0.60	0.442
Period 4				
MRE	22	892.7 ± 82.7		
Control	27	1,245 ± 79.3	9.33	0.004

*Comparison is between groups.

TABLE 45. Mean Urine Concentration (mOsm/kg).

	N	Mean ± SEM	F*	p
Period 1				
MRE	24	869.9 ± 30.7		
Control	22	769.4 ± 39.3	4.14	0.048
Period 2				
MRE	29	856.0 ± 36.1		
Control	28	834.3 ± 34.7	0.19	0.667
Period 3				
MRE	25	899.9 ± 47.0		
Control	26	902.2 ± 30.6	0	0.968
Period 4				
MRE	22	926.2 ± 36.2		
Control	27	857.2 ± 38.1	1.67	0.203

*Comparison is between groups.

of volunteers in the MRE company ranged up to about 937 mL, while those of volunteers in the control company rose over 1,200 mL. Analysis of variance showed that the rise over time in daily urine volume in the control volunteers was significant ($F = 4.83$, $p < 0.004$), while no significant rise in urine volume occurred in MRE volunteers. Urinary concentration was significantly higher among MRE volunteers in barracks; in the field the urine osmolality of MRE volunteers was, on the average, higher than that of control volunteers, but the differences were not significant. No significant changes in urine osmolality with time occurred in either company. In both companies the values remained in the range of about 770 to 925 mOsm/kg.

Urine volumes of healthy men are normally above 750 mL/day and may achieve 2 liters or more; there are no fixed upper limits. Among the variables that can diminish urine volume and raise its osmolality in healthy persons are limitations on the supply of drinking water and sweating. The urine volumes achieved in the field by volunteers of both companies were presumably affected by both variables, and are on the low side of the normal range. Under the circumstances the values within both companies are unremarkable. The higher urine volumes among volunteers of the control company reflect their slightly higher water intakes. Total water intakes (from food and canteens) averaged over the field trial were 2,657 mL/day in MRE volunteers and 3,132 mL/day in control volunteers.

Urine osmolality is highly variable in humans. With usual food and water intakes the range is 500 to 850 mOsm/kg[25], while the upper limit is between 1,200 and perhaps 1,400 mOsm/kg. The average values achieved in the field by volunteers of both companies probably reflect both limited access to drinking water and sweating and are within the range of normal values. The control volunteers showed slightly lower average urine osmolality in the field than did MRE volunteers, in conformity with their higher intakes of water. Neither the urine volume nor the urinary concentration data indicate that men of either company were dehydrated to a meaningful degree.

Blood Constituents -- Hemoglobin and Hematocrit

Hemoglobin values from all periods and hematocrit values from all periods except the second are displayed in Tables 46 and 47. There were no significant differences between values for volunteers of the MRE and the control company. The values in barracks (period 1) are normal, and the values in the field rose progressively but slowly in both MRE and control volunteers. Values for hemoglobin in the field were significantly higher than values in barracks ($F = 18.14$, $p < 0.0001$, both groups combined); the same was true for hematocrit values ($F = 13.16$, $p < 0.0001$, both groups combined). The observed increases are reflective of physiological adjustments to the altitude at PTA and are entirely normal. Normal hemoglobin and hematocrit values are consistent with, but do not prove a state of adequate nutrition. Further information bearing on the state of nutrition of troops in the field is provided below from data on blood and urine nutrient concentrations.

Blood Nutrients

Plasma albumin and total protein (Tables 48 and 49) not only reflect the adequacy of protein intakes but also give an indication of energy nutriture and, under most circumstances, the state of hydration of the blood. Prior to the trial, plasma albumin was significantly lower in MRE volunteers than control volunteers. This finding is aberrant and unexplained. Aside from this, all values for plasma albumin and total protein were normal in volunteers of both companies. Thus during the field trial albumin and total protein values were unchanged with time and were not different between companies. This information is consistent with adequate protein and energy nutrition.

Protein intakes, averaged over all periods of measurement, were 81 g/day in MRE volunteers and 114 g/day in control volunteers. These values represent 81 and 114 percent respectively of the NSOR value of 100 g of protein per day. Energy intakes, as indicated above, were 60 and 82 percent of NSOR. It is judged that protein intakes were adequate to sustain normal concentrations of plasma proteins in both companies and that energy intakes, while not adequate to prevent loss of body weight, were not low enough to depress these concentrations during the time of the field trial. If this judgement is accepted, then the finding of normal values for hemoglobin concentrations and packed cell volumes in the field may be taken as evidence that no significant hemoconcentration took place. This reinforces the evidence on lack of dehydration based upon measurements of urine volumes and concentration discussed above.

TABLE 46. Mean Blood Hemoglobin Concentration (g/dL).

	N	Mean ± SEM	F*	p
Period 1				
MRE	28	15.2 ± 0.5		
Control	30	15.8 ± 0.2	1.39	0.243
Period 2				
MRE	29	17.2 ± 0.2		
Control	30	16.8 ± 0.2	2.23	0.141
Period 3				
MRE	27	16.9 ± 0.2		
Control	30	16.9 ± 0.2	0.01	0.917
Period 4				
MRE	27	17.1 ± 0.2		
Control	30	17.2 ± 0.2	0	0.948

*Comparison is between groups.

TABLE 47. Mean Blood Hematocrit (percent*).

	N	Mean ± SEM	F**	p
Period 1				
MRE	28	46.3 ± 0.6		
Control	30	46.8 ± 0.6	0.37	0.548
Period 3				
MRE	27	49.4 ± 0.5		
Control	30	49.7 ± 0.4	0.27	0.603
Period 4				
MRE	27	49.8 ± 0.5		
Control	29	51.8 ± 1.7	1.23	0.272

*Hematocrit values for Period 2 were not determined because the blood samples were accidentally frozen in transit to the laboratory.

**Comparison is between groups.

TABLE 48. Mean Plasma Albumin Concentration (g/dL).

	N	Mean $\pm$ SEM	F*	p
Period 1				
MRE	28	4.5 $\pm$ 0.0		
Control	30	4.9 $\pm$ 0.1	19.76	0.001
Period 2				
MRE	29	4.7 $\pm$ 0.0		
Control	30	4.8 $\pm$ 0.1	-	-
Period 3				
MRE	27	4.9 $\pm$ 0.1		
Control	30	5.1 $\pm$ 0.1	-	-
Period 4				
MRE	27	4.9 $\pm$ 0.0		
Control	30	5.0 $\pm$ 0.1	-	-

*Comparison is between groups.

TABLE 49. Mean Plasma Total Protein Concentration (g/dL).

	N	Mean $\pm$ SEM	F*	p**
Period 1				
MRE	28	7.6 $\pm$ 0.1		
Control	30	7.8 $\pm$ 0.1	3.81	NS
Period 2				
MRE	29	7.9 $\pm$ 0.1		
Control	30	8.0 $\pm$ 0.1	1.12	NS
Period 3				
MRE	27	8.2 $\pm$ 0.1		
Control	30	8.1 $\pm$ 0.1	0.62	NS
Period 4				
MRE	27	7.9 $\pm$ 0.1		
Control	30	8.0 $\pm$ 0.1	0.35	NS

*Comparison is between groups.
**NS = Not significant ($p > 0.05$).

Serum vitamin C values (Table 50) cannot be taken as exactly reflecting the true concentrations, since under field conditions no precautions were taken to prevent oxidative destruction of the vitamin during transportation to the laboratory. However, all serum samples were treated in the same way, so that the tabular values can be used for comparisons between companies and over time. One value, the average concentration of vitamin C in the serum of MRE volunteer in barracks (period 1) was significantly lower than in control volunteers at the same time. This value was also lower than during the field trial. The reason for this low value is unexplained. However, during the field trial (periods 2, 3, and 4), the average values for volunteers of both companies remained within the narrow limits of 0.9 to 1.0 mg/dL. During the trials there were thus no important differences in serum vitamin C between the different companies or test periods. The values lie within normal reference values published by the New England Journal of Medicine.[26] Average daily intakes of ascorbic acid were well above NSOR values in both companies during the field trial: MRE 105 mg (174 % NSOR), control 154 mg (256 % NSOR).

Serum folate concentrations (Table 51) reflect recent intakes of this vitamin. The values were nearly identical in the volunteers of both companies prior to the field trial, and in both companies there was a fall in the concentrations during the field trial. Analysis of variance has shown that the field values (periods 2, 3, and 4) were significantly lower than barracks values (period 1) in both groups of volunteers (MRE $F = 4.85$, $p < 0.004$; control $F = 4.67$, $p < 0.004$). In no case did values fall below normal limits, less than 1.9 ng/mL.[26]

Plasma pyridoxal phosphate concentrations (Table 52) are considered to express the state of vitamin B_6 nutriture, since the levels of this coenzyme are dependent upon vitamin intake over time. As may be seen from the table, the volunteers of the control company showed virtually no changes in pyridoxal phosphate concentration during the whole period of investigation. On the other hand, the values for MRE volunteers increased as soon as they went into the field and showed steady increases throughout the field trial. The normal range of values experienced by Bio-Science Laboratories is 3.6 to 18.0 mg/mL. The upper value of 18.0 ng/mL was nearly reached during period 2 in the field and was exceeded thereafter. This rise with time in vitamin B_6 coenzyme levels in MRE volunteers but not control volunteers was unexpected. Values were significantly higher in the MRE group, beginning with Period 2, and the increase with time was highly significant ($F = 20.03$, $p < 0.0001$, both groups combined). It has recently been shown that physical exercise (in the form of a 4500-meter run) can raise plasma pyridoxal phosphate levels in adolescent males.[27] In the study published, the highest values reported for pyridoxal 5'-phosphate in serum were: pre-run, 16.81 ng/mL (6.80 nmol/dL) and, after the run, 21.33 ng/mL (8.63 nmol/dL). Thus the post-exercise values were in the range achieved by MRE volunteers in the field. However, both companies would have undergone physical exercise during the field trial, and therefore the effect of exercise would have occurred in both companies.

Pyridoxine intakes of both companies were examined over time in order to assess whether differences in intakes could have accounted for the observed differences in serum pyridoxal phosphate levels. Average daily intakes of this

TABLE 50. Mean Serum Ascorbic Acid Concentration (mg/dL)*

	N	Mean ± SEM	F**	p
Period 1				
MRE	28	0.5 ± 0.0		
Control	30	1.1 ± 0.1	26.04	0.0001
Period 2				
MRE	29	0.9 ± 0.0		
Control	30	1.1 ± 0.1	-	-
Period 3				
MRE	27	1.1 ± 0.0		
Control	30	0.9 ± 0.0	-	-
Period 4				
MRE	27	1.1 ± 0.0		
Control	30	1.0 ± 0.0	-	-

*F and p values omitted for Periods 2-4; see text for explanation.

**Comparison is between groups.

TABLE 51. Mean Serum Folate Concentration (ng/mL)*.

	N	Mean $\pm$ SEM	F*	p**
Period 1				
MRE	28	5.3 $\pm$ 0.7		
Control	30	5.4 $\pm$ 0.5	0.02	NS
Period 2				
MRE	29	4.1 $\pm$ 0.3		
Control	30	4.4 $\pm$ 0.3	0.73	NS
Period 3				
MRE	27	3.5 $\pm$ 0.3		
Control	30	4.3 $\pm$ 0.2	5.02	0.029
Period 4				
MRE	27	3.5 $\pm$ 0.2		
Control	30	3.7 $\pm$ 0.2	0.93	NS

*Comparison is between groups.

**NS = Not significant ($p > 0.05$).

TABLE 52. Mean Serum Pyridoxal Phosphate Concentration (ng/mL).

	N	Mean ± SEM	F*	p**
Period 1				
MRE	28	9.8 ± 1.1		
Control	30	12.2 ± 0.9	3.00	0.089
Period 2				
MRE	29	17.6 ± 1.2		
Control	30	13.2 ± 0.9	8.65	0.005
Period 3				
MRE	27	21.5 ± 1.1		
Control	30	14.2 ± 0.9	26.99	0.0001
Period 4				
MRE	27	24.4 ± 1.1		
Control	30	13.6 ± 0.7	75.53	0.0001

*Comparison is between groups.

vitamin during dietary periods A, B, C, and D, respectively, were for MRE volunteers 3.8, 3.3, 2.8, and 3.0 mg/day, and for control volunteers 2.3, 2.6, 2.4, and 1.9 mg/day. The higher intakes in the MRE group fit well with the observed elevations of the concentration of the pyridoxine coenzyme in the blood serum of MRE volunteers. Although the increases in serum coenzyme levels brought these levels above the normal range, we are unaware of any danger which has been associated with pyridoxal phosphate levels of the order that have been observed here.

Serum retinol (vitamin A) values (Table 53) constitute the only available practical indicator of vitamin A status of humans.[28] While the values do not tend to change rapidly when intakes change, they do reflect longer term intakes. Further, serum retinol levels which fall below acceptable values present the danger of reduced visual acuity at night and are thus extremely hazardous for military personnel. The observed values were essentially the same for volunteers of both companies prior to and throughout the entire field trial. The normal range of values for serum vitamin is 50 to 200 IU/dL (0.15 to 0.6 micrograms/mL).[26] Thus the values observed were at all times near or above the upper normal value. This indicates that an adequate status of vitamin A existed in both MRE and control volunteers. Dietary vitamin A intakes during the field trial averaged 203 percent of NSOR in the MRE company and 201 percent in the control company.

TABLE 53. Mean Retinol Concentration (IU/dL).

	N	Mean $\pm$ SEM
Period 1		
MRE	28	222.2 $\pm$ 7.6
Control	30	234.5 $\pm$ 9.7
Period 2		
MRE	29	191.6 $\pm$ 5.0
Control	30	220.9 $\pm$ 6.6
Period 3		
MRE	27	199.6 $\pm$ 6.3
Control	30	210.0 $\pm$ 5.8
Period 4		
MRE	27	204.0 $\pm$ 7.5
Control	30	225.5 $\pm$ 6.4

The concentrations of zinc in serum and urine and the activity of serum alkaline phosphatase were determined in order to make a partial evaluation of zinc status. Serum zinc concentrations normally range from 0.55 to 1.50 micrograms/mL in healthy adults. Mean values for volunteers in both companies fell near the middle of this range (Table 54). Serum zinc concentrations were, for volunteers of both companies, lower in the field than in barracks and remained steady during the field trial. This difference in serum zinc was significant for both the MRE company ($F = 4.06$, $p < 0.009$) and the control company ($F = 6.92$, $p < 0.0003$). In all periods serum zinc was lower in the MRE company than in the control company. This difference reached significance in all periods except period 2; the overall group difference was not computed. The observed serum zinc concentrations fit well with zinc intakes, which averaged 12.6 mg/day in the MRE company and 17.2 mg/day in the control company over the whole field trial.

Correlations were computed in order to explore whether serum zinc concentrations or urinary excretion of zinc were related to loss of body weight or of lean body mass (computed as body weight x [1 - fraction of fat]). It was found that serum zinc concentration correlated significantly with loss of weight ($r = 0.32$, $p < 0.005$) in the MRE group but not in the control group.

Urinary zinc loss was also correlated with loss of body weight ($r = 0.22$, $p < 0.005$) and of lean body mass ($r = 0.47$, $p < 0.025$) in the MRE group. No such significant correlations were found in the control group.

Serum alkaline phosphatase activity values (Table 55) fell within the normal range experienced by Bio-Science Laboratories, 35 to 148 IU/L at 37°C. The values were steady with time in the experimental volunteers. In the control volunteers the value was lower in barracks than in the field, but the difference was not significant. Mean values were consistently higher in the experimental volunteers than in the control volunteers, but the difference between them was significant only in barracks (period 1).

Excretion of zinc in the urine was computed by multiplying urinary zinc concentration by the daily urinary volume (Table 56). The daily urinary excretion of zinc was lowest in barracks for volunteers of both companies, and rose when the troops moved into the training area. In the experimental company volunteers within the experimental and control companies were compared, the values for zinc excretion in barracks did not differ very much, but values were consistently (but not significantly) higher in the field in the MRE company than in the control company.

The zinc data support two conclusions. First, the fact that values for serum zinc concentration and plasma alkaline phosphatase activity were at all times within normal limits indicates that there was no zinc deficiency among the volunteer troops. Chandra has stated that serum zinc concentrations below (70 micrograms/dL (0.70 micrograms/mL) suggest zinc deficiency, if they are not the result of infection.[29]

TABLE 54. Mean Serum Zinc Concentration ($\mu g/mL$).

	N	Mean $\pm$ SEM	F*	p
Period 1				
MRE	27	1.01 $\pm$ 0.03		
Control	29	1.14 $\pm$ 0.03	7.64	0.008
Period 2				
MRE	27	0.92 $\pm$ 0.03		
Control	28	0.97 $\pm$ 0.02	2.06	0.157
Period 3				
MRE	27	0.90 $\pm$ 0.02		
Control	30	1.02 $\pm$ 0.03	10.87	0.002
Period 4				
MRE	27	0.91 $\pm$ 0.02		
Control	30	1.00 $\pm$ 0.03	8.10	0.006

*Comparison is between groups.

TABLE 55. Mean Serum Alkaline Phosphatase Activity (IU/L at 37^{o}C).

	N	Mean $\pm$ SEM	F*	p
Period 1				
MRE	27	80.5 $\pm$ 3.8		
Control	30	70.2 $\pm$ 2.3	5.66	0.021
Period 2				
MRE	29	80.3 $\pm$ 3.5		
Control	30	76.4 $\pm$ 2.9	0.76	0.386
Period 3				
MRE	27	83.1 $\pm$ 3.3		
Control	30	76.7 $\pm$ 2.6	2.29	0.136
Period 4				
MRE	27	80.7 $\pm$ 3.4		
Control	30	77.2 $\pm$ 2.6	0.68	0.414

*Comparison is between groups.

TABLE 56. Urinary Excretion of Zinc (μg/day).

	N	Mean ± SEM	p*
MRE			
Period 1	23	414.0 ± 46.4	
2	27	704.3 ± 66.0	<0.05
3	24	680.4 ± 76.7	NS
4	22	612.4 ± 75.0	NS
CONTROL			
Period 1	23	411.7 ± 42.9	
2	29	547.3 ± 42.3	NS
3	27	531.4 ± 49.7	NS
4	28	667.1 ± 64.8	<0.05

*Comparison is with Period 1 value for the same group of volunteers, using Scheffe's test. NS is not significant ($p > 0.05$).

Second, the fact that serum alkaline phosphatase activities were not different between experimental and control volunteers during maneuvers indicates that the MRE rations supported zinc nutriture as well as the control rations did. There are several possible explanations for the fact that serum zinc concentrations were lower in the MRE volunteers in three test days. Since the difference occurred in barracks, the difference might simply reflect individual differences unrelated to diet or physical effort. Since the differences persisted during the field trial, differences in zinc intake might also have had an effect. Analysis of data on body weight and percent body fat has shown that losses of lean body mass accompanied losses of body weight; the mean loss of lean body mass among MRE volunteers was almost twice as high as that among control volunteers (1.85 kg compared to 0.95 kg). Loss of lean tissue ordinarily entails urinary loss of zinc. Thus losses of lean tissue could in part explain the observed increases in urinary zinc loss in both companies during the field trial.

CHAPTER 8

MOOD AND MORALE

Summary

The MRE company did not differ from the control company on any of the six mood scales on the Profile of Mood States questionnaire, and both companies showed a considerable improvement in their mood scores during the field test. In a similar manner the two companies did not differ from one another on measures of morale and perceptions of leadership. These latter ratings remained stable over the four data collection points.

1. Introduction

The central question in the present study concerned whether troop effectiveness is compromised by prolonged feeding of operational rations. Troop morale, perceptions of leadership, and mood are clearly critical determinants of troop effectiveness, and their evaluation represent three of the more important measures in this study. In addition to these considerations from a purely research design viewpoint, group differences in mood, morale and leadership at the beginning of the study could have an important bearing on the results and the interpretation of any group differences that developed on our other measures.

Group differences in mood state, morale, and perceptions of leadership could develop from dissatisfaction with the ration or could be mediated by the low levels of nutrient intake and weight loss that occurred during this study. For example, several recent studies have shown mood to be sensitive to dietary manipulations.[30,31] We are not aware of information about nutritional influences on morale or perceptions of leadership.

2. Method

Mood

The Profile of Mood States (POMS) was used to measure mood (Appendix L). This questionnaire which asks the subject to rate 65 adjectives on a five-point scale ranging from 0 = not at all to 4 = extremely. The troops were asked to respond to these adjectives on the basis of how they felt "right now." The questionnaire yields six factorially derived scales: Tension-Anxiety, Depression-Dejection, Anger-Hostility, Vigor-Activity, Fatigue-Inertia, and Confusion-Bewilderment.[32] The test-retest reliabilities for the six scales range from $r = 0.65$ to $r = 0.74$, and all scales possess internal consistency reliabilities in the range of 0.90.[32] The POMS is widely used in psychopharmacological studies and is sensitive to both hypnotics[33] and stimulants.[34]

In the present study the POMS was administered to all the troops in both companies prior to the field test and on days 11/12, 23/24, and 34, which correspond to one-third and two-thirds of the duration, and at the end of the test. Data from all the troops who correctly filled out the questionnaire at all four test points were used in the analysis.

Morale and Leadership

Morale and leadership are clearly interrelated from the perspective of enlisted personnel. A standardized questionnaire developed for the Marine Corps, the Leadership Evaluation and Analysis Program Interaction Inventory Adjunct No. 1 is designed to systematically assess command motivation.[35] This questionnaire deals with a number of motivational issues that come under the control and influence of individuals in positions of leadership within a military command. There are six scales on this instrument: Senior Proficiency, Senior Support, Communication Flow, Organization and Planning, Recognition, and Discipline. These scales tap into many aspects of leadership and morale, but one important dimension of morale, job satisfaction, is not assessed. The Leadership Evaluation and Analysis Program Interaction Inventory Adjunct No. 2 which was also developed for the Marine Corps assesses several aspects of job satisfaction and has six scales which measure: Task Satisfaction, Task Significance, Command Training Readiness, Individual Training Readiness and Command Solidarity from the perspective of the troops.[35] Many of the issues addressed in the two questionnaires are redundant, and administering both of them would have taken more time than was feasible under our test conditions. Accordingly, we drew on both instruments in synthesizing a questionnaire which measured both morale and perceptions of leadership (Appendix M).

There were 45 items on our questionnaire that included questions from the following scales on the Leadership Evaluation Analysis Program Interaction Inventory Adjunct No. 1: Senior Support, Senior Proficiency, Communication Flow and Discipline. Questions from the LEAP Interaction Inventory No. 2 were used to generate three additional scales: Job Satisfaction, which drew on items from the Task Satisfaction and Task Significance Scales; Training Readiness which drew on questions from the Individual Training Readiness, and the Command Training Readiness scale and items from the Command Solidarity Scale. In addition, questions 1-36 were worded so that they referred to "I", whereas questions 37-45 were worded so that they referred to the perceptions of the other troops. Some of the questions were worded negatively. For scoring purposes they were coded so that lower numbers would always reflect a more positive attitude. The questionnaire was administered prior to the study and on days 11/12, 23/24 and 34. Data were used from all subjects who completed the questionnaire correctly at the four test points.

3. Results and Discussion

Figure 27 shows the mood scores of both groups on each of the six scales. There are two striking aspects of this figure. First, the mood scores of the two groups on the six scales are very similar. This visual impression is supported by statistical analyses which revealed only one data point, T_2, on the anger scale, where the two groups significantly differed ($t(88) = 2.03$,

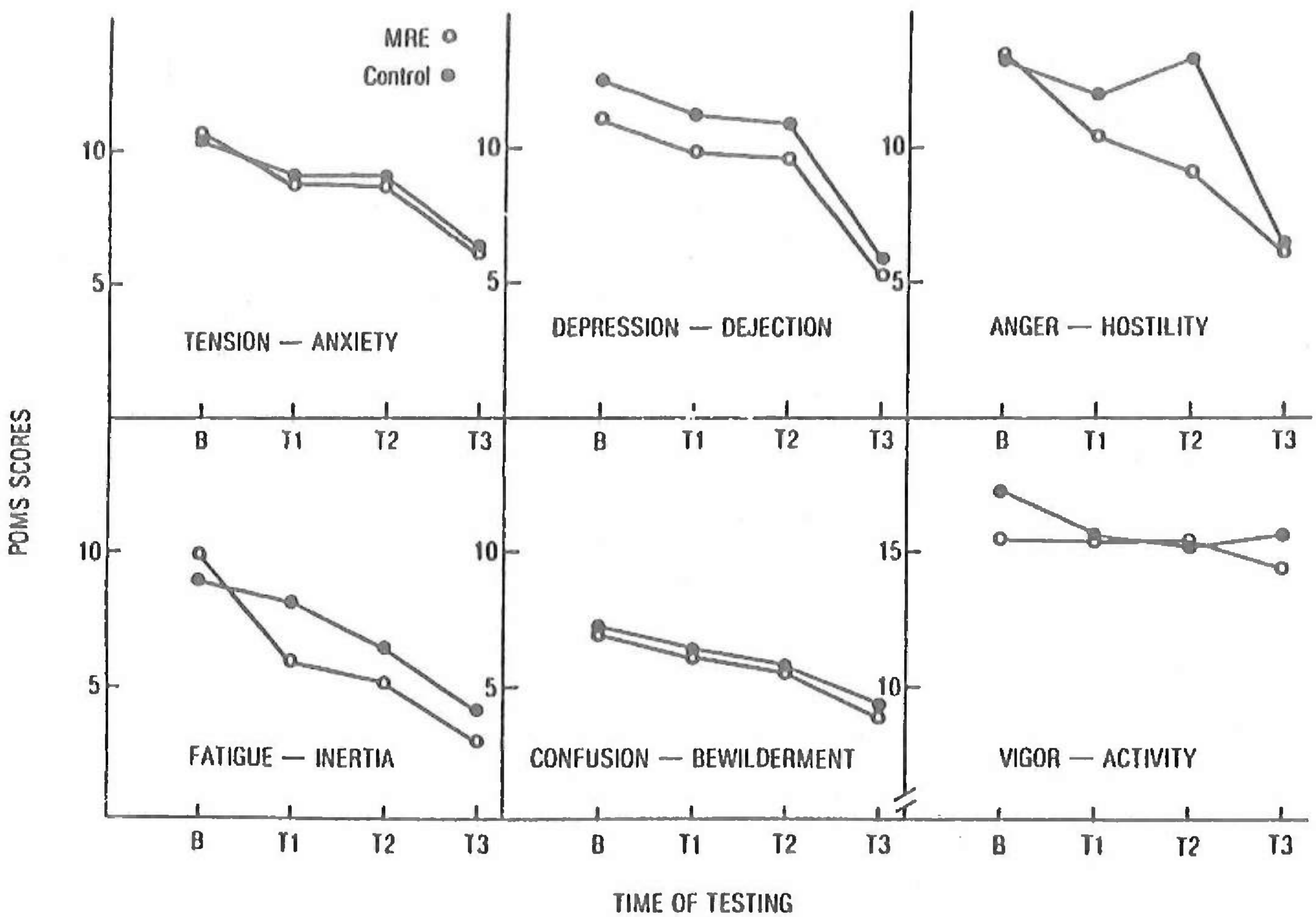

Figure 27. Mean Score on the Six Mood Scales of the Profile of Mood States Questionnaire by the MRE and Control Group.

$p < 0.05$). On this occasion the control group showed a higher anger score than the MRE group. On this scale, trend analysis also revealed that the quadratic component of the trend differed significantly between the groups ($t(88) = 2.55$, $p < 0.05$). The second striking feature of this figure is that each of the five scales that are viewed as negative (Tension-Anxiety, Depression-Dejection, Anger-Hostility, Fatigue-Inertia and Confusion-Bewilderment) showed statistically significant decreases over the course of the study in both groups. Responses to the Vigor-Activity scale of the POMS did not change over time.

It is clear that marked improvements in mood occurred in both groups during the study, but prolonged feeding of the MRE did not affect mood. The improvement in mood over the course of the study was not anticipated, but several converging lines of evidence lead us to regard it as a real phenomenon. First, it is not an artifact of unusually high scores on the five negative scales during baseline testing at Schofield Barracks. The initial scores on these scales are similar to, or slightly lower than, a reference population of male college students.[32] In addition, the pattern of correlations between the six scales is also comparable to the pattern shown by this population of male college students. These two observations indicate that the scores of the troops at baseline were comparable to a large reference population. Secondly, we have previously reported (Chapter 3) that both companies showed a decrease in the frequency with which they reported a number of physical symptoms during the field test. There is some evidence that indicates that self-report data of physical symptoms and somatic complaints are influenced by mood.[36]

Figure 28 shows the average scores on the morale and leadership questionnaire for both companies at the four test points. The similarity of the ratings by the two companies is readily apparent from this figure. The average ratings on all seven scales uniformly fell into the range between 3 and 4 indicating that the troops ratings fell between "somewhat agree" and the neutral point on the scale. These scores indicate that their morale and opinions of their leadership were slightly positive. There was also a complete absence of any change over time in the ratings. The only statistically significant differences that emerged from the analysis of this questionnaire were on the "Discipline" scale, where the attitude of the MRE company was more positive at baseline testing and at the second data collection point than the control company's ratings. When individual questions from the seven scales are grouped according to whether the question refers to the individual or the other troops (two lower right hand panels in Figure 28) there is still no difference between the two companies, but the ratings are significantly more negative when the referrent for the question is other troops.

The finding that the two companies did not differ in their morale or in their views of their leaders is important from two perspectives. Firstly, it indicates that prolonged feeding of the MRE does not affect this important dimension of troop effectiveness. Secondly, it allows us to exclude the possibility that more effective leadership and higher morale allowed the MRE company to overcome any adversity imposed by sustained feeding of operational rations. The absence of group differences on any of the scales on this questionnaire at baseline adds support to this line of argument.

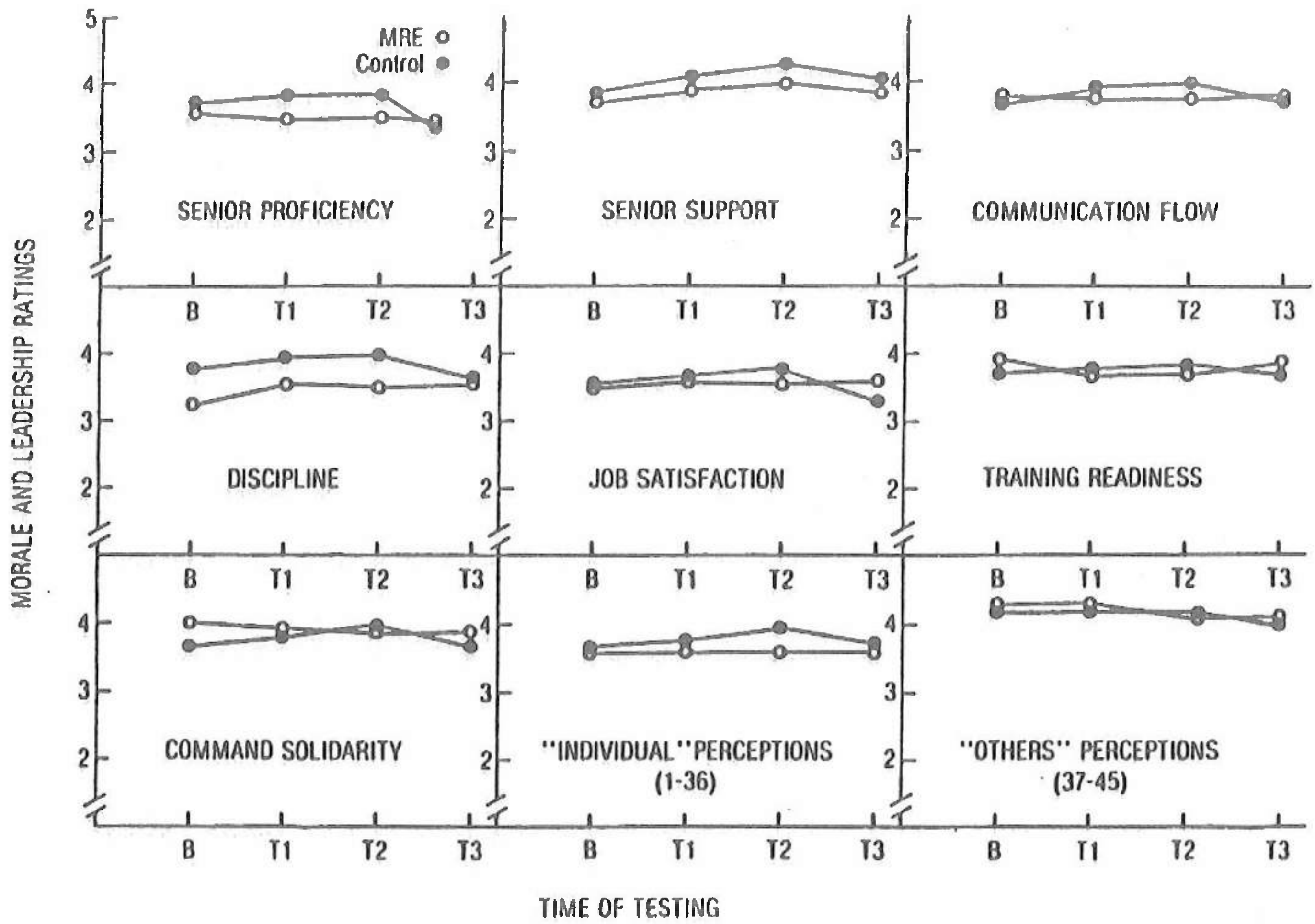

Figure 28. Mean Score on Each Dimension of the Morale and Leadership Questionnaire by the MRE and Control Group.

Finally, we would be remiss if we did not mention in passing that our subjective impressions of the troops in both companies and their leaders was very favorable. We routinely asked them to do things that were not part of their training mission or job, and we never received anything but full cooperation and support. We cannot quantify these impressions and analyze them statistically, but in our own minds they add important confirmation to the conclusions generated by the questionnaires.

CHAPTER 9

COGNITIVE AND PSYCHOMOTOR PERFORMANCE

Summary

Performance on a test battery of cognitive and psychomotor tasks did not differ between troops fed the MRE as their sole source of food for 34 days and troops fed a hot breakfast and dinner and an MRE for lunch. In addition, the performance of the troops within the MRE company who lost more than seven percent of their initial body weight did not differ from the troops in this group who lost the least amount of weight during the field test. Measures of short-term memory capacity, memory scanning rate, reaction time, speed and accuracy of coding digits into symbols, grammatical reasoning, speed and accuracy of solving simple arithmetic problems, hand-eye coordination, speed of gross arm movements, and the accuracy and speed with which stationary and moving targets are located do not appear to be affected by levels of caloric intake and weight loss that were observed in the MRE group in this study.

1. Introduction

In an effort to document the nature and extent of any adverse consequences of subsisting solely on the MRE for an extended period of time, a battery of psychomotor and cognitive performance was developed for this purpose.

Rationale for Task Selection

One of the difficulties in assemblying an appropriate test battery is that there is no standardized methodology for assessing the quality of military performance.[37,38] One of the inherent difficulties in this type of evaluation is that military personnel perform thousands of tasks, and even within an infantry division, there are hundreds of job descriptions with many different physical and mental demands placed on the individual soldier. Even at the level of a single job description, a broad range of physical and psychological demands are common.

Three general approaches have been used to evaluate military performance within the context of testing food, clothing, protective devices or the stresses associated with continuous operations. The most general approach, and the one with high face validity, relies on using the ratings of military evaluators of unit performance.[39,40] A second approach focuses on a single military task with quantifiable measures of performance and examines effects on performance in this narrow sphere.[41,42] The third approach to the problem of evaluating military performance does not focus on a military task per se but measures components of the three factors that are common to all domains of human performance: physical work performance, mental performance, and psychomotor performance.[40,43,44] In the present study we chose the last approach and focussed our effort on measuring aspects of mental and psychomotor performance as an index of troop effectiveness. Our initial plans also called for physical performance to be measured, but in order not to interfere with the training mission of the exercise this measure was not taken. By employing cognitive and psychomotor tasks that are used in current psychological research, we are able to relate our observations to a broad research literature;[45,46] if diet-related deficits were to be observed in some instances, it would be possible to specify the behavioral and physiological processes underlying performance on the task.

Five general criteria were employed in selecting the tasks for this test battery: 1. The test battery as a whole should assess a broad spectrum of cognitive and psychomotor functions. 2. Individual tasks should be brief and the entire battery should not take more than one hour to complete. 3. An individual with an eighth grade reading level should be able to complete all the tasks in a satisfactory manner. 4. The task should be reliable and test-retest reliability should exceed $r = 0.50$. 5. Operating on the assumption that performance deficits would only occur if the troops fed the MRE consumed too little food and/or chose their foods in such a way that the actual diet they consumed was inadequate, we also tried to incorporate tasks that were sensitive to mild nutritional deficiencies. When this was not possible, we looked for tasks that were sensitive to mild stressors such as noise level, time of day or mild sleep loss.

Criteria 1, 2, 3, and 4 were applied to all tasks considered for inclusion in this test battery. Criterion 5 was applied less rigorously, and in some instances tasks were included in the battery even if information about their sensitivity to mild environmental stressors was lacking.

2. Method

The final test battery was composed of three psychomotor tasks and five cognitive performance tasks. The psychomotor tasks were administered individually to each subject and the cognitive tasks were given on four TRS-80 Model III microcomputers with up to four subjects tested at the same time. The microcomputer allowed for precision timing of the tasks (msec accuracy), immediate scoring and summarizing of a subject's data and a compact record of this information. The complete test battery took between 45 and 50 minutes for a trained subject to complete and was administered prior to the study and on days 11/12, 23/24 and 34 of the field test. The test battery was given only to the 30 volunteers from each company who underwent more intensive testing.

Psychomotor Tasks Included in Test Battery

1. Ball - Pipe Task

This test of the speed of arm and hand movements also requires good hand-eye coordination. The frequency with which the subject can pass a ball-bearing through a one-foot length of steel pipe in one minute is measured. Previous research has shown that performance on this task deteriorates during acute starvation[47] or prolonged semi-starvation.[48] Our previous work with this task has revealed that the task is reliable with an average correlation, $r = 0.74$, between performances on seven successive tests separated by a week.[49]

2. Air Combat Maneuvering.

The Atari video game Air Combat Maneuvering was included in the test battery as a measure of compensatory tracking. Skilled performance on this task calls for excellent hand-eye coordination and the ability to track a moving target, to compensate for the movement of a target, and to align a plane with the target, fire a missile and hit the target. In addition to these abilities the task simulates some military tasks such as radar and sonar interception. Each trial takes 2 minutes and 16 seconds. Five trials were given in each test session so that the total time for this task was slightly more than 11 minutes. This task has not been widely employed in research on human performance, and to the best of our knowledge, information on its sensitivity to mild environmental stressors is lacking. However, detailed information on the psychometric properties of this task is available.[50] When ten trials a day are given, test-retest reliability between days 1 and 2 is $r = 0.78$. Our previous experience with this task, when only five trials a day were given, revealed similar high reliabilities with the test-retest correlation between performance on successive days averaging $r = 0.88$.[49] In addition to these attributes, the task is captivating to the subject and sustains his interest and motivation at a high level.

3. Spoke Task.

This task requires sequential tapping between a central target and 32 sequentially numbered targets arranged in a circle around the central target.[51] Adept performance on this task calls for accurate aiming, rapid arm movements, and good hand-eye coordination. The dependent variables on this task are the time to completion (which is less than one minute) and the number of errors. In our version of this task, the subject uses a colored marker rather than a stylus so that errors are clearly defined.

This particular task has not been used in studies concerned with the effects of mild stressors, but another version of this task, in which the surrounding 32 targets are numbered randomly, has been shown to be sensitive to motion environments.[52] We used the sequential version of this task rather than the randomly numbered version because test-retest reliabilities are considerably higher for this form and exceed $r = 0.80$ between successive days.[51] We have also observed test-retest reliabilities in this range.[49]

Cognitive Performance Tasks Included in Test Battery

The cognitive tasks were all administered on a TRS-80 Model III microcomputer. In addition to evaluating an array of cognitive abilities, several of the tasks also measured reaction time, a psychomotor function.

1. Sternberg Memory Scanning Task

In this task the subject is asked to memorize a short list of digits, which remains on the microcomputer screen for one second. This is followed by the presentation of a single digit, and the subject's task is to indicate whether this test digit is part of the set previously memorized. The subject is instructed to respond as quickly as possible by pressing the key marked "YES" or the key marked "NO" on the microcomputer keyboard. The time that elapses between presentation of the test digit and the subject's response is measured.

Sternberg found that mean reaction time is an increasing function of the number of digits that were originally presented (set size).[53] The slope of this function was about 38 msec per item and was not affected by whether the test stimulus was part of the original set (positive trials) or not (negative trials). However, at each set size, negative trials took about 50 msec longer than positive trials.

On the basis of these observations and related research, Sternberg developed a model of short term memory, which posits that memory contents are scanned one item at a time in a serial and exhaustive search.[54] In addition, this model maintains that there are a number of distinct mental operations that occur between the presentation of the test stimulus and the subject's response. The nature of a subject's performance can be used to infer which mental operations are affected by particular experimental manipulations. In the present study, subjects were presented with set sizes of 1 to 4 digits. There were 20 trials at each set size, half were positive trials and half were negative. Positive and negative trials were presented in a predetermined random order; on any one trial, the particular digits were randomly selected by the computer. Reaction times were measured, and both the slope and intercept of the function relating mean reaction time to set size were computed for each subject by the method of least squares.

Previous research has shown that performance on this task is sensitive to alcohol,[55] aging,[56] and methylmercury exposure in the workplace.[57] Furthermore, there is a voluminous literature relating mild environmental stressors to reaction times,[58] which this task also measures. However, studies of mild undernutrition or specific nutrient deficiencies are not encountered in the reaction time literature.

Performance on the Sternberg memory scanning task has also been examined for its stability over repeated sessions.[59] The test-retest reliabilities of the mean reaction times were generally greater than $r = 0.70$, but the reliabilities of the slopes were negligible. This low test-retest reliability may be due to the small number of trials at each set size that were employed by these researchers.

In our previous research with this task we found a somewhat higher pattern of correlations over test sessions.[49] The average correlation for the slope of the function relating set size to reaction time between seven successive sessions was $r = 0.28$ and for the intercept $r = 0.78$.

2. <u>Grammatical Reasoning Test</u>

This is a verbal reasoning task in which the subject has to indicate whether a simple sentence describing the order of a pair of letters is true or false.[60] For example, "B follows A -- BA". The correct answer to this sentence would be "false." Baddeley (1968) has shown that performance on this task correlates +0.59 with performance on the British Army verbal intelligence test and suggests that it can be used as an index of "higher mental processing ability."[61] In our version of the task, sentences were constructed based on the 32 possible combinations of the following five conditions: (1) Positive or negative, (2) Active or passive, (3) Precedes or follows, (4) A or B mentioned first, (5) Letter pair AB or BA. Each sentence was displayed on the microcomputer screen until the subject responded by pressing the key marked "TRUE" or the key marked "FALSE." This was immediately followed by the next sentence. The sentences were presented in a random order. The subject was allowed 90 seconds to respond to as many sentences as he could. The number of correct and incorrect responses was recorded, as was the reaction times timed from the onset of the sentence on the microcomputer screen.

Performance on this task is sensitive to a number of stressors including nitrogen narcosis[62] and the demands of performing a supplementary task such as driving a car (Brown, Tickner & Simmonds cited in Baddeley, 1968).[60] Performance is not sensitive to loud white noise[60] or to carbon dioxide inhalation.[63]

The grammatical reasoning task is also appropriate for use in repeated measures experiments.[64] These investigators have shown that mean performance shows a small linear increase over repeated testing and that intertrial correlations tended to remain high and constant after four test sessions. In our previous work with this task we have observed an average test-retest correlation of r = 0.72 over seven successive weeks.[49]

3. Digit Symbol Substitution Test (DSST)

The Digit Symbol Substitution Test is a component of the Wechsler Adult Intelligence Scale.[65] It is usually administered as a paper and pencil task, where each of the digits 1 through 9 is paired with a different symbol and the subject's task is to draw the symbol appropriate for each digit below that digit on a sheet of paper. The computerized version is analogous; the subject's task is to use the numeric keypad on the microcomputer to duplicate a pattern displayed under each digit at the top of the video screen (see McLeod, Griffiths, Bigelow & Yingling, 1982 for a complete description of the computerized version of this task).[66]

The DSST is a speed test and is regarded as an index of associative ability. It has been widely used to assess performance following the administration of pharmacological agents.[67] The limited research that has been conducted with the computerized version of the task has shown a dose-related decrement in DSST performance following administration of pentobarbital.[66]

The reliability of the paper and pencil version is r = 0.88.[65] Published reliability of the computerized version of this task is lacking, but in our laboratory study the average test-retest reliability of this task on seven successive weeks was r = 0.87.[49]

4. Wechsler Digit Span Forward

The digit span test is a component of the Wechsler Adult Intelligence Scale and is widely employed as an index of short-term memory capacity.[65] In the standard version of this task, a series of digits is read to the subject at the rate of one digit per second, with the inflection of the examiner's voice dropping at the last digit as a signal to the subject to respond. The list of digits begins at a length of three and increases by one digit until the subject gives incorrect responses on two trials at the same digit span. In our computerized version of this task, the digits were presented at the rate of one per second on the microcomputer screen and remained on the screen for one second. After the last digit, a series of question marks appeared on the screen, and the subject was required to press the keys corresponding to the digits that had been displayed, in the order in which they had been displayed. When the subject made an error, that length digit span was repeated. If the subject made a second error at that list length, the task was terminated. A computerized version of the Wechsler Digit Span test was used by Sheehy, Kamon and Kiser (1982) to test the effects of carbon dioxide inhalation on human performance.[63] Although digit span was not affected by CO_2 inhalation, a number of studies have shown that the standard form of this task is sensitive to circadian factors.[62,68] Information on the sensitivity of this task to mild nutritional deficiencies is lacking, but there is voluminous literature relating performance on this task to a variety of neuropsychological disorders (e.g. Filskov & Boll, 1981).[45] In addition, this test is widely used in behavioral toxicology studies (e.g. Hanninin, 1974).[69]

The reliability of the standard form of this task was established by correlating performance on digit span forward with performance on digit span backwards and is $r = 0.71$.[65] A more extensive test series with a much lengthier version of this task found the test-retest reliability to be $r = 0.58$ between days one and two and that with more extensive testing the correlation between performance on this task on successive days reaches 0.85.[70]

5. <u>Mental Addition</u>

In this task the subject was required to verify whether a sum of the form $p + q = m$, where $m \leq 10$, was correct or incorrect. The equation was displayed on the microcomputer screen, and the subject's task was to press the key labelled "TRUE" or "FALSE" as quickly as he could. There were 45 true equations. A set of 45 false equations was generated by adding +1 or −1 to the correct sum of the 45 true equations. Plus 1 was added to 23 of the sums and minus 1 to the other 22. The sequence of problems presented to the subject was randomly generated by the computer with the constraint that 50% were from the "false" set. Task duration was 2 minutes, and reaction times and the number of correct and incorrect responses were recorded.

Simple mathematical tasks are widely used to assess performance.[71] Arithmetic ability tests are incorporated into neuropsychological test batteries[72] and are also sensitive to motion[73] and hyperbaria.[74]

Problems that are much more difficult to solve are generally used in performance batteries (e.g. Seales et al, 1980).[71] Our reasons for using this type of simple addition problem were twofold. Firstly, this type of verification task has been widely used in research concerned with determining the nature of the cognitive processes underlying mental addition.[75] This body of research would allow us to relate the nature of a possible deficit in the MRE group to underlying cognitive processes. Secondly, the last task used in this battery (see below) is a modification of this task, which requires the subject to use the well-learned code for the months of the year (i.e. January = 1, February = 2, etc.) to perform the same arithmetic verification task. Comparison of performance on the two versions of the task could again be used to isolate the process involved, if the MRE group showed a deficit on one of the tasks and not the other.

Paper and pencil versions of simple arithmetic tasks show very high test-retest reliability with correlations above r = 0.90 reported between performance on days 1 and 2.[71] In the computerized version of this simple arithmetic verification task we have observed that test-retest reliabilities are also quite high in a group of students. The average correlation between seven successive trials on this task was r = 0.72.[49]

6. Mental Addition with Coding

As previously mentioned, this task used the same set of mental addition problems used in the preceding task, with the exception that months of the year rather than numbers were used as stimuli and that the test lasted four minutes rather than two. In all other respects the task was presented in the same manner and with the same parameters as the mental addition task. The actual task was a modified version of a task used by Hunt and his colleagues to study the relationship between verbal ability and information processing tasks.[76] Similar mental addition verification tasks are employed to understand the way different notational systems are interpreted by people and how they are used symbolically to map the world.[77] This particular task has not been used in previous research to study how unusual environments or mild stressors affect performance.

In our previous work with this task we have found it to be very reliable, with test-retest correlations which average r = 0.89 between seven successive sessions administered a week apart.[49]

Table 57 is a synopsis of the characteristics of the nine tasks that comprised the performance test battery.

3. Results and Discussion

General Comment on Data Analysis

Performance on the psychomotor and cognitive tasks was measured at four time points: at the beginning of the study representing baseline (B), after 11 or 12 days (Test 1), 23 or 24 days (Test 2) and 34 days (Test 3). For each task, measures of performance (group averages) are plotted as a function of test time. Only subjects for whom we had complete data at all four test points were included in the statistical analysis of a given task.

Differences between the MRE and control groups were assessed in several ways. T-tests (significance level = 0.05) were performed to compare average scores at each time point. In addition, we tested for differences between the groups in the rate at which their performance changed over time. If diet had any systematic effect on performance, then the groups' performance should diverge over time. T-tests were performed to test for the difference between groups in linear trend (straight-line increase or decrease) and quadratic trend (U-shaped curvature).*

*STATISTICAL NOTE: These t-tests are equivalent to the interaction F-tests in a trend analysis.

TABLE 57. Tasks Used in Performance Test Battery.

Task	Length	Functions Tested	Reliability	Performance Sensitive to
1. Ball Pipe	1 min	Speed of arm, hand movements eye-hand coordination	r = 0.74	Starvation, Prolonged semi-starvation
2. Air Combat Maneuvering	11 min	Compensatory racking, eye-hand coordination	r = 0.88	Not established
3. Spoke Task	1 min	Aiming, eye-hand coordination	r = 0.80	Similar task sensitive to motion, brain damage
4. Sternberg Memory Scanning Task	15 min	Short-term memory scanning rate, reaction time	slope r = 0.28 intercept r = 0.78	Alcohol, aging, methylmercury exposure, RT component sensitive to a broad range of mild stressors
5. Baddeley Grammatical Reasoning Task	1.5 min	Reasoning ability	r = 0.72	Nitrogen narcosis, Performing a supplementary task
6. Digit Symbol Substitution	1.5 min	Associative ability	r = 0.87	Pharmacological agents, brain damage
7. Wechsler Digit Span Forward	5 min	Short-term memory capacity	r = 0.36	Time of day, methylmercury exposure
8. Mental Addition	2 min	Simple math skill	r = 0.72	Motion, hyperbaria, neuropsychological disorders
9. Mental Addition with Coding	4 min	Complex coding plus math skill	r = 0.89	Not established

Psychomotor Tasks

1. Ball-Pipe Task

The measure of a subject's performance on the ball pipe-task was the number of times the subject passed the ball-bearing through the pipe. Group averages at each test point are plotted in Figure 29. Comparisons between groups at any test point revealed no significant differences. In addition, the groups did not differ statistically in terms of linear and quadratic trends in performance. Thus, performance on the ball-pipe task was not affected by diet.

2. Air Combat Maneuvering

Each subject's five scores (number of targets hit) in the Air Combat Maneuvering game were summed to generate a single score at each test point. The group averages of these scores are plotted as a function of test time in Figure 30. The averages did not differ significantly at any test point, but the linear trend (slope) was steeper for the MRE group (linear $t(55) = 2.45$, $p < 0.05$). Thus, the MRE group improved more rapidly in performance than the control group. This difference is most pronounced early in the study and is unlikely related to diet.

3. Spoke Task

Performance on the Spoke Task was represented by two measures: the time to complete the task and the number of errors (responses outside the target areas). Figure 31 shows the average time to completion for each group at each test point. The differences at any test point were not significant. Figure 32 shows that the control group tended to make more errors than the MRE group (significant differences for Test 2, $t(55) = 1.96$, $p = 0.055$ and Test 3 $t(55) = 2.61$, $p < 0.05$), but the groups did not differ significantly in linear or quadratic trends in performance.

Since the control group tended to perform less accurately than the MRE group, the similarity of the groups in their average completion times needs to be reconsidered. The control group might have taken longer to complete the task than the MRE group if it had allowed itself fewer errors. To check on this possibility, the completion times were compared while statistically controlling (by multiple regression) for the influence of accuracy on completion time. No significant differences in completion times emerged, even after this adjustment procedure.

Cognitive Tasks

1. Sternberg Memory Scanning Task (SMST)

Performance on the SMST is characterized by low error rates and a linear increase in reaction time as set size increases.[54] In the present study both groups made few incorrect responses (less than 4%) and the error rate did not differ between groups at any test point. In order to examine the relationship

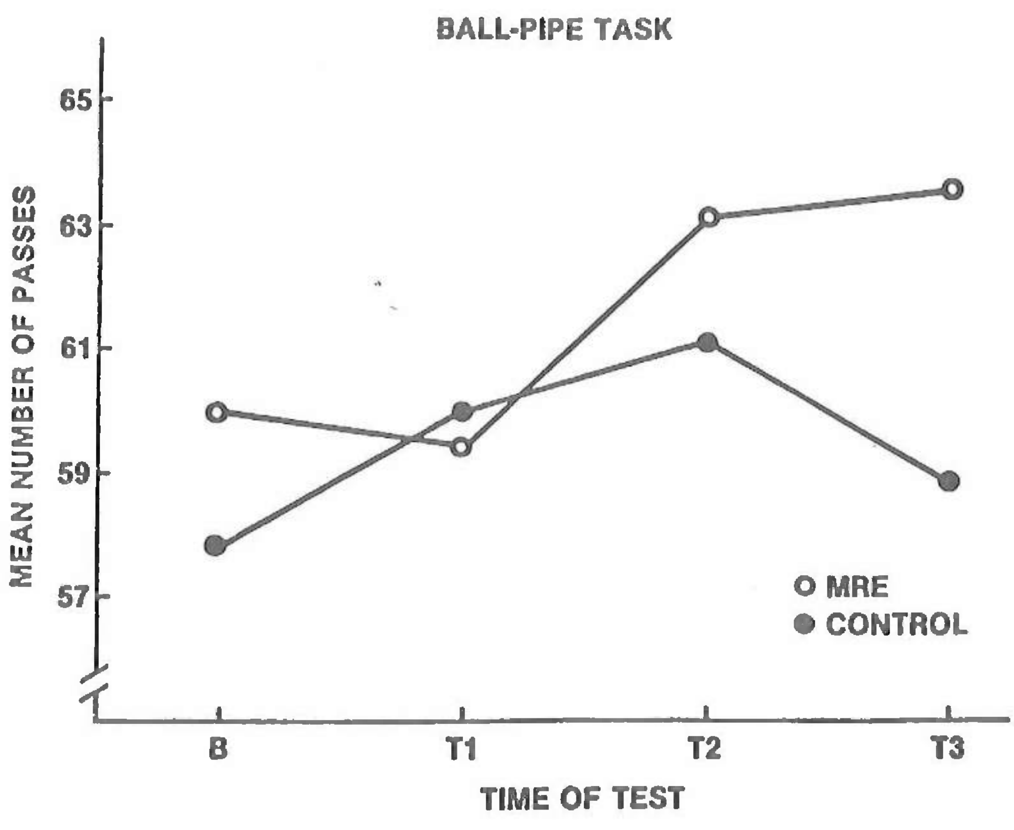

Figure 29. Mean Number of Passes on the Ball-Pipe Task.

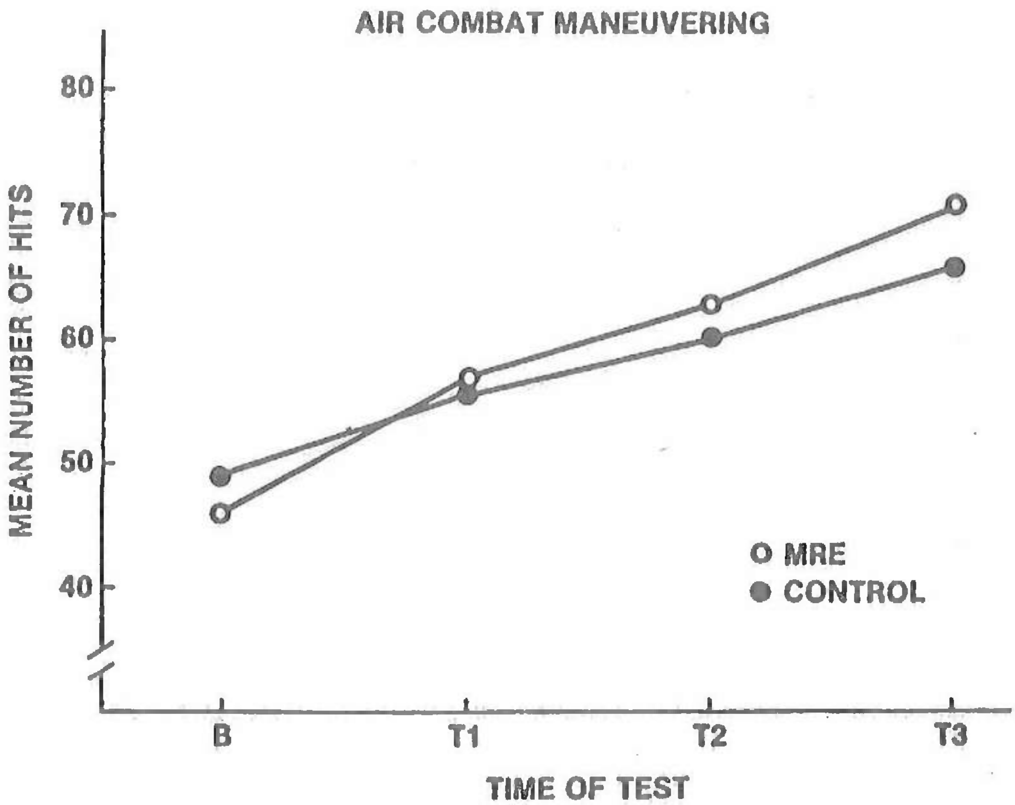

Figure 30. Mean Number of Successful Hits on Five Trials of Air Combat Maneuvering.

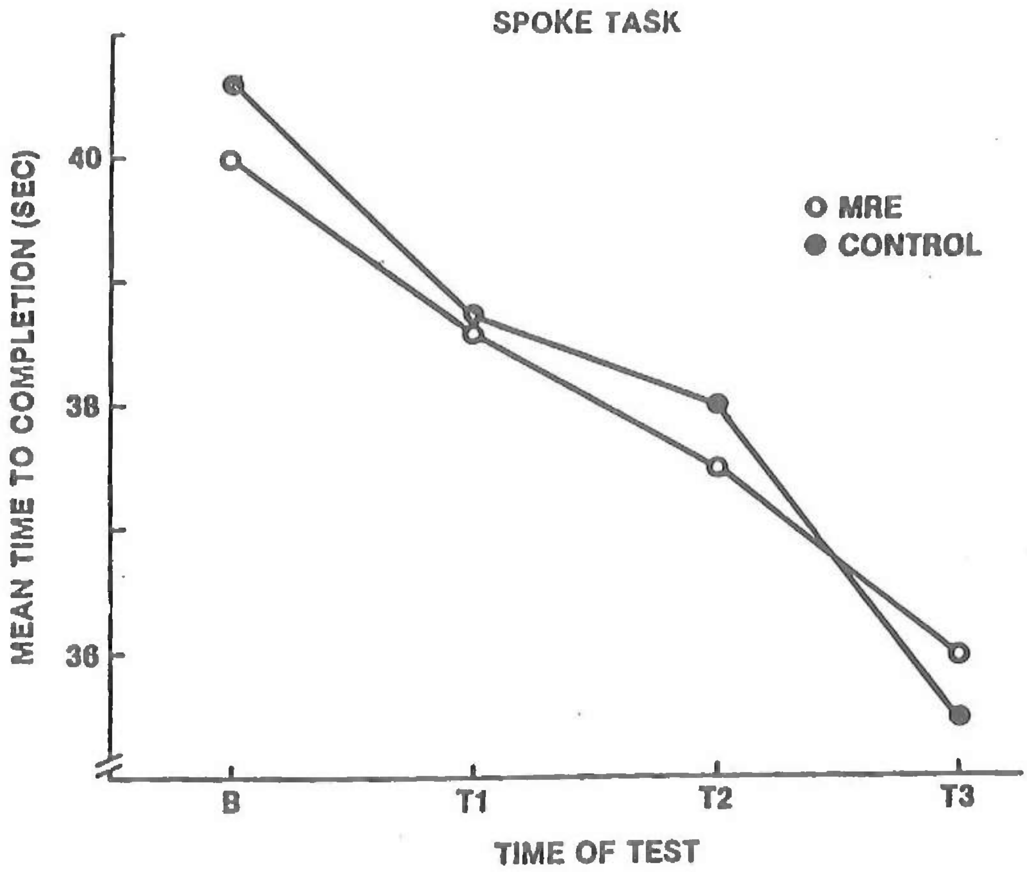

Figure 31. Mean Time to Complete Spoke Task.

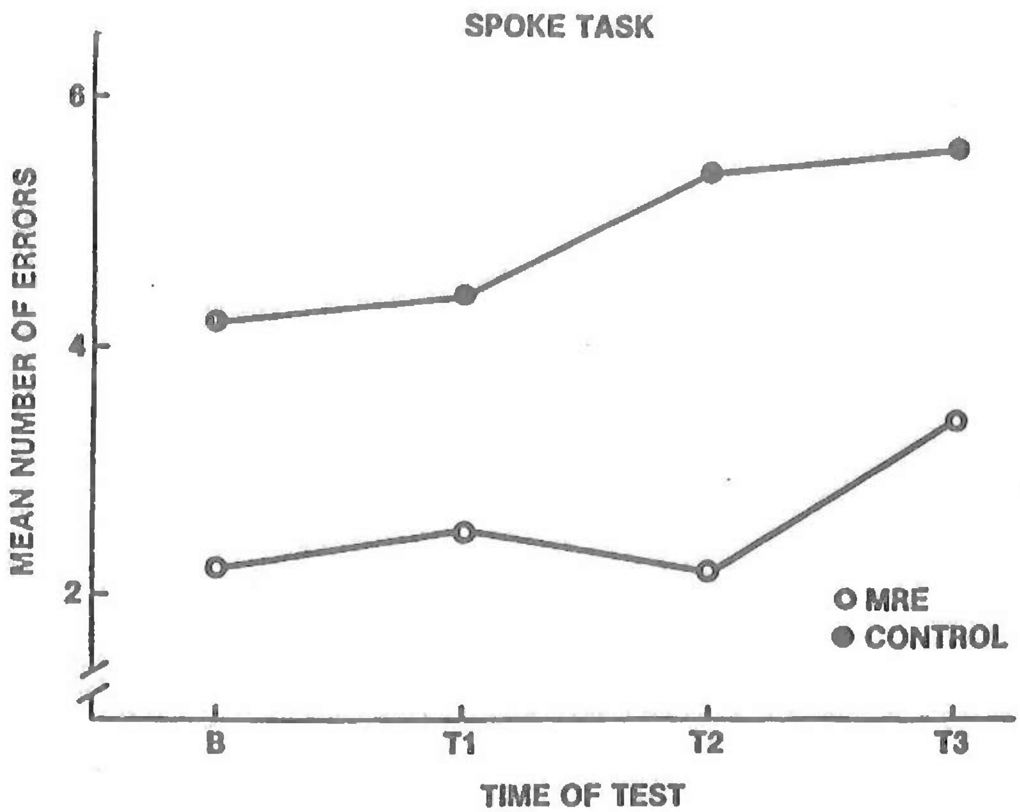

Figure 32. Mean Number of Errors on Spoke Task.

between reaction time (RT) and set size, linear functions were fit to each subject's data at each test point by the method of least squares. The average slopes and intercepts for all subjects are presented in the top half of Table 58. At each test point, the intercepts of the MRE group are significantly lower than those of the control group, indicating that they were responding faster. The slopes of these functions, which are thought to reflect how long it takes to scan the contents of short term memory, do not differ significantly at any test point, but the trends of the slopes over time do differ between the two groups. The slope of the MRE group decreases (i.e. improves) over time whereas the control group's slope does not (linear $t(53) = 2.12$, $p < 0.05$). A closer examination of the control group's performance reveals that at baseline their slope was lower than at any test point. This low value at baseline resulted from the performance of several individuals with negative slopes. A decreasing linear relationship between RT and set size is anomalous in terms the cognitive models proposed to underlie performance on the SMST. Therefore these cases were excluded, and average slopes and intercepts were recomputed based on only those subjects for whom the slope at all test points was positive. This selection criterion resulted in the elimination of five subjects from the MRE group and eleven from the control group.

The slopes and intercepts for the subjects in both groups who showed the typical pattern of responding to this task are shown in the lower half of Table 58. A comparison of the intercepts in the top and bottom halves of Table 58 shows that the effect of excluding subjects with atypical data was to render the performance of the two groups more similar. Figure 33 shows the complete function relating RT to set size for each group at each test point, and Figure 34 shows the average RT's over time, pooled across set size. The slope of the control group at baseline is now 80 instead of 50 (see Table 58), and while the MRE group still shows a decrease in slope over time and the control group does not, the difference in linear trend is not significant. A comparison of slopes at each time point shows that only the slopes at the last test point (Test 3) differ significantly ($t(37) = 2.24$, $p < 0.05$). This difference indicates a somewhat faster rate of memory scanning by the MRE group at the end of the test. The intercepts do not differ at any time point despite consistently shorter RT's by the MRE group, nor do the groups differ in terms of changes in the intercepts over time.

Overall, the results from the SMST show clearly that diet had no effect on average RT. Whatever differences exist in average RT between the control and MRE groups are evident at baseline and remain consistent throughout the test. The reason for the somewhat better performance of the MRE group is not readily apparent, but motivational factors have been shown to affect the speed of response on this task.[78] Different motivational levels may also account for the differences in the average slopes of the set size function at Test 3. The single, most important conclusion, however, is that prolonged feeding of the MRE does not have any detrimental effects on memory scanning or reaction time.

TABLE 58. Average Slopes and Intercepts in SMST Based on All Subjects (Top) and Subjects with Positive Slopes (Bottom).

	SLOPE (MSEC)		INTERCEPT (MSEC)	
	MRE (N=27)	CONTROL (N=28)	MRE	CONTROL
BASELINE	74	50	626	822
TIME 1	71	81	474	604
TIME 2	63	72	489	644
TIME 3	63	80	494	584

	SLOPE (MSEC)		INTERCEPT (MSEC)	
	MRE (N=22)	CONTROL (N=17)	MRE	CONTROL
BASELINE	80	85	608	690
TIME 1	77	93	472	528
TIME 2	69	82	478	566
TIME 3	64	89	504	533

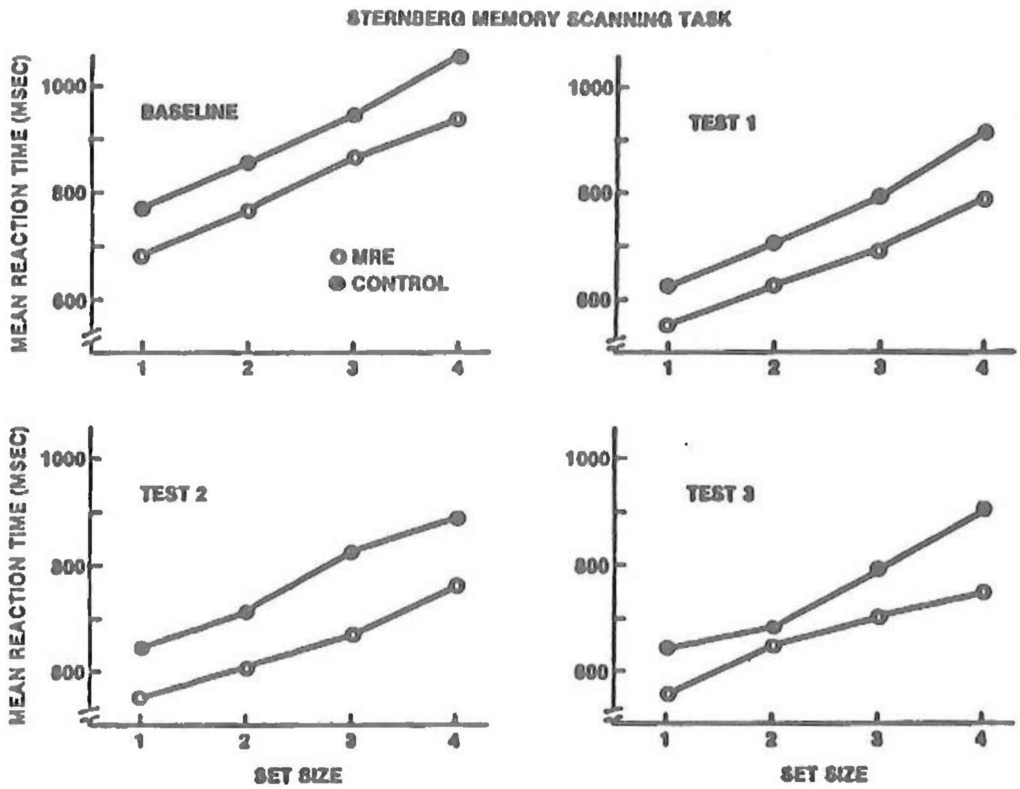

Figure 33. Mean Reaction Time as a Function of Set Size on Sternberg Memory Scanning Task.

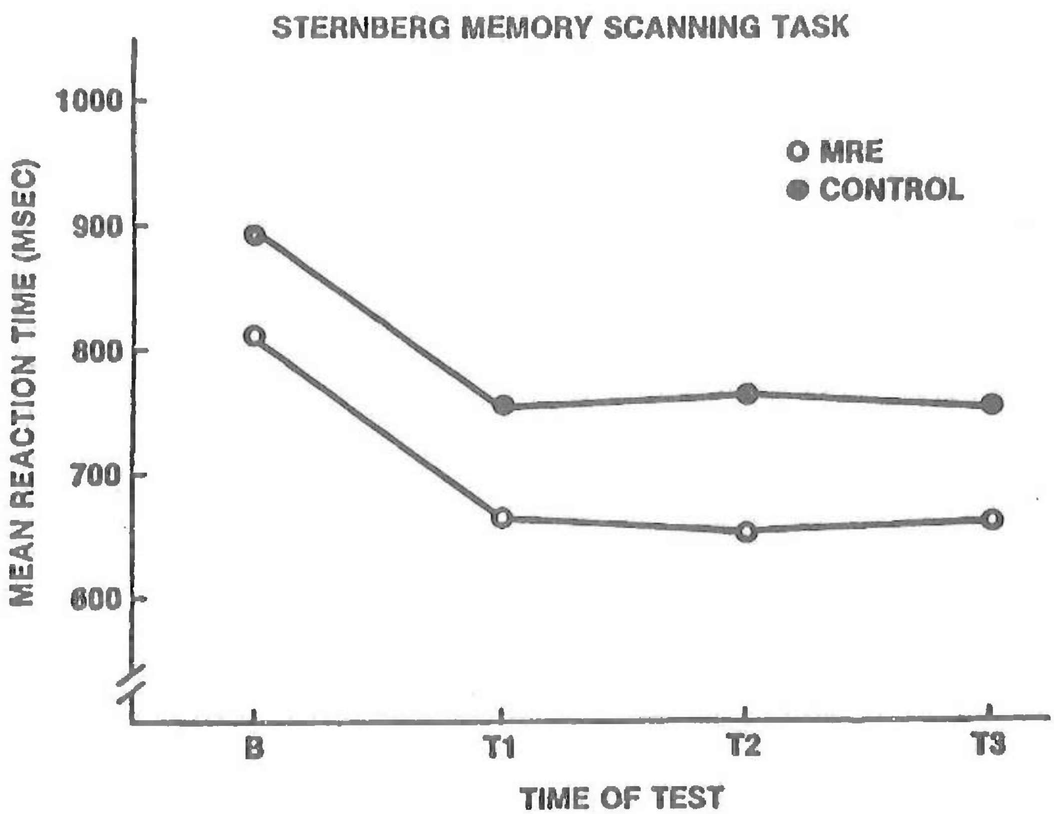

Figure 34. Mean Reaction Time Pooled Over Set Size on the Sternberg Memory Scanning Task.

2. Baddeley Grammatical Reasoning Task

Figure 35 presents the average percent of problems answered correctly on the Baddeley test for each group as a function of time of test. These results are based on data pooled over all trials (those requiring "true" or "false" as a correct response). While the figure shows that the control group performed somewhat better than the MRE group throughout the test, the differences were not statistically significant. The improvement in performance was small over time and similar for both groups. Thus, diet did not affect performance on this task. The troops found this task to be a difficult one. Fifty percent correct represents chance performance on this task, and the overall average percentage correct was approximately 70%. Although reaction times were recorded during this task, they are not reported here, since many subjects performed near chance level. With such high error rates, the reaction times, even on those trials where correct responses were made, are unlikely to represent a meaningful measure of cognitive processing.

Despite our best efforts to ensure that the troops would understand this task and the absence of reported difficulties with this task with military populations, it became apparent during testing that many individuals did not understand what "precedes" means and the task became impossible for them.

3. Digit Symbol Substitution Task

During the administration of this task some subjects had a tendency to rest their hand on the numeric keypad and inadvertently depress one of the keys. Under these circumstances the correct responses were not recorded by the computer and some subjects had scores of less than 50% correct at some test points. These low scores were not characteristic of either group or of the same individuals at other test points. To deal with this problem, a cut-off of 50% at any test point was used to exclude subjects from the analysis. Two subjects were lost from each group.

Figure 36 shows the average percent correct on this task for each group at each time point. The averages do not differ significantly at baseline and at the first two test points, but differ at the last point ($t(51) = 2.02$, $p = 0.049$). Trend analyses reveal no difference in linear trend, but a difference in quadratic trend ($t(53) = 2.56$, $p < 0.05$). This difference most likely reflects the downturn and subsequent upturn in the performance of the control group at Tests 2 and 3, compared to the downturn in the MRE group's performance at Test 3. The magnitude of this effect, however, appears slight.

Overall, the results suggest no clearly interpretable differences between groups in performance on the DSST.

4. Wechsler-Digit Span Test

At each session, the maximum number of digits that each subject could recall without two consecutive errors was recorded. The average digit span is plotted in Figure 37 for each group at each test point. While the average

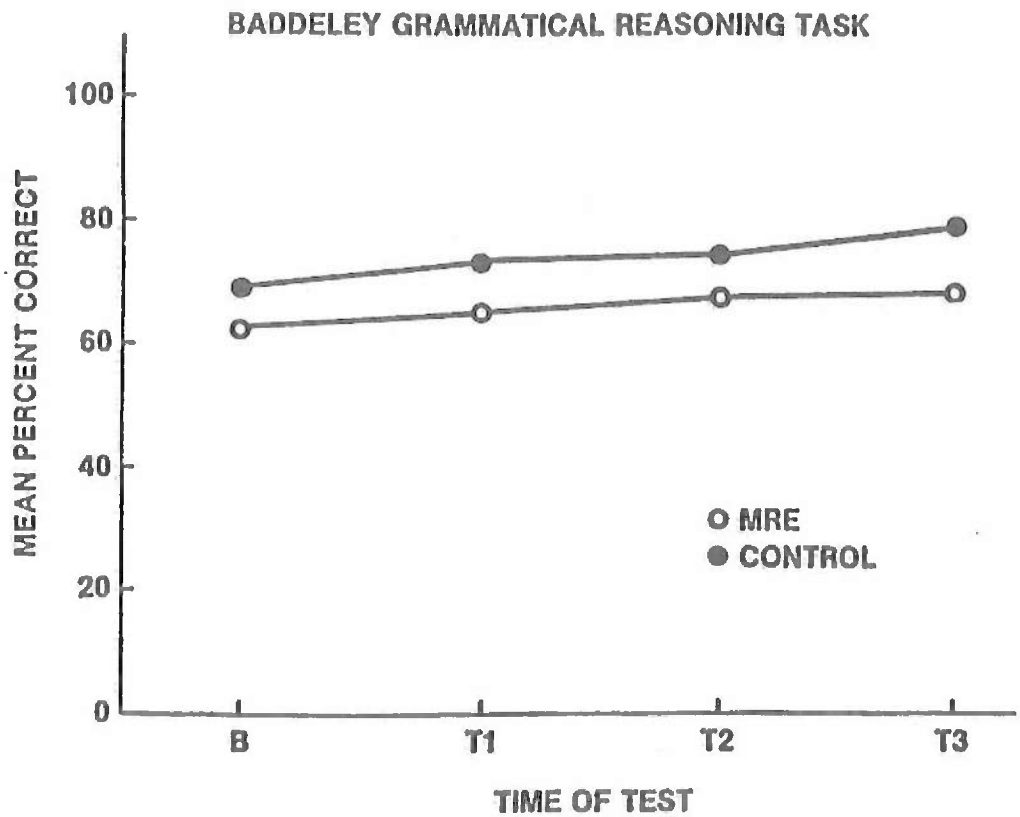

Figure 35. Mean Percent Correct on Baddeley Grammatical Reasoning Task.

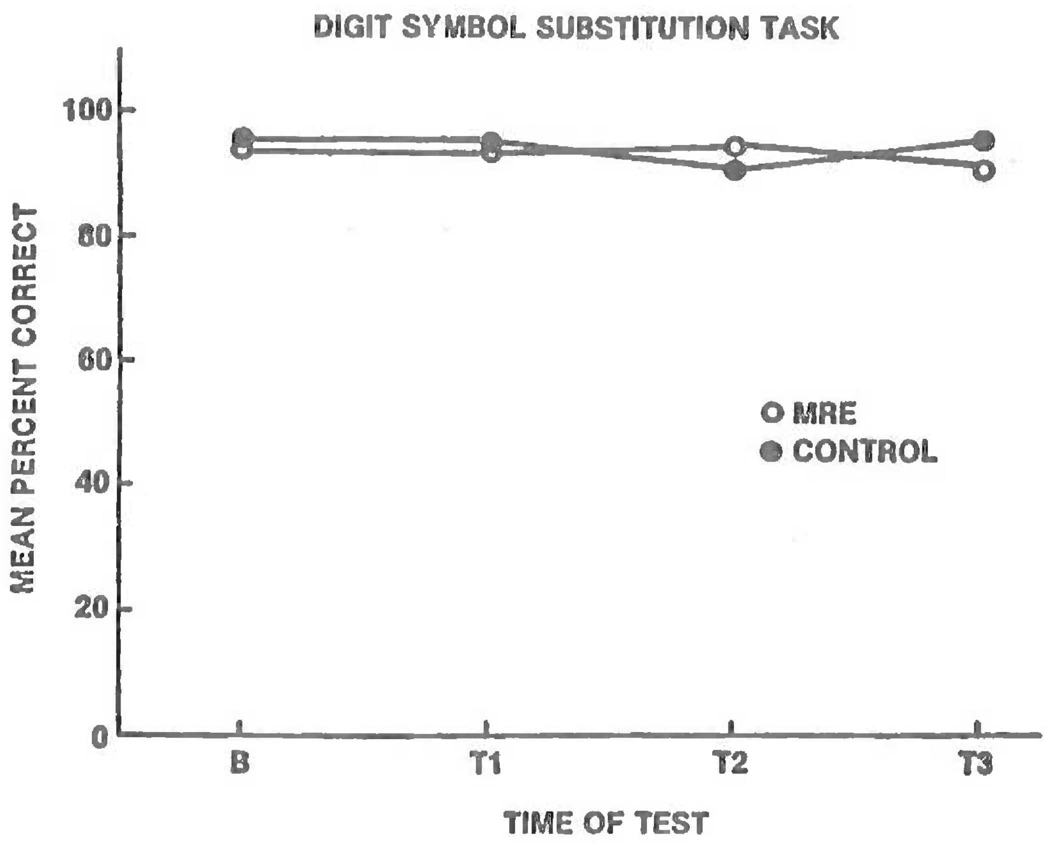

Figure 36. Mean Percent Correct on Digit Symbol Substitution Task.

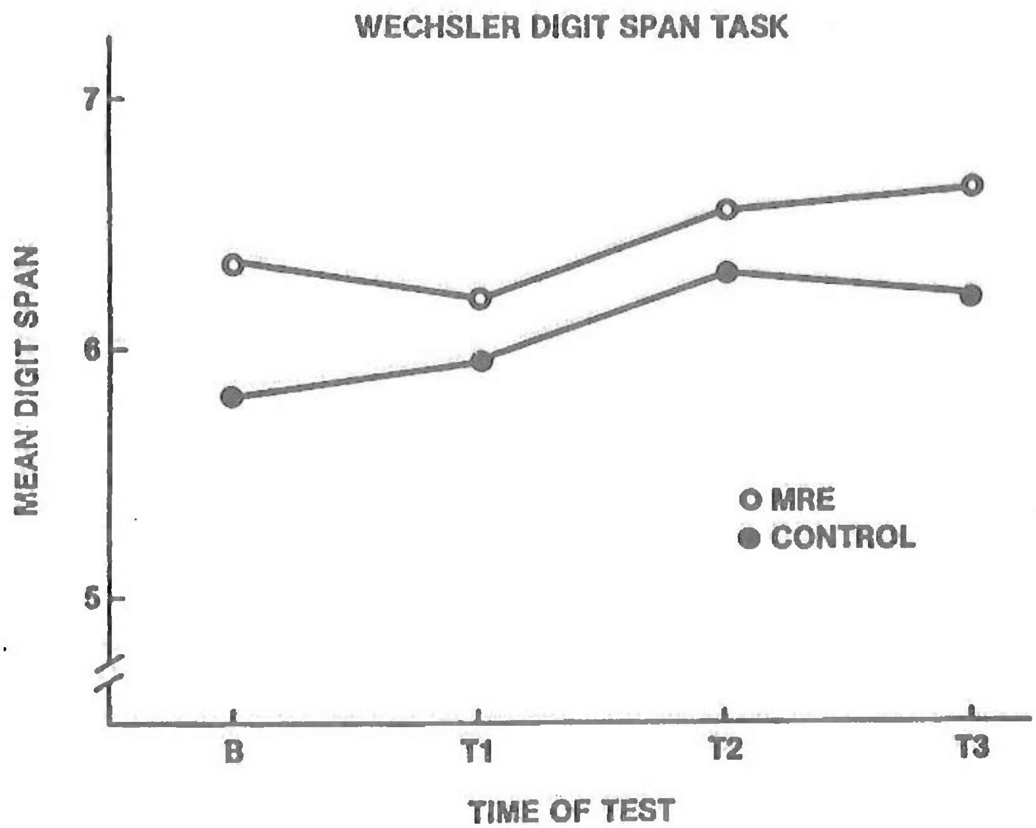

Figure 37. Mean Digit Span on Wechsler Digit Span Task.

performance by the MRE group is somewhat higher than that of the control group, the differences are not significant. There is no indication of a difference between the groups in rate of improvement.

5. Mental Addition

As expected, the average percent correct on the simple mental addition task at each time point by both groups was high (in excess of 98%) and remained stable across the four test points.

Figure 38 displays the average reaction times for both groups for correct responses on this task. It is apparent that the MRE group responded faster than the control group. The group difference in reaction time was not significant during baseline testing but was significant at the three test points ($t(55) = 2.59, 2.09, 2.34$, for T1, T2, T3, $p < 0.05$). However, the two groups showed a very similar pattern of improvement on this task over time and neither the linear nor the quadratic components of the trend differed between the groups. Although it is tempting to attribute the consistently better performance of the MRE group to their diet, the fact that the groups showed the same pattern of change over time and the MRE group began the study responding faster argues against this interpretation. Superior reaction time performance by the MRE group was also seen on the Sternberg Memory Scanning Task.

6. Mental Addition with Coding

The average percent correct on this task at each test point for the two groups was slightly above 80% correct during baseline testing and reached approximately 90% during the field tests. The percent correct did not differ between groups at any time point, nor were there differences in linear or quadratic trends.

Figure 39 displays the average reaction times for both groups for correct responses on this mental addition with coding task. At each test point, the MRE group responded faster than the control group. This difference exceeded 0.5 sec but was not statistically significant. The two groups showed a similar pattern of improvement over time in the speed with which they responded to these problems, and neither the linear nor the quadratic components of the trend differed.

The group differences in reaction time fail to reach significance on account of large within group variability. The standard errors of the mean are approximately 350 msec for both groups. In addition, the distribution of reaction times was skewed towards long reaction times. However, even when the influence of long reaction time is reduced by analyzing median reaction times or geometric means (means of log RT's), the group differences in reaction times are still not statistically significant.

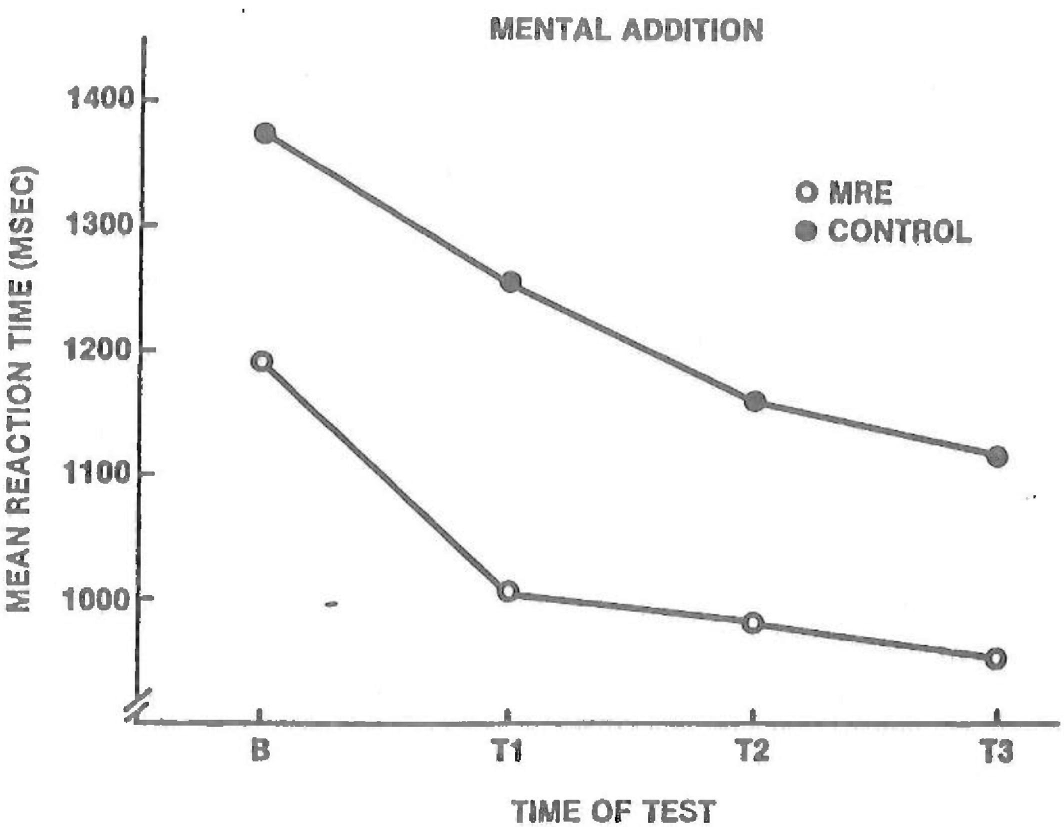

Figure 38. Mean Reaction Time on Mental Addition Task.

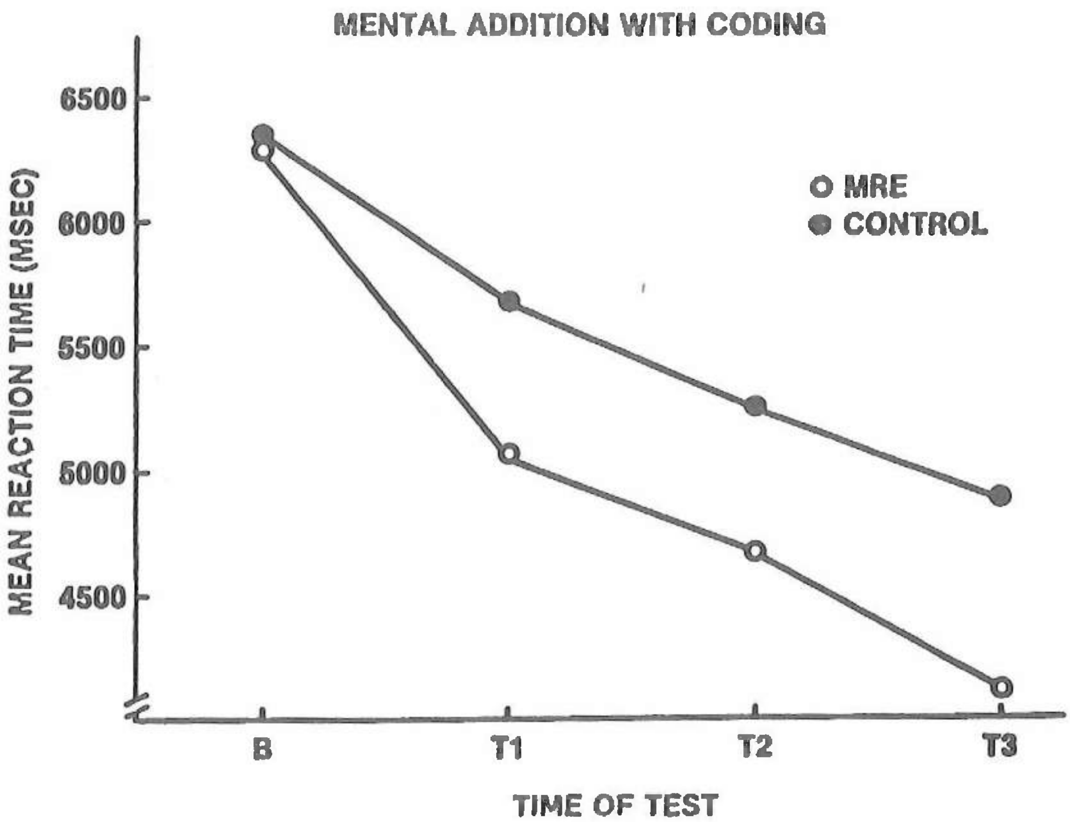

Figure 39. Mean Reaction Time on Mental Addition with Coding Task.

7. Body Weight Loss and Performance

The overriding reason for evaluating cognitive and psychomotor performance during this field test was to specify whether deficits occur if the troops failed to eat the ration in sufficient quantity. We have already reported that the MRE group lost significantly more weight during the field test (Chapters 3 and 7). In these chapters we document in detail the failure to detect performance deficits in the MRE company relative to the control group.

Within the MRE company, body weight loss ranged from 0% to 11%. It is possible that performance deficits were masked by the troops whose weight loss was minimal. To evaluate this possibility we compared the performance scores within the MRE company of the troops who lost the most weight with those who lost the least. A subject was included in the low weight loss group if his percentage body weight loss at the end of the study was less than 5%. The high weight loss group was composed of the troops who lost 7% or more of their initial body weight. These cut-offs resulted in two groups of eight subjects.

The analyses performed in comparing the MRE group to the control group were repeated on the two weight loss groups. There were no systematic or statistically significant differences on any of the measures of cognitive and psychomotor performance tasks. Thus, even this secondary analysis fails to uncover any performance deficits in the MRE subjects who lost the most weight during the course of the study.

The performance measures and their patterns over time clearly indicate that troops fed the MRE as their sole source of food were not compromised in any detectable way during the course of this field test. In fact, although they were few in number, any group differences on these measures of cognitive and psychomotor performance almost always favored the MRE group. In many instances they began the study with better performance scores than the control group and on those few measures that showed a differential pattern of change over time, it was the MRE group that showed a more rapid rate of improvement.

These data suggest that the MRE company perceived the prolonged feeding study as a challenge and, to the extent that performance on this test battery is sensitive to motivational factors (e.g. Franklin & Okada, 1983),[78] the MRE company appears to have been more motivated. There are two troubling aspects of this interpretation. Firstly, our subjective impression of all the troops participating in the performance testing is that they were uniformly highly motivated to perform well. We had to actively discourage them from watching their peers being tested and comparing scores, particularly when their NCO's or CO was involved. They were not disinterested or bored troops going through the motions. Secondly, our systematic measures of mood and morale did not reveal any differences between the two companies during the course of the study. This lack of difference does not preclude a motivational explanation for those instances where the MRE group performed at a higher level than the control company, but it does make such an interpretation less compelling. Alternatively, it is possible that the volunteers from the MRE company were a brighter, more able group of troops to begin with. Certainly the fact that most differences that were observed began with baseline testing at Schofield Barracks before the troops went to the field supports this explanation. In addition, there is a growing literature which shows that performance on the type of information processing tasks used in this test battery correlate very highly with verbal ability.[76] Whichever explanation turns out to be correct, the important conclusion to be drawn within the context of the present study is that troops fed the MRE as their sole source of food for 34 days did not show a decrement in cognitive and psychomotor performance relative to troops fed an A ration breakfast, an MRE lunch and an A ration dinner, despite the fact that they lost significantly more weight during the course of the study. Further support for this conclusion derives from the observation that within the MRE company the troops who lost more than 7% of their initial body weight did not differ on these performance measures from the troops who lost less than 5%.

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Appendix A. Nutrient Composition of MRE Menu Items

RECORD OF NUTRITIVE VALUES MEAL ~~READY-TO-EAT,~~ INDIVIDUAL LP/P DES 33-74A W ALTERNATE MENUS* —

03/26/81

TOTALS	WATER (G)/WT.	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
MENU NR.											
1	127.27	31.92	52.30	7.45	378	703	5.77	2167	913	84	4.91
2	114.80	49.34	49.44	6.76	181	639	5.59	1781	824	142	3.63
3	118.31	44.56	57.26	12.57	432	853	9.02	3027	1314	139	7.36
4	99.71	44.44	49.72	7.62	227	557	5.91	1690	1260	154	3.94
5	127.19	38.90	54.62	8.13	253	650	5.63	2118	1090	152	4.25
6	181.74	39.38	50.80	10.48	321	575	8.51	3334	1599	133	7.32
7	125.50	43.31	49.19	8.17	246	597	5.08	2141	912	91	4.91
8	211.11	46.84	56.81	9.37	389	793	8.78	2513	1191	127	5.19
9	143.35	36.29	46.48	8.47	421	853	5.45	2469	940	93	4.67
10	113.81	34.52	54.10	10.36	258	603	6.31	2669	1310	117	6.44
11	111.62	45.74	54.66	11.36	408	974	5.71	3049	963	89	6.24
12	104.24	39.26	52.77	7.46	237	493	5.37	1727	1066	147	4.19
MEAN	131.55/377	41.21	52.35	9.02	313	691	6.43	2390	1115	122	5.25
Minimum Meal Requirements (1976) 1/3 AR40-25 reqmts		33.3			267		6.0				

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
MENU NR.											
1	6070	.036	6130	106	4.01	1.04	7.1	3.00	133.0	1130	351
2	2070	.019	2100	86	2.33	.89	17.3	.63	121.4	1128	342
3	3230	.241	3630	66	2.64	1.03	9.6	1.91	139.4	1251	371
4	3310	.382	3950	66	2.33	1.04	14.1	.67	136.2	1170	338
5	4630	1.233	6680	96	2.55	.81	12.4	1.87	155.4	1269	384
6	2670	.271	3120	68	1.90	.82	8.6	1.81	167.8	1286	450
7	2510	.004	2520	59	1.74	.78	9.4	1.64	162.9	1268	389
8	3070	.241	3470	63	2.52	1.06	8.1	1.68	105.1	1119	428
9	4990	.618	6020	103	2.93	.90	10.1	3.05	142.5	1134	376
10	3030	.004	3040	59	1.75	.82	7.6	1.81	176.3	1333	[illegible]
11	4990	.084	5130	100	3.20	.98	9.3	3.05	[illegible]	1237	364
12	3310	.019	3340	123	2.31	1.08	13.3	.61	133.9	1165	359
MEAN	3657	.263	4094	83	2.52	.94	10.6	1.84	142.9	1208	377
Minimum Meal Requirements (1967) 1/3 AR 40-25 reqmts			1670	20	0.53	0.67	7.0			[illegible]	

*See footnotes at end of Table

Appendix A

RECORD OF NUTRITIVE VALUES MEAL READY-TO-EAT, INDIVIDUAL LP/P DES 33-74A W ALTERNATE MENUS *

03/26/81

MENU 1	WATER (G) / WT.	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
PORK SSG PAT	.58/34	15.76	13.42	1.91	8	145	1.17	570	242	16	1.28
APPLESAUCE	105.29	.23	.05	.26	4	8	1.34	38	75	4	.74
CRACKERS	1.36	3.96	5.32	1.24	88	46	1.12	432	57	8	.91
CHEESE SPR	18.13	5.84	17.32	2.09	166	298	.63	655	19	6	.81
COOKIES CHCV	.86	2.70	10.36	.57	37	68	.61	90	94	19	.20
COCOA BEV PD	.94	2.98	5.57	1.23	68	111	.55	131	271	23	.32
CATSUP		.44	.12		6	11	.21	244	118	6	.65
COFFEE INSTA			.00	.00	0		.01		0		.00
CREAM SUB ND	.11		.13	.12	1	16	.12	7	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	127.22/351 ~35% H_2O	31.92	52.30	7.45	378	703	5.77	2187	913	84	4.91

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
PORK SSG PAT					.57	.11	3.4	.10	2.3	193	34
APPLESAUCE		.010	20		.02	.01	.1	.03	24.2	98	130
CRACKERS					.76	.36	1.8	.26	28.1	176	40
CHEESE SPR	2480		2480	43	1.25	.11	.0	1.27	.0	179	43
COOKIES CHCV	1080		1080	3	.56	.34	.7	.02	28.0	216	43
COCOA BEV PD	2510		2510	37	.84	.07	.1	1.28	31.8	189	43
CATSUP		.026	40	7	.01	.02	.4	.05	6.4	29	7
COFFEE INSTA	0	.000	0	15	.00	.01	.8		2.5	10	3
CREAM SUB ND					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	6.0	24	6
SUM	6070	.036	6130	106	4.01	1.04	7.1	3.00	133.0	1130	351

*See footnotes at end of Table

RECORD OF NUTRITIVE VALUES   MEAL READY-TO-EAT, INDIVIDUAL   LP/P DES 33-74A W ALTERNATE MENUS *

03/26/81

MENU 2	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
STRAWBER SW	.27	.41	.08	.27	14	18	.33	6	109	10	.01
HAM/CK LOAF	98.99	29.57	5.88	2.51	26	242	1.98	777	268	34	1.62
CRACKERS	1.36	3.96	5.32	1.24	88	46	1.12	432	57	8	.91
PEANUT BUT	.77	11.65	21.44	1.45	20	166	.77	240	268	71	.53
PINEA NUT CK	15.30	3.74	16.60	1.13	33	149	1.26	319	86	18	.56
COFFEE INSTA			.00	.00	0		.01		0		.00
CREAM SUB ND	.11		.13	.12	1	16	.12	7	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	114.80	49.34	49.44	6.76	181	639	5.59	1781	824	142	3.63

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
STRAWBER SW		.019	30	32	.01	.02	.3	.02	14.0	58	15
HAM/CK LOAF					.03	.34	8.3	.23	6.8	198	142
CRACKERS					.76	.36	1.6	.26	28.1	176	40
PEANUT BUT	2070		2070	40	.83	.06	5.7	.11	7.2	268	43
PINEA NUT CK					.69	.09	.7	.01	53.2	377	90
COFFEE INSTA	0	.000	0	15	.00	.01	.8		2.5	10	3
CREAM SUB ND					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	6.0	24	6
SUM	2070	.019	2100	86	2.33	.89	17.3	.63	121.4	1128	342

*See footnotes at end of Table

RECORD OF NUTRITIVE VALUES MEAL READY-TO-EAT, INDIVIDUAL LP/P DES 33-74A W ALTERNATE MENUS *

03/26/81

MENU 3	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
BEAN W/TO SA	92.97	9.75	1.91	2.83	81	186	3.05	598	680	65	1.53
BEEF PAT	.58	19.12	10.24	1.94	9	159	2.53	512	247	21	1.27
CRACKERS	1.36	3.96	5.32	1.24	68	46	1.12	432	57	8	.91
CHEESE SPR	18.13	5.84	17.32	2.09	166	298	.63	655	19	6	.81
BROWN CHCV	2.61	2.91	16.47	.56	37	73	.77	52	109	24	.17
SP/GRAV BASE	.19	1.27	.21	3.22	5	28	.40	696	78	6	2.43
AV CANDY MRE	2.37	1.71	5.65	.52	44	48	.39	74	88	9	.22
COFFEE INSTA			.00	.00	0		.01		0		.00
CREAM SUB ND	.11		.13	.12	1	16	.12	7	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	118.31	44.56	57.26	12.57	432	853	9.02	3027	1314	139	7.36

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
BEAN W/TO SA		.241	400	4	.13	.04	1.2	.13	34.2	193	142
BEEF PAT					.03	.09	4.3	.22	2.1	177	34
CRACKERS					.76	.36	1.6	.26	28.1	176	40
CHEESE SPR	2480		2480	43	1.25	.11	.0	1.27	.0	179	43
BROWN CHCV	590		590	1	.35	.29	.6	.02	27.5	270	50
SP/GRAV BASE					.01	.04	1.0		2.1	15	7
AV CANDY MRE	160		160	3	.11	.08	.1	.01	33.2	191	43
COFFEE INSTA	0	.000	0	15	.00	.01	.8		2.6	10	3
CREAM SUB ND					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	5.0	24	6
SUM	3230	.241	3630	66	2.64	1.03	9.8	1.91	139.4	1251	371

*See footnotes at end of Table

RECORD OF NUTRITIVE VALUES   MEAL READY-TO-EAT, INDIVIDUAL   LP/P DES 33-74A W ALTERNATE MENUS *

03/26/81

MENU 4	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
PEACHES FRDH	.33	.70	.02	.26	3	13	.26	17	111	5	
BEEF W/BQ SA	93.92	23.71	6.80	3.43	34	200	2.62	829	605	41	2.07
CRACKERS	1.36	3.96	5.32	1.24	88	46	1.12	432	57	8	.91
PEANUT BUT	.77	11.65	21.44	1.45	20	166	.77	240	268	71	.53
COOKIES CHCV	.86	2.70	10.36	.57	37	68	.61	90	94	19	.20
AV CANDY MRE	2.37	1.71	5.65	.52	44	48	.39	74	88	9	.22
COFFEE INSTA			.00	.00	0		.01		0		.00
CREAM SUB ND	.11		.13	.12	1	16	.12	7	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	98.71	44.44	49.72	7.62	227	557	5.91	1690	1260	154	3.94

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
PEACHES FRDH		.084	140	3	.01	.00	.5	.01	13.7	58	15
BEEF W/BQ SA		.298	500	3	.06	.18	4.8	.26	13.8	211	142
CRACKERS					.76	.36	1.6	.26	28.1	176	40
PEANUT BUT	2070		2070	40	.83	.06	5.7	.11	7.2	268	43
COOKIES CHCV	1080		1080	3	.56	.34	.7	.02	28.0	216	43
AV CANDY MRE	160		160	3	.11	.08	.1	.01	33.2	191	43
COFFEE INSTA	0	.000	0	15	.00	.01	.8		2.5	10	3
CREAM SUB ND					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	6.0	24	6
SUM	3310	.382	3950	66	2.33	1.04	14.1	.67	136.2	1170	338

*See footnotes at end of Table

RECORD OF NUTRITIVE VALUES   MEAL READY-TO-EAT, INDIVIDUAL   LP/P DES 33-74A W ALTERNATE MENUS *

03/28/81

MENU 5	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
FRUIT MX DEH	.23	.23	.00	.13	5	8	.22	16	73	5	.00
BEEF STEW	107.54	16.17	5.34	2.71	26	154	1.73	983	300	26	1.94
CRACKERS	1.36	3.96	5.32	1.24	88	46	1.12	432	57	8	.91
PEANUT BUT	.77	11.65	21.44	1.45	20	166	.77	240	268	71	.53
CHERRY NTCK	16.25	3.91	16.82	1.21	46	149	1.10	309	84	19	.54
COCOA BEV PD	.94	2.98	5.57	1.23	68	111	.55	131	271	23	.32
COFFEE INSTA			.00	.00	0		.01		0		.00
CREAM SUB ND	.11		.13	.12	1	16	.12	7	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	127.19	38.90	54.62	8.13	253	850	5.63	3118	1090	152	4.25

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
FRUIT MX DEH	50		50	2	.02	.02	.6	.02	14.4	59	15
BEEF STEW		1.233	2050	1	.04	.18	3.1	.18	9.9	153	142
CRACKERS					.76	.36	1.6	.26	28.1	176	40
PEANUT BUT	2070		2070	40	.83	.06	5.7	.11	7.2	268	43
CHERRY NTCK					.05	.10	.5	.01	51.8	374	90
COCOA BEV PD	2510		2510	37	.84	.07	.1	1.28	31.8	189	43
COFFEE INSTA	0	.000	0	15	.00	.01	.8		2.5	10	3
CREAM SUB ND					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	6.0	24	6
SUM	4630	1.233	6680	96	2.55	.81	12.4	1.87	155.4	1269	384

*See footnotes at end of Table

RECORD OF NUTRITIVE VALUES   MEAL READY-TO-EAT, INDIVIDUAL   LP/P DES 33-74A W ALTERNATE MENUS *

03/26/81

MENU 6	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
FRANKFURT	75.92	20.43	32.05	4.44	28	144	2.87	1833	341	20	3.68
BEAN W/TO SA	92.97	9.75	1.91	2.83	81	186	3.05	598	680	65	1.53
CRACKERS	1.38	3.96	5.32	1.24	88	46	1.12	432	57	8	.91
JELLY	8.07	.11	.04	.06	5	14	.19	15	7	1	.01
AV CANDY MRE	2.37	1.71	5.65	.52	44	48	.39	74	88	9	.22
CATSUP		.44	.12		6	11	.21	244	118	6	.65
COCOA BEV PD	.94	2.98	5.57	1.23	68	111	.55	131	271	23	.32
COFFEE INSTA			.00	.00	0		.01		0		.00
CREAM SUB ND	.11		.13	.12	1	16	.12	7	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	181.74	39.38	50.80	10.48	321	575	8.51	3394	1598	133	7.32

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
FRANKFURT					.04	.23	4.4	.08	1.8	377	135
BEAN W/TO SA		.241	400	4	.13	.04	1.2	.13	34.2	193	142
CRACKERS					.76	.36	1.6	.26	28.1	176	40
JELLY		.004	10	1	.00	.00	.0	.00	20.1	81	28
AV CANDY MRE	160		160	3	.11	.08	.1	.01	33.2	191	43
CATSUP		.028	40	7	.01	.02	.4	.05	6.4	29	7
COCOA BEV PD	2510		2510	37	.84	.07	.1	1.28	31.8	189	43
COFFEE INSTA	0	.000	0	15	.00	.01	.8		2.5	10	3
CREAM SUB ND					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	6.0	24	6
SUM	2670	.271	3120	68	1.90	.82	8.6	1.81	167.8	1286	450

*See footnotes at end of Table

RECORD OF NUTRITIVE VALUES   MEAL READY-TO-EAT, INDIVIDUAL   LP/P DES 33-74A W ALTERNATE MENUS *

03/26/81

MENU 7	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
TURK/GRAVY	101.44	29.08	4.53	2.21	20	164	1.20	621	197	23	1.54
POTATO PATTI	.70	2.23	10.42	1.77	24	49	.71	551	231	9	1.42
CRACKERS	1.36	3.96	5.32	1.24	88	46	1.12	432	57	8	.91
JELLY	8.07	.11	.04	.06	5	14	.19	15	7	1	.01
MAPLE NUT CK	12.87	4.96	23.17	1.50	41	197	1.16	385	113	26	.70
COCOA BEV PD	.94	2.98	5.57	1.23	68	111	.55	131	271	23	.32
COFFEE INSTA			.00	.00	0		.01		0		.00
CREAM SUB ND	.11		.13	.12	1	16	.12	7	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	125.50	43.31	49.19	8.17	246	597	5.08	2141	912	91	4.91

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
TURK/GRAVY					.03	.20	5.7	.20	4.4	175	142
POTATO PATTI				5	.02	.03	.4	.08	18.9	178	34
CRACKERS					.76	.36	1.6	.26	28.1	176	40
JELLY		.004	10	1	.00	.00	.0	.00	20.1	81	28
MAPLE NUT CK					.68	.10	.7	.02	47.5	418	90
COCOA BEV PD	2510		2510	37	.84	.07	.1	1.28	31.8	189	43
COFFEE INSTA	0	.000	0	15	.00	.01	.8		2.5	10	3
CREAM SUB ND					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	6.0	24	6
SUM	2510	.004	2520	59	1.74	.78	9.4	1.84	182.9	1268	389

*See footnotes at end of Table

RECORD OF NUTRITIVE VALUES   MEAL READY-TO-EAT, INDIVIDUAL   LP/P DES 33-74A W ALTERNATE MENUS *

03/26/81

MENU 8	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
BEAN W/TO SA	92.97	9.75	1.91	2.83	81	186	3.05	598	680	65	1.53
BEEF/GRAVY	95.93	24.39	15.66	2.49	16	174	3.07	768	289	23	1.76
CRACKERS	1.36	3.96	5.32	1.24	88	46	1.12	432	57	8	.91
CHEESE SPR	18.13	5.84	17.32	2.09	166	298	.63	655	19	6	.81
BROWN CHCV	2.61	2.91	16.47	.56	37	73	.77	52	109	24	.17
COFFEE INSTA			.00	.00	0		.01		0		.00
CREAM SUB ND	.11		.13	.12	1	16	.12	7	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	211.11	46.84	58.81	9.37	389	793	8.78	2513	1191	127	5.19

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
BEAN W/TO SA		.241	400	4	.13	.04	1.2	.13	34.2	193	142
BEEF/GRAVY					.03	.24	3.9	.20	3.2	251	142
CRACKERS					.76	.36	1.6	.26	28.1	176	40
CHEESE SPR	2480		2480	43	1.25	.11	.0	1.27	.0	179	43
BROWN CHCV	590		590	1	.35	.29	.6	.02	27.5	270	50
COFFEE INSTA	0	.000	0	15	.00	.01	.8		2.5	10	3
CREAM SUB ND					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	6.0	24	6
SUM	3070	.241	3470	63	2.52	1.06	8.1	1.88	105.1	1119	438

*See footnotes at end of Table

RECORD OF NUTRITIVE VALUES MEAL READY-TO-EAT, INDIVIDUAL LP/P DES 33-74A W ALTERNATE MENUS *

03/26/81

ALT MENU 9	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
CK A LA KING	107.28	19.17	5.00	2.54	50	193	1.35	755	283	26	1.52
CRACKERS	1.36	3.96	5.32	1.24	88	46	1.12	432	57	8	.91
CHEESE SPR	18.13	5.84	17.32	2.09	166	298	.63	655	19	6	.81
FRUITCAKE	15.53	3.90	13.01	1.21	42	178	1.45	244	156	23	.45
CATSUP		.44	.12		6	11	.21	244	118	6	.65
COCOA BEV PD	.94	2.98	5.57	1.23	68	111	.55	131	271	23	.32
COFFEE INSTA			.00	.00	0		.01		0		.00
CREAM SUB ND	.11		.13	.12	1	16	.12	7	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	143.35	36.29	46.48	8.47	421	853	5.45	2489	940	93	4.67

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
CK A LA KING		.106	180	0	.01	.23	6.3	.18	7.7	153	142
CRACKERS					.78	.36	1.6	.26	28.1	176	40
CHEESE SPR	2480		2480	43	1.25	.11	.0	1.27	.0	179	43
FRUITCAKE		.486	810		.05	.11	.9	.04	66.3	358	90
CATSUP		.026	40	7	.01	.02	.4	.05	6.4	29	7
COCOA BEV PD	2510		2510	37	.84	.07	.1	1.28	31.8	189	43
COFFEE INSTA	0	.000	0	15	.00	.01	.8		2.5	10	3
CREAM SUB ND					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	6.0	24	6
SUM	4990	.618	6020	103	2.93	.90	10.1	3.05	142.5	1134	378

*See footnotes at end of Table

RECORD OF NUTRITIVE VALUES MEAL READY-TO-EAT, INDIVIDUAL LP/P DES 33-74A W ALTERNATE MENUS *

03/28/81

MENU 10	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
MTBALL W/BBQ	91.16	20.32	10.12	4.41	37	169	2.32	1185	563	37	3.16
POTATO PATTI	.70	2.23	10.42	1.77	24	49	.71	551	231	9	1.42
CRACKERS	1.36	3.96	5.32	1.24	88	46	1.12	432	57	8	.91
JELLY	8.07	.11	.04	.06	5	14	.19	15	7	1	.01
CH NUT CAKE	11.47	4.92	22.50	1.49	35	199	1.28	349	145	38	.61
COCOA BEV PO	.94	2.98	5.57	1.23	68	111	.55	131	271	23	.32
COFFEE INSTA			.00	.00	0		.01		0		.00
CREAM SUB NO	.11		.13	.12	1	16	.12	7	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	113.81	34.52	54.10	10.36	258	803	6.31	2569	1310	117	6.44

	A (I.U)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
MTBALL W/BBQ	520		520		.08	.24	3.9	.17	15.7	235	142
POTATO PATTI				5	.02	.03	.4	.08	18.9	178	34
CRACKERS					.76	.36	1.6	.26	28.1	176	40
JELLY		.004	10	1	.00	.00	.0	.00	20.1	81	28
CH NUT CAKE					.06	.10	.7	.02	49.6	421	90
COCOA BEV PO	2510		2510	37	.84	.07	.1	1.28	31.8	189	43
COFFEE INSTA	0	.000	0	15	.00	.01	.8		2.5	10	3
CREAM SUB NO					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	6.0	24	6
SUM	3033	.004	3040	59	1.75	.82	7.6	1.81	176.3	1330	389

*See footnotes at end of Table

RECORD OF NUTRITIVE VALUES   MEAL READY-TO-EAT, INDIVIDUAL   LP/P DES 33-74A W ALTERNATE MENUS *

03/26/81

MENU 11	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
PEACHES FROM	.33	.70	.02	.26	3	13	.26	17	111	5	
HAM SLICES	75.97	28.43	10.41	5.10	20	339	1.98	1494	386	28	3.61
CRACKERS	1.36	3.95	5.32	1.24	88	46	1.12	432	57	8	.91
CHEESE SPR	18.13	5.84	17.32	2.09	166	298	.63	655	19	6	.81
ORANGE/NTROL	14.79	3.83	15.91	1.29	61	151	1.03	313	83	18	.58
COCOA BEV PD	.94	2.98	5.57	1.23	68	111	.55	131	271	23	.32
COFFEE INSTA			.00	.00	0		,01		D		.00
CREAM SUB ND	.11		.13	.12	1	16	.12	?	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	111.62	45.74	54.68	11.36	408	974	5.71	3049	963	89	8.24

	(I.)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
PEACHES FROM		.084	140	3	.01	.00	.5	.01	13.7	58	15
HAM SLICES					.28	.34	5.7	.22	.8	210	120
CRACKERS					.76	.36	1.6	.26	28.1	176	40
CHEESE SPR	2480		2480	43	1.25	.11	.0	1.27	.0	179	43
ORANGE/NTROL					.06	.08	.6	.01	54.2	375	90
COCOA BEV PD	2510		2510	37	.84	.07	.1	1.28	31.8	189	43
COFFEE INSTA	0	.000	0	.15	.00	.01	.8		2.5	6	5
CREAM SUB ND					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	6.0	24	6
SUM	4990	.084	5130	100	3.20	.98	9.3	3.05	140.5	1237	364

*See footnotes at end of Table

RECORD OF NUTRITIVE VALUES MEAL READY-TO-EAT, INDIVIDUAL LP/P DES 33-74A W ALTERNATE MENUS *

03/26/81

ALT MENU 12	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
STRAWBER SW	.27	.41	.08	.27	14	18	.33	6	109	10	.01
PICK SA W/BF	98.50	18.82	9.79	3.26	33	130	2.01	877	414	30	2.31
CRACKERS	1.36	3.98	5.32	1.24	88	46	1.12	432	57	8	.91
PEANUT BUT	.77	11.65	21.44	1.45	20	166	.77	240	268	71	.53
COOKIES CHCV	.86	2.70	10.36	.57	37	68	.61	90	94	19	.20
AV CANDY MRE	2.37	1.71	5.65	.52	44	48	.39	74	88	9	.22
COFFEE INSTA			.00	.00	0		.01		0		.00
CREAM SUB ND	.11		.13	.12	1	16	.12	7	36	0	.01
SUGAR	.00	.00	.00	.03	0	0	.01	0	0	0	.00
SUM	104.24	39.28	52.77	7.46	237	493	5.37	1727	1066	147	4.19

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
STRAWBER SW		.019	30	32	.01	.02	.3	.02	14.8	58	15
PICK SA W/BF					.04	.20	3.0	.18	11.3	209	142
CRACKERS					.76	.36	1.6	.36	28.1	176	40
PEANUT BUT	2070		2070	40	.83	.06	5.7	.11	7.2	268	43
COOKIES CHCV	1080		1080	3	.56	.34	.7	.02	28.0	216	43
AV CANDY MRE	160		160	3	.11	.08	.1	.01	33.2	191	43
COFFEE INSTA	0	.000	0	15	.00	.01	.5		2.5	10	3
CREAM SUB ND					.00	.01	.0	.00	3.6	16	4
SUGAR	0	.000	0	0	.00	.00	.0	.00	6.0	24	6
SUM	3310	.019	3340	123	2.31	1.08	13.28	.61	133.9	1168	339

*See footnotes at end of Table

04/01/81

CANDY	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOSPHORUS (MG)	IRON (MG)	SODIUM (MG)	POTASSIUM (MG)	MAGNESIUM (MG)	NACL (G)
47 CH/SWEET ENR	.42	3.50	8.23	.62	72	88	.28	36	143	2	.09
48 VAN CR CANDY	2.65	1.85	7.88	.60	58	53	.45	96	97	12	.27
STARCH CANDY	5.83	.05	.10	.23	2	1	.03	22	0	1	.02
46 FUDGE CHCOAT	2.58	1.98	7.94	.60	49	53	.60	102	100	18	.23
CARAMEL VAN	.18	1.63	2.79	.64	61	60	.10	99	100	7	.27
COCONUT CAND	2.51	1.28	6.97	.43	22	33	.60	88	86	13	.19

47 CHOCOLATE TRUFFLE
48 VANILLA FUDGE
46 CHOCOLATE FUDGE

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	CHO (G)	CALORIES	WEIGHT (G)
CH/SWEET ENR [illegible] 990			990	18	.39	.13	.3	.01	15.2	149	28
VAN CR CANDY vanilla cream (fudge)					.02	.10	.1	.01	36.6	225	50
STARCH CANDY					.00	.00	.0	.00	50.5	203	57
FUDGE CHCOAT chocolate fudge					.02	.08	.1	.01	36.5	225	50
CARAMEL VAN					.19	.10	.1	.01	29.2	148	34
COCONUT CAND					.01	.05	.1	.01	31.3	193	43

Note 1: Carbohydrate is computed by difference. Calories have been computed using 4,9,4 calorie factors. Calories and protein value for cocoa and coffee are slightly high, since no adjustment has been made for non-protein nitrogen.

Note 2: Cocoa beverage powder, enriched sweet chocolate are fortified with vitamin A, ascorbic acid and thiamin. Coffee is fortified with ascorbic acid. Crackers are fortified with thiamin, riboflavin, niacin and pyridoxine, however this record of nutrient data does not reflect the pyridoxine fortification.

Note 3: No adjustments have been made to compensate for nutritional losses during storage.

corrected copy 2/9/82

Appendix B. Environmental Symptoms Questionnaire

ENVIRONMENTAL SYMPTOMS QUESTIONNAIRE

US Army Research Institute of Environmental Medicine, Natick, MA 01760

INDIVIDUAL:__________________ TIME:__________ DATE:__________

INSTRUCTIONS: Circle each item separately to indicate whether you DO or DO NOT have the symptom at this moment. PLEASE READ EACH ITEM CAREFULLY.

	NOT AT ALL	SLIGHT	SOMEWHAT	MODERATE	QUITE A BIT	EXTREME
1. I feel lightheaded	0	1	2	3	4	5
2. I have a headache	0	1	2	3	4	5
3. I feel sinus pressure	0	1	2	3	4	5
4. I feel dizzy	0	1	2	3	4	5
5. I feel faint	0	1	2	3	4	5
6. My vision is dim	0	1	2	3	4	5
7. My coordination is off	0	1	2	3	4	5
8. I'm short of breath	0	1	2	3	4	5
9. It's hard to breathe	0	1	2	3	4	5
10. It hurts to breathe	0	1	2	3	4	5
11. My heart is beating fast	0	1	2	3	4	5
12. My heart is pounding	0	1	2	3	4	5
13. I have chest pains	0	1	2	3	4	5
14. I have chest pressure	0	1	2	3	4	5
15. My hands are shaking or trembling	0	1	2	3	4	5
16. I have muscle cramps	0	1	2	3	4	5
17. I have stomach cramps	0	1	2	3	4	5
18. My muscles feel tight or stiff	0	1	2	3	4	5
19. I feel weak	0	1	2	3	4	5
20. My legs or feet ache	0	1	2	3	4	5
21. My hands, arms or shoulders ache	0	1	2	3	4	5
22. My back aches.	0	1	2	3	4	5
23. I have a stomach ache	0	1	2	3	4	5
24. I feel sick to my stomach (nauseous)	0	1	2	3	4	5
25. I have gas pressure.	0	1	2	3	4	5
26. I have diarrhea	0	1	2	3	4	5
27. I'm constipated	0	1	2	3	4	5
28. I have to urinate MORE than usual	0	1	2	3	4	5
29. I have to urinate LESS than usual	0	1	2	3	4	5
30. I feel warm	0	1	2	3	4	5
31. I feel feverish	0	1	2	3	4	5
32. My feet are sweaty	0	1	2	3	4	5

Appendix C. Nutritional Standards for Operational Rations

Appendix C

Nutritional Standards for Packaged Operational and Restricted Rations (a)

Nutrient	Unit	Individual Operational Rations	Restricted Rations(b)
Energy	Kcal	3600	1100-1500
Protein	gm	100	50-70
Carbohydrate	gm	440	100-200
Fat	gm	160(max)	50-70
Vitamin A	mcg RE	1000	500
Vitamin D	mcg	10	5
Vitamin E	mg TE	10	5
Ascorbic Acid	mg	60	30
Thiamin	mg	1.8	1.0
Riboflavin	mg	2.2	1.2
Niacin	mg NE	24	13
Vitamin B6	mg	2.2	1.2
Folacin	mcg	400	200
Vitamin B12	mcg	3	1.5
Calcium	mg	800	400
Phosphorus	mg	800	400
Magnesium	mg	400	200
Iron	mg	18	9
Zinc	mg	15	7.5
Sodium	mg	5000-7000(c)	2500-3500(c)
Potassium	mg	1875-5625	950-2800

(a) Values are minimal standards at time of consumption unless shown as a range or a maximum level.

(b) For use under certain operational scenarios such as long range patrol, assault and reconnaissance when troops are required to subsist for short periods (up to 10 days) on an energy restricted ration.

(c) Not including added salt packets.

Appendix D. Mean Daily Intake of Energy and Nutrients (Combined Method): by Weight and Percent NSOR for Each Subject

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 1

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	74	84	76	56	81
PROTEIN, % NSOR	74	84	76	56	81
FAT, g	92	89	97	75	112
FAT, % NSOR	57	56	61	47	70
CARBOHYDRATES, g	203	199	208	172	247
CARBOHYDRATES, % NSOR	46	45	47	39	56
CALORIES	1931	1934	2013	1589	2318
CALORIES, % NSOR	54	54	56	44	64
CALCIUM, mg	489	538	527	339	584
CALCIUM, % NSOR	61	67	66	42	73
PHOSPHORUS, mg	1149	1284	1140	859	1395
PHOSPHORUS, % NSOR	144	160	143	107	174
IRON, mg	11	12	11	8	13
IRON, % NSOR	61	67	63	47	71
SODIUM, mg	4484	4539	4744	3097	6089
SODIUM, % NSOR	75	76	79	52	101
POTASSIUM, mg	1721	1850	1738	1403	1979
POTASSIUM, % NSOR	46	49	46	37	53
MAGNESIUM, mg	207	201	207	190	242
MAGNESIUM, % NSOR	52	50	52	47	60
TOTAL VIT. A, IU	5553	4793	5897	4784	7330

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 1

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	167	144	177	144	220
VIT. C, mg	99	82	95	104	122
VIT. C, % NSOR	164	136	158	174	202
THIAMIN, mg	4.1	3.9	4.7	3.0	4.9
THIAMIN, % NSOR	226	215	263	167	274
RIBOFLAVIN, mg	1.6	1.7	1.9	1.2	1.7
RIBOFLAVIN, % NSOR	73	78	86	53	79
NIACIN, mg	17.6	18.7	17.6	15.9	18.3
NIACIN, % NSOR	73	78	73	66	76
PYRIDOXINE, mg	2.4	2.3	2.4	1.6	3.5
PYRIDOXINE, % NSOR	107	107	108	71	159
TOTAL FOOD, g	629	643	663	499	751

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 2

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	67	67	69	68	61
PROTEIN, % NSOR	67	67	69	68	61
FAT, g	86	90	105	70	74
FAT, % NSOR	54	56	66	44	46
CARBOHYDRATES, g	227	257	297	172	161
CARBOHYDRATES, % NSOR	52	58	68	39	37
CALORIES	1949	2107	2412	1588	1556
CALORIES, % NSOR	54	59	67	44	43
CALCIUM, mg	491	466	597	398	509
CALCIUM, % NSOR	61	58	75	50	64
PHOSPHORUS, mg	1075	1017	1277	928	1081
PHOSPHORUS, % NSOR	134	127	160	116	135
IRON, mg	10	10	12	10	9
IRON, % NSOR	58	56	65	58	51
SODIUM, mg	3680	3638	4309	3402	3217
SODIUM, % NSOR	61	61	72	57	54
POTASSIUM, mg	1662	1773	1880	1379	1592
POTASSIUM, % NSOR	44	47	50	37	42
MAGNESIUM, mg	183	197	204	156	171
MAGNESIUM, % NSOR	46	49	51	39	43
TOTAL VIT. A, IU	6108	6246	8261	3489	6598

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 2

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	183	187	248	105	198
VIT. C, mg	81	96	97	38	97
VIT. C, % NSOR	134	160	161	63	162
THIAMIN, mg	4.2	4.1	5.5	3.1	4.1
THIAMIN, % NSOR	236	231	308	173	230
RIBOFLAVIN, mg	1.8	1.8	2.2	1.5	1.4
RIBOFLAVIN, % NSOR	80	80	100	70	65
NIACIN, mg	15.1	15.1	15.9	15.0	13.8
NIACIN, % NSOR	63	63	66	63	57
PYRIDOXINE, mg	2.7	2.9	3.5	1.6	2.8
PYRIDOXINE, % NSOR	123	134	159	75	126
TOTAL FOOD, g	611	646	706	587	449

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 3

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	110	49	137	117	152
PROTEIN, % NSOR	110	49	137	117	152
FAT, g	180	85	214	196	249
FAT, % NSOR	113	53	133	123	155
CARBOHYDRATES, g	512	213	562	659	664
CARBOHYDRATES, % NSOR	116	49	128	150	151
CALORIES	4110	1818	4715	4873	5497
CALORIES, % NSOR	114	50	131	135	153
CALCIUM, mg	1069	644	1175	1143	1439
CALCIUM, % NSOR	134	80	147	143	180
PHOSPHORUS, mg	2261	1096	2467	2576	3228
PHOSPHORUS, % NSOR	283	137	308	322	403
IRON, mg	19	9	24	21	25
IRON, % NSOR	108	47	136	119	138
SODIUM, mg	6750	3230	9310	6667	8315
SODIUM, % NSOR	113	54	155	111	139
POTASSIUM, mg	3179	1414	3606	3480	4733
POTASSIUM, % NSOR	85	38	96	93	126
MAGNESIUM, mg	380	158	418	429	584
MAGNESIUM, % NSOR	95	39	104	107	146
TOTAL VIT. A, IU	14245	8270	12884	16423	21960

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 3

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	427	248	387	493	659
VIT. C, mg	234	137	185	283	379
VIT. C, % NSOR	389	228	308	471	632
THIAMIN, mg	8.4	5.2	8.6	9.5	11.2
THIAMIN, % NSOR	465	291	475	526	622
RIBOFLAVIN, mg	2.9	1.7	3.6	3.2	3.5
RIBOFLAVIN, % NSOR	133	75	164	143	159
NIACIN, mg	26.6	11.9	30.8	30.3	36.7
NIACIN, % NSOR	111	50	128	126	153
PYRIDOXINE, mg	6.5	3.8	6.6	7.6	8.8
PYRIDOXINE, % NSOR	297	175	300	346	402
TOTAL FOOD, g	1153	463	1362	1378	1540

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 5

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	79	98	82	60	73
PROTEIN, % NSOR	79	98	82	60	73
FAT, g	80	107	82	60	68
FAT, % NSOR	50	67	51	38	42
CARBOHYDRATES, g	249	352	235	186	211
CARBOHYDRATES, % NSOR	57	80	53	42	48
CALORIES	2033	2761	2003	1530	1744
CALORIES, % NSOR	56	77	56	42	48
CALCIUM, mg	439	512	519	336	365
CALCIUM, % NSOR	55	64	65	42	46
PHOSPHORUS, mg	1092	1437	1206	794	852
PHOSPHORUS, % NSOR	137	180	151	99	106
IRON, mg	11	13	12	10	11
IRON, % NSOR	64	74	68	53	59
SODIUM, mg	4237	5131	4232	3495	4015
SODIUM, % NSOR	71	86	71	58	67
POTASSIUM, mg	1512	1640	1558	1338	1511
POTASSIUM, % NSOR	40	44	42	36	40
MAGNESIUM, mg	172	204	185	143	148
MAGNESIUM, % NSOR	43	51	46	36	37
TOTAL VIT. A, IU	2193	2006	3240	1640	1730

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 5

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	66	60	97	49	52
VIT. C, mg	27	27	42	15	21
VIT. C, % NSOR	44	44	70	25	35
THIAMIN, mg	3.0	3.7	3.7	2.3	2.1
THIAMIN, % NSOR	168	206	205	125	118
RIBOFLAVIN, mg	1.8	2.1	1.9	1.5	1.6
RIBOFLAVIN, % NSOR	82	95	86	69	74
NIACIN, mg	17.5	22.2	17.7	13.6	16.1
NIACIN, % NSOR	73	92	74	57	67
PYRIDOXINE, mg	1.7	2.1	2.3	1.0	1.2
PYRIDOXINE, % NSOR	77	97	105	44	53
TOTAL FOOD, g	725	920	744	568	638

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 6

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	38	72	37	22	12
PROTEIN, % NSOR	38	72	37	22	12
FAT, g	37	78	36	17	8
FAT, % NSOR	23	49	22	10	5
CARBOHYDRATES, g	100	235	94	28	16
CARBOHYDRATES, % NSOR	23	53	21	6	4
CALORIES	888	1934	849	351	184
CALORIES, % NSOR	25	54	24	10	5
CALCIUM, mg	202	378	246	83	51
CALCIUM, % NSOR	25	47	31	10	6
PHOSPHORUS, mg	481	1037	421	228	117
PHOSPHORUS, % NSOR	60	130	53	28	15
IRON, mg	6	11	7	3	2
IRON, % NSOR	34	60	39	19	11
SODIUM, mg	2274	3559	2621	1610	820
SODIUM, % NSOR	38	59	44	27	14
POTASSIUM, mg	922	1780	914	559	191
POTASSIUM, % NSOR	25	47	24	15	5
MAGNESIUM, mg	88	191	73	48	18
MAGNESIUM, % NSOR	22	48	18	12	4
TOTAL VIT. A, IU	2188	5640	884	1500	0

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 6

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	66	169	27	45	0
VIT. C, mg	19	57	11	2	0
VIT. C, % NSOR	32	95	18	3	0
THIAMIN, mg	1.5	3.0	1.8	0.3	0.4
THIAMIN, % NSOR	82	165	100	19	22
RIBOFLAVIN, mg	0.8	1.4	0.9	0.3	0.2
RIBOFLAVIN, % NSOR	35	66	41	15	11
NIACIN, mg	8.6	16.0	8.9	4.5	3.4
NIACIN, % NSOR	36	67	37	19	14
PYRIDOXINE, mg	0.9	2.1	0.8	0.3	0.2
PYRIDOXINE, % NSOR	42	96	37	13	11
TOTAL FOOD, g	326	626	341	200	41

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 7

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	55	91	54	36	31
PROTEIN, % NSOR	55	91	54	36	31
FAT, g	46	71	30	51	22
FAT, % NSOR	28	44	19	32	14
CARBOHYDRATES, g	161	291	108	144	70
CARBOHYDRATES, % NSOR	37	66	25	33	16
CALORIES	1274	2167	918	1183	603
CALORIES, % NSOR	35	60	26	33	17
CALCIUM, mg	348	653	256	262	155
CALCIUM, % NSOR	43	82	32	33	19
PHOSPHORUS, mg	743	1255	671	540	390
PHOSPHORUS, % NSOR	93	157	84	67	49
IRON, mg	9	17	7	7	4
IRON, % NSOR	51	95	39	36	25
SODIUM, mg	2960	5345	2593	1665	1875
SODIUM, % NSOR	49	89	43	28	31
POTASSIUM, mg	1563	3092	1234	918	731
POTASSIUM, % NSOR	42	82	33	24	19
MAGNESIUM, mg	156	291	124	110	70
MAGNESIUM, % NSOR	39	73	31	27	17
TOTAL VIT. A, IU	2281	4213	1763	1370	1523

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 7

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	68	126	53	41	46
VIT. C, mg	33	77	29	10	5
VIT. C, % NSOR	54	128	48	17	8
THIAMIN, mg	2.1	3.6	1.9	1.4	1.1
THIAMIN, % NSOR	117	201	106	80	64
RIBOFLAVIN, mg	1.3	1.9	1.2	1.0	0.8
RIBOFLAVIN, % NSOR	58	88	55	47	36
NIACIN, mg	12.9	21.0	13.2	8.3	7.2
NIACIN, % NSOR	54	87	55	34	30
PYRIDOXINE, mg	1.3	2.7	1.2	0.5	0.5
PYRIDOXINE, % NSOR	59	121	54	24	24
TOTAL FOOD, g	494	912	383	350	249

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 8

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	78	116	65	60	70
PROTEIN, % NSOR	78	116	65	60	70
FAT, g	104	149	90	83	90
FAT, % NSOR	65	93	56	52	56
CARBOHYDRATES, g	207	327	172	130	194
CARBOHYDRATES, % NSOR	47	74	39	29	44
CALORIES	2075	3108	1756	1504	1861
CALORIES, % NSOR	58	86	49	42	52
CALCIUM, mg	667	1054	517	575	447
CALCIUM, % NSOR	83	132	65	72	56
PHOSPHORUS, mg	1363	1995	1056	1233	1070
PHOSPHORUS, % NSOR	170	249	132	154	134
IRON, mg	13	21	10	10	12
IRON, % NSOR	72	115	53	53	65
SODIUM, mg	4989	7186	4163	4415	3796
SODIUM, % NSOR	83	120	69	74	63
POTASSIUM, mg	2161	3534	1656	1419	1973
POTASSIUM, % NSOR	58	94	44	38	53
MAGNESIUM, mg	244	355	206	166	250
MAGNESIUM, % NSOR	61	89	52	42	62
TOTAL VIT. A, IU	7603	11804	7620	5433	4530

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 8

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	228	354	229	163	136
VIT. C, mg	128	212	120	92	67
VIT. C, % NSOR	213	353	201	153	111
THIAMIN, mg	5.0	7.4	4.8	4.1	3.0
THIAMIN, % NSOR	277	410	265	229	169
RIBOFLAVIN, mg	1.8	2.8	1.6	1.3	1.3
RIBOFLAVIN, % NSOR	82	128	73	60	61
NIACIN, mg	17.5	24.4	17.2	11.8	16.1
NIACIN, % NSOR	73	102	72	49	67
PYRIDOXINE, mg	3.4	5.5	3.1	2.9	1.6
PYRIDOXINE, % NSOR	155	248	140	133	71
TOTAL FOOD, g	670	1057	480	499	634

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 9

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	95	121	97	84	70
PROTEIN, % NSOR	95	121	97	84	70
FAT, g	120	138	134	105	97
FAT, % NSOR	75	86	84	65	61
CARBOHYDRATES, g	300	327	327	270	265
CARBOHYDRATES, % NSOR	68	74	74	61	60
CALORIES	2665	3033	2902	2357	2220
CALORIES, % NSOR	74	84	81	65	62
CALCIUM, mg	748	984	723	607	642
CALCIUM, % NSOR	93	123	90	76	80
PHOSPHORUS, mg	1706	2132	1724	1421	1470
PHOSPHORUS, % NSOR	213	266	215	178	184
IRON, mg	15	19	14	13	11
IRON, % NSOR	82	107	80	74	58
SODIUM, mg	6022	8619	5726	4619	4676
SODIUM, % NSOR	100	144	95	77	78
POTASSIUM, mg	2360	3002	2346	2228	1617
POTASSIUM, % NSOR	63	80	63	59	43
MAGNESIUM, mg	267	318	277	260	189
MAGNESIUM, % NSOR	67	79	69	65	47
TOTAL VIT. A, IU	9429	10717	8963	8197	10045

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 9

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	283	322	269	246	301
VIT. C, mg	134	160	138	116	118
VIT. C, % NSOR	224	266	229	193	197
THIAMIN, mg	5.5	6.5	5.3	4.8	5.1
THIAMIN, % NSOR	303	361	293	269	283
RIBOFLAVIN, mg	2.0	2.5	2.1	1.7	1.7
RIBOFLAVIN, % NSOR	92	113	93	79	76
NIACIN, mg	20.5	24.5	21.3	20.0	14.3
NIACIN, % NSOR	86	102	89	83	60
PYRIDOXINE, mg	4.5	5.3	4.3	3.7	4.8
PYRIDOXINE, % NSOR	204	242	194	168	217
TOTAL FOOD, g	878	1060	902	786	707

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 10

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	90	94	101	88	71
PROTEIN, % NSOR	90	94	101	88	71
FAT, g	96	100	110	103	59
FAT, % NSOR	60	62	69	65	37
CARBOHYDRATES, g	239	302	277	221	112
CARBOHYDRATES, % NSOR	54	69	63	50	25
CALORIES	2179	2482	2501	2166	1263
CALORIES, % NSOR	61	69	69	60	35
CALCIUM, mg	569	569	600	627	438
CALCIUM, % NSOR	71	71	75	78	55
PHOSPHORUS, mg	1358	1459	1466	1335	1079
PHOSPHORUS, % NSOR	170	182	183	167	135
IRON, mg	13	14	14	13	9
IRON, % NSOR	71	77	79	70	51
SODIUM, mg	4872	4968	5327	5151	3625
SODIUM, % NSOR	81	83	89	86	60
POTASSIUM, mg	2519	3007	2706	2451	1610
POTASSIUM, % NSOR	67	80	72	65	43
MAGNESIUM, mg	244	262	267	267	148
MAGNESIUM, % NSOR	61	66	67	67	37
TOTAL VIT. A, IU	8312	8343	8864	9447	5735

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 10

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	249	250	266	283	172
VIT. C, mg	130	158	121	140	87
VIT. C, % NSOR	217	263	202	234	144
THIAMIN, mg	4.4	3.9	4.9	5.3	3.3
THIAMIN, % NSOR	247	216	274	292	183
RIBOFLAVIN, mg	1.7	1.6	2.1	1.8	1.2
RIBOFLAVIN, % NSOR	79	75	96	83	54
NIACIN, mg	20.3	20.2	22.6	22.0	14.3
NIACIN, % NSOR	85	84	94	92	60
PYRIDOXINE, mg	3.6	4.0	3.4	3.7	3.4
PYRIDOXINE, % NSOR	166	181	155	170	154
TOTAL FOOD, g	727	851	831	678	458

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 11

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	74	87	92	66	39
PROTEIN, % NSOR	74	87	92	66	39
FAT, g	93	102	118	83	56
FAT, % NSOR	58	63	73	52	35
CARBOHYDRATES, g	257	267	315	257	153
CARBOHYDRATES, % NSOR	58	61	72	58	35
CALORIES	2155	2330	2684	2040	1275
CALORIES, % NSOR	60	65	75	57	35
CALCIUM, mg	509	480	652	569	247
CALCIUM, % NSOR	64	60	81	71	31
PHOSPHORUS, mg	1205	1320	1483	1206	614
PHOSPHORUS, % NSOR	151	165	185	151	77
IRON, mg	12	13	16	11	7
IRON, % NSOR	67	70	90	60	40
SODIUM, mg	4232	4713	5221	4246	2008
SODIUM, % NSOR	71	79	87	71	33
POTASSIUM, mg	2280	2853	2651	2058	1196
POTASSIUM, % NSOR	61	76	71	55	32
MAGNESIUM, mg	206	235	249	180	137
MAGNESIUM, % NSOR	51	59	62	45	34
TOTAL VIT. A, IU	7055	7997	8657	7513	2550

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 11

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	212	240	260	225	77
VIT. C, mg	106	108	135	130	23
VIT. C, % NSOR	176	179	224	216	37
THIAMIN, mg	3.6	3.1	5.4	4.0	1.4
THIAMIN, % NSOR	202	171	298	220	79
RIBOFLAVIN, mg	1.5	1.4	2.0	1.6	0.9
RIBOFLAVIN, % NSOR	69	63	90	73	42
NIACIN, mg	14.2	15.0	18.3	14.1	6.6
NIACIN, % NSOR	59	63	76	59	28
PYRIDOXINE, mg	3.2	3.2	4.5	3.4	1.1
PYRIDOXINE, % NSOR	147	147	206	156	48
TOTAL FOOD, g	712	793	903	637	416

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 12

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	101	110	81	118	89
PROTEIN, % NSOR	101	110	81	118	89
FAT, g	139	165	116	133	144
FAT, % NSOR	87	103	73	83	90
CARBOHYDRATES, g	373	418	305	411	352
CARBOHYDRATES, % NSOR	85	95	69	93	80
CALORIES	3150	3602	2592	3313	3063
CALORIES, % NSOR	87	100	72	92	85
CALCIUM, mg	848	983	685	774	999
CALCIUM, % NSOR	106	123	86	97	125
PHOSPHORUS, mg	1920	2223	1535	1927	2032
PHOSPHORUS, % NSOR	240	278	192	241	254
IRON, mg	16	17	13	19	15
IRON, % NSOR	89	97	70	106	81
SODIUM, mg	6034	6347	5158	6413	6310
SODIUM, % NSOR	101	106	86	107	105
POTASSIUM, mg	2698	2700	2070	3341	2674
POTASSIUM, % NSOR	72	72	55	89	71
MAGNESIUM, mg	295	338	221	344	266
MAGNESIUM, % NSOR	74	85	55	86	67
TOTAL VIT. A, IU	12490	14376	8485	11983	16430

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 12

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	375	431	255	360	493
VIT. C, mg	169	198	135	135	227
VIT. C, % NSOR	281	330	225	225	378
THIAMIN, mg	6.5	8.1	5.0	5.5	7.6
THIAMIN, % NSOR	359	450	280	304	421
RIBOFLAVIN, mg	2.3	2.7	2.0	2.3	2.1
RIBOFLAVIN, % NSOR	104	121	90	107	95
NIACIN, mg	20.5	25.0	18.1	22.6	14.2
NIACIN, % NSOR	85	104	75	94	59
PYRIDOXINE, mg	5.8	6.6	3.8	5.6	7.9
PYRIDOXINE, % NSOR	263	298	172	255	361
TOTAL FOOD, g	980	1049	795	1144	911

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 14

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	73	97	43	80	71
PROTEIN, % NSOR	73	97	43	80	71
FAT, g	80	77	46	97	109
FAT, % NSOR	50	48	28	61	68
CARBOHYDRATES, g	171	182	89	189	249
CARBOHYDRATES, % NSOR	39	41	20	43	57
CALORIES	1694	1810	938	1952	2266
CALORIES, % NSOR	47	50	26	54	63
CALCIUM, mg	510	485	325	643	623
CALCIUM, % NSOR	64	61	41	80	78
PHOSPHORUS, mg	1172	1221	678	1444	1430
PHOSPHORUS, % NSOR	146	153	85	180	179
IRON, mg	10	11	6	12	13
IRON, % NSOR	57	63	33	68	70
SODIUM, mg	4226	4497	2671	4970	5038
SODIUM, % NSOR	70	75	45	83	84
POTASSIUM, mg	1593	1728	920	1781	2120
POTASSIUM, % NSOR	42	46	25	48	57
MAGNESIUM, mg	167	187	91	182	229
MAGNESIUM, % NSOR	42	47	23	45	57
TOTAL VIT. A, IU	5401	5147	3530	6327	7200

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 14

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	162	154	106	190	216
VIT. C, mg	95	102	65	108	111
VIT. C, % NSOR	159	171	109	180	184
THIAMIN, mg	3.8	3.8	2.6	4.5	4.3
THIAMIN, % NSOR	209	211	147	252	236
RIBOFLAVIN, mg	1.4	1.8	0.8	1.5	1.5
RIBOFLAVIN, % NSOR	63	80	38	67	70
NIACIN, mg	16.0	24.0	9.9	16.4	12.6
NIACIN, % NSOR	67	100	41	68	53
PYRIDOXINE, mg	3.2	2.9	2.2	4.0	4.0
PYRIDOXINE, % NSOR	146	134	100	180	181
TOTAL FOOD, g	593	700	331	665	715

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 15

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	89	79	99	89	91
PROTEIN, % NSOR	89	79	99	89	91
FAT, g	103	77	133	92	111
FAT, % NSOR	64	48	83	58	69
CARBOHYDRATES, g	272	187	312	287	319
CARBOHYDRATES, % NSOR	62	42	71	65	73
CALORIES	2368	1753	2839	2333	2638
CALORIES, % NSOR	66	49	79	65	73
CALCIUM, mg	709	533	891	716	691
CALCIUM, % NSOR	89	67	111	90	86
PHOSPHORUS, mg	1612	1284	1932	1600	1642
PHOSPHORUS, % NSOR	201	160	241	200	205
IRON, mg	13	10	16	14	13
IRON, % NSOR	74	57	91	78	70
SODIUM, mg	5773	4439	7288	5027	6617
SODIUM, % NSOR	96	74	121	84	110
POTASSIUM, mg	2287	2034	2671	2335	2017
POTASSIUM, % NSOR	61	54	71	62	54
MAGNESIUM, mg	217	175	249	229	215
MAGNESIUM, % NSOR	54	44	62	57	54
TOTAL VIT. A, IU	9719	9007	10980	9556	9140

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 15

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	292	270	329	287	274
VIT. C, mg	150	137	167	153	142
VIT. C, % NSOR	251	228	279	255	236
THIAMIN, mg	5.4	4.6	6.5	5.3	4.8
THIAMIN, % NSOR	298	254	362	296	268
RIBOFLAVIN, mg	1.8	1.5	2.0	1.8	1.9
RIBOFLAVIN, % NSOR	81	66	92	81	85
NIACIN, mg	18.0	15.7	18.6	19.0	19.2
NIACIN, % NSOR	75	66	77	79	80
PYRIDOXINE, mg	5.3	4.6	6.3	5.2	5.0
PYRIDOXINE, % NSOR	242	210	288	238	225
TOTAL FOOD, g	794	631	916	795	853

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 16

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	85	86	105	76	67
PROTEIN, % NSOR	85	86	105	76	67
FAT, g	116	136	131	105	80
FAT, % NSOR	73	85	82	66	50
CARBOHYDRATES, g	257	280	319	237	162
CARBOHYDRATES, % NSOR	58	64	72	54	37
CALORIES	2413	2683	2875	2196	1640
CALORIES, % NSOR	67	75	80	61	46
CALCIUM, mg	681	811	893	518	410
CALCIUM, % NSOR	85	101	112	65	51
PHOSPHORUS, mg	1434	1654	1846	1192	850
PHOSPHORUS, % NSOR	179	207	231	149	106
IRON, mg	13	13	16	11	11
IRON, % NSOR	71	71	89	63	59
SODIUM, mg	4987	4960	6405	4275	3971
SODIUM, % NSOR	83	83	107	71	66
POTASSIUM, mg	1769	1685	2347	1585	1305
POTASSIUM, % NSOR	47	45	63	42	35
MAGNESIUM, mg	205	219	247	197	132
MAGNESIUM, % NSOR	51	55	62	49	33
TOTAL VIT. A, IU	6643	9217	9708	3743	2535

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 16

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	199	277	291	112	76
VIT. C, mg	101	129	153	68	30
VIT. C, % NSOR	168	216	254	114	49
THIAMIN, mg	5.0	6.4	6.5	3.4	3.2
THIAMIN, % NSOR	278	354	358	190	176
RIBOFLAVIN, mg	2.0	2.3	2.5	1.6	1.6
RIBOFLAVIN, % NSOR	92	103	113	74	72
NIACIN, mg	18.5	19.1	21.9	17.8	13.8
NIACIN, % NSOR	77	79	91	74	57
PYRIDOXINE, mg	3.5	4.5	5.2	2.1	1.6
PYRIDOXINE, % NSOR	159	206	234	96	72
TOTAL FOOD, g	765	796	960	662	583

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 17

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	110	117	114	111	94
PROTEIN, % NSOR	110	117	114	111	94
FAT, g	133	152	154	120	92
FAT, % NSOR	83	95	96	75	58
CARBOHYDRATES, g	374	457	388	343	273
CARBOHYDRATES, % NSOR	85	104	88	78	62
CALORIES	3132	3666	3390	2896	2297
CALORIES, % NSOR	87	102	94	80	64
CALCIUM, mg	824	886	968	745	633
CALCIUM, % NSOR	103	111	121	93	79
PHOSPHORUS, mg	1894	2055	2194	1763	1401
PHOSPHORUS, % NSOR	237	257	274	220	175
IRON, mg	17	20	17	16	14
IRON, % NSOR	95	113	96	90	75
SODIUM, mg	6338	6803	6993	5769	5512
SODIUM, % NSOR	106	113	117	96	92
POTASSIUM, mg	2628	3309	2567	2335	2138
POTASSIUM, % NSOR	70	88	68	62	57
MAGNESIUM, mg	278	339	278	264	209
MAGNESIUM, % NSOR	70	85	69	66	52
TOTAL VIT. A, IU	8602	9580	11360	6920	5520

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 17

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	258	287	341	208	166
VIT. C, mg	125	136	167	97	90
VIT. C, % NSOR	209	226	278	162	150
THIAMIN, mg	5.7	5.8	7.0	5.0	4.5
THIAMIN, % NSOR	315	321	390	277	251
RIBOFLAVIN, mg	2.5	2.8	2.6	2.3	2.2
RIBOFLAVIN, % NSOR	113	125	119	106	98
NIACIN, mg	22.3	23.4	22.4	23.3	18.8
NIACIN, % NSOR	93	98	93	97	78
PYRIDOXINE, mg	4.6	4.6	6.1	4.0	3.2
PYRIDOXINE, % NSOR	209	209	277	182	147
TOTAL FOOD, g	1013	1142	1053	984	803

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 18

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	97	128	82	88	86
PROTEIN, % NSOR	97	128	82	88	86
FAT, g	113	156	110	81	98
FAT, % NSOR	70	98	69	51	61
CARBOHYDRATES, g	289	400	286	217	237
CARBOHYDRATES, % NSOR	66	91	65	49	54
CALORIES	2559	3516	2465	1951	2177
CALORIES, % NSOR	71	98	68	54	60
CALCIUM, mg	686	957	641	563	532
CALCIUM, % NSOR	86	120	80	70	66
PHOSPHORUS, mg	1498	2060	1344	1232	1287
PHOSPHORUS, % NSOR	187	257	168	154	161
IRON, mg	15	20	13	13	14
IRON, % NSOR	84	112	73	74	75
SODIUM, mg	5532	7904	4779	4762	4259
SODIUM, % NSOR	92	132	80	79	71
POTASSIUM, mg	2348	3101	2226	1922	2040
POTASSIUM, % NSOR	63	83	59	51	54
MAGNESIUM, mg	249	320	233	203	236
MAGNESIUM, % NSOR	62	80	58	51	59
TOTAL VIT. A, IU	6393	9172	6873	4200	4795

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 13

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	192	275	206	126	144
VIT. C, mg	99	141	109	65	69
VIT. C, % NSOR	164	235	182	109	115
THIAMIN, mg	4.6	6.6	4.3	3.5	3.5
THIAMIN, % NSOR	253	364	239	196	192
RIBOFLAVIN, mg	2.1	2.9	1.9	1.9	1.7
RIBOFLAVIN, % NSOR	96	130	86	86	75
NIACIN, mg	20.1	25.9	17.1	18.1	19.1
NIACIN, % NSOR	84	108	71	76	80
PYRIDOXINE, mg	3.4	5.0	3.2	2.5	2.5
PYRIDOXINE, % NSOR	153	229	146	112	112
TOTAL FOOD, g	875	1182	796	717	771

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 19

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	81	94	61	77	97
PROTEIN, % NSOR	81	94	61	77	97
FAT, g	98	98	68	110	127
FAT, % NSOR	62	61	43	68	80
CARBOHYDRATES, g	213	243	195	218	190
CARBOHYDRATES, % NSOR	48	55	44	49	43
CALORIES	2062	2235	1637	2161	2293
CALORIES, % NSOR	57	62	45	60	64
CALCIUM, mg	636	555	311	872	892
CALCIUM, % NSOR	79	69	39	109	111
PHOSPHORUS, mg	1327	1376	826	1533	1696
PHOSPHORUS, % NSOR	166	172	103	192	212
IRON, mg	12	14	9	13	14
IRON, % NSOR	69	76	51	74	79
SODIUM, mg	4930	4428	3618	5793	6359
SODIUM, % NSOR	82	74	60	97	106
POTASSIUM, mg	2103	2096	2048	2012	2333
POTASSIUM, % NSOR	56	56	55	54	62
MAGNESIUM, mg	207	246	184	187	210
MAGNESIUM, % NSOR	52	62	46	47	52
TOTAL VIT. A, IU	7823	7677	4927	8947	10700

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 19

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	235	230	148	268	321
VIT. C, mg	111	86	64	148	164
VIT. C, % NSOR	185	144	106	247	272
THIAMIN, mg	4.6	4.2	2.1	6.3	6.6
THIAMIN, % NSOR	257	233	115	348	369
RIBOFLAVIN, mg	1.8	2.0	1.2	2.1	2.0
RIBOFLAVIN, % NSOR	82	93	53	94	92
NIACIN, mg	15.8	20.8	12.5	14.0	16.3
NIACIN, % NSOR	66	87	52	58	68
PYRIDOXINE, mg	3.5	2.9	1.6	4.6	5.6
PYRIDOXINE, % NSOR	159	130	73	211	254
TOTAL FOOD, g	713	823	575	707	765

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 20

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	53	111	46	13	38
PROTEIN, % NSOR	53	111	46	13	38
FAT, g	58	114	49	24	37
FAT, % NSOR	36	71	30	15	23
CARBOHYDRATES, g	154	320	142	48	81
CARBOHYDRATES, % NSOR	35	73	32	11	18
CALORIES	1347	2749	1189	462	812
CALORIES, % NSOR	37	76	33	13	23
CALCIUM, mg	365	737	255	124	335
CALCIUM, % NSOR	46	92	32	15	42
PHOSPHORUS, mg	782	1544	653	287	573
PHOSPHORUS, % NSOR	98	193	82	36	72
IRON, mg	9	19	6	2	7
IRON, % NSOR	48	103	34	12	40
SODIUM, mg	3313	6662	2599	977	2868
SODIUM, % NSOR	55	111	43	16	48
POTASSIUM, mg	1399	3124	991	289	1087
POTASSIUM, % NSOR	37	83	26	8	29
MAGNESIUM, mg	139	301	106	36	103
MAGNESIUM, % NSOR	35	75	26	9	26
TOTAL VIT. A, IU	2979	6751	2020	1000	1730

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Experimental Group NSOR is the Nutritional Standards for Operational Rations

Subject: 20

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	89	203	61	30	52
VIT. C, mg	40	92	25	14	26
VIT. C, % NSOR	67	154	41	24	42
THIAMIN, mg	2.3	4.7	1.8	0.7	1.9
THIAMIN, % NSOR	129	260	99	40	107
RIBOFLAVIN, mg	1.2	2.4	1.0	0.3	0.9
RIBOFLAVIN, % NSOR	53	109	46	14	39
NIACIN, mg	11.3	24.0	9.4	2.2	8.9
NIACIN, % NSOR	47	100	39	9	37
PYRIDOXINE, mg	1.8	3.8	1.5	0.6	1.3
PYRIDOXINE, % NSOR	83	172	67	26	58
TOTAL FOOD, g	485	1015	387	135	362

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 22

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	96	104	111	91	68
PROTEIN, % NSOR	96	104	111	91	68
FAT, g	89	95	91	94	66
FAT, % NSOR	55	60	57	59	41
CARBOHYDRATES, g	179	214	153	182	164
CARBOHYDRATES, % NSOR	41	49	35	41	37
CALORIES	1897	2130	1871	1939	1521
CALORIES, % NSOR	53	59	52	54	42
CALCIUM, mg	395	414	420	405	313
CALCIUM, % NSOR	49	52	53	51	39
PHOSPHORUS, mg	1107	1261	1268	967	843
PHOSPHORUS, % NSOR	138	158	158	121	105
IRON, mg	12	13	12	11	10
IRON, % NSOR	66	73	69	62	56
SODIUM, mg	4114	4018	4905	4187	2963
SODIUM, % NSOR	69	67	82	70	49
POTASSIUM, mg	1910	2057	2096	1781	1605
POTASSIUM, % NSOR	51	55	56	47	43
MAGNESIUM, mg	270	298	274	274	216
MAGNESIUM, % NSOR	67	74	68	69	54
TOTAL VIT. A, IU	4782	5409	4957	5513	2480

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 22

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	143	162	149	165	74
VIT. C, mg	83	88	86	101	45
VIT. C, % NSOR	139	147	143	168	75
THIAMIN, mg	3.7	4.0	3.6	4.4	2.2
THIAMIN, % NSOR	204	220	201	245	122
RIBOFLAVIN, mg	1.6	1.8	1.6	1.7	1.1
RIBOFLAVIN, % NSOR	72	82	73	77	48
NIACIN, mg	26.9	29.6	30.1	28.2	16.2
NIACIN, % NSOR	112	123	125	117	67
PYRIDOXINE, mg	1.4	1.4	1.8	1.4	0.9
PYRIDOXINE, % NSOR	65	63	82	65	42
TOTAL FOOD, g	672	745	708	628	576

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 23

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	85	108	89	78	54
PROTEIN, % NSOR	85	108	89	78	54
FAT, g	93	122	96	85	56
FAT, % NSOR	58	76	60	53	35
CARBOHYDRATES, g	200	235	215	212	108
CARBOHYDRATES, % NSOR	45	53	49	48	24
CALORIES	1972	2468	2077	1920	1147
CALORIES, % NSOR	55	69	58	53	32
CALCIUM, mg	526	652	583	420	410
CALCIUM, % NSOR	66	82	73	53	51
PHOSPHORUS, mg	1196	1497	1261	1037	888
PHOSPHORUS, % NSOR	150	187	158	130	111
IRON, mg	11	14	12	9	6
IRON, % NSOR	60	76	69	50	36
SODIUM, mg	4703	7136	4459	3692	2937
SODIUM, % NSOR	78	119	74	62	49
POTASSIUM, mg	1782	2186	2009	1689	974
POTASSIUM, % NSOR	48	58	54	45	26
MAGNESIUM, mg	212	256	233	212	117
MAGNESIUM, % NSOR	53	64	58	53	29
TOTAL VIT. A, IU	7220	8309	7889	6973	4955

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 23

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	217	249	237	209	149
VIT. C, mg	139	159	159	124	99
VIT. C, % NSOR	231	265	265	207	165
THIAMIN, mg	4.6	5.6	5.2	3.7	3.4
THIAMIN, % NSOR	253	310	287	206	189
RIBOFLAVIN, mg	1.6	1.9	1.8	1.4	1.1
RIBOFLAVIN, % NSOR	73	88	81	65	50
NIACIN, mg	22.2	28.7	22.7	20.0	14.8
NIACIN, % NSOR	92	120	94	83	62
PYRIDOXINE, mg	3.3	3.8	3.7	2.7	2.7
PYRIDOXINE, % NSOR	150	174	170	124	122
TOTAL FOOD, g	618	739	679	621	343

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 24

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	83	90	121	71	32
PROTEIN, % NSOR	83	90	121	71	32
FAT, g	93	110	132	76	37
FAT, % NSOR	58	69	82	47	23
CARBOHYDRATES, g	200	226	278	175	83
CARBOHYDRATES, % NSOR	45	51	63	40	19
CALORIES	1970	2250	2777	1662	799
CALORIES, % NSOR	55	63	77	46	22
CALCIUM, mg	460	639	601	353	142
CALCIUM, % NSOR	58	80	75	44	18
PHOSPHORUS, mg	1040	1332	1419	829	349
PHOSPHORUS, % NSOR	130	166	177	104	44
IRON, mg	12	12	16	11	6
IRON, % NSOR	65	65	90	61	31
SODIUM, mg	4734	5335	6762	4350	1367
SODIUM, % NSOR	79	89	113	73	23
POTASSIUM, mg	1910	1693	3058	1854	599
POTASSIUM, % NSOR	51	45	82	49	16
MAGNESIUM, mg	212	242	342	152	60
MAGNESIUM, % NSOR	53	61	86	38	15
TOTAL VIT. A, IU	5861	8135	9176	3610	855

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 24

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	176	244	275	108	26
VIT. C, mg	84	127	140	38	2
VIT. C, % NSOR	140	212	234	63	3
THIAMIN, mg	4.3	6.1	5.6	2.8	1.8
THIAMIN, % NSOR	239	341	313	155	101
RIBOFLAVIN, mg	1.9	2.2	2.5	1.6	0.8
RIBOFLAVIN, % NSOR	84	101	112	71	38
NIACIN, mg	21.7	26.1	32.3	16.0	7.9
NIACIN, % NSOR	90	109	134	67	33
PYRIDOXINE, mg	2.4	3.3	3.4	1.9	0.5
PYRIDOXINE, % NSOR	111	151	154	85	24
TOTAL FOOD, g	616	669	877	535	268

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 25

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	97	76	122	88	106
PROTEIN, % NSOR	97	76	122	88	106
FAT, g	105	76	132	105	109
FAT, % NSOR	66	47	83	65	68
CARBOHYDRATES, g	314	280	389	323	239
CARBOHYDRATES, % NSOR	71	64	88	73	54
CALORIES	2590	2103	3234	2587	2362
CALORIES, % NSOR	72	58	90	72	66
CALCIUM, mg	613	551	724	646	489
CALCIUM, % NSOR	77	69	90	81	61
PHOSPHORUS, mg	1399	1079	1796	1303	1428
PHOSPHORUS, % NSOR	175	135	224	163	178
IRON, mg	15	13	18	16	13
IRON, % NSOR	83	71	99	88	73
SODIUM, mg	5582	4768	7535	4559	5409
SODIUM, % NSOR	93	79	126	76	90
POTASSIUM, mg	2896	2508	3315	2948	2774
POTASSIUM, % NSOR	77	67	88	79	74
MAGNESIUM, mg	307	211	377	301	357
MAGNESIUM, % NSOR	77	53	94	75	89
TOTAL VIT. A, IU	10155	8125	10580	10457	12110

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 25

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	305	244	317	314	363
VIT. C, mg	189	162	208	180	214
VIT. C, % NSOR	315	270	347	300	356
THIAMIN, mg	5.7	4.3	6.2	6.3	6.1
THIAMIN, % NSOR	318	242	346	351	341
RIBOFLAVIN, mg	2.1	1.8	2.5	2.3	1.7
RIBOFLAVIN, % NSOR	97	82	114	106	79
NIACIN, mg	27.1	19.2	34.7	23.6	32.5
NIACIN, % NSOR	113	80	144	98	136
PYRIDOXINE, mg	4.4	4.0	4.7	4.8	4.0
PYRIDOXINE, % NSOR	201	183	215	217	180
TOTAL FOOD, g	866	777	1074	837	731

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 26

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	53	57	47	46	64
PROTEIN, % NSOR	53	57	47	46	64
FAT, g	75	95	57	61	92
FAT, % NSOR	47	59	36	38	57
CARBOHYDRATES, g	159	194	125	145	178
CARBOHYDRATES, % NSOR	36	44	28	33	41
CALORIES	1517	1856	1204	1309	1792
CALORIES, % NSOR	42	52	33	36	50
CALCIUM, mg	413	435	310	389	569
CALCIUM, % NSOR	52	54	39	49	71
PHOSPHORUS, mg	917	938	808	803	1218
PHOSPHORUS, % NSOR	115	117	101	100	152
IRON, mg	9	11	7	7	11
IRON, % NSOR	49	62	38	39	60
SODIUM, mg	3336	3956	2508	2889	4317
SODIUM, % NSOR	56	66	42	48	72
POTASSIUM, mg	1290	1721	894	1083	1547
POTASSIUM, % NSOR	34	46	24	29	41
MAGNESIUM, mg	146	178	113	130	171
MAGNESIUM, % NSOR	36	44	28	32	43
TOTAL VIT. A, IU	3234	2663	2720	3530	4415

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 26

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	97	80	82	106	132
VIT. C, mg	59	38	60	71	69
VIT. C, % NSOR	98	64	99	118	115
THIAMIN, mg	2.7	2.3	2.6	2.8	3.2
THIAMIN, % NSOR	149	128	146	154	177
RIBOFLAVIN, mg	1.2	1.4	1.0	1.2	1.2
RIBOFLAVIN, % NSOR	54	64	44	53	57
NIACIN, mg	11.2	10.9	11.7	11.3	10.8
NIACIN, % NSOR	47	46	49	47	45
PYRIDOXINE, mg	1.6	1.2	1.4	1.5	2.6
PYRIDOXINE, % NSOR	72	52	65	70	118
TOTAL FOOD, g	473	595	390	375	561

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 27

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	67	114	60	56	22
PROTEIN, % NSOR	67	114	60	56	22
FAT, g	80	125	83	67	25
FAT, % NSOR	50	78	52	42	15
CARBOHYDRATES, g	205	310	238	151	81
CARBOHYDRATES, % NSOR	47	70	54	34	19
CALORIES	1804	2822	1937	1434	634
CALORIES, % NSOR	50	78	54	40	18
CALCIUM, mg	511	902	455	432	124
CALCIUM, % NSOR	64	113	57	54	15
PHOSPHORUS, mg	1043	1814	922	889	299
PHOSPHORUS, % NSOR	130	227	115	111	37
IRON, mg	11	18	12	10	3
IRON, % NSOR	63	100	67	55	14
SODIUM, mg	4397	6724	4804	3881	1071
SODIUM, % NSOR	73	112	80	65	18
POTASSIUM, mg	1838	2782	2135	1519	456
POTASSIUM, % NSOR	49	74	57	40	12
MAGNESIUM, mg	180	289	190	152	45
MAGNESIUM, % NSOR	45	72	48	38	11
TOTAL VIT. A, IU	5737	10407	5453	4337	1260

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 27

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	172	312	164	130	38
VIT. C, mg	82	166	71	46	29
VIT. C, % NSOR	137	277	118	77	48
THIAMIN, mg	3.7	7.3	2.9	2.9	0.9
THIAMIN, % NSOR	208	408	163	160	43
RIBOFLAVIN, mg	1.6	2.9	1.2	1.3	0.4
RIBOFLAVIN, % NSOR	70	130	57	60	18
NIACIN, mg	13.9	24.6	11.6	11.5	4.6
NIACIN, % NSOR	58	103	48	48	19
PYRIDOXINE, mg	3.1	5.5	3.0	2.1	0.9
PYRIDOXINE, % NSOR	139	252	135	96	42
TOTAL FOOD, g	613	955	663	499	195

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 28

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	67	89	97	34	42
PROTEIN, % NSOR	67	89	97	34	42
FAT, g	82	110	122	38	49
FAT, % NSOR	51	69	76	24	31
CARBOHYDRATES, g	174	249	278	56	83
CARBOHYDRATES, % NSOR	40	56	63	13	19
CALORIES	1706	2338	2592	697	940
CALORIES, % NSOR	47	65	72	19	26
CALCIUM, mg	502	666	752	201	335
CALCIUM, % NSOR	63	83	94	25	42
PHOSPHORUS, mg	1128	1380	1794	407	834
PHOSPHORUS, % NSOR	141	172	224	51	104
IRON, mg	9	13	14	4	5
IRON, % NSOR	52	73	75	24	26
SODIUM, mg	4264	6202	5576	1927	2894
SODIUM, % NSOR	71	103	93	32	48
POTASSIUM, mg	1381	2382	1720	598	545
POTASSIUM, % NSOR	37	64	46	16	15
MAGNESIUM, mg	157	234	225	75	60
MAGNESIUM, % NSOR	39	59	56	19	15
TOTAL VIT. A, IU	5170	8332	7077	1897	2480

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 28

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	155	250	212	57	74
VIT. C, mg	93	151	112	50	43
VIT. C, % NSOR	155	252	186	83	72
THIAMIN, mg	3.8	5.3	5.4	1.7	2.3
THIAMIN, % NSOR	212	297	300	94	131
RIBOFLAVIN, mg	1.5	1.9	2.1	0.8	0.9
RIBOFLAVIN, % NSOR	67	87	95	36	40
NIACIN, mg	15.3	19.2	22.4	9.2	7.9
NIACIN, % NSOR	64	80	93	38	33
PYRIDOXINE, mg	2.7	4.1	3.8	0.9	1.8
PYRIDOXINE, % NSOR	123	186	172	41	80
TOTAL FOOD, g	543	752	810	233	293

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 29

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	97	134	90	78	77
PROTEIN, % NSOR	97	134	90	78	77
FAT, g	117	153	101	95	120
FAT, % NSOR	73	96	63	59	75
CARBOHYDRATES, g	299	411	241	239	310
CARBOHYDRATES, % NSOR	68	93	55	54	70
CALORIES	2634	3558	2229	2119	2631
CALORIES, % NSOR	73	99	62	59	73
CALCIUM, mg	712	819	781	617	592
CALCIUM, % NSOR	89	102	98	77	74
PHOSPHORUS, mg	1586	2015	1546	1312	1412
PHOSPHORUS, % NSOR	198	252	193	164	176
IRON, mg	15	19	14	13	13
IRON, % NSOR	82	106	75	71	74
SODIUM, mg	5489	6649	5329	4890	4888
SODIUM, % NSOR	91	111	89	81	81
POTASSIUM, mg	2516	3214	2337	2168	2262
POTASSIUM, % NSOR	67	86	62	58	60
MAGNESIUM, mg	265	364	218	206	277
MAGNESIUM, % NSOR	66	91	54	52	69
TOTAL VIT. A, IU	9873	10464	10737	7903	10645

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 29

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	296	314	322	237	319
VIT. C, mg	137	124	166	115	149
VIT. C, % NSOR	229	206	277	191	247
THIAMIN, mg	5.9	6.1	7.0	5.0	5.2
THIAMIN, % NSOR	327	339	387	279	289
RIBOFLAVIN, mg	2.2	3.0	2.2	1.7	1.6
RIBOFLAVIN, % NSOR	99	136	99	79	72
NIACIN, mg	21.7	31.2	19.7	15.9	18.9
NIACIN, % NSOR	90	130	82	66	79
PYRIDOXINE, mg	4.7	4.7	5.6	4.0	4.2
PYRIDOXINE, % NSOR	212	215	253	183	192
TOTAL FOOD, g	867	1175	748	711	819

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 30

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	105	124	96	95	105
PROTEIN, % NSOR	105	124	96	95	105
FAT, g	122	152	111	96	133
FAT, % NSOR	76	95	70	60	83
CARBOHYDRATES, g	380	447	328	337	419
CARBOHYDRATES, % NSOR	86	102	75	77	95
CALORIES	3036	3648	2698	2590	3292
CALORIES, % NSOR	84	101	75	72	91
CALCIUM, mg	702	844	610	623	749
CALCIUM, % NSOR	88	106	76	78	94
PHOSPHORUS, mg	1564	1959	1341	1359	1614
PHOSPHORUS, % NSOR	196	245	168	170	202
IRON, mg	16	18	15	16	17
IRON, % NSOR	91	98	84	90	92
SODIUM, mg	5831	6411	5633	5127	6313
SODIUM, % NSOR	97	107	94	85	105
POTASSIUM, mg	3010	3218	2854	2854	3167
POTASSIUM, % NSOR	80	86	76	76	84
MAGNESIUM, mg	282	299	255	282	297
MAGNESIUM, % NSOR	70	75	64	70	74
TOTAL VIT. A, IU	7542	11080	6351	4537	8530

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Experimental Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 30

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	226	332	191	136	256
VIT. C, mg	121	166	99	91	132
VIT. C, % NSOR	202	276	166	151	219
THIAMIN, mg	4.9	6.9	4.3	3.5	5.0
THIAMIN, % NSOR	272	382	238	194	276
RIBOFLAVIN, mg	2.3	2.6	2.1	2.2	2.4
RIBOFLAVIN, % NSOR	105	120	94	99	109
NIACIN, mg	22.3	26.3	19.4	20.5	23.3
NIACIN, % NSOR	93	110	81	85	97
PYRIDOXINE, mg	3.8	5.3	3.4	2.2	4.6
PYRIDOXINE, % NSOR	173	241	155	100	210
TOTAL FOOD, g	1006	1180	849	947	1071

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group NSOR is the Nutritional Standards for Operational Rations

Subject: 1

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	86	115	86	73	62
PROTEIN, % NSOR	86	115	86	73	62
FAT, g	107	131	102	99	90
FAT, % NSOR	67	82	64	62	56
CARBOHYDRATES, g	221	250	192	262	159
CARBOHYDRATES, % NSOR	50	57	44	60	36
CALORIES	2196	2678	2024	2231	1681
CALORIES, % NSOR	61	74	56	62	47
CALCIUM, mg	985	1114	962	1086	675
CALCIUM, % NSOR	123	139	120	136	84
PHOSPHORUS, mg	1488	1963	1353	1437	1056
PHOSPHORUS, % NSOR	186	245	169	180	132
IRON, mg	14	20	14	12	9
IRON, % NSOR	79	110	75	68	53
SODIUM, mg	4929	5021	4116	6644	3440
SODIUM, % NSOR	82	84	69	111	57
POTASSIUM, mg	2476	2836	2493	2336	2120
POTASSIUM, % NSOR	66	76	66	62	57
MAGNESIUM, mg	217	257	208	225	157
MAGNESIUM, % NSOR	54	64	52	56	39
TOTAL VIT. A, IU	5671	8808	5237	5027	2582

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 1

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	170	264	157	151	77
VIT. C, mg	91	83	86	111	82
VIT. C, % NSOR	152	138	144	185	136
THIAMIN, mg	2.5	3.9	2.6	2.0	0.8
THIAMIN, % NSOR	138	217	146	113	44
RIBOFLAVIN, mg	2.1	2.5	2.0	2.1	1.4
RIBOFLAVIN, % NSOR	94	113	93	96	64
NIACIN, mg	15.3	24.3	14.7	10.4	9.9
NIACIN, % NSOR	64	101	61	43	41
PYRIDOXINE, mg	1.9	2.9	1.8	1.6	0.8
PYRIDOXINE, % NSOR	85	134	81	72	35
TOTAL FOOD, g	1432	1470	1486	1398	1343

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 2

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	79	104	76	47	95
PROTEIN, % NSOR	79	104	76	47	95
FAT, g	88	102	88	54	118
FAT, % NSOR	55	64	55	34	73
CARBOHYDRATES, g	224	246	225	163	284
CARBOHYDRATES, % NSOR	51	56	51	37	65
CALORIES	1998	2326	1984	1317	2549
CALORIES, % NSOR	56	65	55	37	71
CALCIUM, mg	661	646	660	548	855
CALCIUM, % NSOR	83	81	83	69	107
PHOSPHORUS, mg	1158	1489	1072	761	1388
PHOSPHORUS, % NSOR	145	186	134	95	174
IRON, mg	14	20	12	9	16
IRON, % NSOR	77	111	65	48	88
SODIUM, mg	3037	3428	3042	2416	3376
SODIUM, % NSOR	51	57	51	40	56
POTASSIUM, mg	2695	3572	2373	1843	3142
POTASSIUM, % NSOR	72	95	63	49	84
MAGNESIUM, mg	191	235	192	124	225
MAGNESIUM, % NSOR	48	59	48	31	56
TOTAL VIT. A, IU	4552	7083	5940	1373	3445

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 2

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	137	212	178	41	103
VIT. C, mg	136	237	87	114	92
VIT. C, % NSOR	227	396	145	190	153
THIAMIN, mg	1.5	2.5	1.6	0.7	1.2
THIAMIN, % NSOR	86	139	91	40	64
RIBOFLAVIN, mg	1.6	1.8	1.6	1.2	1.8
RIBOFLAVIN, % NSOR	72	83	71	55	84
NIACIN, mg	16.4	26.4	13.1	7.5	19.6
NIACIN, % NSOR	68	110	55	31	82
PYRIDOXINE, mg	1.2	2.0	1.1	0.4	1.2
PYRIDOXINE, % NSOR	54	92	52	19	53
TOTAL FOOD, g	1792	2095	1758	1074	2469

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 3

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	121	136	135	104	104
PROTEIN, % NSOR	121	136	135	104	104
FAT, g	138	155	136	117	148
FAT, % NSOR	86	97	85	73	92
CARBOHYDRATES, g	291	330	216	307	319
CARBOHYDRATES, % NSOR	66	75	49	70	72
CALORIES	2869	3254	2595	2684	2980
CALORIES, % NSOR	80	90	72	75	83
CALCIUM, mg	1475	1416	1735	1422	1250
CALCIUM, % NSOR	184	177	217	178	156
PHOSPHORUS, mg	2048	2102	2316	1902	1783
PHOSPHORUS, % NSOR	256	263	289	238	223
IRON, mg	19	24	16	17	18
IRON, % NSOR	104	134	88	94	100
SODIUM, mg	5798	6954	6063	5258	4474
SODIUM, % NSOR	97	116	101	88	75
POTASSIUM, mg	3957	4625	3544	3378	4443
POTASSIUM, % NSOR	106	123	94	90	118
MAGNESIUM, mg	308	368	304	257	299
MAGNESIUM, % NSOR	77	92	76	64	75
TOTAL VIT. A, IU	7216	9931	8761	4569	4796

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 3

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	216	298	263	137	144
VIT. C, mg	143	202	138	98	132
VIT. C, % NSOR	239	337	230	163	219
THIAMIN, mg	3.1	3.0	4.2	2.4	2.7
THIAMIN, % NSOR	172	167	232	133	148
RIBOFLAVIN, mg	3.1	3.2	3.3	3.0	2.6
RIBOFLAVIN, % NSOR	139	146	149	136	119
NIACIN, mg	25.1	32.2	24.9	22.3	19.0
NIACIN, % NSOR	105	134	104	93	79
PYRIDOXINE, mg	2.6	1.9	4.0	2.1	2.2
PYRIDOXINE, % NSOR	118	85	184	95	102
TOTAL FOOD, g	2753	3015	2598	2579	2852

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 4

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	52	73	42	46	43
PROTEIN, % NSOR	52	73	42	46	43
FAT, g	57	68	49	49	66
FAT, % NSOR	36	43	31	31	41
CARBOHYDRATES, g	120	174	70	139	86
CARBOHYDRATES, % NSOR	27	40	16	32	19
CALORIES	1202	1636	887	1161	1088
CALORIES, % NSOR	33	45	25	32	30
CALCIUM, mg	311	408	316	277	211
CALCIUM, % NSOR	39	51	40	35	26
PHOSPHORUS, mg	743	1115	636	602	556
PHOSPHORUS, % NSOR	93	139	80	75	69
IRON, mg	9	13	7	9	8
IRON, % NSOR	53	73	41	50	44
SODIUM, mg	2136	3527	1459	1337	2263
SODIUM, % NSOR	36	59	24	22	38
POTASSIUM, mg	1785	1992	1595	1903	1582
POTASSIUM, % NSOR	48	53	43	51	42
MAGNESIUM, mg	164	199	148	154	148
MAGNESIUM, % NSOR	41	50	37	39	37
TOTAL VIT. A, IU	2620	4410	2007	2176	1520

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 4

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	79	132	60	65	46
VIT. C, mg	81	120	47	86	66
VIT. C, % NSOR	135	200	79	144	109
THIAMIN, mg	1.3	2.1	1.3	1.0	0.7
THIAMIN, % NSOR	74	115	75	57	39
RIBOFLAVIN, mg	1.0	1.3	0.9	1.0	0.8
RIBOFLAVIN, % NSOR	44	57	39	44	34
NIACIN, mg	15.3	21.8	12.9	14.1	10.8
NIACIN, % NSOR	64	91	54	59	45
PYRIDOXINE, mg	1.0	1.1	1.1	0.9	0.8
PYRIDOXINE, % NSOR	46	52	51	43	35
TOTAL FOOD, g	1866	1526	2084	2070	1742

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 5

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	105	118	95	111	90
PROTEIN, % NSOR	105	118	95	111	90
FAT, g	120	122	105	132	120
FAT, % NSOR	75	77	66	82	75
CARBOHYDRATES, g	312	312	274	363	293
CARBOHYDRATES, % NSOR	71	71	62	83	67
CALORIES	2738	2841	2419	3054	2590
CALORIES, % NSOR	76	79	67	85	72
CALCIUM, mg	997	1101	911	1237	610
CALCIUM, % NSOR	125	138	114	155	76
PHOSPHORUS, mg	1575	1822	1335	1817	1204
PHOSPHORUS, % NSOR	197	228	167	227	150
IRON, mg	19	23	15	19	17
IRON, % NSOR	104	127	83	107	94
SODIUM, mg	5311	3991	5010	7769	4054
SODIUM, % NSOR	89	67	84	129	68
POTASSIUM, mg	3496	3583	3110	3948	3266
POTASSIUM, % NSOR	93	96	83	105	87
MAGNESIUM, mg	270	285	255	301	221
MAGNESIUM, % NSOR	67	71	64	75	55
TOTAL VIT. A, IU	5870	7061	7273	5131	3089

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 5

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	176	212	218	154	93
VIT. C, mg	161	129	143	243	113
VIT. C, % NSOR	268	216	238	405	188
THIAMIN, mg	2.6	3.0	2.7	2.7	2.0
THIAMIN, % NSOR	146	167	147	148	110
RIBOFLAVIN, mg	2.4	2.7	2.1	2.7	1.9
RIBOFLAVIN, % NSOR	109	121	96	124	86
NIACIN, mg	21.3	27.2	17.5	20.2	20.1
NIACIN, % NSOR	89	113	73	84	84
PYRIDOXINE, mg	1.8	1.7	2.0	2.0	1.4
PYRIDOXINE, % NSOR	82	77	92	93	62
TOTAL FOOD, g	2097	2189	1843	2371	1931

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 6

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	124	153	107	125	106
PROTEIN, % NSOR	124	153	107	125	106
FAT, g	153	170	140	145	159
FAT, % NSOR	96	106	88	90	99
CARBOHYDRATES, g	334	324	278	384	358
CARBOHYDRATES, % NSOR	76	74	63	87	81
CALORIES	3202	3458	2794	3321	3254
CALORIES, % NSCR	89	96	78	92	90
CALCIUM, mg	1319	1643	1189	1305	1049
CALCIUM, % NSOR	165	205	149	163	131
PHOSPHORUS, mg	2053	2567	1821	1989	1725
PHOSPHORUS, % NSOR	257	321	228	249	216
IRON, mg	19	24	15	19	19
IRON, % NSOR	108	135	85	105	104
SODIUM, mg	4916	5142	4610	5078	4794
SODIUM, % NSOR	82	86	77	85	80
POTASSIUM, mg	3913	4361	3156	4052	4167
POTASSIUM, % NSOR	104	116	84	108	111
MAGNESIUM, mg	295	339	265	305	259
MAGNESIUM, % NSCR	74	85	66	76	65
TOTAL VIT. A, IU	7275	8477	8601	6113	5226

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 6

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	218	254	258	183	157
VIT. C, mg	156	122	139	207	157
VIT. C, % NSOR	260	203	231	345	262
THIAMIN, mg	3.1	3.4	3.6	2.7	2.6
THIAMIN, % NSOR	173	186	202	150	144
RIBOFLAVIN, mg	2.8	3.2	2.5	3.0	2.3
RIBOFLAVIN, % NSOR	129	147	116	138	107
NIACIN, mg	24.8	31.0	20.8	25.3	21.0
NIACIN, % NSOR	104	129	87	106	87
PYRIDOXINE, mg	2.2	2.3	2.6	1.7	2.3
PYRIDOXINE, % NSOR	101	107	120	75	105
TOTAL FOOD, g	2304	2508	2079	2369	2238

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 7

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	132	136	116	130	154
PROTEIN, % NSOR	132	136	116	130	154
FAT, g	163	154	134	144	248
FAT, % NSOR	102	96	84	90	155
CARBOHYDRATES, g	371	375	288	369	494
CARBOHYDRATES, % NSOR	84	85	65	84	112
CALORIES	3471	3444	2815	3279	4781
CALORIES, % NSOR	96	96	78	91	133
CALCIUM, mg	1409	1535	1221	1355	1583
CALCIUM, % NSOR	176	192	153	169	198
PHOSPHORUS, mg	2246	2552	1926	2072	2530
PHOSPHORUS, % NSOR	281	319	241	259	316
IRON, mg	21	20	18	19	28
IRON, % NSOR	115	114	100	107	153
SODIUM, mg	5203	4545	5174	4539	7230
SODIUM, % NSOR	87	76	86	76	120
POTASSIUM, mg	4297	4768	3532	3710	5618
POTASSIUM, % NSOR	115	127	94	99	150
MAGNESIUM, mg	314	356	292	274	342
MAGNESIUM, % NSOR	78	89	73	69	86
TOTAL VIT. A, IU	9211	14395	7939	6365	7611

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 7

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	276	432	238	191	228
VIT. C, mg	171	249	105	157	171
VIT. C, % NSOR	284	416	175	262	285
THIAMIN, mg	3.8	3.6	3.5	3.7	4.5
THIAMIN, % NSOR	209	201	195	205	249
RIBOFLAVIN, mg	3.0	2.7	2.6	3.3	3.6
RIBOFLAVIN, % NSOR	136	125	117	148	163
NIACIN, mg	25.7	25.9	19.9	26.2	33.3
NIACIN, % NSOR	107	108	83	109	139
PYRIDOXINE, mg	3.4	4.6	2.8	2.7	3.5
PYRIDOXINE, % NSOR	154	209	127	123	158
TOTAL FOOD, g	2493	2640	2093	2100	3459

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 8

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	118	144	92	122	112
PROTEIN, % NSOR	118	144	92	122	112
FAT, g	136	142	116	130	165
FAT, % NSOR	85	89	72	81	103
CARBOHYDRATES, g	353	359	299	398	358
CARBOHYDRATES, % NSOR	80	82	68	90	81
CALORIES	3104	3316	2599	3241	3338
CALORIES, % NSOR	86	92	72	90	93
CALCIUM, mg	1241	1215	1176	1461	1047
CALCIUM, % NSOR	155	152	147	183	131
PHOSPHORUS, mg	1946	2224	1589	2184	1707
PHOSPHORUS, % NSOR	243	278	199	273	213
IRON, mg	19	25	15	17	21
IRON, % NSOR	108	141	83	96	114
SODIUM, mg	4737	4869	4483	4665	5027
SODIUM, % NSOR	79	81	75	78	84
POTASSIUM, mg	3803	4252	3156	3833	4056
POTASSIUM, % NSOR	101	113	84	102	108
MAGNESIUM, mg	313	356	285	332	264
MAGNESIUM, % NSOR	78	89	71	83	66
TOTAL VIT. A, IU	7222	6465	7799	9004	4818

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 8

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	217	194	234	270	145
VIT. C, mg	173	173	136	239	133
VIT. C, % NSOR	289	288	226	399	221
THIAMIN, mg	3.3	2.9	3.0	4.3	2.9
THIAMIN, % NSOR	185	160	167	241	164
RIBOFLAVIN, mg	2.9	3.1	2.5	3.3	2.5
RIBOFLAVIN, % NSOR	131	139	113	149	115
NIACIN, mg	25.7	34.4	19.1	25.5	22.7
NIACIN, % NSOR	107	143	80	106	95
PYRIDOXINE, mg	2.5	2.1	2.2	3.5	2.3
PYRIDOXINE, % NSOR	115	94	100	160	103
TOTAL FOOD, g	2343	2782	1983	2365	2192

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 9

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	110	124	86	121	107
PROTEIN, % NSOR	110	124	86	121	107
FAT, g	116	129	88	120	133
FAT, % NSOR	73	81	55	75	83
CARBOHYDRATES, g	319	273	261	374	394
CARBOHYDRATES, % NSOR	73	62	59	85	90
CALORIES	2760	2784	2173	3042	3178
CALORIES, % NSOR	77	77	60	85	88
CALCIUM, mg	1144	1180	983	1405	944
CALCIUM, % NSOR	143	147	123	176	118
PHOSPHORUS, mg	1752	2036	1338	2021	1542
PHOSPHORUS, % NSOR	219	254	167	253	193
IRON, mg	17	19	14	17	20
IRON, % NSOR	96	108	79	93	110
SODIUM, mg	3433	3244	2957	3903	3726
SODIUM, % NSOR	57	54	49	65	62
POTASSIUM, mg	3194	3129	2678	3634	3407
POTASSIUM, % NSOR	85	83	71	97	91
MAGNESIUM, mg	264	276	206	319	250
MAGNESIUM, % NSOR	66	69	51	80	63
TOTAL VIT. A, IU	3990	3489	3200	6310	2451

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 9

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	120	105	96	189	74
VIT. C, mg	116	78	45	252	74
VIT. C, % NSOR	193	131	75	420	124
THIAMIN, mg	2.4	1.8	1.9	3.9	1.9
THIAMIN, % NSOR	134	101	106	215	105
RIBOFLAVIN, mg	2.5	2.4	2.1	3.2	2.3
RIBOFLAVIN, % NSOR	114	109	95	144	103
NIACIN, mg	21.4	27.0	13.9	24.1	19.9
NIACIN, % NSOR	89	113	58	101	83
PYRIDOXINE, mg	1.4	1.5	0.9	2.0	1.2
PYRIDOXINE, % NSCR	65	66	41	92	56
TOTAL FOOD, g	2076	2206	1706	2281	2131

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 10

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	114	129	107	112	105
PROTEIN, % NSOR	114	129	107	112	105
FAT, g	129	127	128	122	146
FAT, % NSOR	81	79	80	76	91
CARBOHYDRATES, g	294	228	329	279	363
CARBOHYDRATES, % NSOR	67	52	75	63	83
CALORIES	2789	2596	2882	2646	3152
CALORIES, % NSOR	77	72	80	73	88
CALCIUM, mg	1316	1468	1273	1383	1051
CALCIUM, % NSOR	164	183	159	173	131
PHOSPHORUS, mg	1890	2147	1801	1862	1682
PHOSPHORUS, % NSOR	236	268	225	233	210
IRON, mg	17	19	16	16	19
IRON, % NSOR	96	106	89	87	104
SODIUM, mg	5751	3603	6559	7243	5523
SODIUM, % NSOR	96	60	109	121	92
POTASSIUM, mg	3606	3529	3499	3619	3863
POTASSIUM, % NSOR	96	94	93	97	103
MAGNESIUM, mg	295	281	320	283	295
MAGNESIUM, % NSOR	74	70	80	71	74
TOTAL VIT. A, IU	6393	5085	8347	6062	5920

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 10

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	192	153	250	182	178
VIT. C, mg	140	101	143	182	131
VIT. C, % NSOR	233	168	238	304	219
THIAMIN, mg	2.5	2.0	2.6	2.9	2.3
THIAMIN, % NSOR	137	110	146	162	129
RIBOFLAVIN, mg	2.7	2.7	2.6	3.1	2.3
RIBOFLAVIN, % NSOR	122	123	117	139	104
NIACIN, mg	22.3	27.0	22.5	19.3	19.3
NIACIN, % NSOR	93	112	94	81	80
PYRIDOXINE, mg	1.7	1.2	1.8	1.9	2.0
PYRIDOXINE, % NSOR	77	53	82	87	92
TOTAL FOOD, g	2074	1952	2157	2062	2152

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 11

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	115	120	117	103	121
PROTEIN, % NSOR	115	120	117	103	121
FAT, g	136	129	133	126	167
FAT, % NSOR	85	81	83	79	104
CARBOHYDRATES, g	287	251	281	279	361
CARBOHYDRATES, % NSOR	65	57	64	63	82
CALORIES	2830	2681	2785	2653	3385
CALORIES, % NSOR	79	74	77	74	94
CALCIUM, mg	1055	789	631	1494	1433
CALCIUM, % NSOR	132	99	79	187	179
PHOSPHORUS, mg	1843	1834	1497	2025	2100
PHOSPHORUS, % NSOR	230	229	187	253	262
IRON, mg	20	21	20	16	22
IRON, % NSOR	108	117	113	87	120
SODIUM, mg	4706	5034	5229	3774	4830
SODIUM, % NSOR	78	84	87	63	80
POTASSIUM, mg	3828	2911	3566	3693	5798
POTASSIUM, % NSOR	102	78	95	98	155
MAGNESIUM, mg	306	276	290	294	396
MAGNESIUM, % NSOR	77	69	73	73	99
TOTAL VIT. A, IU	6779	8071	6444	7299	4565

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 11

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	203	242	193	219	137
VIT. C, mg	110	104	107	138	83
VIT. C, % NSOR	184	174	178	230	138
THIAMIN, mg	3.4	3.3	3.4	3.8	2.6
THIAMIN, % NSOR	187	185	191	211	147
RIBOFLAVIN, mg	2.5	2.2	2.2	3.0	3.0
RIBOFLAVIN, % NSOR	116	99	99	135	137
NIACIN, mg	26.7	30.0	27.6	21.2	28.8
NIACIN, % NSOR	111	125	115	88	120
PYRIDOXINE, mg	2.7	2.5	2.6	3.3	2.4
PYRIDOXINE, % NSOR	124	113	119	150	109
TOTAL FOOD, g	2883	1811	2223	3118	5131

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 12

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	126	140	123	110	135
PROTEIN, % NSOR	126	140	123	110	135
FAT, g	157	153	142	164	176
FAT, % NSOR	98	96	89	102	110
CARBOHYDRATES, g	361	281	309	491	362
CARBOHYDRATES, % NSOR	82	64	70	112	82
CALORIES	3360	3084	3000	3867	3553
CALORIES, % NSOR	93	86	83	107	99
CALCIUM, mg	1247	1301	1101	1409	1141
CALCIUM, % NSOR	156	163	138	176	143
PHOSPHORUS, mg	2100	2286	1782	2239	2090
PHOSPHORUS, % NSOR	263	286	223	280	261
IRON, mg	21	24	19	19	21
IRON, % NSOR	115	131	105	108	117
SODIUM, mg	5160	5361	4952	4713	5839
SODIUM, % NSOR	86	89	83	79	97
POTASSIUM, mg	4121	4053	4059	4305	4039
POTASSIUM, % NSOR	110	108	108	115	108
MAGNESIUM, mg	334	332	333	339	327
MAGNESIUM, % NSOR	83	83	83	85	82
TOTAL VIT. A, IU	9705	9970	7006	13900	7063

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 12

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	291	299	210	417	212
VIT. C, mg	138	107	87	261	79
VIT. C, % NSOR	231	179	144	434	132
THIAMIN, mg	3.8	3.1	2.9	5.8	3.4
THIAMIN, % NSOR	213	173	161	323	187
RIBOFLAVIN, mg	2.8	2.8	2.6	3.0	2.9
RIBOFLAVIN, % NSOR	127	125	120	135	130
NIACIN, mg	27.3	32.5	26.6	20.3	31.1
NIACIN, % NSOR	114	135	111	85	129
PYRIDOXINE, mg	3.7	2.8	2.5	6.7	2.4
PYRIDOXINE, % NSOR	167	125	112	303	107
TOTAL FOOD, g	2583	2559	2869	2327	2572

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 13

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	120	126	94	132	133
PROTEIN, % NSOR	120	126	94	132	133
FAT, g	141	116	123	157	180
FAT, % NSOR	88	72	77	98	113
CARBOHYDRATES, g	312	223	292	371	385
CARBOHYDRATES, % NSOR	71	51	66	84	87
CALORIES	2993	2475	2645	3412	3662
CALORIES, % NSOR	83	69	73	95	102
CALCIUM, mg	1082	960	955	1318	1101
CALCIUM, % NSOR	135	120	119	165	138
PHOSPHORUS, mg	1820	1895	1465	2042	1906
PHOSPHORUS, % NSOR	227	237	183	255	238
IRON, mg	19	20	17	19	22
IRON, % NSOR	107	109	93	108	123
SODIUM, mg	4668	3966	4862	4356	5895
SODIUM, % NSOR	78	66	81	73	98
POTASSIUM, mg	3438	2604	3053	3844	4658
POTASSIUM, % NSOR	92	69	81	103	124
MAGNESIUM, mg	269	218	227	328	323
MAGNESIUM, % NSOR	67	55	57	82	81
TOTAL VIT. A, IU	6421	5954	6287	6272	7546

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 13

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	193	179	189	188	226
VIT. C, mg	95	56	76	143	110
VIT. C, % NSOR	158	93	126	238	183
THIAMIN, mg	3.2	2.9	2.7	3.8	3.7
THIAMIN, % NSOR	180	161	148	213	205
RIBOFLAVIN, mg	2.6	2.3	2.2	3.3	2.8
RIBOFLAVIN, % NSOR	120	106	99	149	128
NIACIN, mg	25.2	27.4	17.1	28.5	28.9
NIACIN, % NSOR	105	114	71	119	120
PYRIDOXINE, mg	1.9	2.0	1.7	1.8	2.4
PYRIDOXINE, % NSOR	87	91	76	80	109
TOTAL FOOD, g	1798	1509	1597	1935	2330

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 14

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	114	162	116	101	60
PROTEIN, % NSOR	114	162	116	101	60
FAT, g	124	152	134	109	91
FAT, % NSOR	78	95	84	68	57
CARBOHYDRATES, g	317	353	354	327	193
CARBOHYDRATES, % NSOR	72	80	80	74	44
CALORIES	2837	3446	3079	2672	1811
CALORIES, % NSOR	79	96	86	74	50
CALCIUM, mg	1220	1455	1240	1359	628
CALCIUM, % NSOR	152	182	155	170	79
PHOSPHORUS, mg	1846	2418	1935	1786	944
PHOSPHORUS, % NSOR	231	302	242	223	118
IRON, mg	18	26	18	16	11
IRON, % NSOR	101	144	100	88	60
SODIUM, mg	8443	10330	6988	9832	5712
SODIUM, % NSOR	141	172	116	164	95
POTASSIUM, mg	3756	4799	3602	3815	2336
POTASSIUM, % NSOR	100	128	96	102	62
MAGNESIUM, mg	298	394	307	287	156
MAGNESIUM, % NSOR	74	98	77	72	39
TOTAL VIT. A, IU	5323	8938	5548	3509	2286

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 14

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	160	268	166	105	69
VIT. C, mg	148	197	90	200	82
VIT. C, % NSOR	246	328	150	333	136
THIAMIN, mg	2.4	3.6	2.7	2.0	1.1
THIAMIN, % NSOR	136	197	151	108	62
RIBOFLAVIN, mg	2.7	3.1	3.0	2.8	1.4
RIBOFLAVIN, % NSOR	122	142	134	126	65
NIACIN, mg	22.5	37.2	20.9	17.3	10.8
NIACIN, % NSOR	94	155	87	72	45
PYRIDOXINE, mg	1.7	2.1	2.1	1.4	0.9
PYRIDOXINE, % NSOR	77	97	95	64	43
TOTAL FOOD, g	2200	2638	2192	2295	1411

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 15

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	130	123	141	117	142
PROTEIN, % NSOR	130	123	141	117	142
FAT, g	150	142	145	153	162
FAT, % NSOR	93	88	91	96	101
CARBOHYDRATES, g	401	382	370	441	414
CARBOHYDRATES, % NSOR	91	87	84	100	94
CALORIES	3449	3295	3340	3583	3644
CALORIES, % NSOR	96	92	93	100	101
CALCIUM, mg	1110	1083	1186	1172	945
CALCIUM, % NSOR	139	135	148	147	118
PHOSPHORUS, mg	1980	1936	2028	1996	1949
PHOSPHORUS, % NSOR	247	242	253	250	244
IRON, mg	22	23	24	20	22
IRON, % NSOR	124	130	131	111	123
SODIUM, mg	5770	6661	6947	4550	4496
SODIUM, % NSOR	96	111	116	76	75
POTASSIUM, mg	4582	4423	4787	4261	4996
POTASSIUM, % NSOR	122	118	128	114	133
MAGNESIUM, mg	343	340	390	330	300
MAGNESIUM, % NSOR	86	85	97	82	75
TOTAL VIT. A, IU	8972	10604	11715	6642	5904

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 15

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	269	318	351	199	177
VIT. C, mg	216	242	195	253	149
VIT. C, % NSOR	359	404	325	422	249
THIAMIN, mg	3.2	3.5	3.6	2.9	2.7
THIAMIN, % NSOR	180	197	201	162	148
RIBOFLAVIN, mg	2.6	2.5	2.8	2.7	2.5
RIBOFLAVIN, % NSOR	120	114	126	125	112
NIACIN, mg	28.5	29.6	28.1	23.7	34.5
NIACIN, % NSOR	119	123	117	99	144
PYRIDOXINE, mg	2.6	3.0	2.8	2.6	1.6
PYRIDOXINE, % NSOR	117	134	127	116	75
TOTAL FOOD, g	2339	2162	2463	2218	2602

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 16

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	115	122	92	108	148
PROTEIN, % NSOR	115	122	92	108	148
FAT, g	135	137	127	109	184
FAT, % NSOR	85	86	79	68	115
CARBOHYDRATES, g	344	287	302	368	458
CARBOHYDRATES, % NSOR	78	65	69	84	104
CALORIES	3046	2891	2707	2873	4044
CALORIES, % NSOR	85	80	75	80	112
CALCIUM, mg	1173	1278	974	1213	1255
CALCIUM, % NSOR	147	160	122	152	157
PHOSPHORUS, mg	1838	1975	1578	1764	2133
PHOSPHORUS, % NSOR	230	247	197	221	267
IRON, mg	19	22	16	18	23
IRON, % NSOR	107	120	89	98	127
SODIUM, mg	4658	4022	4433	3535	7634
SODIUM, % NSOR	78	67	74	59	127
POTASSIUM, mg	3753	3764	3060	3567	5054
POTASSIUM, % NSOR	100	100	82	95	135
MAGNESIUM, mg	308	289	297	289	381
MAGNESIUM, % NSOR	77	72	74	72	95
TOTAL VIT. A, IU	7471	9249	9925	4990	4844

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 16

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	224	277	298	150	145
VIT. C, mg	169	153	163	194	161
VIT. C, % NSOR	281	255	272	323	269
THIAMIN, mg	3.3	3.3	3.7	2.9	3.4
THIAMIN, % NSOR	183	182	204	161	188
RIBOFLAVIN, mg	2.8	2.8	2.3	2.9	3.3
RIBOFLAVIN, % NSOR	125	125	103	132	148
NIACIN, mg	25.5	29.2	18.8	24.6	31.5
NIACIN, % NSOR	106	122	78	102	131
PYRIDOXINE, mg	2.2	1.8	3.0	1.7	2.2
PYRIDOXINE, % NSOR	99	82	136	79	99
TOTAL FOOD, g	2265	2196	1974	2352	2672

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 17

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	127	115	131	131	133
PROTEIN, % NSOR	127	115	131	131	133
FAT, g	157	131	149	165	195
FAT, % NSOR	98	82	93	103	122
CARBOHYDRATES, g	409	375	361	460	455
CARBOHYDRATES, % NSOR	93	85	82	104	103
CALORIES	3529	3105	3299	3827	4063
CALORIES, % NSOR	98	86	92	106	113
CALCIUM, mg	1418	1450	1543	1577	943
CALCIUM, % NSOR	177	181	193	197	118
PHOSPHORUS, mg	2092	1981	2104	2276	1965
PHOSPHORUS, % NSOR	262	248	263	284	246
IRON, mg	22	20	20	23	24
IRON, % NSOR	120	113	113	127	131
SODIUM, mg	5676	5002	5531	5695	6873
SODIUM, % NSOR	95	83	92	95	115
POTASSIUM, mg	4470	4364	4256	4760	4519
POTASSIUM, % NSOR	119	116	113	127	121
MAGNESIUM, mg	352	342	326	366	385
MAGNESIUM, % NSOR	88	85	82	91	96
TOTAL VIT. A, IU	8000	8026	9229	7250	7241

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 17

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	240	241	277	218	217
VIT. C, mg	221	300	147	257	158
VIT. C, % NSOR	368	500	244	428	264
THIAMIN, mg	3.9	3.5	3.7	4.3	3.8
THIAMIN, % NSOR	214	195	207	241	213
RIBOFLAVIN, mg	3.1	2.9	3.2	3.5	2.6
RIBOFLAVIN, % NSOR	141	133	144	159	120
NIACIN, mg	25.9	23.1	23.5	24.9	35.4
NIACIN, % NSOR	108	96	98	104	147
PYRIDOXINE, mg	2.9	2.7	3.0	3.4	2.4
PYRIDOXINE, % NSOR	133	125	135	154	110
TOTAL FOOD, g	2717	2741	2551	2824	2768

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 18

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	114	107	93	121	147
PROTEIN, % NSOR	114	107	93	121	147
FAT, g	141	104	110	167	205
FAT, % NSOR	88	65	69	104	128
CARBOHYDRATES, g	336	240	270	438	429
CARBOHYDRATES, % NSOR	76	55	61	99	98
CALORIES	3064	2349	2428	3716	4116
CALORIES, % NSOR	85	65	67	103	114
CALCIUM, mg	1158	716	884	1621	1539
CALCIUM, % NSOR	145	89	111	203	192
PHOSPHORUS, mg	1975	1605	1544	2306	2682
PHOSPHORUS, % NSOR	247	201	193	288	335
IRON, mg	20	19	16	22	23
IRON, % NSOR	110	107	91	122	128
SODIUM, mg	4659	3521	4137	5275	6223
SODIUM, % NSOR	78	59	69	88	104
POTASSIUM, mg	3753	2728	3122	4409	5252
POTASSIUM, % NSOR	100	73	83	118	140
MAGNESIUM, mg	320	253	270	374	414
MAGNESIUM, % NSOR	80	63	68	94	103
TOTAL VIT. A, IU	9552	9051	8575	10405	10487

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 18

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	287	272	257	312	315
VIT. C, mg	168	107	116	258	202
VIT. C, % NSOR	279	178	193	429	337
THIAMIN, mg	4.3	3.5	3.4	5.4	5.1
THIAMIN, % NSOR	237	194	187	299	286
RIBOFLAVIN, mg	2.7	2.2	2.0	3.7	3.2
RIBOFLAVIN, % NSOR	124	98	90	168	147
NIACIN, mg	25.8	28.8	18.9	26.3	31.2
NIACIN, % NSOR	108	120	79	109	130
PYRIDOXINE, mg	3.6	2.7	3.3	4.4	4.5
PYRIDOXINE, % NSOR	165	121	152	198	202
TOTAL FOOD, g	2438	1819	2244	2717	3240

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 19

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	131	132	119	144	128
PROTEIN, % NSOR	131	132	119	144	128
FAT, g	140	128	129	154	155
FAT, % NSOR	88	80	81	96	97
CARBOHYDRATES, g	385	325	345	462	418
CARBOHYDRATES, % NSOR	87	74	78	105	95
CALORIES	3315	2992	3009	3786	3552
CALORIES, % NSOR	92	83	84	105	99
CALCIUM, mg	1632	1453	1824	1822	1329
CALCIUM, % NSOR	204	182	228	228	166
PHOSPHORUS, mg	2212	2138	2122	2496	2031
PHOSPHORUS, % NSOR	277	267	265	312	254
IRON, mg	21	22	18	23	22
IRON, % NSOR	118	125	100	129	121
SODIUM, mg	6564	4896	6059	8022	7636
SODIUM, % NSOR	109	82	101	134	127
POTASSIUM, mg	4698	4356	4641	4939	4934
POTASSIUM, % NSOR	125	116	124	132	132
MAGNESIUM, mg	371	323	416	372	373
MAGNESIUM, % NSOR	93	81	104	93	93
TOTAL VIT. A, IU	7712	8262	9419	7049	5322

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 19

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	231	248	283	211	160
VIT. C, mg	216	199	203	277	168
VIT. C, % NSOR	359	332	338	461	281
THIAMIN, mg	2.9	2.8	3.2	3.2	2.4
THIAMIN, % NSOR	163	154	176	180	132
RIBOFLAVIN, mg	3.1	2.8	3.0	3.7	2.8
RIBOFLAVIN, % NSOR	141	129	137	167	128
NIACIN, mg	23.6	27.3	20.1	25.0	21.6
NIACIN, % NSOR	99	114	84	104	90
PYRIDOXINE, mg	2.5	2.3	2.6	2.7	2.3
PYRIDOXINE, % NSOR	114	104	119	125	105
TOTAL FOOD, g	2614	2428	2605	2801	2625

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 20

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	110	130	103	99	110
PROTEIN, % NSOR	110	130	103	99	110
FAT, g	125	130	124	103	149
FAT, % NSOR	78	81	78	64	93
CARBOHYDRATES, g	323	323	306	334	331
CARBOHYDRATES, % NSOR	73	73	69	76	75
CALORIES	2849	3001	2747	2649	3074
CALORIES, % NSOR	79	83	76	74	85
CALCIUM, mg	1160	1283	1079	1257	950
CALCIUM, % NSOR	145	160	135	157	119
PHOSPHORUS, mg	1818	2126	1742	1708	1634
PHOSPHORUS, % NSOR	227	266	218	214	204
IRON, mg	19	22	17	16	20
IRON, % NSOR	105	125	96	90	110
SODIUM, mg	4865	4720	6210	3882	4537
SODIUM, % NSOR	81	79	104	65	76
POTASSIUM, mg	3713	4031	3410	3396	4164
POTASSIUM, % NSOR	99	107	91	91	111
MAGNESIUM, mg	285	324	292	256	262
MAGNESIUM, % NSOR	71	81	73	64	66
TOTAL VIT. A, IU	5857	6549	7413	4952	3841

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 20

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	176	197	222	149	115
VIT. C, mg	135	156	95	173	108
VIT. C, % NSOR	225	260	158	288	180
THIAMIN, mg	2.6	3.1	2.8	2.5	1.8
THIAMIN, % NSOR	145	171	158	137	100
RIBOFLAVIN, mg	2.6	2.9	2.2	2.8	2.3
RIBOFLAVIN, % NSOR	116	130	102	125	102
NIACIN, mg	23.1	30.6	19.1	20.2	22.0
NIACIN, % NSOR	96	128	80	84	92
PYRIDOXINE, mg	2.3	2.3	3.0	2.0	1.4
PYRIDOXINE, % NSOR	102	104	135	93	65
TOTAL FOOD, g	2207	2462	2118	2092	2132

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 21

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	107	138	90	119	65
PROTEIN, % NSOR	107	138	90	119	65
FAT, g	115	130	101	129	90
FAT, % NSOR	72	81	63	81	56
CARBOHYDRATES, g	254	249	254	322	158
CARBOHYDRATES, % NSOR	58	57	58	73	36
CALORIES	2467	2739	2281	2907	1676
CALORIES, % NSCR	69	76	63	81	47
CALCIUM, mg	1165	1398	1021	1366	730
CALCIUM, % NSOR	146	175	128	171	91
PHOSPHORUS, mg	1745	2157	1455	1998	1182
PHOSPHORUS, % NSOR	218	270	182	250	148
IRON, mg	16	21	14	18	10
IRON, % NSOR	91	114	80	101	56
SODIUM, mg	4982	6204	4170	5039	4280
SODIUM, % NSOR	83	103	70	84	71
POTASSIUM, mg	3345	3848	3169	4043	1807
POTASSIUM, % NSOR	89	103	84	108	48
MAGNESIUM, mg	249	273	246	275	177
MAGNESIUM, % NSOR	62	68	61	69	44
TOTAL VIT. A, IU	6030	4850	7523	6952	4176

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 21

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	181	146	226	209	125
VIT. C, mg	161	136	146	254	85
VIT. C, % NSOR	269	227	243	423	141
THIAMIN, mg	2.5	2.5	2.4	2.5	2.6
THIAMIN, % NSOR	137	139	132	137	144
RIBOFLAVIN, mg	2.5	3.0	2.1	3.0	1.5
RIBOFLAVIN, % NSOR	113	135	97	137	67
NIACIN, mg	20.9	29.0	16.6	22.0	13.6
NIACIN, % NSOR	87	121	69	92	57
PYRIDOXINE, mg	2.1	2.0	2.1	2.2	2.2
PYRIDOXINE, % NSOR	96	92	96	99	100
TOTAL FOOD, g	2133	2331	1936	2313	1864

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 22

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	128	146	132	110	124
PROTEIN, % NSOR	128	146	132	110	124
FAT, g	150	150	162	132	160
FAT, % NSOR	94	94	101	82	100
CARBOHYDRATES, g	330	310	343	294	397
CARBOHYDRATES, % NSOR	75	70	78	67	90
CALORIES	3196	3209	3363	2808	3509
CALORIES, % NSOR	89	89	93	78	97
CALCIUM, mg	1588	1689	1736	1474	1384
CALCIUM, % NSOR	198	211	217	184	173
PHOSPHORUS, mg	2270	2452	2460	1988	2135
PHOSPHORUS, % NSOR	284	307	308	248	267
IRON, mg	19	21	18	16	21
IRON, % NSOR	105	118	100	88	116
SODIUM, mg	5443	5522	6947	3977	5269
SODIUM, % NSOR	91	92	116	66	88
POTASSIUM, mg	3739	3775	4011	3279	3967
POTASSIUM, % NSOR	100	101	107	87	106
MAGNESIUM, mg	308	315	357	253	308
MAGNESIUM, % NSOR	77	79	89	63	77
TOTAL VIT. A, IU	8247	7826	12943	5177	6439

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 22

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	247	235	388	155	193
VIT. C, mg	117	58	173	106	139
VIT. C, % NSOR	196	97	289	177	232
THIAMIN, mg	3.8	2.9	5.6	2.9	4.1
THIAMIN, % NSOR	213	159	312	159	228
RIBOFLAVIN, mg	3.1	3.3	3.0	3.0	3.0
RIBOFLAVIN, % NSOR	140	148	137	137	135
NIACIN, mg	21.8	28.9	20.3	15.8	22.5
NIACIN, % NSOR	91	120	85	66	94
PYRIDOXINE, mg	3.2	1.8	5.6	2.1	3.1
PYRIDOXINE, % NSOR	143	81	254	97	142
TOTAL FOOD, g	2016	1963	2010	1893	2287

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 23

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	105	113	106	106	91
PROTEIN, % NSOR	105	113	106	106	91
FAT, g	114	101	116	131	104
FAT, % NSOR	71	63	72	82	65
CARBOHYDRATES, g	322	243	344	405	285
CARBOHYDRATES, % NSOR	73	55	78	92	65
CALORIES	2730	2356	2840	3201	2417
CALORIES, % NSOR	76	65	79	89	67
CALCIUM, mg	1325	1276	1462	1426	1042
CALCIUM, % NSOR	166	159	183	178	130
PHOSPHORUS, mg	1853	1886	2011	1904	1490
PHOSPHORUS, % NSOR	232	236	251	238	186
IRON, mg	17	18	15	18	16
IRON, % NSOR	94	98	86	101	90
SODIUM, mg	4320	4664	4720	3688	4151
SODIUM, % NSOR	72	78	79	61	69
POTASSIUM, mg	3455	3252	3731	3620	3096
POTASSIUM, % NSOR	92	87	99	97	83
MAGNESIUM, mg	307	285	347	303	287
MAGNESIUM, % NSOR	77	71	87	76	72
TOTAL VIT. A, IU	8491	6069	14837	6817	5119

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 23

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	255	182	445	205	154
VIT. C, mg	169	159	199	217	68
VIT. C, % NSOR	282	265	331	362	113
THIAMIN, mg	3.6	2.9	5.0	3.7	2.2
THIAMIN, % NSOR	198	160	277	206	121
RIBOFLAVIN, mg	2.7	2.7	2.5	3.2	2.1
RIBOFLAVIN, % NSOR	123	121	116	148	98
NIACIN, mg	21.2	27.6	17.7	19.5	19.4
NIACIN, % NSOR	88	115	74	81	81
PYRIDOXINE, mg	3.0	2.2	5.3	2.3	1.8
PYRIDOXINE, % NSOR	136	100	241	104	80
TOTAL FOOD, g	2191	2100	1961	2305	2503

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 24

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	116	140	112	114	87
PROTEIN, % NSOR	116	140	112	114	87
FAT, g	136	142	145	128	127
FAT, % NSOR	85	88	90	80	79
CARBOHYDRATES, g	293	215	297	369	287
CARBOHYDRATES, % NSOR	66	49	67	84	65
CALORIES	2854	2734	2922	3064	2616
CALORIES, % NSOR	79	76	81	85	73
CALCIUM, mg	1227	1378	1379	1255	732
CALCIUM, % NSOR	153	172	172	157	92
PHOSPHORUS, mg	1866	2203	1912	1881	1268
PHOSPHORUS, % NSOR	233	275	239	235	159
IRON, mg	18	23	17	18	16
IRON, % NSOR	102	125	92	99	89
SODIUM, mg	4097	4258	4567	3747	3677
SODIUM, % NSOR	68	71	76	62	61
POTASSIUM, mg	3684	3804	3951	3862	2836
POTASSIUM, % NSOR	98	101	105	103	76
MAGNESIUM, mg	286	303	344	267	200
MAGNESIUM, % NSOR	71	76	86	67	50
TOTAL VIT. A, IU	7366	7576	9776	7237	3628

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 24

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	221	227	293	217	109
VIT. C, mg	131	65	134	243	57
VIT. C, % NSOR	219	109	223	406	95
THIAMIN, mg	2.8	2.5	3.6	3.1	1.6
THIAMIN, % NSOR	155	137	202	171	88
RIBOFLAVIN, mg	2.6	2.7	2.8	2.9	2.0
RIBOFLAVIN, % NSOR	120	123	125	132	89
NIACIN, mg	22.7	29.5	19.3	22.7	17.3
NIACIN, % NSOR	94	123	80	95	72
PYRIDOXINE, mg	2.2	1.7	2.7	3.0	1.0
PYRIDOXINE, % NSOR	100	77	123	135	46
TOTAL FOOD, g	2179	2332	2198	2191	1901

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 25

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	123	156	109	111	109
PROTEIN, % NSOR	123	156	109	111	109
FAT, g	141	163	119	132	155
FAT, % NSOR	88	102	75	82	97
CARBOHYDRATES, g	350	322	342	383	356
CARBOHYDRATES, % NSOR	80	73	78	87	81
CALORIES	3152	3407	2860	3137	3230
CALORIES, % NSOR	88	95	79	87	90
CALCIUM, mg	1251	1563	1100	1247	1013
CALCIUM, % NSOR	156	195	138	156	127
PHOSPHORUS, mg	1942	2467	1681	1834	1708
PHOSPHORUS, % NSOR	243	308	210	229	213
IRON, mg	20	24	19	19	19
IRON, % NSOR	114	132	107	108	107
SODIUM, mg	4501	5282	4534	3771	4375
SODIUM, % NSOR	75	88	76	63	73
POTASSIUM, mg	4162	4209	4200	4017	4251
POTASSIUM, % NSOR	111	112	112	107	113
MAGNESIUM, mg	332	377	340	309	286
MAGNESIUM, % NSOR	83	94	85	77	71
TOTAL VIT. A, IU	6643	8657	7548	4599	5329

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 25

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	199	260	226	138	160
VIT. C, mg	173	135	169	199	195
VIT. C, % NSOR	288	225	282	332	325
THIAMIN, mg	2.8	3.1	2.3	2.6	3.2
THIAMIN, % NSOR	154	171	130	145	177
RIBOFLAVIN, mg	2.7	3.2	2.3	2.7	2.3
RIBOFLAVIN, % NSOR	121	145	106	124	106
NIACIN, mg	26.1	35.8	21.3	22.3	24.6
NIACIN, % NSOR	109	149	89	93	102
PYRIDOXINE, mg	1.9	1.7	2.0	1.9	2.2
PYRIDOXINE, % NSOR	87	77	89	84	100
TOTAL FOOD, g	2219	2204	2307	2151	2214

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 26

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	112	132	90	125	95
PROTEIN, % NSOR	112	132	90	125	95
FAT, g	146	147	131	151	156
FAT, % NSOR	91	92	82	94	98
CARBOHYDRATES, g	356	340	314	421	344
CARBOHYDRATES, % NSOR	81	77	71	96	78
CALORIES	3168	3226	2792	3517	3123
CALORIES, % NSOR	88	90	78	98	87
CALCIUM, mg	1223	1410	986	1513	865
CALCIUM, % NSOR	153	176	123	189	108
PHOSPHORUS, mg	1905	2245	1609	2106	1539
PHOSPHORUS, % NSOR	238	281	201	263	192
IRON, mg	21	24	18	22	19
IRON, % NSOR	114	132	97	120	104
SODIUM, mg	4533	4624	4581	5071	3517
SODIUM, % NSOR	76	77	76	85	59
POTASSIUM, mg	4022	4400	3318	4494	3803
POTASSIUM, % NSOR	107	117	88	120	101
MAGNESIUM, mg	301	325	273	335	257
MAGNESIUM, % NSOR	75	81	68	84	64
TOTAL VIT. A, IU	7369	10340	7530	6863	3430

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method): By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 26

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	221	310	226	206	103
VIT. C, mg	171	206	119	246	88
VIT. C, % NSOR	286	343	198	409	146
THIAMIN, mg	3.1	4.0	3.2	3.3	1.5
THIAMIN, % NSOR	174	221	177	185	83
RIBOFLAVIN, mg	2.7	2.9	2.2	3.3	2.1
RIBOFLAVIN, % NSOR	121	130	102	148	94
NIACIN, mg	22.3	27.7	17.4	24.4	18.3
NIACIN, % NSOR	93	115	73	102	76
PYRIDOXINE, mg	2.5	3.1	2.6	2.8	1.1
PYRIDOXINE, % NSOR	115	142	119	128	52
TOTAL FOOD, g	2370	2295	2036	2789	2356

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 27

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	130	159	128	118	107
PROTEIN, % NSOR	130	159	128	118	107
FAT, g	152	177	141	143	146
FAT, % NSOR	95	111	88	90	91
CARBOHYDRATES, g	374	378	358	414	333
CARBOHYDRATES, % NSOR	85	86	81	94	76
CALORIES	3373	3759	3174	3403	3046
CALORIES, % NSOR	94	104	88	95	85
CALCIUM, mg	1506	1883	1598	1406	950
CALCIUM, % NSOR	188	235	200	176	119
PHOSPHORUS, mg	2164	2707	2117	2066	1566
PHOSPHORUS, % NSOR	270	338	265	258	196
IRON, mg	20	25	18	19	18
IRON, % NSOR	112	139	102	104	100
SODIUM, mg	4695	5066	5185	4038	4389
SODIUM, % NSOR	78	84	86	67	73
POTASSIUM, mg	4185	4491	4386	4105	3546
POTASSIUM, % NSOR	112	120	117	109	95
MAGNESIUM, mg	342	386	371	308	282
MAGNESIUM, % NSOR	85	97	93	77	71
TOTAL VIT. A, IU	8167	10220	9680	7034	4520

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 27

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	245	307	290	211	136
VIT. C, mg	179	164	164	252	112
VIT. C, % NSOR	298	274	274	421	187
THIAMIN, mg	3.5	4.5	3.5	3.1	2.5
THIAMIN, % NSOR	195	252	197	175	137
RIBOFLAVIN, mg	3.1	3.8	3.0	3.0	2.4
RIBOFLAVIN, % NSOR	143	175	138	137	111
NIACIN, mg	26.6	34.9	24.3	23.1	22.6
NIACIN, % NSOR	111	145	101	96	94
PYRIDOXINE, mg	2.4	2.4	2.9	2.4	1.3
PYRIDOXINE, % NSOR	107	111	132	110	60
TOTAL FOOD, g	2468	2612	2582	2321	2304

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 28

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	138	154	156	128	99
PROTEIN, % NSOR	138	154	156	128	99
FAT, g	169	164	180	181	141
FAT, % NSOR	105	102	113	113	88
CARBOHYDRATES, g	466	450	437	523	449
CARBOHYDRATES, % NSOR	106	102	99	119	102
CALORIES	3917	3901	3991	4190	3420
CALORIES, % NSOR	109	108	111	116	95
CALCIUM, mg	1151	1338	1131	1330	634
CALCIUM, % NSOR	144	167	141	166	79
PHOSPHORUS, mg	2106	2443	2106	2156	1526
PHOSPHORUS, % NSOR	263	305	263	269	191
IRON, mg	25	30	26	23	21
IRON, % NSOR	140	165	145	127	115
SODIUM, mg	5728	6750	6520	5078	3980
SODIUM, % NSOR	95	112	109	85	66
POTASSIUM, mg	4638	4759	4839	4294	4672
POTASSIUM, % NSOR	124	127	129	115	125
MAGNESIUM, mg	351	363	400	320	305
MAGNESIUM, % NSOR	88	91	100	80	76
TOTAL VIT. A, IU	7683	10268	9863	5714	3489

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 28

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	231	308	296	171	105
VIT. C, mg	214	235	191	196	246
VIT. C, % NSOR	357	391	318	327	410
THIAMIN, mg	3.3	3.9	3.6	3.4	1.7
THIAMIN, % NSOR	181	216	197	187	95
RIBOFLAVIN, mg	3.1	3.6	3.3	3.4	1.7
RIBOFLAVIN, % NSOR	142	165	150	155	78
NIACIN, mg	31.4	39.4	32.3	27.1	24.4
NIACIN, % NSOR	131	164	135	113	102
PYRIDOXINE, mg	2.4	3.0	2.8	2.1	1.6
PYRIDOXINE, % NSOR	111	135	129	95	71
TOTAL FOOD, g	2773	2715	2934	2695	2734

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 29

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	110	130	91	98	125
PROTEIN, % NSOR	110	130	91	98	125
FAT, g	130	140	123	102	170
FAT, % NSOR	81	87	77	64	106
CARBOHYDRATES, g	333	325	273	336	433
CARBOHYDRATES, % NSOR	76	74	62	76	98
CALORIES	2930	3C89	2548	2625	3723
CALORIES, % NSCR	81	86	71	73	103
CALCIUM, mg	896	868	654	924	1256
CALCIUM, % NSOR	112	109	82	116	157
PHOSPHORUS, mg	1734	2007	1381	1632	2009
PHOSPHORUS, % NSOR	217	251	173	204	251
IRON, mg	21	26	18	17	23
IRON, % NSOR	115	142	98	95	130
SODIUM, mg	4497	5145	4378	3552	5121
SODIUM, % NSOR	75	86	73	59	85
POTASSIUM, mg	3757	4096	3214	3330	4703
POTASSIUM, % NSCR	100	109	86	89	125
MAGNESIUM, mg	286	309	281	231	342
MAGNESIUM, % NSOR	71	77	70	58	86
TOTAL VIT. A, IU	7673	9307	11011	5067	4124

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 29

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	230	279	330	152	124
VIT. C, mg	146	164	124	193	80
VIT. C, % NSOR	243	274	207	322	133
THIAMIN, mg	2.9	3.2	4.1	2.0	2.0
THIAMIN, % NSOR	162	177	230	112	109
RIBOFLAVIN, mg	2.3	2.2	1.9	2.4	2.8
RIBOFLAVIN, % NSOR	104	101	87	107	129
NIACIN, mg	26.0	31.9	23.0	21.4	28.5
NIACIN, % NSOR	108	133	96	89	119
PYRIDOXINE, mg	2.5	3.1	2.9	2.0	1.6
PYRIDOXINE, % NSOR	113	142	134	91	74
TOTAL FOOD, g	2613	2692	2477	2184	3345

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 30

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
PROTEIN, g	119	132	112	115	116
PROTEIN, % NSOR	119	132	112	115	116
FAT, g	139	139	119	142	166
FAT, % NSOR	87	87	74	89	104
CARBOHYDRATES, g	345	294	297	421	380
CARBOHYDRATES, % NSOR	78	67	68	96	86
CALORIES	3108	2980	2704	3418	3441
CALORIES, % NSOR	86	83	75	95	96
CALCIUM, mg	1526	1681	1545	1548	1235
CALCIUM, % NSOR	191	210	193	194	154
PHOSPHORUS, mg	2039	2270	1947	2026	1851
PHOSPHORUS, % NSOR	255	284	243	253	231
IRON, mg	19	20	16	19	19
IRON, % NSOR	104	114	91	108	104
SODIUM, mg	4382	4897	4167	3754	4877
SODIUM, % NSOR	73	82	69	63	81
POTASSIUM, mg	4103	3855	3660	4448	4622
POTASSIUM, % NSOR	109	103	98	119	123
MAGNESIUM, mg	335	324	302	381	329
MAGNESIUM, % NSOR	84	81	76	95	82
TOTAL VIT. A, IU	6917	7050	8872	6612	4242

(CONTINUED)

Mean Daily Intake of Energy and Nutrients (Combined Method):
By Weight and Percent NSOR for Each Subject in the Control Group
NSOR is the Nutritional Standards for Operational Rations

Subject: 30

	Period				
	Total	Sept. 2-4	Sept. 9-11	Sept. 15-17	Sept. 25-26
	Mean Intake	Mean Intake	Mean Intake	Mean Intake	Mean Intake
TOTAL VIT. A, % NSOR	208	212	266	198	127
VIT. C, mg	166	118	124	262	154
VIT. C, % NSOR	276	197	207	437	256
THIAMIN, mg	3.2	2.8	3.2	3.8	2.8
THIAMIN, % NSOR	176	156	178	209	154
RIBOFLAVIN, mg	3.1	3.2	2.9	3.6	2.6
RIBOFLAVIN, % NSOR	141	145	132	162	120
NIACIN, mg	25.5	28.7	21.0	24.4	29.0
NIACIN, % NSOR	106	119	88	102	121
PYRIDOXINE, mg	2.0	1.6	2.6	1.9	1.8
PYRIDOXINE, % NSOR	91	74	117	88	82
TOTAL FOOD, g	2491	2547	2112	2600	2811

Appendix E. MRE Food Acceptability Form

Appendix E

MRE

Social Security # ______________ Date: ______________ Breakfast ☐ Lunch ☐ Dinner ☐

We would like your honest evaluation of the MRE items you ate at this meal. Please put a check by each item you ate and circle the number on the right that best expresses your opinion about that item. The words that correspond to the rating numbers are printed above the columns and range from extremely bad (1) to extremely good (9). Please do not discuss your ratings with your friends. If you have any comments, please write them on the back of this sheet.

	CHECK ITEMS EATEN	EXTREMELY BAD	VERY BAD	MODERATELY BAD	SLIGHTLY BAD	NEUTRAL	SLIGHTLY GOOD	MODERATELY GOOD	VERY GOOD	EXTREMELY GOOD
ENTREE										
BEEF W/ BARBEQUE SAUCE	☐	1	2	3	4	5	6	7	8	9
BEEF W/ GRAVY	☐	1	2	3	4	5	6	7	8	9
BEEF W/ SPICED SAUCE	☐	1	2	3	4	5	6	7	8	9
BEEF PATTIES	☐	1	2	3	4	5	6	7	8	9
BEEF STEW	☐	1	2	3	4	5	6	7	8	9
CHICKEN ALA KING	☐	1	2	3	4	5	6	7	8	9
FRANKFURTERS	☐	1	2	3	4	5	6	7	8	9
HAM/CHICKEN LOAF	☐	1	2	3	4	5	6	7	8	9
HAM SLICES	☐	1	2	3	4	5	6	7	8	9
MEATBALLS W/ BARBEQUE SAUCE	☐	1	2	3	4	5	6	7	8	9
PORK SAUSAGE PATTIES	☐	1	2	3	4	5	6	7	8	9
TURKEY W/ GRAVY	☐	1	2	3	4	5	6	7	8	9
STARCH										
CRACKERS	☐	1	2	3	4	5	6	7	8	9
BEANS W/ TOMATO SAUCE	☐	1	2	3	4	5	6	7	8	9
POTATO PATTY	☐	1	2	3	4	5	6	7	8	9
SPREAD										
CHEESE	☐	1	2	3	4	5	6	7	8	9
JELLY	☐	1	2	3	4	5	6	7	8	9
PEANUT BUTTER	☐	1	2	3	4	5	6	7	8	9
FRUIT										
APPLESAUCE	☐	1	2	3	4	5	6	7	8	9
MIXED FRUITS	☐	1	2	3	4	5	6	7	8	9
PEACHES	☐	1	2	3	4	5	6	7	8	9
STRAWBERRIES	☐	1	2	3	4	5	6	7	8	9
DESSERT										
BROWNIE	☐	1	2	3	4	5	6	7	8	9
CHERRY NUT CAKE	☐	1	2	3	4	5	6	7	8	9
CHOCOLATE-COVERED COOKY	☐	1	2	3	4	5	6	7	8	9
FRUITCAKE	☐	1	2	3	4	5	6	7	8	9
MAPLE NUT CAKE	☐	1	2	3	4	5	6	7	8	9
ORANGE NUT ROLL	☐	1	2	3	4	5	6	7	8	9
PINEAPPLE NUT CAKE	☐	1	2	3	4	5	6	7	8	9

Appendix F. A Ration Breakfast Food Acceptability Form

Appendix F

BKFT

We would like your honest evaluations of the items you ate for breakfast TODAY. Please circle the number on the right that best expresses your opinion of each particular item that you chose for this meal. Please do not discuss your opinion with your friends. Additional comments may be made at the bottom of this paper.

	CHECK ITEM EATEN	EXTREMELY BAD	VERY BAD	MODERATELY BAD	SLIGHTLY BAD	NEUTRAL	SLIGHTLY GOOD	MODERATELY GOOD	VERY GOOD	EXTREMELY GOOD
EGGS	☐	1	2	3	4	5	6	7	8	9
HOT CEREAL	☐	1	2	3	4	5	6	7	8	9
COLD CEREAL	☐	1	2	3	4	5	6	7	8	9
FRENCH TOAST	☐	1	2	3	4	5	6	7	8	9
PANCAKES	☐	1	2	3	4	5	6	7	8	9
BISCUITS	☐	1	2	3	4	5	6	7	8	9
COFFEE CAKE	☐	1	2	3	4	5	6	7	8	9
DOUGHNUTS	☐	1	2	3	4	5	6	7	8	9
TOAST	☐	1	2	3	4	5	6	7	8	9
CREAMED GROUND BEEF	☐	1	2	3	4	5	6	7	8	9
BACON	☐	1	2	3	4	5	6	7	8	9
SAUSAGE PATTIES	☐	1	2	3	4	5	6	7	8	9
HAM SLICES	☐	1	2	3	4	5	6	7	8	9
HASHED BROWN POTATOES	☐	1	2	3	4	5	6	7	8	9

ADDITIONAL COMMENTS:

NAME____________________

DATE____________________

Appendix G. A Ration Dinner Food Acceptability Form

Appendix G

DINNER (C)

Social Security # ____________________ Date ____________________

We would like your honest opinion of each food item you ate for dinner to see how acceptable the foods are. Please WRITE IN the name of the food you ate for each of the categories listed and then circle the number that best expresses your opinion. Please do not discuss your ratings with your friends. Additional comments may be made on the back of this paper.

MAIN DISH:		STARCH/POTATO/RICE:		SALAD:	
Extremely Good	9	Extremely Good	9	Extremely Good	9
Very Good	8	Very Good	8	Very Good	8
Moderately Good	7	Moderately Good	7	Moderately Good	7
Slightly Good	6	Slightly Good	6	Slightly Good	6
Neutral	5	Neutral	5	Neutral	5
Slightly Bad	4	Slightly Bad	4	Slightly Bad	4
Moderately Bad	3	Moderately Bad	3	Moderately Bad	3
Very Bad	2	Very Bad	2	Very Bad	2
Extremely Bad	1	Extremely Bad	1	Extremely Bad	1

VEGETABLE:		DESSERT:		FRUIT:	
Extremely Good	9	Extremely Good	9	Extremely Good	9
Very Good	8	Very Good	8	Very Good	8
Moderately Good	7	Moderately Good	7	Moderately Good	7
Slightly Good	6	Slightly Good	6	Slightly Good	6
Neutral	5	Neutral	5	Neutral	5
Slightly Bad	4	Slightly Bad	4	Slightly Bad	4
Moderately Bad	3	Moderately Bad	3	Moderately Bad	3
Very Bad	2	Very Bad	2	Very Bad	2
Extremely Bad	1	Extremely Bad	1	Extremely Bad	1

Appendix H. Food Preference Survey

Appendix H

NAME ____________ SS# ____________ DATE ____________

We are interested in obtaining your overall preferences for the following food items. This means we want you to think of each food item in a general way, rather than any particular time you have eaten it.

Use the following scale to indicate how much you like or dislike each item by marking the number that best expresses your opinion. If you have never tried a particular item, please mark the "NEVER TRIED" category and leave the rating scale blank.

NEVER TRIED	DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
0	1	2	3	4	5	6	7	8	9

NEVER TRIED	DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
0	1	2	3	4	5	6	7	8	9

1. APRICOT PIE	0	1	2	3	4	5	6	7	8	9
2. PIZZA	0	1	2	3	4	5	6	7	8	9
3. WHITE BREAD	0	1	2	3	4	5	6	7	8	9
4. POT ROAST W/ GRAVY	0	1	2	3	4	5	6	7	8	9
5. BACON, LETTUCE & TOMATO SANDWICH	0	1	2	3	4	5	6	7	8	9
6. PANCAKES	0	1	2	3	4	5	6	7	8	9
7. COCONUT CANDY	0	1	2	3	4	5	6	7	8	9
8. CORNED BEEF HASH	0	1	2	3	4	5	6	7	8	9
9. COFFEE CAKE	0	1	2	3	4	5	6	7	8	9
10. APPLE CRUNCH	0	1	2	3	4	5	6	7	8	9
11. FRENCH FRIED ONION RINGS	0	1	2	3	4	5	6	7	8	9
12. DINNER ROLLS	0	1	2	3	4	5	6	7	8	9
13. FRESH FRUIT CUP	0	1	2	3	4	5	6	7	8	9
14. BAKED BEANS WITH TOMATO SAUCE	0	1	2	3	4	5	6	7	8	9
15. BEEF WITH BARBEQUE SAUCE	0	1	2	3	4	5	6	7	8	9
16. HERSHEY BAR	0	1	2	3	4	5	6	7	8	9
17. TURKEY WITH GRAVY	0	1	2	3	4	5	6	7	8	9
18. CANNED PEARS	0	1	2	3	4	5	6	7	8	9
19. FRESH PLUMS	0	1	2	3	4	5	6	7	8	9
20. BISCUITS	0	1	2	3	4	5	6	7	8	9
21. GRILLED STEAK	0	1	2	3	4	5	6	7	8	9
22. FRUIT CAKE	0	1	2	3	4	5	6	7	8	9
23. TOMATO JUICE	0	1	2	3	4	5	6	7	8	9

NEVER TRIED	DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
0	1	2	3	4	5	6	7	8	9

24.	LIME-FLAVORED KOOL-AID	0	1	2	3	4	5	6	7	8	9
25.	HAM SLICES	0	1	2	3	4	5	6	7	8	9
26.	TOSSED GREEN SALAD	0	1	2	3	4	5	6	7	8	9
27.	CHERRY CRISP	0	1	2	3	4	5	6	7	8	9
28.	LEMON MERINGUE PIE	0	1	2	3	4	5	6	7	8	9
29.	TURKEY SANDWICH	0	1	2	3	4	5	6	7	8	9
30.	FREEZE-DRIED PEACHES	0	1	2	3	4	5	6	7	8	9
31.	LOBSTER	0	1	2	3	4	5	6	7	8	9
32.	CHEESEBURGER	0	1	2	3	4	5	6	7	8	9
33.	LIVER AND ONIONS	0	1	2	3	4	5	6	7	8	9
34.	OATMEAL	0	1	2	3	4	5	6	7	8	9
35.	SHRIMP CREOLE	0	1	2	3	4	5	6	7	8	9
36.	SCRAMBLED EGGS	0	1	2	3	4	5	6	7	8	9
37.	SPECIAL K	0	1	2	3	4	5	6	7	8	9
38.	CHEESE SPREAD WITH CRACKERS	0	1	2	3	4	5	6	7	8	9
39.	BISCUITS	0	1	2	3	4	5	6	7	8	9
40.	HAM AND CHICKEN LOAF	0	1	2	3	4	5	6	7	8	9
41.	BEEF WITH SPICY SAUCE	0	1	2	3	4	5	6	7	8	9
42.	PORK SAUSAGE	0	1	2	3	4	5	6	7	8	9
43.	BAKED CHICKEN	0	1	2	3	4	5	6	7	8	9
44.	GARDEN COTTAGE CHEESE SALAD	0	1	2	3	4	5	6	7	8	9
45.	BRAISED BEEF CUBES	0	1	2	3	4	5	6	7	8	9
46.	PINEAPPLE NUT CAKE	0	1	2	3	4	5	6	7	8	9
47.	COLA	0	1	2	3	4	5	6	7	8	9
48.	GINGER SNAPS	0	1	2	3	4	5	6	7	8	9

NEVER TRIED	DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
0	1	2	3	4	5	6	7	8	9

49.	LIMA BEANS	0	1	2	3	4	5	6	7	8	9
50.	BOILED NAVY BEANS	0	1	2	3	4	5	6	7	8	9
51.	STEWED PRUNES	0	1	2	3	4	5	6	7	8	9
52.	ICE CREAM SUNDAE	0	1	2	3	4	5	6	7	8	9
53.	BACON	0	1	2	3	4	5	6	7	8	9
54.	MILK	0	1	2	3	4	5	6	7	8	9
55.	FRESH APPLES	0	1	2	3	4	5	6	7	8	9
56.	SPAGHETTI W/ MEAT SAUCE	0	1	2	3	4	5	6	7	8	9
57.	FRENCH TOAST	0	1	2	3	4	5	6	7	8	9
58.	PEANUT BUTTER & JELLY SANDWICH	0	1	2	3	4	5	6	7	8	9
59.	CRANBERRY JUICE	0	1	2	3	4	5	6	7	8	9
60.	BUTTERED RICE	0	1	2	3	4	5	6	7	8	9
61.	CANNED PINEAPPLE	0	1	2	3	4	5	6	7	8	9
62.	MASHED POTATOES	0	1	2	3	4	5	6	7	8	9
63.	FRESH ORANGES	0	1	2	3	4	5	6	7	8	9
64.	CORN	0	1	2	3	4	5	6	7	8	9
65.	COLESLAW	0	1	2	3	4	5	6	7	8	9
66.	JELLIED VEGETABLE SALAD	0	1	2	3	4	5	6	7	8	9
67.	OVEN-FRIED CHICKEN	0	1	2	3	4	5	6	7	8	9
68.	BAKED TUNA WITH NOODLES	0	1	2	3	4	5	6	7	8	9
69.	ORANGE JUICE	0	1	2	3	4	5	6	7	8	9
70.	WHEATIES	0	1	2	3	4	5	6	7	8	9
71.	CHOCOLATE BROWNIES	0	1	2	3	4	5	6	7	8	9
72.	BEEF WITH GRAVY	0	1	2	3	4	5	6	7	8	9
73.	FRENCH FRIED POTATOES	0	1	2	3	4	5	6	7	8	9
74.	APPLESAUCE	0	1	2	3	4	5	6	7	8	9

NEVER TRIED	DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
0	1	2	3	4	5	6	7	8	9

75.	ITALIAN BREAD	0	1	2	3	4	5	6	7	8	9
76.	CANNED FRUIT COCKTAIL	0	1	2	3	4	5	6	7	8	9
77.	BUTTERSCOTCH BROWNIES	0	1	2	3	4	5	6	7	8	9
78.	POTATO PATTY	0	1	2	3	4	5	6	7	8	9
79.	ROAST BEEF W/ NATURAL GRAVY	0	1	2	3	4	5	6	7	8	9
80.	ORANGE NUT BREAD	0	1	2	3	4	5	6	7	8	9
81.	HOT CHOCOLATE	0	1	2	3	4	5	6	7	8	9
82.	BOLOGNA SANDWICH	0	1	2	3	4	5	6	7	8	9
83.	SALAMI SANDWICH	0	1	2	3	4	5	6	7	8	9
84.	STEWED TOMATOES	0	1	2	3	4	5	6	7	8	9
85.	GRAPEFRUIT JUICE	0	1	2	3	4	5	6	7	8	9
86.	SWISS STEAK	0	1	2	3	4	5	6	7	8	9
87.	TEA	0	1	2	3	4	5	6	7	8	9
88.	CORNBREAD	0	1	2	3	4	5	6	7	8	9
89.	YOGURT WITH FRUIT	0	1	2	3	4	5	6	7	8	9
90.	CANNED APRICOTS	0	1	2	3	4	5	6	7	8	9
91.	FRANKFURTERS	0	1	2	3	4	5	6	7	8	9
92.	LEMONADE	0	1	2	3	4	5	6	7	8	9
93.	BEEF PATTY	0	1	2	3	4	5	6	7	8	9
94.	FREEZE-DRIED SWEETENED STRAWBERRIES	0	1	2	3	4	5	6	7	8	9
95.	WHOLE WHEAT BREAD	0	1	2	3	4	5	6	7	8	9
96.	SPINACH	0	1	2	3	4	5	6	7	8	9
97.	MEATBALLS WITH BARBEQUE SAUCE	0	1	2	3	4	5	6	7	8	9
98.	GREEN BEANS	0	1	2	3	4	5	6	7	8	9
99.	STRAWBERRY SHORTCAKE	0	1	2	3	4	5	6	7	8	9
100.	COFFEE	0	1	2	3	4	5	6	7	8	9

Appendix I. Final MRE Questionnaire

Appendix I

MRE QUESTIONNAIRE

1. Your name: ________________________________

2. Your social security number: ____________________

3. What is your age? _____ Years

4. What is your rank? E-____ W-____ or O-____

5. How long have you served in the Army? _____ Years _____ Months

6. What are your FEELINGS ABOUT MILITARY SERVICE? Circle one number.

DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SOMEWHAT	NEITHER LIKE NOR DISLIKE	LIKE SOMEWHAT	LIKE MODERATELY	LIKE VERY MUCH
1	2	3	4	5	6	7

7. Do you plan to REENLIST when your present enlistment ends? Circle one number.

    1. Definitely yes
    2. Probably yes
    3. Undecided
    4. Probably no
    5. Definitely no
    6. No, retiring

8. Please rate how SATISFIED or DISSATISFIED you were with each of the following aspects of THIS EXERCISE. Please circle one number for each aspect.

VERY DISSATISFIED	MODERATELY DISSATISFIED	SOMEWHAT DISSATISFIED	NEITHER SATISFIED NOR DISSATISFIED	SOMEWHAT SATISFIED	MODERATELY SATISFIED	VERY SATISFIED
1	2	3	4	5	6	7

a. Leadership	1	2	3	4	5	6	7
b. Training	1	2	3	4	5	6	7
c. Supply of drinking water	1	2	3	4	5	6	7
d. Mess food (1/21 CSC only)	1	2	3	4	5	6	7
e. Combat rations (MRE's)	1	2	3	4	5	6	7
f. Sleeping conditions	1	2	3	4	5	6	7
g. Condition of equipment	1	2	3	4	5	6	7
h. Availability of showers	1	2	3	4	5	6	7
i. Weather	1	2	3	4	5	6	7
j. Free time	1	2	3	4	5	6	7

PLEASE TURN PAGE OVER.

9. ANSWER THIS QUESTION ONLY IF YOU BELONG TO THE 1/35 CSC. IF YOU BELONG TO the 1/21 CSC, LEAVE THIS QUESTION BLANK.

Please rate how much you LIKE or DISLIKE eating the MRE's (combat rations) for breakfast, lunch and dinner. Circle one number for each of the three meals.

	DISLIKE VERY MUCH	DISLIKE MODER-ATELY	DISLIKE SOME-WHAT	NEITHER LIKE NOR DISLIKE	LIKE SOME-WHAT	LIKE MODER-ATELY	LIKE VERY MUCH
For breakfast	1	2	3	4	5	6	7
For lunch	1	2	3	4	5	6	7
For dinner	1	2	3	4	5	6	7

10. When did you eat your combat ration? Circle one number.

1. At designated meal times
2. Throughout the day, as time permitted
3. Both of the above

11. Did your combat ration provide you with enough snacks for you to eat while on-the-move? Circle one answer.

YES NO

12. Overall, did you get enough to eat during this exercise or were you often hungry? Circle one number.

1. Got enough to eat
2. Often was hungry

13. Please rate how SATISFIED or DISSATISFIED you were with each of the following aspects of the COMBAT RATIONS (MRE's) you ate during this exercise. Circle one number for each aspect.

VERY DISSATISFIED	MODERATELY DISSATISFIED	SOMEWHAT DISSATISFIED	SATISFIED NOR DISSATISFIED	SOMEWHAT SATISFIED	MODERATELY SATISFIED	VERY SATISFIED
1	2	3	4	5	6	7

a. How easy the ration is to prepare	1	2	3	4	5	6	7
b. How the food tastes	1	2	3	4	5	6	7
c. How the food looks	1	2	3	4	5	6	7
d. How much food there is in a meal (one MRE)	1	2	3	4	5	6	7
e. How much variety there is from meal to meal	1	2	3	4	5	6	7

14. How HUNGRY did you feel BETWEEN meals during the first week of the exercise and during this last week? Circle one number for each.

	NOT AT ALL HUNGRY	SOMEWHAT HUNGRY	MODERATELY HUNGRY	VERY HUNGRY
First week	1	2	3	4
Last week	1	2	3	4

15. Compared to what you usually eat when you are NOT on a field exercise, did you find the food during this exercise:

MUCH LESS VARIED	MODERATELY LESS VARIED	SOMEWHAT LESS VARIED	ABOUT EQUALLY AS VARIED	SOMEWHAT MORE VARIED	MODERATELY MORE VARIED	MUCH MORE VARIED
1	2	3	4	5	6	7

16. We would like to know how satisfied you were with the VARIETY from meal to meal in your COMBAT RATIONS (MRE's). Was there enough variety or should there be more? Please circle one number for each component of the ration.

VARIETY NOW ENOUGH	SHOULD BE SOMEWHAT MORE VARIETY	SHOULD BE MODERATELY MORE VARIETY	SHOULD BE MUCH MORE VARIETY
1	2	3	4

a. Entrees (main dishes)	1	2	3	4
b. Side dishes (for example, beans, potatoes)	1	2	3	4
c. Desserts (cakes, cookies)	1	2	3	4
d. Fruits	1	2	3	4
e. Supplementary items (for example,	1	2	3	4
crackers, spreads)	1	2	3	4
f. Accessory items (for example, pepper, hot sauce)	1	2	3	4
g. Drinks	1	2	3	4

17. We would like to know what you think of the amount of food provided in a single COMBAT RATION (MRE). Were the portions too small, too large, or just about right? Please circle one number for each component of the ration.

PORTION MUCH TOO SMALL	PORTION MODERATELY TOO SMALL	PORTION SOMEWHAT TOO SMALL	PORTION JUST ABOUT RIGHT	PORTION SOMEWHAT TOO LARGE	PORTION MODERATELY TOO LARGE	PORTION MUCH TOO LARGE
1	2	3	4	5	6	7

a. Entrees (main dishes)	1	2	3	4	5	6	7
b. Side dishes (beans w/ tomato sauce, potato patty)	1	2	3	4	5	6	7
c. Desserts (cake, cookies)	1	2	3	4	5	6	7
d. Dehydrated (dry) fruit	1	2	3	4	5	6	7
e. Supplementary items (for example, cheese spread)	1	2	3	4	5	6	7
f. Drinks (cocoa, coffee)	1	2	3	4	5	6	7

PLEASE TURN PAGE OVER.

18. How often did you HEAT the ENTREE (main dish) in your ration? Circle one number

1. Almost never
2. Sometimes
3. Often
4. Almost always

19. What were your reasons for NOT HEATING the entree (main dish) in your ration? Circle ALL the reasons that apply to you. If you ALWAYS heated your entree, circle "h." only.

a. Entrees tasted better cold (which ones? ____________________)
b. Entrees had better texture when cold (which ones? ________________)
c. Not enough water available for heating
d. No equipment available for heating
e. Too much trouble to heat entree
f. Not enough time to heat entree
g. Other reasons -- explain:
h. Always heated my entree

If you circled MORE than one reason, what was the MOST FREQUENT reason for not heating an entree? Please write in the letter from the list above: ______

20. How often did you rehydrate (mix with water) the dehydrated (dry) components of your ration? Please circle one number for each component.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
a. Dehydrated entree (beef patty, pork sausage patty)	1	2	3	4
b. Dehydrated potato patty	1	2	3	4
c. Dehydrated fruit	1	2	3	4

21. How often did you use HOT water to mix with the dehydrated (dry) components of your ration? Circle one number.

1. Almost never
2. Sometimes
3. Often
4. Almost always

22. What were your reasons for NOT REHYDRATING (mixing with water) the dehydrated (dry) components of your ration? Circle ALL the reasons that apply to you. If YOU ALWAYS added water to your dry components, circle "g" only.

a. Dehydrated foods tasted better dry (which ones? ____________________)
b. Dehydrated foods had better texture dry (which ones? _________________)
c. Not enough water available for mixing
d. Too much trouble to mix with water
e. Not enough time to mix with water
f. Other reasons -- explain:
g. Always added water to my dehydrated(dry) rations

If you circle MORE than one reason, what was the MOST FREQUENT reason for not adding water to the dry components? Please write in the letter from the list above: ________

23. How often did you use the salt packet, the sugar packet, or hot sauce with your MREs? Write the number that best describes how often you used these items.

1. Almost never
2. Sometimes
3. Often
4. Almost always

Salt _______
Sugar _______
Hot sauce ______

24. How often did you TRADE rations or parts of rations? Check one.

_____ Never
_____ Once or twice
_____ Several times (about how many times during a typical week? _______)

25. How often were you unable to trade? Check one.

_____ Always able to trade
_____ Unable to trade once or twice
_____ Unable to trade several times (about how many times during a typical week? ________)
_____ Never wanted to trade

26. How often did you TRADE in order to GET each of the following? Circle one number for each. If you NEVER traded, leave this question blank.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
a. Entire rations	1	2	3	4
b. Entrees (main dishes)	1	2	3	4
c. Side dishes (beans w/tomato sauce, potato patty)	1	2	3	4
d. Desserts (cakes cookies)	1	2	3	4
e. Fruit (dry)	1	2	3	4
f. Supplementary items (for example, crackers)	1	2	3	4
g. Drinks (cocoa, coffee)	1	2	3	4

PLEASE TURN PAGE OVER.

27. Please rate how EASY or DIFFICULT you found each of the following aspects of preparing your combat ration (MRE). Circle one number for each.

VERY EASY	MODERATELY EASY	SOMEWHAT EASY	NEITHER EASY NOR DIFFICULT	SOMEWHAT DIFFICULT	MODERATELY DIFFICULT	VERY DIFFICULT
1	2	3	4	5	6	7

a. Opening the outer bag (pouch)	1	2	3	4	5	6	7
b. Opening individual packets	1	2	3	4	5	6	7
c. Heating the entree	1	2	3	4	5	6	7
d. Mixing the dehydrated (dry) components with water	1	2	3	4	5	6	7

28. Where did you store your combat rations (MRE)? Circle one number.

    1. On your person
    2. In a vehicle
    3. Other. Explain: ______________

29. What was the greatest number of ration packets (MREs) you carried on your person at any one time? Write "0" if you did not carry any MREs on your person.

    Number of MREs carried ______

30. Did you carry an MRE in its bag (pouch) or did you open the bag and carry the contents separately? Circle one number.

    1. Carried MRE in bag
    2. Carried contents separately

31. Where on your person did you store your combat rations (backpack, jacket pockets, and so on)? Please describe.

32. How convenient did you find carrying the MRE combat ration? Circle one number.

    1. Very inconvenient
    2. Moderately inconvenient
    3. Somewhat inconvenient
    4. Neither convenient nor inconvenient
    5. Somewhat convenient
    6. Moderately convenient
    7. Very convenient

33. What foods or drinks would you like ADDED to the MRE combat rations. Place the number "1" next to the food or drink you would like added most, "2" for the next one and so on. Please be realistic.

34. What foods or drinks in the MRE would you like DROPPED? Again, please place the number "1" next to the first item you would like dropped, "2" for the next and so on.

35. Did you eat any of your own (privately-purchased) food during this exercise? Please he honest.

YES NO (Circle one)

If YES, what did you eat (drink)?

PLEASE TURN PAGE OVER.

36. Below is a list of possible ways of improving the MRE COMBAT RATION. Please write the number "1" next to the one improvement that you think is MOST IMPORTANT, the number "2" next to the improvement you think is SECOND in importance, the number "3" next to the improvement you think is THIRD in importance, the number "4" next to what is FOURTH and the number "5" next to what is FIFTH in importance.

_____ Make the rations taste better

_____ Increase the variety in the rations

_____ Make the rations easier to prepare

_____ Include breakfast foods in the ration

_____ Make the entree portion sizes larger

37. Do you have any other comments on the MRE?

Appendix J. Standard AMEDD Methods for Determining Body Fat Composition and Maximum Allowable Weight (Memorandum for Army Dietitians and Physical Therapists)

APPENDIX J

DEPARTMENT OF THE ARMY
OFFICE OF THE SURGEON GENERAL
WASHINGTON, DC 20310

REPLY TO
ATTENTION OF

30 Jan 1983

DASG-DB

MEMORANDUM FOR ARMY DIETITIANS AND PHYSICAL THERAPISTS

SUBJECT: Standard AMEDD Methods for Determining Body Fat Composition and Maximum Allowable Weight

1. Reference message 041800Z Jan 83 from DASG regarding AMEDD support for the Army Weight Control Program.

2. This memorandum and its enclosures provide additional guidance to AMEDD personnel as promised in above reference for use in determining body fat composition and maximum allowable weight of Army service members.

3. Enclosure 1 is the new age adjusted screening weight table from the 1 Feb 83 revision of AR 600-9. Individuals whose weight exceeds the value shown on this table for their age, sex and height are to be referred to medical personnel for determination of their body fat composition.

4. Enclosure 2 displays the age and sex adjusted body fat standards from the revised AR 600-9.

5. Enclosure 3 describes skin fold sites, anatomic landmarks and standard techniques for determining body fat composition using skin fold calipers.

6. Enclosures 4 and 5 display the Durnin-Womersley Tables to be used when converting the sum of the four body skin folds to an estimation of percent body fat among male and female soldiers respectively.

7. Enclosure 6 indicates how to calculate a maximum allowable weight based on the percent body fat determination. This calculated weight objective is very important to the overweight soldier because it is the weight he/she must meet before being released from the weight control program. A determination of body fat will not be routinely repeated to clear the individual from the weight control program since body weight lost as fat may not accurately be reflected by a change in body skin fold measurements.

8. Since body fat measurements of soldiers will have a great impact on their personal careers, health care personnel using calipers will have to demonstrate competency and will need to be credentialled before they can perform official body fat determinations. Enclosure 7 provides the basic methodology for assessing the reliability of caliper users. It specifically demonstrates how to determine the degree of agreement (reproducibility) between two sets of measurements performed on the same subjects by the same examiner using the same

caliper. An average difference between the two readings of 10% or less would indicate an acceptable level of competence on the part of the caliper user. It must be understood that a close agreement between the two readings does not necessarily indicate that the caliper user is accurately reflecting the subjects true percent body fat. If the user's technique is improper he/she may consistently overestimate or underestimate body fat each time a measurement is taken. Thus it is also advisable for the experienced supervisor to check a trainee's measurements against his/her own to insure reasonable agreement. Methodology to assess reliability is presently being refined. Initially, AMEDD officers supervising caliper users should maintain records of reliability scores and data from test subjects used to assess reliability.

9. Additional administrative guidance as well as a restatement of this technical information will be provided to the AMEDD in a TAGO letter projected for March 1983. The guidance contained in this letter should be shared with all personnel who will be making body fat measurements at MEDCENS/MEDDACS and supported clinics.

10. The points of contact at The Surgeon General's Office are LTC Frederick Erdtmann, AUTOVON 227-1874, COL Francis Iacoboni AUTOVON 227-1710 and COL Virginia Metcalf AUTOVON 291-1371.

Jessie S. Brewer

7 Encl
as

JESSIE S. BREWER
COL, AMSC
Chief, Army Medical Specialist Corps

Weight for Height Table (Screening Table Weight)

Height (in inches)	MALE Age 17–20	21–27	28–39	40+	FEMALE Age 17–20	21–27	28–39	40+
58	—	—	—	—	104	107	110	113
59	—	—	—	—	107	110	114	117
60	132	136	139	141	111	114	117	121
61	136	140	144	146	115	118	121	125
62	141	144	148	150	119	123	126	130
63	145	149	153	155	123	126	130	134
64	150	154	158	160	126	130	134	138
65	155	159	163	165	130	134	138	142
66	160	163	168	170	135	139	143	147
67	165	169	174	176	139	143	148	151
68	170	174	179	181	143	147	151	156
69	175	179	184	186	147	151	155	160
70	180	185	189	192	151	156	160	165
71	185	189	194	197	155	159	164	169
72	190	195	200	203	160	164	169	174
73	195	200	205	208	165	169	174	179
74	201	206	211	214	170	174	180	185
75	206	212	217	220	175	179	184	190
76	212	217	223	226	180	185	190	196
77	218	223	229	232	184	190	195	201
78	223	229	235	238	189	194	200	206
79	229	235	241	244	194	199	205	211
80	234	240	247	250	198	204	210	216

NOTES:

1. Height and weight data do not include allowances for shoes and clothing.

2. If the individual's measured height falls between two height values (given in inches) on the table, then the following rules apply for determining the screening weight:

a. If the height fraction is less than ½ inch, round down to the screening weight shown for the lower height value for the appropriate age.

b. If the height fraction is ½ inch or more use the screening weight shown for the higher height value for the appropriate age.

FOR EXAMPLE. If the measured height (without shoes) of a 25--year old male is 68¼ inches, his screening weight value is 174 pounds. If his measured height is 68½ inches, his screening weight value is 179 pounds. If his measured height is 68¾ inches, his screening weight value is 179 pounds.

3. The measured weight of an individual will be rounded to the nearest whole pound.

FOR EXAMPLE: An individual whose measured weight is 180¼ pounds will be officially considered 180 pounds. If he weighs 180½ pounds his official weight will be considered to be 181 pounds.

Body Fat Standards

(Percent of Body Weight as Fat)

	Age			
	17-20	21-27	28-39	40+
Males	20	22	24	25
Females	28	30	32	34

DESCRIPTION OF SKIN FOLD SITES, THEIR ANATOMIC LANDMARKS AND STANDARD TECHNIQUE

1. Skin Fold Sites and Landmarks

a. Biceps	This skin fold should be picked up parallel to the length of the arm at the mid-point of the biceps muscle belly. The arm should hang vertically at rest (See Figures 1A and 1B).
b. Triceps	This skin fold should be picked up parallel to the length of the arm at the mid-point of the muscle belly, mid-way between the olecranon and the tip of the acromion. The arm should hang vertically at rest (See Figures 2A and 2B).
c. Subscapular	This skin fold should be picked up at an angle of 45 degrees to the vertical just below the tip of the inferior angle of the scapula (See Figures 3A and 3B).
d. Suprailiac	This skin fold is slightly oblique and should be picked up just above the iliac crest at the mid-axillary line along the natural diagonal line of the skin fold (See Figures 4A and 4B).

2. Technique.

a. The right side of the body should be used when measuring skin folds.

b. At each site the skin fold is picked up firmly with the thumb and fore-finger of the left hand. A full fold should be pinched, lifted slightly away from the underlying tissue, and shaken gently to assure that the muscle slips out of the fold. The fold is then held firmly between the fingers while the caliper is applied at a right angle to the fold approximately 1 centimeter below the thumb. Once the caliper is applied, the pressure of the fingers should be released momentarily so that the pressure at the time of measurement is exerted by the caliper face-points and not by the fingers. The caliper should be held on the fold until the reading reaches a relatively stable value (about 2 seconds). There may be an initial rapid movement of the caliper reading when first applied due to compression of the tissue (particularly at the subscapular and suprailiac sites). The reading should be recorded after two seconds or when any initial rapid change ceases.

c. A single reading should be taken and recorded at each of the four skin fold sites. This should be repeated two more times in succession. If the initial reading shows a large discrepancy from the next two readings, discard the first and take a fourth measurement. Readings should be taken to the nearest 0.5 mm. The gauge mark on the caliper should be read looking at it straight on, not from an angle. The three readings at each site should then be averaged and each average should be totaled to obtain the sum of four skin folds. This sum should be rounded down to the nearest whole millimeter. The Durnin-Womersley tables are then used to obtain the percent body fat of the individual based on the sum of four skin folds, sex, and age. If the measured sum of four skin folds falls between two table values (displayed in 5 mm intervals) select the precent body fat shown for the lower of the two values. For example, if the sum of four skin folds is 53 millimeters, use the percent body fat shown for 50 millimeters in the appropriate column for age and sex.

c. A worksheet is attached to assist in the recording of data.

BODY FAT COMPOSITION

WORK SHEET

NAME ____________________

SEX _____ AGE _____ PRESENT BODY WEIGHT _____ LBS

HEIGHT _________ BODY FAT STANDARD _______ %

STEP 1 Measure skin folds IAW provided guidance and record below. Sum each site and divide by 3 to obtain the average skin fold per site.

	BICEPS	TRICEPS	SUBSCAPULAR	SUPRAILIAC
1st reading				
2nd reading				
3rd reading				
Summation				
(÷ by 3) Average reading				

STEP 2 Sum the four average skin folds __________. Using this sum refer to the DURNIN-WOMERSLEY Tables appropriate for the sex and age of the individual (incl 4/5). Record % body fat _________ %.

STEP 3 IAW incl 6, determine lean body mass (LBM) and maximum allowable weight (MAW)

a. LBM = present body weight X (1 - % body fat as a decimal)

LBM _________ = ___________ X (1 -   )

b. MAW = $\dfrac{\text{LBM}}{(1 - \%\ \text{body fat standard as a decimal})}$

MAW _________ = $\dfrac{\qquad\qquad}{(1 - \qquad)}$

STEP 4 Record results:

Present body weight ___________ lbs

MAW ___________ lbs

☐ Individual requires weight loss of ___________ lbs to be in compliance with Army standards

☐ Individual is in compliance with Army standards

asured by (print name/date) ______________________

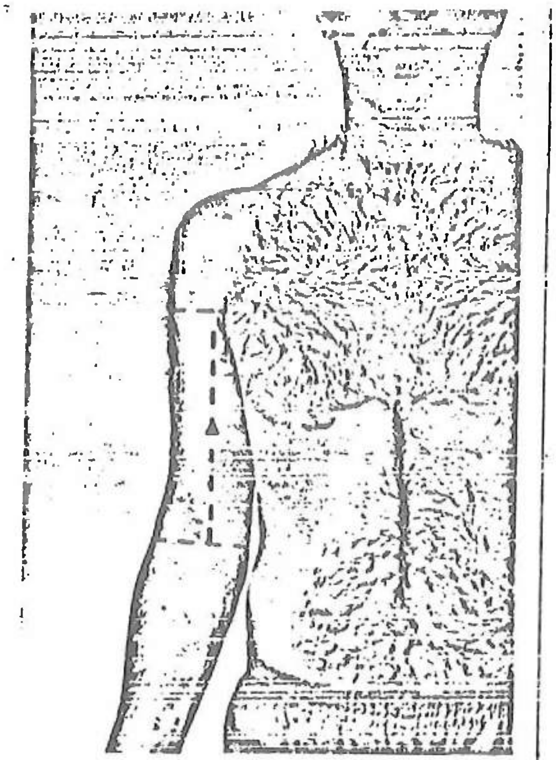
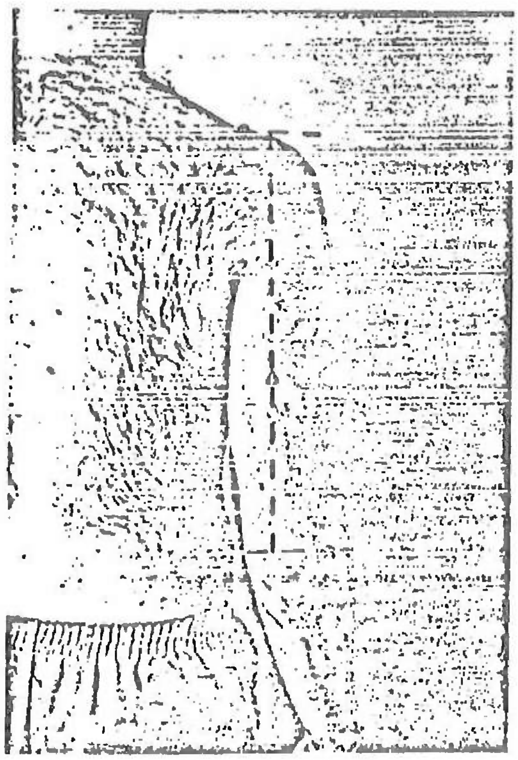


Figure 1 A

Figure 1 B



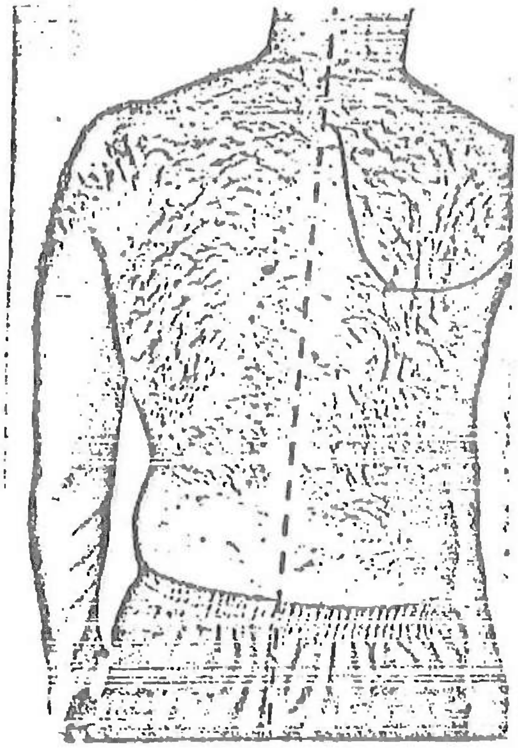


Figure 3 A

Figure 3 B

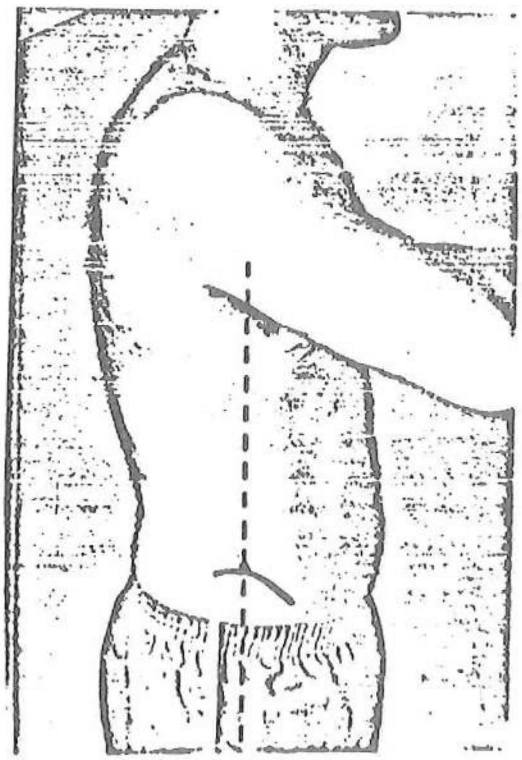


Figure 4 A

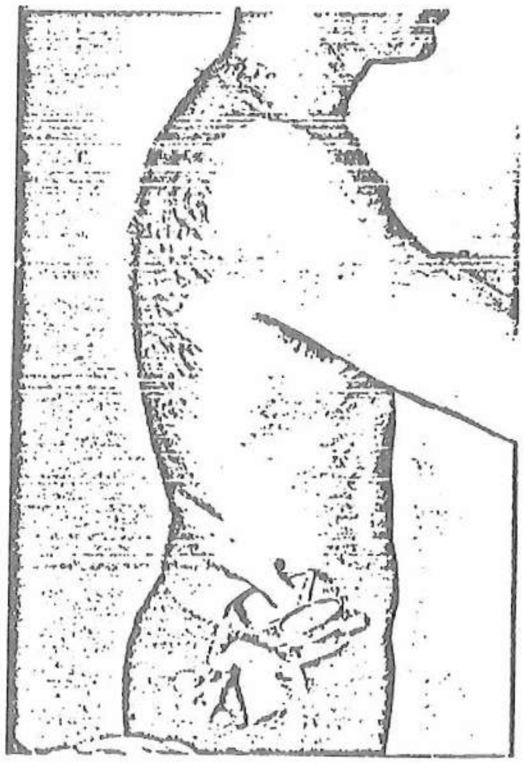


Figure 4 B

THE EQUIVALENT FAT CONTENT, AS A PERCENTAGE OF BODY-WEIGHT, 1/ FOR A RANGE OF VALUES FOR THE SUM OF FOUR SKINFOLDS (BICEPS, TRICEPS, SUBSCAPULAR AND SUPRA-ILIAC) OF MALES OF DIFFERENT AGES.

Skinfolds (mm)	Males (age in years) 17-29	30-39	40-49	50+	Skinfolds (mm)	Males (age in years) 17-29	30-39	40-49	50+
15	4.8	- -	- -	- -	115	29.4	30.6	36.4	39.7
20	8.1	12.2	12.2	12.6	120	30.0	31.1	37.0	40.4
25	10.5	14.2	15.0	15.6	125	30.5	31.5	37.6	41.1
30	12.9	16.2	17.7	18.6	130	31.0	31.9	38.2	41.8
35	14.7	17.7	19.6	20.8	135	31.5	32.3	38.7	42.4
40	16.4	19.2	21.4	22.9	140	32.0	32.7	39.2	43.0
45	17.7	20.4	23.0	24.7	145	32.5	33.1	39.7	43.6
50	19.0	21.5	24.6	26.5	150	32.9	33.5	40.2	44.1
55	20.1	22.5	25.9	27.9	155	33.3	33.9	40.7	44.6
60	21.2	23.5	27.1	29.2	160	33.7	34.3	41.2	45.1
65	22.2	24.3	28.2	30.4	165	34.1	34.6	41.6	45.6
70	23.1	25.1	29.3	31.6	170	34.5	34.8	42.0	46.1
75	24.0	25.9	30.3	32.7	175	34.9	- -	- -	- -
80	24.8	26.6	31.2	33.8	180	35.3	- -	- -	- -
85	25.5	27.2	32.1	34.8	185	35.6	- -	- -	- -
90	26.2	27.8	33.0	35.8	190	35.9	- -	- -	- -
95	26.9	28.4	33.7	36.6	195	- -	- -	- -	- -
100	27.6	29.0	34.4	37.4	200	- -	- -	- -	- -
105	28.2	29.6	35.1	38.2	205	- -	- -	- -	- -
110	28.8	30.1	35.8	39.0	210	- -	- -	- -	- -

1/ In two-thirds of the instances the error was within ± 3.5% of the body-weight as fat for the women and ± 5% for the men.

Source: Durnin and Womersley; British Journal of Nutrition, Vol 32, p. 95, 1974.

THE EQUIVALENT FAT CONTENT, AS A PERCENTAGE OF BODY-WEIGHT, 1/ FOR A RANGE OF VALUES FOR THE SUM OF FOUR SKINFOLDS (BICEPS, TRICEPS, SUBSCAPULAR AND SUPRA-ILIAC) OF FEMALES OF DIFFERENT AGES.

Skinfolds (mm)	Females (age in years) 16-29	30-39	40-49	50+	Skinfolds (mm)	Females (age in years) 16-29	30-39	40-49	50+
15	10.5	- -	- -	- -	115	38.4	39.1	41.5	44.5
20	14.1	17.0	19.8	21.4	120	39.0	39.6	42.0	45.1
25	16.8	19.4	22.2	24.0	125	39.6	40.1	42.5	45.7
30	19.5	21.8	24.5	26.6	130	40.2	40.6	43.0	46.2
35	21.5	23.7	26.4	28.5	135	40.8	41.1	43.5	46.7
40	23.4	25.5	28.2	30.3	140	41.3	41.6	44.0	47.2
45	25.0	26.9	29.6	31.9	145	41.8	42.1	44.5	47.7
50	26.5	28.2	31.0	33.4	150	42.3	42.6	45.0	48.2
55	27.8	29.4	32.1	34.6	155	42.8	43.1	45.4	48.7
60	29.1	30.6	33.2	35.7	160	43.3	43.6	45.8	49.2
65	30.2	31.6	34.1	36.7	165	43.7	44.0	46.2	49.6
70	31.2	32.5	35.0	37.7	170	44.1	44.4	46.6	50.0
75	32.2	33.4	35.9	38.7	175	- -	44.8	47.0	50.4
80	33.1	34.3	36.7	39.6	180	- -	45.2	47.4	50.8
85	34.0	35.1	37.5	40.4	185	- -	45.6	47.8	51.2
90	34.8	35.8	38.3	41.2	190	- -	45.9	48.2	51.6
95	35.6	36.5	39.0	41.9	195	- -	46.2	48.5	52.0
100	36.4	37.2	39.7	42.6	200	- -	46.5	48.8	52.4
105	37.1	37.9	40.4	43.3	205	- -	- -	49.1	52.7
110	37.8	38.6	41.0	43.9	210	- -	- -	49.4	53.0

1/ In two-thirds of the instances the error was within ± 3.5% of the body-weight as fat for the women and ± 5% for the men.

Source: Durnin and Womersley; British Journal of Nutrition. Vol 32. n. 95. 1974.

DETERMINATION OF MAXIMUM ALLOWABLE WEIGHT

STEP ONE - Determine Lean Body Mass (LBM)

LBM = Present Body Weight x (1-Measured Percent Body Fat expressed as a decimal)

STEP TWO - Determine Maximum Allowable Weight (MAW)

$$\text{MAW} = \frac{\text{LBM}}{\text{1 - Percent Body Fat Standard expressed as a decimal}}$$

EXAMPLE #1

Sex - Male
Age - 18
Present Weight - 185
Measured Percent Body Fat - 15%
Percent Body Fat Standard - 20%

LBM = 185 x (1-.15)

LBM = 185 x .85

LBM = 157.25

$\text{MAW} = \frac{157.25}{1-.20}$

$\text{MAW} = \frac{157.25}{.80}$

MAW = 197 lbs.

Interpretation: Individual is highly muscular, is presently in compliance with Army standards and can weigh up to 197 lbs. before he exceeds Army standards for his age.

EXAMPLE #2

Sex - Male
Age - 30
Present Weight - 190
Measured Percent Body Fat - 30%
Percent Body Fat Standard - 24%

LBM = 190 x (1-.30)

LBM = 190 x .70

LBM = 133.00

$\text{MAW} = \frac{133.00}{1-.24}$

$\text{MAW} = \frac{133.00}{.76}$

MAW = 175 lbs.

Interpretation: Individual requires a weight loss of 15 lbs. to be in compliance with Army standards.

A TEST TO ASSESS THE RELIABILITY OF CALIPER USERS

1. METHODOLOGY

a. Select 25 or more individuals upon whom percent body fat can be measured on two occasions within a 7-day period by the same examiner. The examiner should use the same skin fold caliper for all measurements. It is desirable to select those individuals who exceed current weight tables. It is also desirable to select both men and women of different age categories.

b. Weigh the individual at the beginning of the two test measurement periods. Any individual whose weight has increased or decreased by more than 5 lbs. should be disqualified as a test subject.

c. Obtain the sum of 4 skin folds (in millimeters) for each subject for both the first and second examination, record in a column, as shown in the example below, and calculate the reliability score of the caliper examiner.

d. Any reliability score (average percent difference) of 10% or less indicates adequate competency of the caliper examiner.

2. EXAMPLE:

SUBJECT (#)	FIRST READING (mm)	SECOND READING (mm)	DIFFERENCE (mm)	PERCENT DIFFERENCE* (%)
1	50	47	3	6.0
2	52	54	2	3.8
3	63	59	6	9.5
4	44	49	5	11.4
5	72	68	6	8.3
6	61	65	4	6.6
7	80	75	5	6.2
8	73	70	3	4.1
9	65	68	3	4.6
10	51	46	5	9.8
11	48	41	7	14.6
12	56	56	0	0.0
13	67	68	1	1.5
14	49	44	5	10.2
15	85	81	4	4.7
16	77	79	2	2.6
17	64	68	4	6.2
18	47	50	3	6.4
19	57	51	6	10.5
20	62	70	8	12.9
21	78	82	4	5.1
22	43	47	4	9.3
23	55	51	4	7.3
24	64	69	5	7.8
25	71	65	6	8.5
			Sum:	177.9

$$\text{Average Percent Difference} = \frac{\text{Sum of Percent Differences}}{\text{Number of Subjects}}$$

$$\text{Average Percent Difference} = \frac{177.9}{25} = \boxed{7.1 = \text{Reliability Score}}$$

*Determined by: $\frac{\text{Difference Between First \& Second Reading}}{\text{[illegible]}}$ X 100

Appendix K. Methodology for Biochemical Determinations

Appendix K

TEST INFORMATION SUMMARY

Bio-Science Laboratories

NAME OF TEST	TOTAL PROTEIN, ALBUMIN, GLOBULIN, A/G RATIO	TEST CODE	010, 010T
TYPE OF SAMPLE	SERUM	DATE	8/7/78
METHOD		SPECIMEN VOLUME	1 ml
SPECIAL HANDLING (PRESERVATIVES, ETC.)	NONE		
MAILING CONTAINER	B-1		
STABILITY TIME, IN DAYS			
ROOM TEMP. (30°)	4		
REFRIGERATOR	30		
FROZEN (−20° FREEZER)	YES	AVERAGE REPORTING TIME	1 DAYS
FROZEN (−70° DRY ICE)			

PRINCIPLE: Total protein is determined by the buiret reaction, in which the proteins react with cupric ions in alkaline solution and the resultant purple color is measured photometrically. Total globulin is determined by reacting the globulins with glyoxylic acid in an acid medium to form a purple color. The reaction, which is due to the presence of tryptophan in globulin, is sensitized by cupric ions. The resultant color is measured photometrically. The albumin is calculated by subtracting the total globulin value from the total protein value.

NORMAL RANGE:

	Adults	
Total Protein:	6.6 - 8.3 g/100 ml	(1)
Albumin:	3.5 - 5.0 g/100 ml	
Globulin:	2.4 - 3.5 g/100 ml	
A/G Ratio:	1.0 - 2.2	(2) (3)

CLINICAL SIGNIFICANCE: Protein level increased in dehydration due to fluid loss, in metabolic disorders such as multiple myeloma. Albumin is decreased in liver diseases due to failure of production and in renal disease due to frank loss of albumin. Decrease in A/G ratio occurring in this condition leads to a reduction in osmotic pressure with resultant ascites or edema.

REFERENCES:

1. Henry, R.J., et al., Anal. Chem. 29:1491, 1957.
2. Goldenberg, H. and Drewes, P.A., Clin. Chem. 17:358, 1971.
3. Reed, A., et al.. Clin. Chem. 18:57, 1972.

Protein (Total), Albumin, Globulin
A/G Ratio in Serum, AutoAnalyzer Method

Test Code 010,010T

Quality Control:

Include the controls described below with each run of unknowns and record results of the controls on Q.C. charts prepared using the indicated limits. Label each Q.C. chart with the identity of control materials and with the concentration of each standard to be charted. Enter any "out of limits" condition on the "Out of Limits" log sheet, describing the cause of the problem and the action taken to correct it. Bring any such condition to the attention of the supervisor. Submit a daily summary on an "Out of Limits" report form to the Director or Assistant Director of the department.

6/27/78

Protein (Total), Albumin, Globulin, A/G Ratio in Serum, AutoAnalyzer Method

Test Code 010,010T

Test each new log of reagent (except those prepared fresh daily) concurrently with one of known acceptability before the new reagent is placed in routine use. Record the date of preparation and use check on the container label and record the introduction of a new reagent into routine use on the Q.C. chart or on a "New Reagents" log sheet to be kept with the Q.C. chart.

For emergency or research specimens, sufficient controls shall be employed to assure valid results. These controls may differ from those described below as necessary depending upon the circumstances under which the test is run.

Standards:

a.	Composition:	Total Protein: Lyophilized serum and/or Dow Diagnostest. Protein standard standardized by Kjeldahl. Globulin: Lyophilized serum, value obtained by Dow Diagnostest (standardized by Kjeldahl) and confirmed by protein electrophoresis.
b.	Concentrations:	Total Protein: Approx. 6 - 7.5 g/100 ml Globulin: 3.0 g/100 ml or equivalent
c.	Storage:	Lyophilized serum stable indefinitely refrigerated. When reconstituted, aliquot and maintain frozen until used.
d.	Run Position:	Include standards at beginning of run.
e.	Q.C. Chart:	Plot blank and corrected absorbance reading (S-B). Limits: $\pm$ 5%

Control:

a.	Composition:	Lyophilized serum or pooled patient sera.
b.	Concentrations:	Total Protein: 5 - 9 g/100 ml and different from standard. Globulin: 2 - 4 g/100 ml and different from standard.

6/27/78

c. Storage: Lyophilized serum stable indefinitely refrigerated. When reconstituted, aliquot and store frozen.

d. Run Position: Immediately following standards.

e. Q.C. Chart: Plot values in g/100 ml

Limits: $\tilde{x} \pm 2$ S.D.

S.D. = mx + b

Total Protein:
m = 0.035
b = 0.05

Globulin:
m = 0.026
b = 0.064

P Drewes
6/27/78

TEST INFORMATION SUMMARY

Bio-Science Laboratories

NAME OF TEST .... PHOSPHATASE, ALKALINE

TEST CODE 273

TYPE OF SAMPLE .... SERUM

DATE 9/26/79

METHOD .... AUTOMATED ANALYSIS

SPECIMEN VOLUME 1 ml

SPECIAL HANDLING (PRESERVATIVES, ETC.) .... SEPARATE SERUM FROM THE CLOT WITHIN 1 HOUR

MAILING CONTAINER B-1

STABILITY TIME, IN DAYS ....
ROOM TEMP.(30°) 7
REFRIGERATOR 7
FROZEN (—20° FREEZER) 99
FROZEN (—70° DRY ICE) ....

AVERAGE REPORTING TIME 1 DAYS

PRINCIPLE .... Alkaline phosphatase (AP) is an enzyme that catalyzes the conversion of para-nitrophenyl phosphate (PNPP) to p-nitrophenol (PNP) reversibly. Since PNP absorbs light energy at 415 nm, the AP activity is assayed by following the increase in absorbance of PNP. The unit of activity is defined as the number of μmoles of PNP formed per liter of serum per minute at 37°C and under other specified conditions of the test. (1, 2, 3, 4)

REFERENCE RANGE .... 35 - 148 IU/L at 37°C (4, 5, 6)

CLINICAL SIGNIFICANCE .... Levels are elevated in osseous and hepatobiliary diseases as well as during pregnancy. (7)

REFERENCES ....

1. Abbott Bichromatic Analyzer (ABA-100).
2. Morgenstern, S. et al., Clin. Chem. 11:876, 1965.
3. BSL Procedure for Technicon SMA 12/60 AutoAnalyzer.
4. BSL Research Notebook: #652, Beattie, J., 1972.
5. Streeto, J., Hartford Hospital Bull. 16:38, 1961.
6. King, et al., Can. Med. Assoc. J., 31:376, 1934.
7. Tietz, N.W., Fundamentals of Clinical Chemistry, 2nd Ed., W.B. Saunders Comp., Philadelphia, 1976, p. 603.

Phosphatase, Alkaline, Serum, Using the Abbott Bichromatic Analyzer (ABA-100)

Test Code 273,273T

Quality Control:

Include the controls described below with each run of unknowns and record results of the controls on Q.C. charts prepared using the indicated limits. Label each Q.C. chart with the identity and source of control materials and with the concentration of the material to be charted. Enter any "out of

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Bio-Science

limits" condition on the "Out of Limits" log sheet, describing the cause of the problem and the action taken to correct it. Bring any such condition to the attention of the supervisor. Submit a daily summary on an "Out of Limits" report form to the Director of Assistant Director of the department.

Test each new lot of reagent (except those prepared fresh daily) concurrently with one of known acceptability before the new reagent is placed in routine use Record the date of preparation and use check on the container label and record the introduction of a new reagent into routine use on the Q.C. chart or on a "New Reagents" log sheet to be kept with the Q.C. chart.

For emergency or research specimens, sufficient controls shall be employed to assure valid results. These controls may differ from those described below as necessary depending upon the circumstances under which the test is run.

Control:

a. Composition: Lyophilized control sera.

b. Concentration: Two control pools are used:
Normal: Approximately 40-100 units
Elevated: Approximately 200-400 units

c. Storage: Reconstituted daily and refrigerated. Lyophilized material stored in refrigerator. Stable indefinitely.

d. Run Position: Both normal and elevated at beginning of each run (Position #2 and Position #3 and at the end Positions #29 and #30.

e. Q.C. Chart: Plot the pool results in units on Q.C. chart with the blank reading (Position 1).

Limits: $\bar{x} \pm 2$ S.D.

S.D. = mx + b

Where: m = 0.025
b = 3.3

D Han

3/15/78

TEST INFORMATION SUMMARY

Bio-Science Laboratories

NAME OF TEST	ASCORBIC ACID (VITAMIN C)	TEST CODE	269
TYPE OF SAMPLE	PLASMA, SERUM	DATE	12/23/77
METHOD	SPECTROPHOTOMETRY	SPECIMEN VOLUME	7 ml
SPECIAL HANDLING (PRESERVATIVES, ETC.)	OXALATED PLASMA OR SERUM. FREEZE		
MAILING CONTAINER	B-5 or B-1		
STABILITY TIME, IN DAYS			
ROOM TEMP. (30°)	NOT STABLE		
REFRIGERATOR	NOT STABLE		
FROZEN (−20° FREEZER)	6	AVERAGE REPORTING TIME	3 DAYS
FROZEN (−70° DRY ICE)			

PRINCIPLE: A protein-free filtrate of serum or plasma is prepared with trichloroacetic acid. Charcoal is added and the ascorbic acid in the filtrate is oxidized to dehydroascorbic acid. Dehydroascorbic acid is coupled with 2,4-dinitrophenylhydrazine to form the 2,4-dinitrophenylosazone. Treatment of the osazone with strong sulfuric acid causes rearrangement to yield a reddish complex which is measured at 515 nm. (1,2,3,4)

NORMAL RANGE: 0.2 - 2.0 mg/100 ml (1)

CLINICAL SIGNIFICANCE: Increased: Seasonal changes in the ascorbic acid intake in the diet are reflected in serum. Circulating levels tend to be maximal during the summer months. Levels of ascorbic acid are extremely high in the blood of newborn infants, during the first 3 days of life. Sex hormones may regulate circulating levels of the vitamin. Increased serum ascorbic acid noted in females during sexual maturation.

(continued next page)

REFERENCES:

1. Roe, J.H., Standard Methods of Clinical Chemistry, Edited by Seligson, D., Academic Press, New York, N.Y., 1961, Vol. 3, p.35.

2. Roe, J.H., and Kuether, C.A., J. Biol. Chem., 147:399, 1943.

3. Henry, R.J., et al., Clinical Chemistry,

(continued next page)

TEST INFORMATION SUMMARY

NAME OF TEST ASCORBIC ACID (VITAMIN C) TEST CODE 269

Page Two

CLINICAL SIGNIFICANCE
(continued) Decreased: In adults receiving an ascorbic acid-deficient diet, it takes 3 to 4 months for the initial clinical signs of scurvy to appear. Hyperaminoaciduria and hyperfibrinogenemia are associated with the onset of scurvy. A correlation may also exist between Vitamin C deficiency and abnormal pregnancy. Faulty wound repair can be expected after surgery if the ascorbic acid level falls below the normal limit. Patients with steatorrhea are apt to suffer from Vitamin C deficiency. Children with severe thalassemia will be affected with a mild deficiency of the vitamin. (5)

REFERENCES....
(continued)

Principles and Technics, 2nd Edition, Harper & Row, New York, 1974, p.1393.

4. BSL Research Notebook:#203, Ban. 1964; 228, Fernandez, A.A., 1965; 1268, Dominguez,M. 1976.

5. Searcy, R.L., Diagnostic Biochemistry, McGraw-Hill Book Company, New York, N.Y., 1969, p.65.

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lew York Branch	(516) 766-2233
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'ury City Branch	(213) 553-2333
.nicago Branch	(312) 987-9800
.altimore/Washington Branch	(301) 997-8900
'etroit Branch	(313) 478-4414
ı Louis Branch	(314) 426-3474
an Francisco Branch	(415) 632-5500

Specimen Pickup Services

Courier services are also available, with containers and Dry Ice for your convenience in the following metropolitan areas.

Atlanta	(404) 875-0261
Cleveland Akron	(216) 327-1700
Minneapolis/St. Paul	(612) 333-3549
San Diego	(714) 298-7176
San Francisco Bay Area	(415) 621-5800
Seattle-Tacoma	(206) 623-1956

Call for regular or occasional pickups of your specimens as needed

Call our Main Laboratory toll-free concerning courier services in other cities

Ascorbic Acid (Vitamin C) in Plasma, Serum & Urine Test Code 269, 361
by Spectrphotometry

Ref: 1) Searcy, R.L., Diagnostic Biochemistry, McGraw-Hill Book Company, New York, N.Y., 1969, p.65

2) Latner, A.L., Cantarow and Trumper, Clinical Chemistry, 7th Ed., W.B. Saunders Company, Philadelphia, 1975, p. 821.

Notes:

1. Preprogrammed computer notes which have been devised for this test are: None.

Quality Control:

Include the controls described below with each run of unknowns and record results of the controls on Q.C. charts prepared using the indicated limits. Label each Q.C. chart with the identity and/or source of control materials and with the concentration of each standard to be charted. Enter any "out of limits" condition on the "Out of Limits" log sheet, describing the cause of the problem and the action taken to correct it. Bring any such condition to the attention of the supervisor. Submit a daily summary on an "Out of Limits" report form to the Director or Assistant Director of the department.

For emergency or research specimens, sufficient controls shall be employed to assure valid results. These controls may differ from those described below as necessary depending on the circumstances under which the test is run.

Test each new lot of reagent (except those prepared fresh daily) concurrently with one of known acceptability before the new reagent is placed in routine use. Record the date of preparation and use check on the container label. Record the introduction of a new reagent into routine use on the Quality Control chart or on a "New Reagents" log sheet which is to be kept with the Quality Control chart.

Standards:

a. Composition: Ascorbic acid in oxalic acid solution

b. Concentrations: 0, 0.25 and 0.5 mg/100 ml

c. Storage: Prepare fresh for each run

d. Run Positions: At beginning of run

e. Q.C. Chart: Plot the corrected absorbance of the standard $(A_s - A_{sb}) - (A_b - A_{bb})$.

Limits: $\bar{x} \pm 2$ C.V.
1 C.V. = 5%

P. Dunn

TEST INFORMATION SUMMARY

Bio-Science Laboratories

NAME OF TEST	FOLATE	TEST CODE	406
TYPE OF SAMPLE	SERUM	DATE	8/27/80
METHOD	RADIOASSAY (RA)	SPECIMEN VOLUME	1 ML
SPECIAL HANDLING (PRESERVATIVES, ETC.)	FROZEN OR WITH ASCORBIC ACID		
MAILING CONTAINER	Y-1		
STABILITY TIME, IN DAYS			
ROOM TEMP. (30°)	NOT STABLE (STABLE WITH ASCORBIC ACID)		
REFRIGERATOR	APPROX. 2 HOURS		
FROZEN (-20° FREEZER)	APPROX. 1 MONTH		
FROZEN (-70° DRY ICE)		AVERAGE REPORTING TIME	2 DAYS

PRINCIPLE

The folate radioassay kit is based on the principles of competitive protein binding. After destruction of endogenous binders by heating (100°C, 15 minutes), 5-methyl-tetrahydrofolic acid (also known as MTHF, or physiologically active-folate) in the specimen competes with ^{125}I - labelled pteroylglutamic acid (^{125}I - PGA) for

(continued page 2)

REFERENCE RANGE

Over 1.5 ng/ml (4)

CLINICAL SIGNIFICANCE

The majority of folate deficiencies appear in persons on diets devoid of raw fruits and vegetables, or with pregnancy, alcoholism, intestinal malabsorption problems and megaloblastic anemia. A low serum folate level suggests that the patient's diet is low in folate or that a malabsorption problem exists; but does not

(continued page 2)

REFERENCES

1. Instruction Manual Folate Radioassay Kit (^{125}I), Becton Dickinson.

2. Dunn, R.T. and Foster, L.B., Clin. Chem., 19:1101, 1973.

(continued page 2)

TEST INFORMATION SUMMARY

NAME OF TEST FOLATE TEST CODE 406

PRINCIPLE................. (continued) binding sites on β-lactoglobulin. The unbound fraction is removed by adsorption onto dextran-coated charcoal, and the bound fraction (supernatant after centrifugation) is then counted in a gamma counter. The isotope diluting ability of the MTHF in the specimen is compared with that of PGA standards to get a measure of folate activity. (1,2,3,4)

CLINICAL SIGNIFICANCE....... (continued) necessarily mean that the patient requires folate therapy.

A low RBC folate indicates that there is tissue deficiency or that a vitamin B_{12} deficiency blocks the absorption of folate. Therefore, it is advisable to determine serum and RBC folates as well as vitamin B_{12} levels. (5,6)

REFERENCES................. (continued)

3. Rothenberg, S.P., *et al.*, *N. Engl. J. Med.*, *286*:1335, 1972.

4. BSL Research Notebook Nos. 1451 and 1466 (1978); 1240 (1979); 1617 (1980).

(continued page 3)

Bio-Science Laboratories

MAIN LABORATORY:
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ew York Branch	(516) 829-8000
Philadelphia Branch	(215) 561-6900
San Francisco Branch	(415) 632-5500
St. Louis Branch	(314) 426-3474

Specimen Pickup Services

Specimen pick-up service is available in many metropolitan areas. For this service simply call the appropriate phone number listed in our fee schedule. Your specimens will be picked up by our courier and delivered to our nearest Branch Laboratory or air shipped to our Main Laboratory at Van Nuys for receipt the following morning.

Call our Main Laboratory, toll-free, concerning courier services in cities not listed in our fee schedule.

TEST INFORMATION SUMMARY

NAME OF TEST FOLATE TEST CODE 406

Page 3

REFERENCES................ (continued)

5. Herbert, V., Folic Acid and Vitamin B_{12}. "Modern Nutrition in Health and Disease." 5th ed., edited by R.S. Goodhart and M.E. Shils, Sea and Febiger, Philadelphia, 1973, pp. 221-244.

6. Chanarin, I., "The Assay and Concentration of Folate in Blood and other Tissues." "The Megaloblastic Anaemias," Blackwell Scientific Publications, Oxford, 1969, pp. 306-336.

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Test Information Summary

Bio-Science

TEST CODE 791

NAME OF TEST................PYRIDOXAL PHOSPHATE

TYPE OF SAMPLE..............EDTA PLASMA

SPECIMEN VOLUME.............2.5 ML

METHOD......................ENZYMOMETRY

SPECIAL HANDLING............STORE AND SHIP FROZEN. PROTECT FROM LIGHT

MAILING CONTAINER...........B-1 AVERAGE REPORTING TIME 3 DAYS

STABILITY TIME, IN DAYS
ROOM TEMP.(30°)........NOT STABLE
REFRIGERATOR (2-8°)....NO DATA AVAILABLE
FROZEN (-20° FREEZER)..60
FROZEN (-70° DRY ICE)..

REFERENCE RANGE.............3.6-18 NG/ML (4)

PRINCIPLE

Deproteinized plasma and aqueous pyridoxal phosphate (PLP) standard are incubated with tyrosine apodecarboxylase to permit association of PLP with apoenzyme to form active enzyme. The enzymatic reaction is initiated by the addition of L-tyrosine-1-^{14}C substrate; it is terminated and $^{14}CO_2$ released from solution by the addition of HCl. Liberated $^{14}CO_2$ is trapped on a KOH-soaked filter paper wick suspended above the reaction mixture. The paper wick is dropped into liquid scintillation fluid and ^{14}C-activity determined. (1,2)

CLINICAL SIGNIFICANCE

Deficiencies have been found in:

1. Specific illnesses such as uremia, chronic alcoholism, neonatal seizures, diabetes mellitus, gestational diabetes, and malnutrition.

2. Industrial exposure to hydrazine compounds.

(Continued Page 2)

10/07/83

Test Information Summary

Bio-Science

TEST CODE 791

NAME OF TEST................PYRIDOXAL PHOSPHATE

CLINICAL SIGNIFICANCE (Continued)

3. Vitamin B_6 antagonism by specific drug therapies, e.g., isoniazide or cycloserine for tuberculosis, and penicillamine for Wilson's disease, cystinuria, and heavy metal intoxication.

4. Normal pregnancies, and frequently in oral contraceptive users.

Some illnesses have been associated with dependency on vitamin B_6. These include cystathioninuria, and some cases of anemia and neonatal seizures.

Symptoms of B_6 depletion include mental depression, nervous disorders, irritability, convulsions, peripheral neuropathy, anemia, dermatitis, and depression of the immune response. (3)

REFERENCES

1. Sundaresan, P.R. and Coursin, D.B., Methods Enzymol 18:509, 1970.

2. Curry, A.S. and Hewiott, J.V., Biochemistry of Women: Methods for Clinical Investigation, CRC Press, Cleveland, p. 317.

3. Sauberlich, H.E., et al, Amd J Clin Nutr 25:625, 1972.

4. BSL Research Notebooks No.: 912, 953, 1240, 1704.

10/07/83

Quality Control:

Include the controls described below with each run of unknowns and record results of the controls on Q.C. charts prepared using the indicated limits. Label each Q.C. chart with the identity and/or source of control materials and with the concentration of each standard to be charted. Enter any "out of limits" condition on the "Out of Limits" log sheet, describing the cause of the problem and the action taken to correct it. Bring any such condition to the attention of the supervisor. Submit a daily summary on an "Out of Limits" report form to the Director or Assistant Director of the department.

Test each new lot of reagent (except those prepared fresh daily) concurrently with one of known acceptability before the new reagent is placed in routine use. Record the date of preparation and use check on the container label. Record the introduction of a new reagent into routine use on the Quality Control or on a "New Reagents" log sheet which is to be kept with the Quality Control chart.

For emergency or research specimens, sufficient controls shall be employed to assure valid results. These controls may differ from those described below as necessary depending on the circumstances under which the test is run.

Standard:

a.	Composition:	Pyridoxal phosphate (codecarboxylase) monohydrate in water.
b.	Concentration:	Stock standard: 120 μg/ml Intermediate standard: 120 ng/ml (a dilution of stock standard 1:1000). Working standard: 12 ng/ml (a dilution of intermediate standard 1:10).
c.	Storage:	At 4°C and protected from light. Stock standard stable for up to 3 weeks. Intermediate and working standards are not stable and have to be prepared immediately prior to use.
d.	Run Position:	At beginning of run following blanks.
e.	Q.C. Chart:	Plot standard counts/total counts

Controls:

a.	Composition:	Plasma from EDTA blood, either pooled specimens or spiked plasma may be used
b.	Concentrations:	Low Pool: Approx. 3 ng PLP/ml plasma High Pool: Approx.20 ng PLP/ml plasma
c.	Storage:	At -70°C, protected from light. (1.0 ml aliquots of well-mixed plasma dispensed into 12x75 mm disposable Kimble glass vials, tightly covered with double parafilm).
d.	Run Position:	High pool following standard and low pool at end of run.
e.	Q.C. Chart:	Plot average result in ng PLP (Vit. B_6)/ml plasma.

Limits: $\bar{x} \pm 2$ SD

1 SD = mx + b
m = 0.06
b = +0.3

P Drewes

12/13/79*

Test Code 024,209
RECD NOV 26 1976

VITAMIN A AND CAROTENE IN SERUM
BY SPECTROPHOTOMETRY

References:

1. Sobel, A.E., and S.D. Snow, J. Biol. Chem. 171:617, 1947.
2. Roels, D.A. and M. Trout, Standard Methods of Clin. Chem. 7:215, 1972.
3. BSL Research Notebook #668, Demetriou, J., 1972, #732, Bolz, G., 1973, and #979, Twomey, S., 1976.

Principle:

Separate aliquots of serum are treated with ethanolic KOH to split Vitamin A and carotene from their protein complexes. Vitamin A is extracted by petroleum ether and reacted with dichloropropanol. A blue color, changing to violet in about 2 minutes, is measured at 550 nm. Carotene is extracted with iso-octane and measured at 450 nm. The determined Vitamin A value is corrected for the contribution of carotene present in the specimen.

Quality Control:

Include the controls described below with each run of unknowns and record results of the controls on Q.C. charts prepared using the indicated limits. Label each Q.C. chart with the identity and/or source of control materials and with the concentration of each standard to be charted. Enter any "out of limits" condition on the "Out of Limits" log sheet, describing the cause of the problem and the action taken to correct it. Bring any such condition to the attention of the supervisor. Submit a daily summary on an "Out of Limits" report form to the Director or Assistant Director of the department.

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For emergency or research specimens, sufficient controls shall be employed to assure valid results. These controls may differ from those described below as necessary depending on the circumstances under which the test is run.

Standards:

a.	Composition:	Vitamin A:	Vitamin A Reference Standard diluted with chloroform
		Carotene:	β-carotene dissolved in iso-octane
b.	Concentrations:	Vitamin A:	0, 200, and 400 IU/100 ml
		Carotene:	0, 0.6 and 1.2 μg/ml (set up 3 times a year to check standardization)
c.	Storage:	Vitamin A:	Refrigerated at 4°C
		Carotene:	Not stable
d.	Run Positions:	Immediately after blank	
e.	Q.C. Chart:	Vitamin A:	Plot absorbance of blank (blk vs H_2O) and corrected value (std - blk) of 200 and 400 IU/100 ml standards
		Carotene:	Should be recorded when run (once a month)

7/09./77

Appendix L. Profile of Mood States

NAME ________________________________ DATE __________

Below is a list of words that describe feelings people have. Please read each one carefully. Then fill in ONE space under the answer to the right which best describes HOW YOU are feeling right now

IDENTIFICATION

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

The numbers refer to these phrases.

0 = Not at all
1 = A little
2 = Moderately
3 = Quite a bit
4 = Extremely

	NOT AT ALL	A LITTLE	MODERATELY	QUITE A BIT	EXTREMELY
T					
1. Friendly	0	1	2	3	4
2. Tense	0	1	2	3	4
D 3. Angry	0	1	2	3	4
4. Worn out	0	1	2	3	4
5. Unhappy	0	1	2	3	4
A 6. Clear-headed	0	1	2	3	4
7. Lively	0	1	2	3	4
8. Confused	0	1	2	3	4
V 9. Sorry for things done	0	1	2	3	4
10. Shaky	0	1	2	3	4
11. Listless	0	1	2	3	4
F 12. Peeved	0	1	2	3	4
13. Considerate	0	1	2	3	4
14. Sad	0	1	2	3	4
C 15. Active	0	1	2	3	4
16. On edge	0	1	2	3	4
17. Grouchy	0	1	2	3	4
18. Blue	0	1	2	3	4
19. Energetic	0	1	2	3	4
20. Panicky	0	1	2	3	4

	NOT AT ALL	A LITTLE	MODERATELY	QUITE A BIT	EXTREMELY
21. Hopeless	0	1	2	3	4
22. Relaxed	0	1	2	3	4
23. Unworthy	0	1	2	3	4
24. Spiteful	0	1	2	3	4
25. Sympathetic	0	1	2	3	4
26. Uneasy	0	1	2	3	4
27. Restless	0	1	2	3	4
28. Unable to concentrate	0	1	2	3	4
29. Fatigued	0	1	2	3	4
30. Helpful	0	1	2	3	4
31. Annoyed	0	1	2	3	4
32. Discouraged	0	1	2	3	4
33. Resentful	0	1	2	3	4
34. Nervous	0	1	2	3	4
35. Lonely	0	1	2	3	4
36. Miserable	0	1	2	3	4
37. Muddled	0	1	2	3	4
38. Cheerful	0	1	2	3	4
39. Bitter	0	1	2	3	4
40. Exhausted	0	1	2	3	4
41. Anxious	0	1	2	3	4
42. Ready to fight	0	1	2	3	4
43. Good natured	0	1	2	3	4
44. Gloomy	0	1	2	3	4

	NOT AT ALL	A LITTLE	MODERATELY	QUITE A BIT	EXTREMELY
45. Desperate	0	1	2	3	4
46. Sluggish	0	1	2	3	4
47. Rebellious	0	1	2	3	4
48. Helpless	0	1	2	3	4
49. Weary	0	1	2	3	4
50. Bewildered	0	1	2	3	4
51. Alert	0	1	2	3	4
52. Deceived	0	1	2	3	4
53. Furious	0	1	2	3	4
54. Efficient	0	1	2	3	4
55. Trusting	0	1	2	3	4
56. Full of pep	0	1	2	3	4
57. Bad-tempered	0	1	2	3	4
58. Worthless	0	1	2	3	4
59. Forgetful	0	1	2	3	4
60. Carefree	0	1	2	3	4
61. Terrified	0	1	2	3	4
62. Guilty	0	1	2	3	4
63. Vigorous	0	1	2	3	4
64. Uncertain about things	0	1	2	3	4
65. Bushed	0	1	2	3	4

MAKE SURE YOU HAVE ANSWERED EVERY ITEM.

Appendix M. Morale and Leadership Questionnaire

Appendix M

NAME ______________________ DATE ______________ SSN ______________

The following statements are concerned with your feelings about the Command (company, platoon, or squad) you are presently assigned to and your sense of morale. Please respond to each statement as you honestly feel about it. This is not a test of any kind and your answers will not be shown to anyone in the Command.

Regardless of how long you have been assigned to this Command, your opinions are important, so please take your time and answer each statement as honestly as you can.

INSTRUCTIONS

Read each statement carefully and decide how you feel about the statement. Take your time in responding. There is no time limit, and there are no trick questions. If you have difficulty understanding or reading the statements, ask the person giving the test for assistance. To the right of each statement are the numbers 1 through 7. Please circle the number that most closely describes how you wish to respond to each statement. The following scale shows what the numbers mean:

1 means that you STRONGLY AGREE with the statement.

2 means that you MODERATELY AGREE with the statement.

3 means that you SOMEWHAT AGREE with the statement.

4 means that you NEITHER AGREE OR DISAGREE with the statement.

5 means that you SOMEWHAT DISAGREE with the statement.

6 means that you MODERATELY DISAGREE with the statement.

7 means that you STRONGLY DISAGREE with the statement.

1. The leaders in this Command take an active interest in the troops.	1	2	3	4	5	6	7
2. The workload and details are equally shared by the troops in this Command.	1	2	3	4	5	6	7
3. The troops in this Command get rewarded for doing a good job.	1	2	3	4	5	6	7
4. Punishment is not equally administered in this Command.	1	2	3	4	5	6	7
5. The leaders in this Command know their jobs.	1	2	3	4	5	6	7
6. The leaders in this Command explain the mission to the troops	1	2	3	4	5	6	7
7. I enjoy my work in this Command.	1	2	3	4	5	6	7

STRONGLY AGREE	MODERATELY AGREE	SOMEWHAT AGREE	NEITHER AGREE OR DISAGREE	SOMEWHAT DISAGREE	MODERATELY DISAGREE	STRONGLY DISAGREE
1	2	3	4	5	6	7

8. I feel that I can trust most of the troops in this Command.	1	2	3	4	5	6	7
9. Being a member of this Command makes me proud to be in the Army.	1	2	3	4	5	6	7
10. The morale in this Command is pretty good.	1	2	3	4	5	6	7
11. I have to look out for myself.	1	2	3	4	5	6	7
12. I get a sense of satisfaction out of doing my job in this Command.	1	2	3	4	5	6	7
13. The troops in this Command get a lot of opportunity to express their own ideas.	1	2	3	4	5	6	7
14. The leaders in this Command have good control over the troops.	1	2	3	4	5	6	7
15. Troops who break the rules in this Command clearly know what will happen to them.	1	2	3	4	5	6	7
16. My job in this Command is very important.	1	2	3	4	5	6	7
17. I am properly trained to function in my MOS.	1	2	3	4	5	6	7
18. The troops are treated like children in this Command.	1	2	3	4	5	6	7
19. All in all, I feel that this is a good Command to be in.	1	2	3	4	5	6	7
20. I work with the other troops as part of a team.	1	2	3	4	5	6	7
21. A lot of the troops in this Command are affected by how well I do my job.	1	2	3	4	5	6	7
22. There is poor communication between the troops and the leadership in this Command.	1	2	3	4	5	6	7
23. The troops in this Command have confidence in the officers and the NCOs.	1	2	3	4	5	6	7
24. The troops in this Command understand why they are punished for committing an offense.	1	2	3	4	5	6	7
25. My job gives me an opportunity to show how well I can do things.	1	2	3	4	5	6	7

STRONGLY AGREE	MODERATELY AGREE	SOMEWHAT AGREE	NEITHER AGREE OR DISAGREE	SOMEWHAT DISAGREE	MODERATELY DISAGREE	STRONGLY DISAGREE
1	2	3	4	5	6	7

26.	I have a lot of opportunity for educational development.	1	2	3	4	5	6	7
27.	The leaders in this Command make the troops feel important.	1	2	3	4	5	6	7
28.	I feel that I am wasting my time being in this Command.	1	2	3	4	5	6	7
29.	I feel that I have a lot of friends among the troops in this Command.	1	2	3	4	5	6	7
30.	I can make a lot of important decisions in my job.	1	2	3	4	5	6	7
31.	A lot of the time I don't know what I'm supposed to be doing.	1	2	3	4	5	6	7
32.	The leaders in this Command set a good example to follow.	1	2	3	4	5	6	7
33.	This Command needs more discipline.	1	2	3	4	5	6	7
34.	The promotion system in this Command is unfair.	1	2	3	4	5	6	7
35.	My experience in this Command will help when I leave the Army.	1	2	3	4	5	6	7
36.	I can't trust the leaders in this Command.	1	2	3	4	5	6	7

We would now like to get your opinions on how you think the other troops feel. Please respond to each of the following statements in the way you believe that most of the other troops would feel about it.

37.	They get a lot of opportunity to use their own judgement in this.	1	2	3	4	5	6	7
38.	They feel competent in their job.	1	2	3	4	5	6	7
39.	The officers and NCOs in this Command are not very concerned about them as individuals.	1	2	3	4	5	6	7
40.	Most of the time they are bored.	1	2	3	4	5	6	7
41.	They are learning a good skill in this Command.	1	2	3	4	5	6	7
42.	They don't have the opportunity to do things on their own in this Command.	1	2	3	4	5	6	7
43.	They have a clear understanding of their job in this Command.	1	2	3	4	5	6	7

STRONGLY AGREE	MODERATELY AGREE	SOMEWHAT AGREE	NEITHER AGREE OR DISAGREE	SOMEWHAT DISAGREE	MODERATELY DISAGREE	STRONGLY DISAGREE
1	2	3	4	5	6	7

44. There is a big gap between the troops and the officers and NCOs in this Command 1 2 3 4 5 6 7

45. Most of the time they are satisfied being in this Command. 1 2 3 4 5 6 7