

REPORT NO T21-90

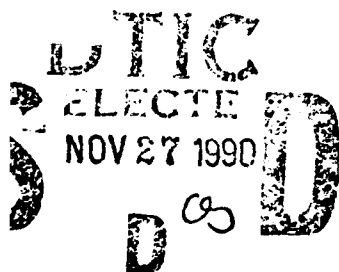
A Comparison of the Meal, Ready-to-Eat VIII  
with Supplemental Pack and the  
Ration, Cold Weather Consumed in an  
Arctic Environment

AD-A229 412

U S ARMY RESEARCH INSTITUTE  
OF  
ENVIRONMENTAL MEDICINE

Natick, Massachusetts

September 1990



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1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE		3. REPORT TYPE AND DATES COVERED Final	
4. TITLE AND SUBTITLE A Comparison of the Meal, Ready-to-Eat VIII with Supplemental Pack and the Ration, Cold Weather Consumed in an Arctic Environment				5. FUNDING NUMBERS PR P623002819R0	
6. AUTHOR(S) Edwards, John S.A., D.E. Roberts, S.H. Mutter, R.J. Moore					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Institute of Environmental Medicine Military Nutrition Division Natick, MA 01760-5007				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution unlimited				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) Neither the Meal, Ready-to-Eat (MRE) nor the Ration, Cold Weather (RCW) has demonstrated any clear nutritional advantage when comparing one against the other. A Supplemental Pack containing popular foods added to the latest version of the MRE (MRE VIII) has been shown to increase energy intake. This study compares the MRE plus a Supplemental Pack with the RCW to assess whether either or both provide the nutritional support required by military personnel working in an arctic environment. The subjects were two companies of light infantry taking part in an 8-day field exercise in Alaska. Activity levels of both groups were similar. Fluid intake was generally good. The results of this study indicate that both rations are similar in terms of their nutritional intake and ability to maintain hydration status but neither group consumed sufficient calories to meet the MRDAs and maintain body weight. A decision on which ration to use must, therefore, depend on the logistical and tactical scenarios.					
14. SUBJECT TERMS Meal, Ready-to-Eat (MRE); Ration, Cold Weather (RCW); supplemental pack; nutritional intake; hydration status; calories				15. NUMBER OF PAGES	
				16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UL		

**A COMPARISON OF THE MEAL, READY-TO-EAT VIII  
WITH SUPPLEMENTAL PACK  
AND THE RATION, COLD WEATHER  
CONSUMED IN AN ARCTIC ENVIRONMENT**

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## **ACKNOWLEDGEMENTS**

No field study is easy, particularly when temperatures fall to as low as -55°F. The success of this study was very much dependent on the data collectors to whom the authors would like to express their thanks. The data collectors were: LTC E.W. Askew, Elaine Christensen, Ann Curran, Cathy Harvey, Debbie Jezior, Trish Riley, Rick Mahnke, SPC Glass and SPC Shelby. In addition, our thanks to Cory Baker-Fulco, Tanya Jones, Carlo Radovsky and SSG Martin who provided the less glamorous but essential back-up to an field study; and to the staff at Fort Greely who, as always, went out of their way to make our stay there as pleasant as possible.

Most importantly, we would like to sincerely thank the Commanding Officer, Officers and Enlisted personnel of the 5th Battalion, 9th Infantry, without whose help and co-operation this study would not have been possible.

## **EXECUTIVE SUMMARY**

Neither the Meal, Ready-to-Eat (MRE) nor the Ration, Cold Weather (RCW) has demonstrated any clear nutritional advantage when comparing one against the other. A Supplemental Pack containing popular foods added to the latest version of the MRE (MRE VIII) has been shown to increase energy intake.

This study compares the MRE plus a Supplemental Pack (MRE VIII +), with the RCW to assess whether either, or both, provide the nutritional support required by military personnel working in an arctic environment.

The subjects were two Companies of Light Infantry (n = approximately 80 each) taking part in an 8-day field exercise in Alaska (minimum temperature -55°F). The body weight and height were measured and a urine sample taken from all subjects the day before and on the last day of the exercise. Blood samples (n = 47 and 42) were also taken and activity monitors (n = 25 and 15) attached to a randomly selected subsample in each group. One group received, as their sole source of food, three MRE VIII plus a Supplemental Pack (4604 kcal) daily and the other group, one RCW (4568 kcal) daily. Daily measurements included food and water intake, food acceptability as measured by a 9-point hedonic scale and a urine sample. A questionnaire was administered to all subjects on the last day of the study to ascertain subjects' opinions on various aspects of the ration.

Activity levels of both groups were similar: mean hours of sleep 6.98 for the MRE VIII + group and 7.08 for the RCW group. Mean daily energy intakes were significantly different: 2729 kcal for the MRE VIII + group and 2943 kcal for the RCW group. These failed to meet the Military Recommended Dietary Allowances (MRDA) of 4500 kcal and maintain body weight; the mean losses were 2.8 lb (1.6%) for the MRE VIII + group and 2.9 lb (1.7%) for the RCW group. Part of the low nutrient intake can be attributed to the very low food consumption on days one and two. Mean intakes for days three to eight were 2963 kcal for the MRE VIII + group and 2948 kcal for the RCW group. Nutrient intake for all except four micronutrients in the MRE VIII + group and five micronutrients in the RCW met the MRDAs. Blood values were within the accepted physiological ranges. Some blood values were significantly different

but these are not considered to be clinically significant. In general, the MRE was more favorably received than the RCW; the Supplemental Pack was extremely popular. No pattern indicated a change in acceptability over time.

Fluid intake was generally good: the mean daily water intake was 3.4 L/day for the MRE VIII + group and 3.7 L/day for the RCW group. The mean urine specific gravities were 1.020 for the MRE VIII + group and 1.021 for the RCW group indicating adequate hydration.

The results of this study indicate that both rations are similar in terms of their nutritional intake and ability to maintain hydration status, but neither group consumed sufficient calories to meet the MRDAs and maintain body weight. A decision on which ration to use must therefore depend on the logistical and tactical scenarios.

## **INTRODUCTION**

### **DEVELOPMENT OF THE RATION, COLD WEATHER (RCW) AND THE MEAL, READY-TO-EAT (MRE)**

The choice of ration for use in a cold environment is not simple. Fully hydrated (wet pack) items are convenient to use, provide very palatable meals and are ready to eat. They are, however, heavy to carry and prone to freezing, thereby not only making them difficult to consume but also susceptible to damage. On the other hand, dehydrated rations are lightweight, more compact and therefore easier to carry. They do not freeze although they do require additional water for rehydration and consumption.

In 1983, due mainly to their operational commitment to Norway, the Marine Corps established a requirement for a ration suited to a cold environment. The design criteria to be incorporated into the ration were that it:

1. Provide 4500 kilocalories in entrees, snacks and numerous hot drinks.
2. Not freeze.
3. Have external packaging that was flat, flexible and waterproof.
4. Be convenient to use.
5. Be significantly lighter and smaller than four Meals, Ready-to-Eat.
6. Have a reduced sodium content.

In response to this statement of Required Operational Capability, development of a cold weather ration, based on the Food Packet, Assault, began in 1983. Since then, a number of studies have been undertaken to establish the acceptability and suitability of this type of ration.

Initial evaluation began in 1984 with two studies involving Navy SEALs and centered primarily on evaluating the acceptability, consumption times, satisfaction, convenience, quality and water availability of a prototype Ration, Cold Weather (RCW)<sup>1</sup>. Similar data were collected in 1985 in a 5-day study in Alaska using troops from Fort Wainwright. Fifty soldiers ate the prototype RCW and 50 ate the Meal, Ready-to-Eat (MRE) and B-Type Rations supplemented with hot chocolate, soup, granola and oatmeal<sup>2</sup>. Ration acceptability,

satisfaction, convenience, quality and daily food consumption data were collected; pre- and post-weights taken; and a body fluid status questionnaire completed<sup>3</sup>.

The ration was again tested in January to March 1986 by the Cold Regions Test Center, Fort Greely, Alaska, to determine if it provided superior operational characteristics over four MREs<sup>4</sup>. The test included two isolated field exercises, the first involving 36 soldiers, the second 18 soldiers over a 10-day period when temperatures ranged from -23°C to 8°C.

A comparison of nutrient intake was first addressed in 1986 during a 10-day cold weather training exercise involving four teams of Special Forces Soldiers<sup>5,6</sup>. The average caloric intakes were 2733 kcal for the MRE group and 2751 kcal for the RCW group. These values were approximately 1000 kcal less than the estimated energy expenditure and in part, accounted for body weight losses of 6.9 lbs and 5.7 lbs respectively. There did not appear to be any significant difference in the consumption of the two rations and both groups showed evidence of dehydration, as indicated by elevated urine specific gravity. The RCW was found to be more acceptable to the troops in terms of taste, appearance, amount of food and variety with most components receiving 7 and 8 on a 9-point hedonic scale. Unpopular items were identified for reformulation or substitution.

An 11-day field test in January 1988 compared the most recent version of the MRE (MRE VIII), the RCW and the Ration, Lightweight (RLW) at the Marine Corps Mountain Warfare Training Center<sup>7</sup>. Twenty-eight subjects were divided into three groups each group consuming one of the rations. Food and water intakes, hydration status, body weight changes, blood chemistries and ration acceptability were recorded. The average caloric intakes were 3305, 3015 and 3120 kcal/day for the MRE, RCW and RLW, respectively. Although the three groups lost a significant amount of weight, 3.3%-4.4%, the difference between groups was not significant. The RCW and RLW groups also consumed significantly less protein and sodium than the MRE group, which would be important if water availability were to be limited. However, ample water was available and all groups were adequately hydrated. All rations proved to be acceptable in cold weather at moderate altitude, but none were superior at



reducing weight loss or increasing caloric and water intake.

In all of the studies conducted to date, the RCW, with few exceptions, has proven to be equal or superior to the MRE in terms of acceptability, convenience and the operational characteristics of weight, volume and not freezing. However, despite these advantages, neither ration demonstrates a clear advantage in meeting energy requirements, preventing body weight loss or maintaining hydration status. The theoretical reduction in water intake caused by the lower protein and sodium content of the RCW may be advantageous when water supplies are limited.

The advantages offered by the RCW have led the Marine Corps to adopt this ration for use in a cold environment. There is currently some utilization of the RCW by the Army, while their primary ration for this environment remains the Meal, Ready-to-Eat (MRE).

The MRE was adopted into service in 1985 as a replacement for the ration, the Meal, Combat Individual (C-Ration) and since then a number of modifications have been made. A study into the Army Field Feeding System, including the MRE<sup>8</sup>, identified the need for a Supplemental Pack to enhance the acceptability of MRE IV through VII. In addition, it was suggested that this pack might form the basis of a cold weather supplement. Accordingly, a separate package was developed incorporating those items most often requested and taken to the field by soldiers.

In order to determine the suitability of the Supplemental Pack, a 10 day field study in March 1989 was conducted in Alaska with troops from the 1st and 2nd Bn 17th Infantry who were taking part in an evaluation exercise. Approximately half of the troops in one Company were fed four MRE VIs and the other half three or four MRE VIIIs daily. In the other Company, half of the troops were fed three MRE VIs plus a Supplemental Pack and the other half, three MRE VIIIs plus a Supplemental Pack daily. Initial body weights, heights, blood and urine samples were taken on all subjects and, on a smaller sample, activity monitors were attached. Daily urine measurements were taken and dietary logs were completed on the amount and acceptability of individual food items and water consumption. At the end of the study, final body weight measurements,

blood and urine samples were taken and two questionnaires were administered.

The results confirmed the superiority of the MRE VIII over the MRE VI. Furthermore the addition of a Supplemental Pack to the MRE VIII increased caloric intake from 2830 kcal to 3553 kcal. Water consumption and therefore hydration status in all groups was inadequate and only improved when forced drinking was instituted. *It was also concluded that instead of issuing four MREs in a cold environment, three MREs and one Supplemental Pack would be a viable alternative<sup>9,10</sup>.*

## OBJECTIVES

The objectives of this study were to compare consumption of the Meal, Ready-to-Eat VIII with a Supplemental Pack (MRE VIII +) to that of the Ration, Cold Weather (RCW) and assess whether either, or both, provide the nutritional support required by military personnel working in an arctic environment. Specifically, the aims of the study were to establish:

1. *Whether soldiers fed the MRE VIII + or the RCW consume sufficient calories to maintain their body weight within acceptable limits.*
2. *Whether soldiers fed the MRE VIII + or the RCW consume sufficient quantities of menu items to adequately meet The Office of the Surgeon General's Military Recommended Dietary Allowances (MRDA) for protein, vitamins and minerals (AR 40-25<sup>11</sup>).*
3. *The acceptability and suitability of both rations for use in an arctic environment.*
4. *Whether there is a variation in the water requirements of soldiers consuming either ration and if consumption is adequate to maintain hydration status.*
5. *Quantify and identify the particular problems experienced by soldiers consuming these rations in an arctic environment and how well they cope with them.*

6. To provide further data on the energy requirements of soldiers working in a cold environment.
7. To establish a data base to assist in the formulation of Cold Weather Field Feeding Doctrine.

## METHODS

### EXPERIMENTAL DESIGN

The study was designed to utilize two independent groups of approximately Company size carrying out their normal military mission for a minimum of 7 and a maximum of 10 days. The preferred subjects were cold acclimatized infantry from the Regular Army undertaking moderately active work in a cold environment. To eliminate the likelihood of subjects trading the two types of rations, the two groups were required to be geographically separated and with no access to other food sources either supplied to them or taken as 'pogey bait'.

Once subjects had been briefed, Volunteer Agreement Affidavits and Registration Forms signed, pre-measurements were required to be taken before breakfast and prior to deployment. Once in the field the following feeding regimen was to be adopted:

Group 1	3 x MRE VIII 1 x Supplemental Pack	4604 kcal
Group 2	1 x RCW	4568 kcal

---

Due to a delay in the analysis of the Doubly Labelled Water used to assess energy expenditure, this aspect has been omitted from the current report. A further Technical Report will be produced describing the methodology and results, once analysis is complete.

Thereafter, access to subjects was required on a daily basis in order to collect food and water intake data, food acceptability data and a urine sample. Post-measurements were required at the end of the study and the completion of a questionnaire.

## **TEST SUBJECTS**

Two Companies (B and C) from the 5th Battalion, 9th Infantry, 6th Infantry Division (Light) (6ID (L)), stationed at Fort Wainwright, Alaska, served as test subjects. Prior to the start of the exercise all subjects were briefed on the purpose and aims of the study. They were then invited to ask questions before completing and signing Volunteer Agreement Affidavits (Appendix A) and Volunteer Registration Forms. The opportunity was also taken at this stage to familiarize subjects with the RCW and to explain how it should be prepared and heated.

## **OPERATIONAL SCENARIO**

The field study was conducted concurrently with a Battalion exercise held in the Bolio Lake Training Area, Fort Greely, Alaska. The unit deployed on day one with personnel from both Companies either air assaulting or moving by road to the vicinity of the temporary airstrip at Fort Greely. Here they established a hasty defensive position and spent the night. The following morning they air assaulted into a hill position where they established a planned defensive position. During the time in defense, regular patrols were sent out, and activities conducive to a defensive position were conducted. Due partly to the non-availability of helicopter support and partly to the extreme cold weather, a further planned air assault was cancelled and both Companies remained in their defensive position. On day seven, both Companies moved and set up a further defensive position in readiness for the final phase, a Brigade live fire exercise.

## **RATIONS**

One group of subjects (C Company) was issued three MRE Vills and one Supplemental Pack per day and the second group (B Company) one RCW per day. Rations were resupplied daily when data collectors met with the subjects.

The MRE and RCW were standard rations drawn through appropriate channels at Fort Greely. Fact Sheets for the RCW and MRE outlining the development and current improvement program are at Appendix B. A summary of the relative merits of the MRE and RCW is also given.

The Supplemental Packs used for the study were based on the pack developed and tested during 1989<sup>9,10</sup>. These were assembled at Natick and shipped to Alaska. Details of the contents of the packs are given in Appendix B.

## **PROCEDURES**

### **Anthropometric and Demographic Data**

Body weight was measured using a Seca digital battery operated scale (accurate to  $\pm 0.1$  lb). Scales were calibrated using a 50 lb weight and subjects were weighed in "boxer shorts", before breakfast, prior to deployment and on the last day in the field. Heights were measured prior to deployment to  $\pm 0.1$  cm. Demographic information was gathered using a questionnaire (Appendix D) administered on the final morning of the study.

### **Food Intake and Nutritional Status**

Food intake was calculated from data collected using a 24-hour Dietary Log maintained by each subject. Examples of the Dietary Logs are given at Appendix C. Subjects selected (from the itemized list of foods) the estimated portion size consumed (e.g., 1/4, 1/2, 3/4, 1, 2, 3) by circling the appropriate number. Where portion sizes were outside this range, actual figures were written in at the side. Completed Dietary Logs were collected daily by trained data collectors who interviewed subjects in order to confirm the validity of the entries made. In addition, each soldier collected his empty wrappers, unwanted food and food waste in a plastic Ziploc<sup>®</sup> trash bag. These were retrieved and used to help resolve any queries that arose from the Dietary Logs. The data were analyzed to provide details of the nutritional intake and to compare consumption between groups and against the MRDA.

Nutritional status was evaluated from blood samples taken the morning prior to deployment and on the last day in the field. On both occasions blood samples (40 cc) were venous blood from an antecubital vein, drawn prior to 'breakfast' following an overnight fast with subjects in a recumbent position. Samples were taken by trained phlebotomists provided by the Medical Company (6ID (L)), supervised and assisted by trained phlebotomists accredited by the U.S. Army Research Institute on Environmental Medicine (USARIEM).

Serum samples were analyzed to determine changes in both nutritional and hydration status from the beginning to the end of the study. Analysis was conducted in-house for hemoglobin and hematocrit and by contract (Louisiana State University) for a standard panel of blood chemistries. This panel consisted of:

Albumin	Potassium
Amylase	SGOT (AST)
Alkaline Phosphatase	SGPT (ALT)
Bilirubin, Total	Sodium
Calcium	Protein, Total
Carbon Dioxide	Triglycerides
Chloride	Urea Nitrogen (BUN)
Cholesterol	Uric Acid
Creatinine	A/G Ratio
Glucose	BUN/Creatinine Ratio
Iron	Electrolyte Balance
Lactic Dehydrogenase (LDH)	Osmolality
Phosphorus, Inorganic Globulin	Gamma-Glutamyl Transferase
HDL Cholesterol	
LDL Cholesterol	

### **Ration Acceptance**

**Food Item Acceptability.** Food item acceptability was ascertained by two methods: on a daily basis using the 24-hour Dietary Log, and at the end of the study on the final questionnaire. In both cases a 9 point hedonic scale was used to record acceptability: 1 = "Dislike Extremely", 5 = "Neither Like nor

Dislike", 9 = "Like Extremely".

**Human Factors.** Soldiers' opinions on general aspects of the two feeding regimens, the rations used, what particular problems and difficulties were encountered and how they coped with them, were established during the daily interviews and other informal feedback sessions conducted in the field. These subjective comments were later quantified and expanded in the final questionnaire administered at the end of the study. An example of the questionnaire is given in Appendix D.

### **Fluid Intake and Hydration Status**

Fluid intake was ascertained using self reporting procedures on the 24-hour Dietary Log. Subjects recorded the number of canteens of water: drunk as plain water; used and consumed as a beverage, for example coffee; or mixed with food during 3 time frames (morning, afternoon and evening). They were also asked to check one item as the primary source or origin of that water. As some subjects found it more convenient to record consumption by canteen cup, care was taken during the daily interview to ascertain the exact unit of measurement used by the subject. In addition, where water would customarily be added to food, subjects were asked to record on the 24-hour Dietary Log, whether they had done so. This action was taken in order to measure the effects of rehydrating food on the hedonic rating.

Hydration status was assessed from changes between the pre- and post-blood samples, indicative of circulating volume, and in the daily urine samples, indicative of decreased clearance or increased reabsorption of water.

Urine samples were obtained before deployment, daily in the field and on the last day of the exercise. The urine was a first void of the morning, taken prior to breakfast and collected in 50 cc screw top tubes. It was analyzed on site for:

Urinary Ketone  
Urinary Protein  
Leucocytes  
pH  
Specific Gravity

### **Activity Levels**

Activity levels were measured in a subsample of each Company (26 in the MRE VIII + group and 15 in the RCW group) using ambulatory activity monitors. The activity monitors are compact (2.5" x 3.5" x 0.75"), lightweight (3 oz) microprocessor based units which are worn on the wrist. They do not restrict the normal range of motion and do not interfere with training and daily activities.

Prior to being attached they were initialized to record motor activity in 3-minute epochs for the period of the study and strapped to the subjects' wrist. Thereafter, they were checked daily to ensure their presence before being recovered on the final day of the study. The data collected and stored in them was down-loaded at the end of the study and analyzed using a sleep wake algorithm for wrist activity<sup>12</sup>.

### **Meteorological Data**

Meteorological data were collected and recorded daily by the Atmospheric Science Laboratory, Alaska Meteorological Team, Fort Greely, as part of their routine duties. For the duration of the study, details of the hourly minimum and maximum thermometer temperatures, wind speed and direction, wind chill, solar radiation, and precipitation were provided from the remote weather station located in the Bolio Lake training area and, from the main weather station at Fort Greely, the times of sunrise and sunset.

### **Statistical Methods**

Data were analyzed to address the overall aims of the study using USARIEM developed software<sup>13</sup> in conjunction with the SPSS-X statistical package on a Digital VAX 780. Nutritional adequacy of the actual dietary



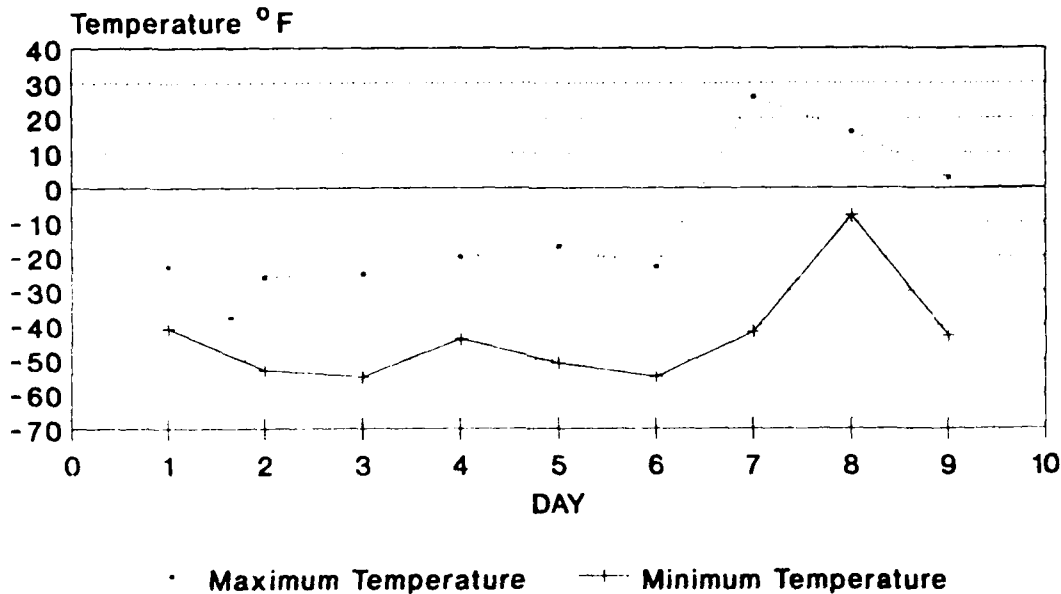
intakes of energy, protein, carbohydrate, fat, vitamin A, vitamin E, ascorbic acid, thiamin, riboflavin, niacin, vitamin B<sub>6</sub>, folacin, vitamin B<sub>12</sub>, calcium, phosphorus, magnesium, iron, zinc sodium and potassium was determined by comparing the frequencies, means and standard deviations obtained from the MRE VIII + against those obtained from the RCW and also the MRDAs found in AR 40-25<sup>11</sup>. Similar calculations were made for the demographic, fluid and hydration data. Food preferences were determined by rank ordering the mean acceptability ratings for each food item. Results were compared using a paired t-test and one-way ANOVA. The level of statistical significance selected was 0.05 and results were not considered to have occurred through chance when the p value was less than 0.05.

## RESULTS

### METEOROLOGICAL DATA

Weather conditions for a cold weather study were considered to be ideal although at times perhaps too severe. Thermometer temperatures recorded at Bolio Lake are summarized in Figure 1 and ranged from a minimum of  $-55^{\circ}\text{F}$  to a maximum of  $+26^{\circ}\text{F}$ , although for six consecutive days of the study the maximum temperature did not rise above  $-17^{\circ}\text{F}$ . Wind chill did not affect the minimum recorded temperatures and, with the exception of two days where the mean hourly readings over the 24-hour period were 4.2 and 6.3 knots (peak speed 22 knots), it was not a major factor for most of the study. Precipitation as snow occurred on six days and expressed as water ranged from a trace to 0.1 inches. Solar radiation ranged from 0 to 23 Langleys<sup>\*\*</sup>. Sunrise and sunset at the start of the study were 0907 hours and 1648 hours. The total number of daylight hours increased daily and by the last day of the study, sunrise was at 0841 hours and sunset at 1714 hours.

Figure 1. Minimum and Maximum Thermometer Temperatures  
Bolio Lake Training Area, Fort Greely, Alaska



<sup>\*\*</sup> An electromagnetic radiation incident upon a surface:  
a value of energy per unit area equal to one calorie per square centimeter.

## DEMOGRAPHIC AND ANTHROPOMETRIC DATA

Demographic data, collected as part of the final questionnaire, is summarized in Table 1. The majority of the subjects (95%) were enlisted personnel whose ranks ranged from E-1 to E-7; 72% of those were between the ranks of E-2 to E-4. The groups were not significantly different. The mean heights were 177.1 cm for the MRE VIII + group and 174.2 cm for the RCW group. These were significantly different but as the differences between the groups was very small (2.9 cm) it is not considered that this had any effect on the results. The average age of both groups was 23 years and length of service was 3.5 years.

Table 1. Demographic Information.

	Group 1 MRE VIII +	Group 2 RCW
<b>Distribution of Ranks (%)</b>		
<b>Enlisted</b>		
E-1	4.9	6.8
E-2	9.9	13.5
E-3	13.6	20.3
E-4	53.1	33.8
E-5	4.9	8.1
E-6	6.2	9.5
E-7	1.2	1.4
<b>Officers</b>		
O-1	3.7	2.7
O-2	1.2	---
O-3	1.2	1.4
<b>Length of Service</b>		
Years	3.5 (.35)*	3.5 (.45)
<b>Age</b>		
Years	23.0 (.46)	23.0 (.55)

\* Numbers in parentheses are standard errors.

### Body Weight Change

Where body weights could not be taken at the end of the study, either because the subjects had dropped out or were not available, their pre-weights have been excluded. Details of body weights are given in Table 2. The mean pre-weight for the MRE VIII + group was 172.2 lb (SD  $\pm$  25.2) and 168.6 lb (SD  $\pm$  24.1) for the RCW group. These were not significantly different. The mean post-weights were 169.4 lb (SD  $\pm$  24.2) for the MRE VIII + group and 165.7 lb (SD  $\pm$  23.4) for the RCW group. While not statistically different between groups, significant differences did exist between the pre- and post-weights. Thirteen subjects from the MRE VIII + and 11 subjects from the RCW group gained weight, the remainder lost weight. The mean weight loss was 2.8 lb (1.6%) for the MRE VIII + and 2.9 lb (1.7%) for the RCW group. These weight losses are within the generally accepted limits of 3%. The majority of soldiers (Table 3) were neither trying to lose nor gain weight during the field exercise. Slightly more (5%) of the MRE VIII + group were trying to lose weight and slightly more (5.5%) of the RCW group were trying to gain weight.

Table 2. Changes in Pre- and Post-Weights

	Group 1 MRE VIII + n = 72 lbs	Group 2 RCW n = 68 lbs
<b>Pre-weight</b>		
Mean	172.2	168.6
SD	25.2	24.1
<b>Post-weight</b>		
Mean	169.4	165.7
SD	24.2	23.4
<b>Changes*</b>		
Mean	- 2.8	- 2.9
SD	3.1	3.3
%	- 1.6%	- 1.7%

\* Pre- and post-weights are significantly different ( $p < 0.05$ ) in both groups.

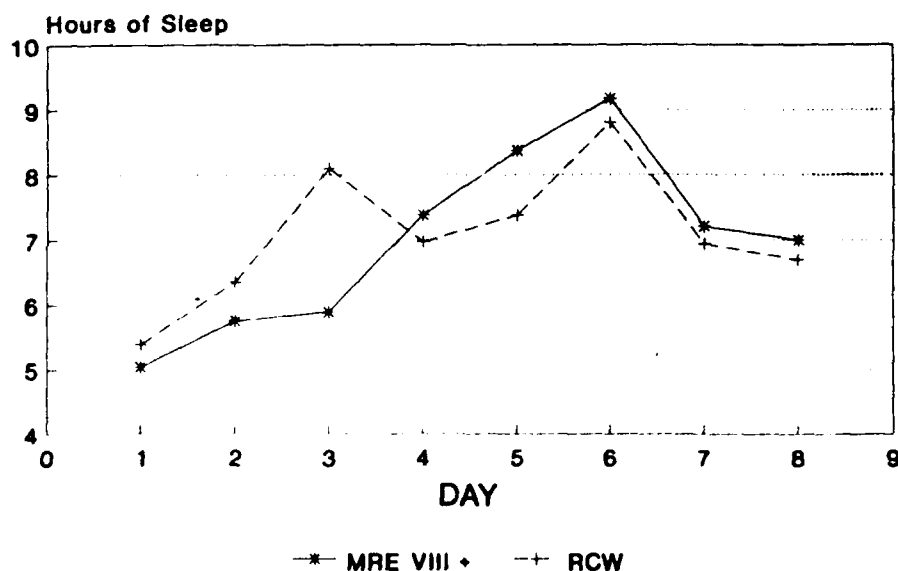
Table 3. Details of Personnel Who Were Either Trying to Lose or Gain Weight.

	Group 1 MRE VIII +	Group 2 RCW
Trying to Lose Weight (%)	18.5	13.5
Trying to Gain Weight (%)	14.8	20.3

## ACTIVITY LEVELS

Forty-one subjects (26 in the MRE VIII + and 15 in the RCW group) were initially set up to wear activity monitors but only 16, eight in each group, were available for analysis over the entire period. This was due partly to a small number of subjects who dropped out but mainly to the malfunctioning of the monitors. This higher than normal incidence of equipment malfunction was probably due to a temporary battery failure caused by the extreme cold weather. The mean daily number of hours of sleep are shown in Figure 2. During the eight day period the MRE VIII + group received, on average, 6.98 (SD  $\pm$  1.38) hours of sleep and the RCW group 7.08 (SD  $\pm$  1.05) hours. There were no significant differences between groups.

Figure 2. Mean Hours of Sleep



## FOOD INTAKE AND NUTRITIONAL STATUS

### Food Intake

MRE VIII + and RCW. Nutrient intakes were calculated from the 24-hour Dietary Logs. Details of the usable number of logs are given in Table 4.

Table 4. Details of the Usable Number of 24-Hour Dietary Logs.

Day	Group 1 MRE VIII +	Group 2 RCW
1	76	69
2	75	72
3	76	75
4	75	74
5	75	74
6	75	75
7	76	73
8	75	76

The average daily nutrient intakes of the MRE VIII + and RCW groups together with the MRDAs<sup>11</sup> are presented in Table 5. There were significant differences between the intakes of the MRE VIII + and RCW groups for all but four micronutrients. The RCW group consumed 214 kcal more than the MRE VIII + group during the eight days. When viewed on a daily basis (Figure 3) it can be seen that consumption was low for both groups on day one, improved for the RCW group on day two, but does become adequate for the MRE VIII + group, until day three. The mean intakes for the macronutrients have therefore been calculated for days two to eight, inclusive, and days three to eight, inclusive, and are shown in Tables 6 and 7.

Table 5. Mean Intakes and Significant Differences for the Meal, Ready-to-Eat VIII with Supplemental Pack and the Ration, Cold Weather Together with the Military Recommended Dietary Allowances (Male Personnel)<sup>11</sup>.

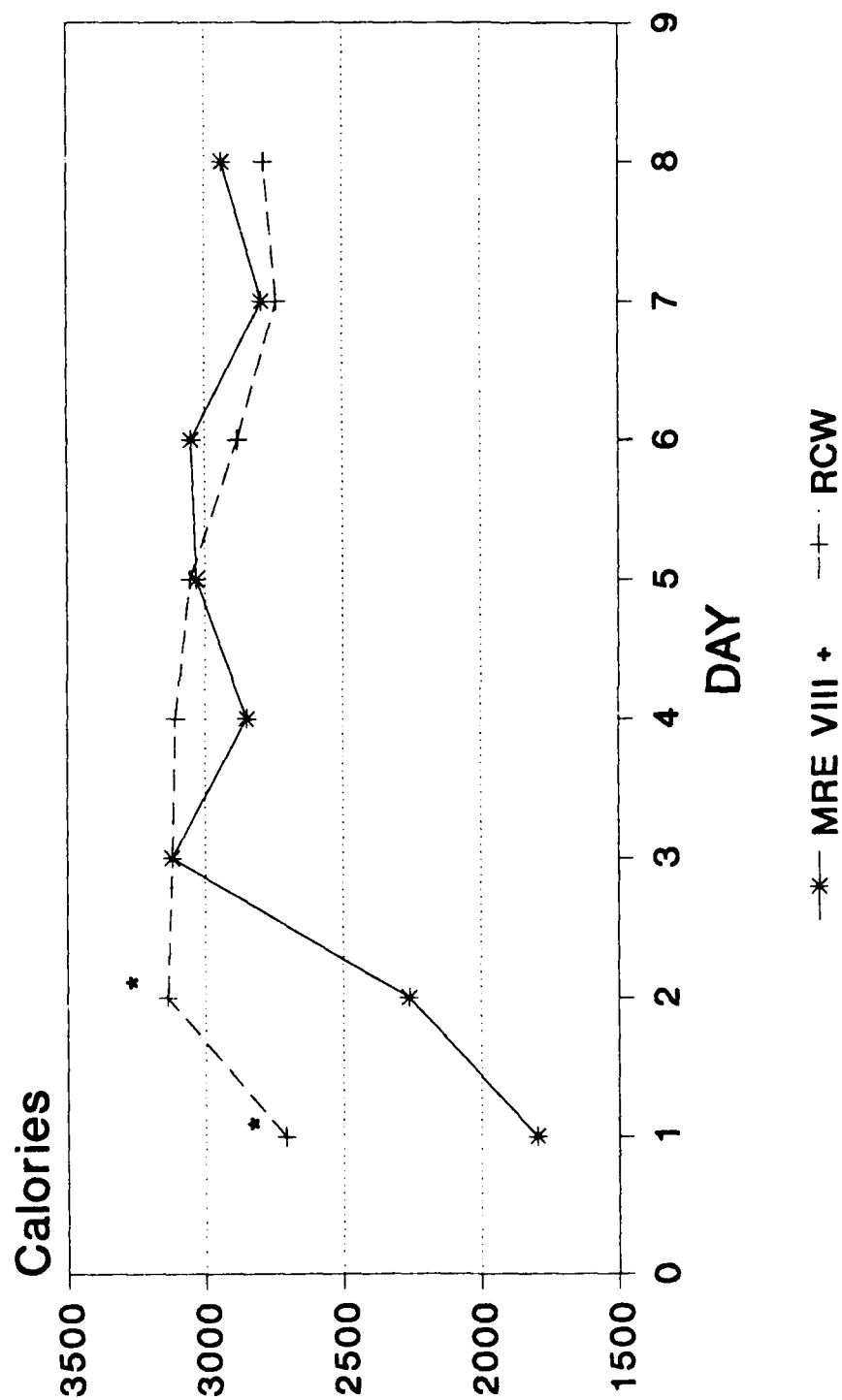
Nutrient	Unit	MRDA	Group 1 MRE VIII +		Group 2 RCW	
			Mean	SD	Mean	SD
Energy	kcal	4500	2729	1057	2943*	969
Protein	gm	100	113.8	41.0	97.3*	32.9
Carbohydrate#	gm	440	319.9	137.0	420.9*	150.2
Fat#	gm	160	110.4	45.6	101.8*	37.9
Vitamin A	mcg RE	1000	1067	903	1488*	1083
Vitamin E	mg TE	10	11.4	4.8	13.1*	5.4
Ascorbic Acid	mg	60	130.3	99.2	140.9	110.3
Thiamin	mg	1.6	3.9	2.5	3.7	2.0
Riboflavin	mg	1.9	1.8	0.8	1.5*	0.6
Niacin	mg NE	21	26.3	10.6	27.5	13.2
Vitamin B <sub>6</sub>	mg	2.2	2.7	2.0	2.5*	1.6
Folacin	mcg	400	168.2	76.2	171.2	83.6
Vitamin B <sub>12</sub>	mcg	3	2.0	1.0	0.9*	0.6
Calcium	mg	800-1200	811.8	418.4	730.5*	420.6
Phosphorus	mg	800-1200	1576	660	1739*	567
Magnesium	mg	350-400	275.1	114.3	393.6*	130.5
Iron	mg	10-18	15.0	6.4	12.4*	4.3
Zinc	mg	15	10.2	5.1	9.0*	4.6
Sodium##	mg	5000-7000	4489	1912	3721*	1293
Potassium	mg	1875-5626	2442	1047	2816*	1030

# No recommendations are made for carbohydrate and fat although these values are given in the Nutritional Standards for Operational Rations<sup>11</sup>.

## Upper target.

\*  $p < 0.05$

Figure 3. Mean Daily Energy Intake for the Meal, Ready-to-Eat + Supplemental Pack and Ration, Cold Weather



\*  $p < 0.05$



Table 6. Mean Intakes of Macronutrients for the Meal, Ready-to-Eat VIII with Supplemental Pack and the Ration, Cold Weather for Days 2 to 8 Inclusive.

Nutrient	Unit	Group 1 MRE VIII +		Group 2 RCW	
		Mean	SD	Mean	SD
Energy	kcal	2863	1022	2974	966
Protein	g	118.8	39.1	98.3*	33.2
Carbohydrate	g	336.6	133.6	426.2*	149.9
Fat	g	115.7	44.6	102.6*	37.8

\*  $p < 0.05$

Table 7. Mean Intakes of Macronutrients for the Meal, Ready-to-Eat VIII with Supplemental Pack and the Ration, Cold Weather for Days 3 to 8 Inclusive.

Nutrient	Unit	Group 1 MRE VIII +		Group 2 RCW	
		Mean	SD	Mean	SD
Energy	kcal	2963	1001	2948	944
Protein	g	123.2	37.0	98.9*	34.1
Carbohydrate	g	347.8	132.2	421.6*	144.2
Fat	g	119.8	44.0	101.6*	37.6

\*  $p < 0.05$

### Supplemental Pack

The average daily intakes of nutrients obtained from the Supplemental Pack are presented in Table 8. Macronutrient intakes were also calculated for days two to eight inclusive and three to eight inclusive as shown in Table 9.

Table 8. Mean Nutrient Intakes Obtained Only from the Supplemental Pack.

Nutrient	Unit	Group 1 MRE VIII +	
		Mean	SD
Energy	kcal	538	332
Protein	gm	19.0	13.7
Carbohydrate	gm	67.6	48.1
Fat	gm	21.3	12.9
Vitamin A	mcg RE	7.3	13.0
Vitamin E	mg TE	2.5	1.6
Ascorbic Acid	mg	11.6	22.5
Thiamin	mg	0.3	0.2
Riboflavin	mg	0.2	0.1
Niacin	mg NE	4.5	3.8
Vitamin B <sub>6</sub>	mg	0.07	0.05
Folacin	mcg	21.9	14.0
Vitamin B <sub>12</sub>	mcg	0.4	0.6
Calcium	mg	73.2	63.7
Phosphorus	mg	223.2	136.3
Magnesium	mg	57.0	36.9
Iron	mg	3.9	4.2
Zinc	mg	2.6	2.5
Sodium	mg	750	655
Potassium	mg	361.0	241.9

Table 9. Mean Intakes of Macronutrients for the Supplemental Pack for Days 2 to 8 and 3 to 8 Inclusive.

Nutrient	Unit	Days 2 - 8		Days 3 - 8	
		Mean	SD	Mean	SD
Energy	kcal	544	322	536	324
Protein	g	18.6	13.5	18.0	12.9
Carbohydrate	g	69.3	48.5	69.0	47.9
Fat	g	21.3	12.8	20.9	12.3

#### Percentages of Energy Obtained from Protein, Carbohydrate and Fat

The percentages of energy supplied and actually obtained from protein, carbohydrate and fat for the MRE VIII, Supplemental Pack and RCW are given for the total period, days two to eight and three to eight, inclusive, in Tables 10, 11 and 12.

Table 10. Percentages of Energy Supplied and Consumed for the Meal, Ready-to-Eat Less the Supplemental Pack.

Nutrient	Supplied	Percentages of Energy Period of Consumption		
		Days 1-8	Days 2-8	Days 3-8
Energy (kcal)	(3864)	(2190)	(2319)	(2427)
Protein	14.9	17.3	17.3	17.3
Carbohydrate	49.1	46.1	46.1	46.0
Fat	36.0	36.6	36.6	36.7

Table 11. Percentages of Energy Supplied and Consumed for the Supplemental Pack.

Nutrient	Supplied	Percentages of Energy Period of Consumption		
		Days 1-8	Days 2-8	Days 3-8
Energy (kcal)	(740)	(538)	(544)	(536)
Protein	11.7	14.1	13.7	13.4
Carbohydrate	56.2	50.3	51.0	51.4
Fat	32.0	35.6	35.2	35.1

Percentages do not equal 100 due to rounding

Table 12. Percentages of Energy Supplied and Consumed for the Ration, Cold Weather.

Nutrient	Supplied	Percentages of Energy Period of Consumption		
		Days 1-8	Days 2-8	Days 3-8
Energy	(4568)	(2943)	(2974)	(2948)
Protein	10.5	13.2	13.2	13.4
Carbohydrate	58.1	57.2	57.3	57.2
Fat	31.4	31.1	31.0	31.0

Percentages do not equal 100 due to rounding

### **Nutritional Status**

Fasting blood samples were drawn by venipuncture prior to deployment and on the last day in the field. The results of the blood chemistry analysis are shown in Table 13. The values shown include the means  $\pm$  SD and the normal range for each test.

Abnormal values were not expected since the subjects were young, active soldiers. All values were within the accepted physiological range, but some significant differences over the course of the field exercises were found. Significant changes were noted in cholesterol, triglycerides, and proteins (albumin and globulin).

Table 13. A Comparison of Pre- and Post-Blood Values Together with Normal Ranges.

Test	Group 1 MRE VIII +		Group 2 RCW		Normal Range
	Pre	Post	Pre	Post	
Glucose, mg/dL	83.0 ± 11.9	79.0 ± 12.4	89.0 ± 9.3	77.0 ± 14.3*	70-105
BUN, mg/dL	14.0 ± 2.7	16.0 ± 2.1*	15.0 ± 3.0	15.0 ± 2.6	7-18
Creatinine, mg/dL	1.1 ± 0.1	1.2 ± 0.1	1.1 ± 0.1	1.2 ± 0.2	0.6-1.3
Sodium, mmol/L	139.0 ± 3.3	138.0 ± 2.1	140.0 ± 4.3	139.0 ± 1.7	135-145
Potassium, mmol/L	4.3 ± 0.4	4.3 ± 0.4	4.4 ± 0.4	4.2 ± 0.4	3.6-5.0
Chloride, mmol/L	102.0 ± 2.7	101.0 ± 1.9	103.0 ± 3.9	101.0 ± 1.6*	101-111
CO <sub>2</sub> , Serum, mmol/L	27.3 ± 1.6	28.1 ± 1.1*	28.0 ± 1.4	28.1 ± 1.5	21-31
Uric Acid, mg/dL	5.9 ± 1.0	5.9 ± 0.8	5.5 ± 0.7	6.1 ± 0.7*	2.6-7.2
Total Protein, g/dL	7.6 ± 0.5	7.5 ± 0.4	7.6 ± 0.4	7.3 ± 0.2*	6.7-8.2
Albumin, g/dL	4.4 ± 0.3	4.6 ± 0.3*	4.5 ± 0.2	4.6 ± 0.2	3.2-5.5
Calcium, mg/dL	9.9 ± 0.5	9.9 ± 0.3	10.0 ± 0.3	9.8 ± 0.4*	8.4-10.2
Phosphate, mg/dL	4.4 ± 0.7	3.9 ± 0.4*	4.1 ± 0.7	4.0 ± 0.5	2.5-4.6
Cholesterol, mg/dL	174.0 ± 42.0	165.0 ± 34.0*	181.0 ± 40.0	167.0 ± 36.0*	140-200
Triglycerides, mg/dL	113.0 ± 47.0	75.0 ± 44.0*	101.0 ± 39.0	67.0 ± 17.0*	35-160
HDL, mg/dL	48.0 ± 14.0	50.0 ± 15.7*	45.0 ± 12.1	49.0 ± 12.9*	30-70
LDL, mg/dL	104.0 ± 33.0	99.0 ± 24.0	116.0 ± 35.0	101.0 ± 30.0*	65-175
Bilirubin,Tot, mg/dL	0.8 ± 0.3	0.9 ± 0.3*	0.9 ± 0.2	0.9 ± 0.3	0.2-1.0
CK, IU/L	153.0 ± 83.0	364.0 ± 317.0*	281.0 ± 342.0	366.0 ± 218.0	22-269
LD, IU/L	149.0 ± 24.0	179.0 ± 30.0*	143.0 ± 23.0	182.0 ± 25.0*	91-180
AST, IU/L	25.0 ± 6.8	32.0 ± 10.3*	25.0 ± 9.2	32.0 ± 7.2*	10-42
ALT, IU/L	21.0 ± 11.6	22.0 ± 9.9	20.0 ± 9.6	21.0 ± 5.8	10-60
Akl Phosphatase,IU/L	79.0 ± 19.8	70.0 ± 19.7*	69.0 ± 23.0	76.0 ± 21.4*	42-121
GGT, IU/L	18.0 ± 8.2	16.0 ± 6.3*	18.0 ± 9.3	18.0 ± 7.9	7-64
Amylase, U/L	62.0 ± 22.4	69.0 ± 29.4*	70.0 ± 28.7	70.0 ± 31.1	25-125
Osmolality	277.0 ± 6.4	276.0 ± 4.0	280.0 ± 8.1	277.0 ± 3.4	
Anion Gap	14.5 ± 1.7	13.2 ± 1.5*	13.0 ± 1.3	13.7 ± 1.4*	
A/G Ratio	1.4 ± 0.2	1.6 ± 0.2*	1.5 ± 0.2	1.7 ± 0.2*	
BUN/Creatinine	13.4 ± 2.5	14.0 ± 1.5	13.6 ± 2.8	13.5 ± 2.0	

\* p < 0.05      Mean ± SD

## **RATION ACCEPTANCE**

### **Food Item Acceptability**

The acceptability of each food component was assessed using a 9-point hedonic scale where 1 corresponded to "dislike extremely", 5 corresponded to "neither like nor dislike", and 9 corresponded to "like extremely." Acceptability ratings of the food items found in the MRE VIII, Supplemental Pack and RCW are given in Tables 14, 15 and 16. In addition, the hedonic ratings of 'common' or 'similar' items found in both the MRE VIII and RCW are given in Table 17.

In general the acceptability ratings of the MRE VIII were high and with the exception of strawberries, all items were rated at least "like slightly" with the majority of items rated higher. Ratings for strawberries, because of the very small number of responses, can be regarded as anomalous. Although the hedonic ratings obtained from the final questionnaire are not reported here, they generally reflect the results obtained on a daily basis although in some cases are lower. For example, entrees in the MRE were well liked with the least favorite being chicken a la king, which was rated "like slightly" on a daily basis and "dislike moderately" in the final questionnaire.

The acceptability ratings of the Supplemental Pack were high with all items being rated at least "like moderately". When asked to rate the portion sizes in the final questionnaire, most soldiers thought that the components, especially the pouched bread, were not large enough. Over 70% of the group thought that it was extremely important to include the Supplemental Pack with the MRE confirming the validity of using the Pack in a cold environment.

Overall, the acceptability ratings of the individual components of the RCW were not as high as the MRE and the acceptability ratings for the fruit soups were below the neutral point. These latter ratings were lower still in the final questionnaire, being "disliked moderately" and 30% of the group considering that the fruit soups should be dropped from the ration.

In a comparison of the 'similar' items (Table 17), the MRE VIII components, with the exception of chicken a la king, scored higher marks for both the individual items and the food groups, entrees; desserts and candies; and beverages. These latter differences were significant.

The addition of water to the dehydrated food components is known to affect hedonic ratings. Subjects were therefore asked to indicate whether water was added to those components. Where possible, a comparison was made between the hedonic ratings of those components consumed with and without water. These results are given in Tables 18 and 19.

Table 14. Acceptability Ratings of the Meal, Ready-to-Eat VIII.

Product	n	Hedonic Mean	Rating SE
<b>Entrees</b>			
Ham Slice	126	7.87	.11
Spaghetti, Meat & Sauce	133	7.53	.12
Tuna with Noodles	104	7.32	.15
Pork with Rice in BBQ Sauce	118	7.25	.17
Beef Stew	107	7.13	.16
Omelet with Ham	118	7.10	.15
Escalloped Potatoes with Ham	100	7.10	.15
Chicken & Rice	125	7.00	.15
Corned Beef Hash	120	6.94	.15
Meatballs, Rice & Sauce	105	6.75	.22
Chicken Stew	102	6.50	.18
Chicken a la King	83	6.01	.22
<b>Starches</b>			
Potato au Gratin	158	7.04	.17
Crackers	439	6.93	.08
<b>Spreads</b>			
Cheese Spread	286	7.56	.09
Jelly	214	7.54	.11
Peanut Butter	198	7.37	.12
<b>Fruits</b>			
Apple Sauce	180	7.79	.14
Fruit Mix	90	6.76	.23
Peaches	56	6.71	.34
Pears	46	6.22	.40
Strawberries	2	5.00	4.00
<b>Desserts</b>			
Chocolate Nut Cake	114	7.96	.12
Chocolate Covered Cookie Bar	169	7.74	.10
Oatmeal Cookie Bar	185	7.54	.16
Maple Nut Cake	63	6.83	.23
Cherry Nut Cake	70	6.83	.20
Chocolate Covered Brownie	114	6.65	.19
<b>Beverages</b>			
Beverage Base Powder	380	7.61	.11
Cocoa Powder	170	7.32	.19
Sugar	91	7.09	.29
Coffee	51	7.00	.36
Non Dairy Creamer	64	6.94	.36
<b>Candies</b>			
Tootsie Roll	2	8.50	.50
M & M s	253	8.50	.06
Caramel	143	8.16	.11
Gum	211	7.94	.10
Gnarms	263	7.90	.09
<b>Others</b>			
Salt	62	7.66	.21
Tabasco Sauce	229	7.60	.13



Table 15. Acceptability Ratings of the Supplemental Pack.

Product	n	Hedonic Rating	
		Mean	SE
M & M s	171	8.50	.08
Pouched Bread	420	8.17	.08
Charms	123	8.03	.14
Beverage Base Powder	180	7.98	.14
Beef Jerky	208	7.87	.10
Granola Bar	151	7.66	.13
Raisin Nut Trail Mix	159	7.28	.18

Table 16. Acceptability Ratings of the Ration, Cold Weather.

Product	n	Hedonic Mean	Rating SE
<b>Breakfasts</b>			
Oatmeal (Apple & Cinnamon)	221	7.19	.18
Oatmeal (Strawberry)	223	7.10	.14
Oatmeal (Maple & Brown Sugar)	77	6.34	.30
<b>Entrees</b>			
Vermicelli with Meat Sauce	65	6.98	.22
Beef & Vegetable Stew	105	6.75	.19
Escalloped Potatoes and Pork	134	6.67	.17
Chicken a la King	11	6.64	.64
Chicken and Rice	180	6.61	.17
Chicken Stew	105	6.46	.23
<b>Candies</b>			
Chewing Gum	293	7.62	.11
Fig Bar	318	7.32	.13
Blueberry Bar	186	7.19	.16
Oatmeal Cookie	418	6.98	.11
Chocolate Bar	289	6.93	.13
Chocolate Covered Cookie	225	6.70	.15
Granola Bar	383	6.60	.12
Nut Raisin Mix	315	6.58	.13
Brownie	191	5.98	.18
<b>Beverages</b>			
Cocoa	338	7.27	.13
Cider	242	6.88	.19
Tea Mix Lemon Flavor	246	6.86	.18
Orange Beverage	251	6.67	.19
Chicken Noodle Soup	259	6.59	.17
Coffee	122	6.55	.28
Non Dairy Creamer	70	6.20	.39
Sugar	85	6.12	.34
Raspberry Fruit Soup	55	4.96	.42
Strawberry Fruit Soup	108	4.72	.29

Table 17. A Comparison of the Acceptability Ratings of 'Similar' Items in the Meal, Ready-to-Eat VIII and the Ration, Cold Weather.

Meal, Ready-to-Eat	Hedonic Rating		Ration, Cold Weather	Hedonic Rating	
	Mean	SE		Mean	SE
<b>Entrees</b>					
Spaghetti, Meat & Sauce	7.53	.12	Vermicelli & Meat Sauce	6.98*	.22
Beef Stew	7.13	.16	Beef & Vegetable Stew	6.75	.19
Escalloped Potatoes/w Ham	7.10	.15	Escalloped Potatoes and Pork	6.67	.17
Chicken & Rice	7.00	.15	Chicken & Rice	6.61	.17
Chicken Stew	6.50	.18	Chicken Stew	6.46	.23
Chicken a la King	<u>6.01</u>	<u>.22</u>	Chicken a la King	<u>6.64</u>	<u>.64</u>
<b>Total Entrees</b>	6.94	.07		6.66*	.09
<b>Desserts and Candies</b>					
Gum	7.94	.10	Chewing Gum	7.62*	.11
Chocolate Covered Cookie	7.74	.10	Chocolate Covered Cookie	6.70*	.15
Oatmeal Cookie Bar	<u>7.54</u>	<u>.16</u>	Oatmeal Cookie Bar	<u>6.98*</u>	<u>.11</u>
<b>Total Desserts and Candies</b>	7.75	.07		7.11*	.07
<b>Beverages</b>					
Beverage Base Powder	7.61	.11	Orange Beverage	6.67*	.19
Cocoa Powder	7.32	.19	Cocoa	7.27	.13
Coffee	7.00	.36	Coffee	6.55	.28
Sugar	7.09	.29	Sugar	6.12*	.34
Non Dairy Creamer	<u>6.94</u>	<u>.36</u>	Non Dairy Creamer	<u>6.20</u>	<u>.39</u>
<b>Total Beverages</b>	7.38	.09		6.79*	.10

\* p < 0.05

Table 18. A Comparison of the Acceptability Ratings of Food Items in the Meal, Ready-to-Eat Consumed With and Without Water.

Product	Without Water			With Water		
	n	Mean	SE	n	Mean	SE
Fruit Mix	66	6.73	.24	24	6.83	.54
Peaches	44	6.30	.40	12	8.25*	.31
Pears	26	6.12	.48	20	6.35	.70
Bev. Base Powder	137	7.18	.21	243	7.85*	.13
Cocoa	47	6.60	.39	123	7.59*	.21
Coffee	8	6.38	.99	43	7.12	.39

\*  $p < 0.05$

Table 19. A Comparison of the Acceptability Ratings of Food Items in the Ration, Cold Weather Consumed With and Without Water.

Product	Without Water			With Water		
	n	Mean	SE	n	Mean	SE
Oatmeal (Apple)	11	5.18	1.06	210	7.30*	.11
Oatmeal (Maple)	7	2.57	1.33	70	6.71*	.27
Oatmeal (Strawberry)	9	4.56	1.32	214	7.21*	.14
Chicken Stew	10	4.30	.93	95	6.68*	.22
Beef & Veg Stew	5	5.80	1.02	100	6.80	.19
Escalloped Potatoes	7	6.71	.57	127	6.67	.18
Vermicelli & M/Sauce	7	6.43	.30	58	7.05	.24
Chicken & Rice	6	6.67	.49	174	6.60	.18
Chicken N/Soup	32	5.44	.54	227	6.76*	.17
Strawberry Fruit Soup	25	3.48	.58	83	5.10*	.32
Raspberry Fruit Soup	10	2.60	.82	45	5.49*	.45
Cocoa	36	6.69	.49	302	7.34	.14
Coffee	16	6.69	.78	106	6.53	.30
Tea Mix	24	7.13	.57	222	6.83	.19
Orange Beverage	36	6.17	.52	215	6.75	.20
Cider	27	6.52	.57	215	6.92	.20

\*  $p < 0.05$

## **Human Factors**

A number of questions included in the final questionnaire were designed to elicit soldiers' opinions and identify particular problems experienced when using these rations. The results are summarized in Tables 20.

### **Overall Acceptability, Amount of Food, Hunger, Variety and Ease or Difficulty of Use**

The overall acceptability of the rations was rated on a 9-point scale, "extremely unacceptable" to "extremely acceptable" and soldiers rated the MRE significantly higher than the RCW. Soldiers rated the MRE significantly more acceptable than the RCW. This takes into account several other conditions which may affect overall acceptability and are elucidated below.

The amount of food provided in both rations was considered to be insufficient when rated on a 7-point scale ranging from "much too small" to "much too large". The MRE group would like significantly more food added to the ration than the RCW group. The ratings of individual food groups indicate that soldiers consuming the MRE would like a little more of everything. The soldiers consuming the RCW, with the exception of fruit soups which were unpopular, would like a little more of everything and much more of the entrees and chicken noodle soup.

There were no differences between the groups in their ratings of hunger on a 6-point scale ranging from "never hungry" to "always hungry". The mean rating was between "sometime" to "fairly often" which is seen as a normal response. It is interesting that the RCW group should report a greater intensity of hunger but the MRE group consider that more food is required, particularly in view of the amounts of food that were unconsumed.

Overall, both groups rated the amount of variety in each ration, on a 4-point scale "variety is fine as is" to "need much more variety", as needing "somewhat more variety". Individually, the MRE and RCW food groups were rated similar corresponding to "need somewhat more variety". Scores between the groups were not significantly different.

When asked to rate the ease or difficulty of use of the rations on a 9-point scale, "extremely difficult" to "extremely easy", the MRE was rated significantly easier than the RCW. The mean MRE rating corresponded to "moderately easy" while the RCW rating corresponded to "slightly easy". This was probably an effect of the RCW requiring water to prepare.

Table 20. A Comparison of the Overall Acceptability, Amount in the Ration, Variety and Ease of Use of the Meal, Ready-to-Eat and the Ration, Cold Weather.

	Group 1 MRE VIII + Mean SE		Group 2 RCW Mean SE	
Overall Acceptability of the Ration	6.78	.17	5.01*	.27
Amount of Food in Ration	3.04	.09	3.40*	.08
How Often Hungry	3.28	.14	3.63	.12
Variety of Food in Ration	2.30	.10	2.31	.09
Ease or Difficulty of Use	6.89	.18	5.96*	.23

\*  $p < 0.05$

## HEATING METHODS

Several heating methods were reported as being used. A few soldiers had access to either a canteen cup stand with heat tabs, an Optimus III hiker or ranger stove, mounted vehicle heater or squad stove, but over 90% of both groups reported using the Yukon Stove as their primary source for heating food and water. For those who reported using more than one heating device to heat different parts of the ration, the Yukon Stove was identified as being the best method. There were no significant differences between the groups of the temperatures of items normally eaten warm. The mean rating for entrees and hot beverages corresponded to "warm" on a 7-point scale with 1 corresponding to "very cold", 4 to neutral and 7 to "very hot".

## FLUID INTAKE

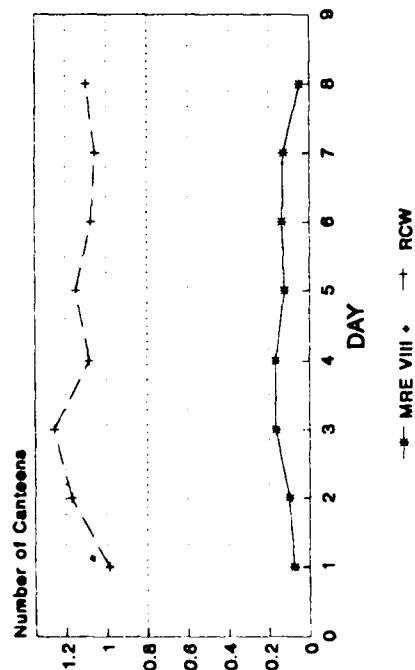
The data for water intake (Figures 4, 5, 6 and 7) were obtained from the 24-hour Dietary logs and verified daily by interview. The water intake is divided into the water mixed with food (Figure 4), water mixed with beverage mixes (Figure 5), water consumed as water (Figure 6) and the total water (Figure 7). Each figure shows the comparison between the two groups. The beverage water was significantly lower for the MRE VIII + group on the first two days and this contributed to their low water intake on those days. The RCW group consumed a third of their water with the meal since the meal requires hydration. The biggest difference in the two groups is in the amount of water consumed as water in days 3 through 8 by the MRE VIII + group. The mean water intake for the study was  $3.4 \pm 2.2$  L/day for the MRE VIII + group and  $3.7 \pm 1.6$  L/day for the RCW group.

## HYDRATION STATUS

The state of hydration was assessed on a daily basis by measurement of urinary specific gravity (SG) on a first void urine sample. The data are presented in Figure 8. A normal range for SG for an overnight urine in a well hydrated individual is 1.015 to 1.022 with values over 1.030 indicating hypohydration<sup>14</sup>. All mean values were within the normal range, but the initial values of the MRE VIII + group were significantly higher than the RCW group. The mean value across the duration of the study was  $1.020 \pm 0.007$  for the MRE VIII + group and  $1.021 \pm 0.007$  for RCW group.

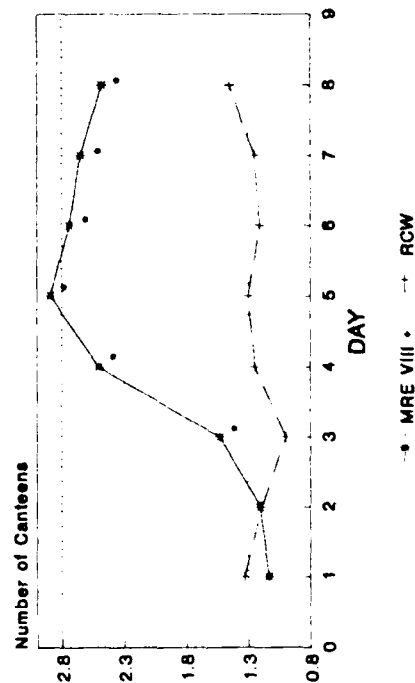
Results of the pre- and post-measurements of hematocrit and hemoglobin are shown in Table 22. The hematocrit levels were lower than previous studies but still within the normal range.

Figure 4. Mean Daily Water Consumption Mixed With Food



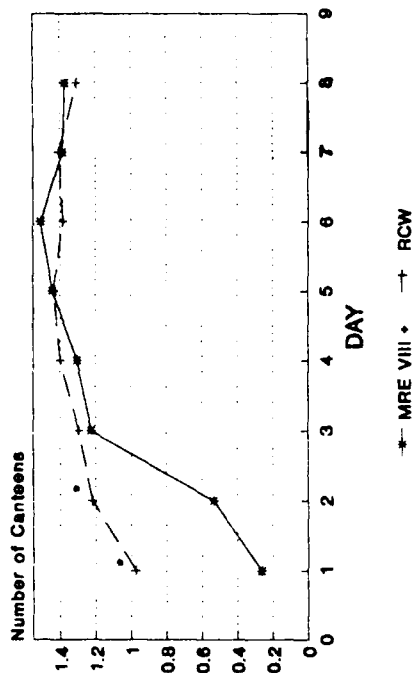
• All values are significant,  $p < 0.05$

Figure 6. Mean Daily Water Intake Consumed as Plain Water



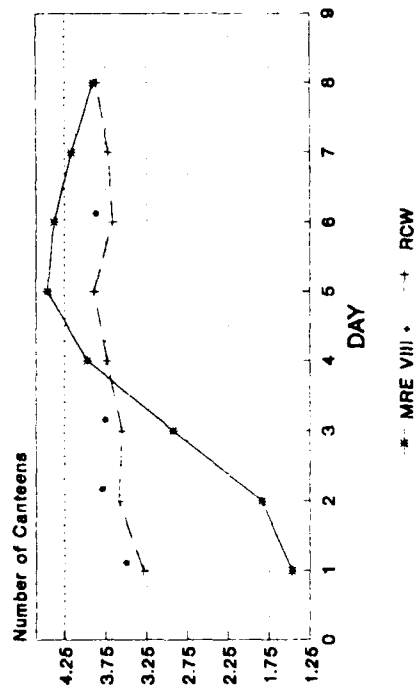
•  $p < 0.05$

Figure 5. Mean Daily Water Intake Consumed as Beverages



•  $p < 0.05$

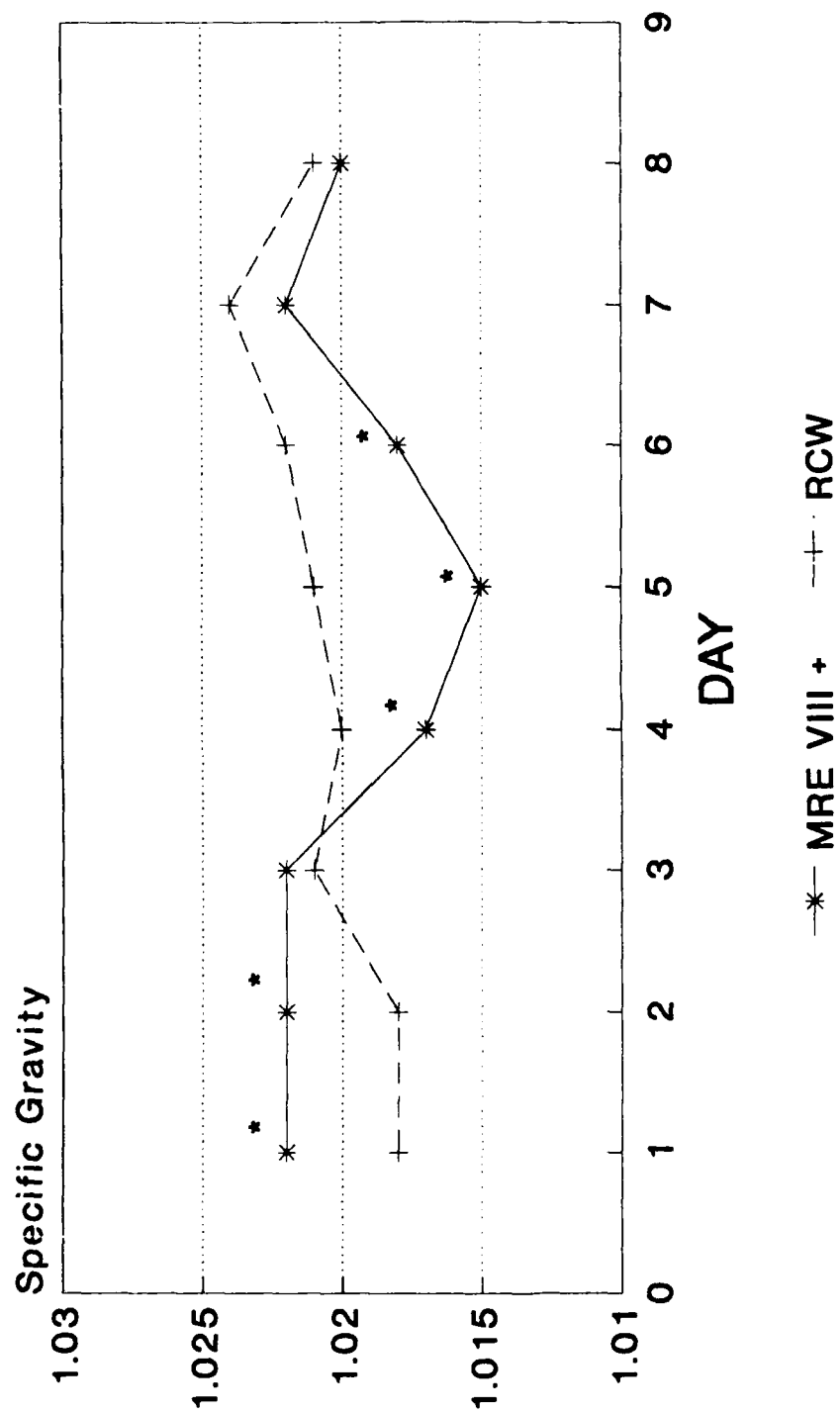
Figure 7. Mean Daily Water Consumption From All Sources



•  $p < 0.05$



Figure 8. Mean Daily Urine Specific Gravity



\*  $p < 0.05$

Table 21. A Comparison of Pre- and Post-Hematocrit and Hemoglobin Values.

	Group 1 MRE VIII +		Group 2 RCW	
	Pre	Post	Pre	Post
Hematocrit	40.9 $\pm$ 5.0	38.4 $\pm$ 2.4*	38.5 $\pm$ 3.1	37.1 $\pm$ 3.0
Hemoglobin	16.4 $\pm$ 1.0	15.9 $\pm$ 1.1*	15.6 $\pm$ 1.3	15.4 $\pm$ 0.8

\*  $p < 0.05$

Mean  $\pm$  SD

### OBTAINING WATER AND THIRST

Ratings for difficulty and frequency in obtaining water and reported feelings of thirst are given in Table 23. The RCW group found it significantly harder to obtain water (mean ratings between "neutral" and "slightly difficult") than the MRE VIII + group (mean ratings "slightly easy"). Although thirst is not always a good indicator of dehydration, the RCW group rated themselves, on a 6-point scale with 1 corresponding to "never" and 6 corresponding to "always", as being thirsty "fairly often" while the MRE was "sometimes thirsty". These differences were significant. However, when asked about being able to obtain enough water to prepare dehydrated foods on a 6-point scale with 1 corresponding to "never" and 6 corresponding to "always", both group means corresponded to "fairly often".

Table 22. A Comparison Between the Meal, Ready-to-Eat and the Ration, Cold Weather in the Difficulty and How Often Water was Obtained and Reported Feelings of Thirst.

	Group 1		Group 2	
	MRE VIII +		RCW	
	Mean	SE	Mean	SE
Difficulty in Obtaining Water	4.59	.23	5.34*	.24
How Often Enough Water Obtained	4.07	.13	3.84	.11
Reported Feelings of Thirst	3.51	.13	4.08*	.12

\*  $p < 0.05$

## DISCUSSION

### NUTRIENT INTAKE

#### Macronutrients

Ensuring soldiers consume adequate intakes of nutrients, particularly energy, has always provided a major challenge when eating operational rations. It is estimated from body weight loss during the period of this study that there was a daily energy deficit of 1225 kcal in the MRE VIII + group and 1269 kcal in the RCW group. This gives average daily energy expenditures of 3954 kcal and 4212 kcal in the MRE VIII + and RCW groups, respectively. The MRDA is for 4500 kcal in a cold environment and the estimated energy expenditures were close to this level<sup>11</sup>. However, total food intake for the period was 61% of the recommendation in the MRE VIII + group and 65% in the RCW group. Although more soldiers (18.5%) in the MRE VIII + group were trying to lose weight and more soldiers (20.3%) in the RCW group were trying to gain weight, it is not thought that this had a major impact on the overall mean food intakes.

Energy intake of the MRE VIII + group for days three to eight was 2963 kcal, considerably less than last year's study<sup>9</sup> when intake for the similar group was 3518 kcal during the middle seven days of the study. This was probably due to the differences in the field training exercises. Last year's exercise was a fast moving attack/defensive exercise whereas this year's exercise was characterized as a static defensive exercise with comparatively little movement. Energy expenditure for the group in last year's exercise, calculated from food consumed and body weight loss, was 4603 kcal and compares to 3998 kcal for the similar group this year. It should also be noted from last year's study that the group consuming 3.5 MRE VIII had an energy intake of 2769 kcal for the middle 7 days of the study and an expenditure, again calculated from body weight loss, of 4027 kcal, similar to the results of the present study.

The daily energy intakes for the MRE VIII + group on days one and two are considered to be extremely low; and low on day one for the RCW group. This phenomenon has been seen on previous studies<sup>5</sup> and can partly be explained by the time of day that soldiers deploy, the move to the exercise area, the initial

setting-up phase and a general preoccupation with the tactical scenario. All of these activities tend to assume the highest priority to the detriment of food (and water) consumption. In the case of this exercise, deployment of the main party was after breakfast for some groups and after lunch for the majority. The exercise area was at least 3 hours drive, by convoy, from the post. In addition, despite thorough briefings on how the 24-hour Dietary Logs should be completed, there is an initial lack of experience and may have been some misunderstanding during the first day or two of data collection which could result in some under-reporting of food consumed. Food consumption, particularly for the entrees, took place inside the tents with no specific meal-times, food being consumed throughout the day. The MRE VIII + group tended towards 2 to 3 meal occasions per day and the RCW group 2 meal occasions per day. Just as water discipline is used to ensure adequate fluid consumption, the introduction of definite feeding or meal times (as the tactical scenario permits) could assist and should be considered as a method of increasing total food intake.

The MRDAs for energy in a cold environment are increased from 3600 kcal to 4500 kcal per day although they do not specify which macronutrients should be increased to make up the shortfall. In a review of the literature, Askew<sup>15</sup> summarizes the data gathered from general findings rather than experimental evidence and considers that the 'ideal diet' should be composed of 100 g protein, 250 g fat and 500 g carbohydrate (4650 kcal). The MRE, if consumed at this level of calories, would supply approximately 166 g protein, 181 g fat and 579 g of carbohydrate.

The MRDA for protein is similar to the 'ideal diet', however, if the MRE was consumed to caloric adequacy, protein intake would be rather high. Protein consumed in excess of requirements is oxidized and the nitrogen, in the form of urea, is excreted. In doing so additional water (obligatory water) is required and for this reason it is generally agreed that the intake of protein should be limited, particularly when water supplies may be restricted. Increasing fat to approach the 'ideal diet' is, in view of current diet/health related issues, unlikely to be acceptable and the increased energy required to balance the reduced protein and fat will probably need to be found from carbohydrate. This would be difficult to achieve with the current nutrient balance found in the MRE VIII +.

The percentages of energy obtained from protein (Tables 10 and 11) supplied by the MRE VIII and Supplemental Pack exceed the 'ideal diet'. Protein supplied in the RCW (Table 12) is considerably closer. It is clear that although restricting the intake of protein may be advantageous, soldiers given a fairly mixed diet chose, in this exercise, to consume high quantities of protein. This is not necessarily unacceptable so long as adequate quantities of water are available.

### **Micronutrients**

The intakes of riboflavin, folacin, vitamin B<sub>12</sub>, and zinc were below the minimum MRDA levels for both groups and, in addition, below the minimum levels for magnesium in the MRE VIII + group and calcium in the RCW group. The primary reason why folacin and zinc failed to reach the nutritional standards was that insufficient quantities are currently contained in the ration. Consideration may therefore need to be given to further fortification of these and the other micronutrients in the food items identified as being popular and well consumed. Similarly, riboflavin folacin, vitamin B<sub>12</sub>, iron and zinc are not contained in adequate quantities in the RCW to meet the nutritional standards. Consideration may also be needed on the further fortification of these micronutrients.

Intakes of sodium are below the MRDA upper level<sup>11</sup>. As water is required to excrete excess salt, a low consumption of salt can be most advantageous where water supplies may be limited and low consumption of salt is therefore something to be encouraged. Both groups were able to maintain normal levels of blood sodium.

### **NUTRITIONAL STATUS - BLOOD CHEMISTRIES**

Serum electrolytes are carefully controlled by the body to maintain the osmotic balance which controls water distribution in the body spaces. Sodium is the most controlled of the positive ions and its concentration will be maintained even when intake is reduced. In this exercise, the intake of sodium was reduced for the RCW group (75% of recommended minimum level), but the mechanism for maintenance of sodium levels (substitution of potassium excretion) did not come into play because of the short duration of the study.

Serum chloride is the major negative ion and has its chief function in controlling the water distribution in the extracellular space and control of the cation-anion balance. There was a decrease in the levels in both groups, with the RCW group having the greatest decrease. This decrease was probably related to the decreased intake of salt.

Changes in total proteins, and the albumin to globulin ratio can be used as indicators of body protein status. Protein consumption was above the recommended level for the MRE group, but slightly below for the RCW group. The total protein decreased for the RCW group reflecting this decrease in intake. Another indicator of protein status is the increased breakdown when intake is insufficient, which is reflected in an elevated BUN which does not show up in the test panel. For the short duration of this field exercise, protein was not a problem.

Cholesterol and triglycerides tend to be high in American diets, but all values were within accepted ranges. Both values tend to drop during field operations and this was true in this exercise. Both groups consumed less than the 160 g of fat recommended. There was an increase in the HDL fraction and a decrease in the LDL fraction of cholesterol. These changes have been shown to be caused by changes in work levels, cold exposure, and weight loss<sup>16,17,18</sup> and are generally regarded as being beneficial to cardiovascular health.

The blood chemistries displayed no group differences in the pre-exercise measurements, but differences were shown pre- to post- evaluation exercise which probably reflects the influence of the two different types of ration systems. These differences were relatively small and not of clinical significance.

## **RATION ACCEPTANCE**

### **Food Item Acceptability**

In general the MRE was more favorably received than the RCW with the Supplemental Pack being extremely popular. No discernable pattern could be found with either rations or individual food components indicating that acceptability increased or declined over time. This was probably due, in part, to the comparatively short length of the study and the fact, for example, that

entrees in the RCW may only have been tasted once. There was, however, a noticeable but not quantified trend of certain items being returned in larger quantities towards the latter part of the study. The items included breakfast oatmeal, chocolate covered cookie, cocoa and lemon tea mix in the RCW and maple and cherry nut cake, crackers and chocolate covered brownie in the MRE.

In the final questionnaire many soldiers asked for some of the MRE components to be added to the RCW, for example, spaghetti, peanut butter, crackers and salt while others asked for more substantial meals. It became apparent during the unstructured interviews conducted when soldiers were met daily that the high carbohydrate elements of this ration were primarily sweet items with few savoury items being present. Ten percent reported in the final questionnaire that they felt lethargic as a result of this sugar while others reported experiencing "highs and lows". It may therefore be advantageous, while retaining similar levels of carbohydrate, to increase the proportion of complex carbohydrates (savoury items) at the expense of items high in sucrose (sweet items).

Similarly, reducing the salt content in an effort to limit the obligatory water has led to a number of adverse comments. This was particularly noticeable with the nut raisin mix. A non-sodium flavoring to this and similar products may assist and alleviate this type of criticism.

A further method of quantifying food item acceptability is to estimate the quantities (i.e., percentages) of food eaten in relation to the amounts issued. The feeding regimen adopted for this study called for 3 MRE VIIIs and 1 Supplemental Pack per man/day to be issued to one group and 1 RCW per man/day to be issued to a second group. No record was kept of what menus were actually issued. It is assumed though, for the purposes of these calculations, that the menus were packed in accordance with the specifications and that no substitutions were made.

The estimated percentages of food components consumed from the MRE VIII are shown in Table 24. Within the caveat of menus being packed in accordance with the specifications, a pattern emerges of what food items are popular and are therefore eaten in greater quantities. Clearly those food items



where consumption is less than half need to be re-evaluated and their continued retention or recipe reformulation considered.

Unfortunately, similar calculations could not be made for the RCW and Supplemental Packs. It became apparent when the rations were issued daily that the menu varieties were very unevenly distributed and this is supported when the number of responses for the acceptability ratings (Table 16) are viewed; chicken a la king, for example, is poorly represented.

Against a background of under consumption it is interesting to note that there were no significant differences when soldiers were asked to rate their hunger (Table 20). However, 43% of the MRE VIII + group felt that they always ate enough while in the RCW group, 24.3% always felt they ate enough. The main reasons for not eating enough in the MRE VIII + group were disliking the food, not enough food, got bored with the food and just didn't feel hungry. In the RCW group the reasons receiving the highest responses were disliking the food, not enough food, insufficient water to prepare the ration and got bored with the food. For those who identified more than one reason for not eating enough food, a lack of water was the most frequent with 47.3% in the RCW group and 8.6% in the MRE group giving this reason.

A comparison of the hedonic ratings for components eaten with and without water is very subjective as in the main they are designed to be consumed when fully hydrated. This may, however, be an important indicator for when supplies of water are limited. As would be expected, all items in the MRE and all but two in the RCW were rated higher when water was added. Surprisingly, there were no significant differences in some items that would normally only be consumed with water, for example, cocoa, cider. This can in part be explained by the imbalance in the number of responses and by the fact that these items were added to other food, mainly oatmeal, and not classified by the soldiers as having water added to them.

Table 23. Estimated Percentages of Food Components Consumed from the Meal, Ready-to-Eat VIII.

Product	Estimated Percentages of Food Consumed
<b>Entrees</b>	
Spaghetti, Meat & Sauce	90
Ham Slice	88
Corned Beef Hash	84
Pork with Rice in BBQ Sauce	83
Chicken & Rice	82
Omelet with Ham	76
Beef Stew	74
Tuna with Noodles	71
Meatballs, Rice & Sauce	69
Escaloped Potatoes with Ham	67
Chicken Stew	65
Chicken a la King	54
<b>Starches</b>	
Potato au Gratin	58
Crackers	41
<b>Spreads</b>	
Cheese Spread	64
Jelly	47
Peanut Butter	40
<b>Fruits</b>	
Fruit Mix	70
Apple Sauce	69
Pears	34
Peaches	22
<b>Desserts</b>	
Chocolate Nut Cake	76
Oatmeal Cookie Bar	70
Chocolate Covered Cookie Bar	66
Cherry Nut Cake	53
Chocolate Covered Brownie	44
Maple Nut Cake	24

### Human Factors

Although there was a high incidence of the MRE wetpack items freezing, there were no reported cases of this causing the pouch to be damaged or rendering the contents unfit for consumption. This is in line with last year's findings where damage only really became apparent once the rations were taken back to post and checked<sup>10</sup>.

As expected, there were no problems with the RCW freezing. A number of packaging problems were experienced with the external cardboard containers of the RCW which when frozen easily fell apart. There was an inequitable distribution of menus within each case and, for example, the chicken a la king was poorly represented. Where the two pouches are held together by an elastic band, there were at least 4 occasions when two breakfast components had been bound together.

## FLUID INTAKE

The 6th ID (L) has an operational standard that each soldier should consume at least 4 liters of water per day. The source of this potable water was from a water buffalo which was filled from an approved supply point. Delivery is made in 5 gallon cans (metal with ceramic liners or plastic). Snow in a very cold climate is very dry requiring approximately 10 volumes of snow to produce 1 volume of water and it requires purification, so the use of snow as a source of water is minimized. On the day of deployment when supplies tend to be confused, the troops reported that 6% of the water was obtained by melting snow. On each subsequent day the incidence of use of melted snow was less than 2%. Water transported in 5 gallon cans in unheated vehicles is usually delivered frozen and can require up to 8 hours to thaw when placed beside a Yukon stove. In this exercise, water was readily available, since troop movement was minimized. This is reflected in the uniformity of total water intake in the RCW group and in the MRE group after the initial days.

It is evident from the data presented in Figure 5, that the amount of water used for making beverages is very similar for the two rations. The MRE does not require water for mixing with the major food components, while the RCW does. If the troops eating the MRE are going to achieve the 4 liters per day intake, the water will have to come from an increased level of consumption of plain water. This happened in this study and is shown in Figure 6. It is unclear if this was a conscious effort on the part of the troops or upon the command structure to enforce better water discipline. There were a few cases of individuals not consuming sufficient water and this resulted in elevated urinary specific gravities. When these cases were brought to the attention of the Company Commander, they were promptly resolved through 'forced drinking'.

It is evident from the data in this exercise that it is possible to maintain hydration in the field when using either type of ration. It was easier to ensure hydration because we were monitoring and reporting when necessary. It is necessary to enforce some type of water discipline, and this becomes more difficult when troop movement is involved and supply becomes more difficult.

## **HYDRATION STATUS**

Hypohydration causes drowsiness, impatience, discomfort, weariness, irritability, reduced work efficiency, reduced cognitive ability, reduced resistance to cold exposure, and reduced caloric intake<sup>19,20,21</sup>. This group of symptoms can have serious effects on the combat efficiency of a unit and if not corrected, can lead to a loss of unit efficiency. The method of prevention of these symptoms is to ensure adequate water intake for all troops by allowing time to obtain water and food and having adequate supplies.

The daily measurement of urinary specific gravity allows a closer monitoring of the subjects and makes interventions more timely. In this exercise, the troops maintained their hydration levels very well (Figure 8), and it was in large part due to a steady supply of water. The operational plan did not involve much movement so supply lines were operational and the troops had sufficient supplies and time to ensure hydration.

In Figure 8, the means for the two groups were significantly different on most days, but the mean values were always within the accepted range. There was a significant decrease in the hematocrit and hemoglobin levels (Table 22) for the MRE group from the pre- to the post-level which would indicate a decrease in the circulating fluid volume and a better hydration state at the end of the exercise. If this happened, it was because of the increased level of water intake by that group toward the end of the exercise.

## SUMMARY

The Meal, Ready-to-Eat (MRE) and the Ration, Cold Weather (Marine Corps Arctic Ration) are currently the two individual combat rations available for general use in a cold environment. In the field studies conducted to date, the RCW, with few exceptions, has proven to be equal or superior to the MRE in terms of acceptability, convenience and operational characteristics but neither has demonstrated any clear advantage in meeting energy requirements, preventing body weight loss or maintaining hydration status. In a field study conducted in Alaska in 1989, it was shown that, by adding to the MRE, a Supplemental Pack containing popular food items most commonly taken into the field by soldiers, energy intake could be increased from 2830 kcal to 3553 kcal. It was concluded that in a cold environment, three MREs and one Supplemental Pack would be a viable alternative to the normal issue of four MREs.

The objectives of this study were to compare consumption of the Meal, Ready-to-Eat VIII with a Supplemental Pack (MRE VIII +) against consumption of the Ration, Cold Weather (RCW) and to assess whether either, or both, provides the nutritional support required by military personnel working in an arctic environment.

The study was conducted concurrently using two Companies of Light Infantry soldiers, each approximately 80 strong, who were exercising in Fort Greely, Alaska, in temperatures with a minimum of -55°F. Prior to deployment, initial body weights, heights were measured and a urine sample taken from all subjects. On a smaller subsample, activity monitors were attached and a blood sample taken. Once in the field additional or privately purchased food was not permitted and one Company was fed three MRE VIII and one Supplemental Pack (4604 kcal) daily and the other Company, one RCW (4568 kcal) daily. Subjects recorded their food and water intake, and food acceptability in a 24-hour Dietary Log. These were verified daily when subjects were met at which time a urine sample was also collected. Post-measurements, taken on the last morning of the study, included body weights and a urine sample from all subjects and a blood sample from those who had provided a sample at the beginning of the study. A questionnaire was also administered to ascertain subjects' opinions on various aspects of the ration.

Activity levels of both groups over the eight days of the study were similar. Mean daily energy intakes were significantly different: 2729 kcal for the MRE VIII + group and 2943 kcal for the RCW group. These failed to meet the MRDAs of 4500 kcal and also to maintain body weight. Mean body weight losses were significant being 2.8 lb (1.6%) for the MRE VIII + group and 2.9 lb (1.7 lb) for the RCW group. Part of the low nutrient intake can be attributed to the very low food consumption on days one and two. When these days are excluded, mean intakes are no longer significantly different being 2963 kcal for the MRE VIII + group and 2948 kcal for the RCW group.

The energy intake of MRE VIII + group (2963 kcal) was considerably less than in last year's study when intake for the similar group was 3518 kcal. This was probably due to differences in energy expenditure which calculated from food intake and weight loss was estimated as 3998 kcal for this year's study and 4603 kcal for last year's study. Nutrient intake for all but four micronutrients for both groups and in addition, for calcium in the RCW group met the MRDAs.

Blood values were within the accepted physiological ranges although some significant differences were found over the course of the study. These differences probably reflect the two rations and are not considered to be clinically significant.

In general, the MRE was more favorably received than the RCW, with the Supplemental Pack being extremely popular. No pattern could be seen indicating that acceptance changed over time, partly because of the comparatively short length of the study.

Fluid intake was generally good and the mean daily water intake was 3.4 L/day for the MRE VIII + group and 3.7 L/day for the RCW group. Mean urine specific gravities were 1.020 for the MRE VIII + group and 1.021 for the RCW group.

## **CONCLUSIONS**

During this field study, run concurrently with a defensive exercise, neither ration proved to be superior in preventing body weight loss, increasing nutrient intake to meet the MRDA or maintaining hydration status. The MRE was, however, slightly more acceptable.

Both rations have advantages and disadvantages in terms of their physical characteristics and a decision on which ration to adopt must therefore depend on the logistical and tactical scenario.

## **RECOMMENDATIONS**

1. Replace or reformulate food components in both rations identified as being unpopular.
2. Ensure that: the distribution of menus in each box of rations is either equitable or based on popularity; breakfast and entree packages are correctly matched and the RCW boxes are securely held together.
3. Replace some of the items in the RCW, high in sucrose (sweet items) with complex carbohydrates (savory items).
4. Add a sodium replacement to selected products such as nut raisin mix in the RCW.
5. Selectively fortify popular, well consumed foods with those micronutrients identified as not reaching the MRDA.

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## **APPENDIX A**

### **VOLUNTEER AGREEMENT AFFIDAVIT**

## VOLUNTEER AGREEMENT AFFIDAVIT

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

### PRIVACY ACT OF 1974

**Authority:** 10 USC 3013, 44 USC 3101, and 10 USC 1071-1087

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

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

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

### PART A(1) - VOLUNTEER AFFIDAVIT

#### Volunteer Subjects in Approved Department of the Army Research Studies

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

I, \_\_\_\_\_, SSN \_\_\_\_\_,  
having full capacity to consent and having attained my \_\_\_\_\_ birthday, do hereby volunteer/give consent as legal  
representative for \_\_\_\_\_ to participate in A Comparison  
of the Meal, Ready-to-Eat with Supplemental Pack and the Ration, Cold Weather  
Consumed in an Arctic Environment.  
(Research study)  
under the direction of Lt Col John S.A. Edwards  
conducted at Fort Greely, Alaska.  
(Name of Institution)

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

Contact telephone(s): AV 256 5309 Commercial (508) 651 5309

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

Office of Chief Counsel

at US Army Natick Research, Development and Engineering Center (508)651-4322  
(Name, Address and Phone Number of Hospital (Include Area Code))

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

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

I, \_\_\_\_\_, SSN \_\_\_\_\_, having full  
capacity to consent and having attained my \_\_\_\_\_ birthday, do hereby volunteer for \_\_\_\_\_  
\_\_\_\_\_ to participate in \_\_\_\_\_  
(Research Study)  
under the direction of \_\_\_\_\_  
conducted at \_\_\_\_\_  
(Name of Institution)

(Continue on Reverse)

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

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

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

at

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

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

**PART B - TO BE COMPLETED BY INVESTIGATOR**

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

The purpose of this study is to assess the suitability and acceptability of the Meal, Ready-to-Eat with a supplemental pack (MRE VIII +) and the Ration, Cold Weather (RCW) eaten in a cold environment. The study will last for 10 days and will be conducted in conjunction with your normal cold weather military training except that you will only be given either MREs or RCWs to eat. You will not be permitted to supplement these rations by bringing your own food into the field.

Prior to the start of the exercise you will be weighed, your height measured and you will be asked to provide a urine sample. You will be asked to fill out daily food logs and you will receive training on how to do this. Urine samples will be collected daily. A small blood sample may be taken from a vein in your arm using a hypodermic type needle. The amount of blood that we will draw will be less than three tablespoons. Trained personnel will be used to draw blood although localized pain and a small bruise may occur. There is a slight chance of infection at the puncture site although this is no greater than that experienced in blood drawing at a hospital.

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

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

REVERSE OF DA FORM 5303-R, MAY 88

You may be asked to drink a small glass of modified water, have measurements taken of your waist and neck, provide saliva samples and lightweight activity monitor attached to your wrist.

At the end of the study, a further blood sample (less than three tablespoons), saliva sample and weight will be taken and you may be asked to drink another small glass of modified water.

The blood samples will be analyzed to determine if any changes occur in your nutritional status and water balance during the course of this trial, while urine is required to establish whether or not you receive or drink sufficient water. The modified water will enable us to determine your energy expenditure and the activity monitor will measure the levels of activity between participating groups.

You will be asked to answer questions about yourself, your background, medical history, past dietary patterns, habits and attitudes. This will assist us when analyzing the results.

The information you give, together with the other information that we will collect, will be treated in the strictest confidence and will not be revealed to any person who is not authorized to receive it or has no need to know. However you should know that complete confidentiality cannot be promised, particularly to subjects who are military personnel, because information bearing on your health may be required to be revealed to appropriate medical or command authorities. Information about you may be inspected by the Institutional Review Boards for Human Studies and officials of the US Army Medical Research and Development Command.

You will be participating in a field exercise and consuming the Meal, Ready-to-Eat with a supplemental pack (MRE VIII +) or Ration, Cold Weather (RCW) for 10 days as part of your regular Army activity. You will receive no direct benefit from participating in this study other than to know that you helped shape future changes in combat rations.

Participation in this study is on a voluntary basis. If you choose not to take part or if you choose to withdraw from the study, you will not be excused or withdrawn from the field. The decision to remove you from the field would be made by your local senior military commander.

A second copy of this Agreement Form is provided here for your information and retention.

SIGNATURE OF VOLUNTEER	DATE SIGNED	SIGNATURE OF LEGAL GUARDIAN (if volunteer is a minor)	
PERMANENT ADDRESS OF VOLUNTEER	TYPED OR PRINTED NAME AND SIGNATURE OF WITNESS		DATE SIGNED

## **APPENDIX B**

DETAILS OF THE MEAL, READY-TO-EAT,  
SUPPLEMENTAL PACK AND  
THE RATION, COLD WEATHER

10 May 1989

## FACT SHEET

SUBJECT: Meal, Ready-to-Eat (MRE)

PURPOSE: To provide information on the development of the MRE.

## FACTS:

- 0 The use of the flexible pouch in the MRE in lieu of the conventional three-piece metal can used in C rations represented the culmination of an extensive scientific and engineering effort, reflecting a significant breakthrough in food packaging and processing technologies.
- 0 Food packaging technology available during the late 1960's and early 1970's was unable to meet the total Army requirement for a new operational ration, to include: a non-rigid container; extended shelf life (a minimum of three years at 70°); increased portability; overall utility; and reduced weight.
- 0 Due to the revolutionary packaging concept necessary to meet the requirements, (i.e., the trilaminate flexible pouch) the Regulatory Agency (e.g., the Food and Drug Administration (FDA)) proceeded cautiously in reviewing data and granting final approval for use. This process covered a period of six years resulting in final FDA approval in 1978.
- 0 Subsequent to development, operational testing and adoption by the Army, the MRE has been bought yearly since 1980. However, the ration was not used extensively in the field until 1983 to allow the use of previously procured C rations.
- 0 MRE menus were redesigned between 1984 and 1988 based on user feedback from extensive field tests with nine new entrees being developed, tested and incorporated during this time. Prior to adoption, each change had to be approved by the Office of The Surgeon General (OTSG) and the user Services.
- 0 Natick reviews MRE menus on a continuous basis and actively solicits user feedback to identify areas for improvement in order to maximize acceptance. Therefore, the MRE is a living dynamic entity, constantly evolving to meet the changing tastes of its user, the soldier.
- 0 It is noteworthy to point out that the Packaging Institute, United States of America presented Natick with a special award in 1973 recognizing the development of the retort pouch as the most significant accomplishment in the food packaging industry since the development of canned foods in the early 19th century.

Ray Mansur/AV256-5198/Approved by: \_\_\_\_\_

PHILIP BRANDLER, Acting Director  
Food Engineering Directorate



17 January 1990

## FACT SHEET

SUBJECT: Meal, Ready-to-Eat, Individual (MRE)

PURPOSE: To update the MRE Improvement Program.

## FACTS:

- O The 1988 MRE procurement (MRE VIII) included significant changes vs. original 12 MRE menus:
  - oo All entrees or entree/starch combinations to be 8 ounces or more.
  - oo Nine new entree items (Beef Stew, Ham Slice and Chicken ala King are retained from original 12 menus).
  - oo Cold Beverage Powder in each menu and hot sauce in four menus.
  - oo Commercially recognizable candies (M&Ms, Charms, Caramels).
  - oo A pre-moistened Towelette in each accessory packet.
- O Changes planned for near-term procurements include:
  - oo Availability of white bread to complement current MREs.
  - oo Inclusion of brown seven inch spoon in lieu of current white five inch spoon.
  - oo Addition of more wet-pack fruits in lieu of freeze-dehydrated fruits.
  - oo Flameless self heating device for MRE entrees.
  - oo Improved cold weather retort pouch material.
- O Long-term MRE research and development includes thirty foods, either developed by Natick or repackaged popular commercial snack foods, that have potential as MRE menu components.
- O Proposed MRE menu characteristics to include:
  - oo Up to 24-menu design for improved variety.
  - oo Replacement of lower acceptance items in current menus as determined by field acceptance data.
  - oo Fast foods (hamburgers, smokey franks, pizza, burritos).
  - oo Snack foods (corn chips, onion rings, mixed nuts, etc.).
  - oo More breakfast-type foods (hardboiled eggs, chipped beef).

RAYMOND MANSUR/AV256-5198

## INFORMATION PAPER

SUBJECT: Ration, Cold Weather (Marine Corps Arctic Ration)

PURPOSE: To provide current information on Ration, Cold Weather

## FACTS:

- The requirement for a cold weather ration originated with the Marine Corps annual deploying of units to Norway for cold weather training. Subsistence items and rations presently available are unsatisfactory because they are too bulky or heavy, produce 50 percent more trash, contain excessive sodium and protein, or the high water content makes them susceptible to freezing, which affects consumption and may degrade packaging integrity.
- The Food Packet, Assault (FPA), type classified in March 1986, was the basis for the initial Ration, Cold Weather (RCW) concept. It included FPA food bars supplemented by components, which provide extra calories and drink mixes to encourage increased water consumption.
- Primary essential characteristics are: 4500 kilocalories per menu; will not freeze; contain entrees, snacks, and numerous hot drinks; flat, flexible waterproof packaging; requires little preparation; lighter and smaller than four Meal, Ready-to-Eat, Individual (MRE); the mean sodium content per menu must be within the guidelines of Army Regulation 40-25.
- Prototype testing included two Marine NATO exercises, climatic chamber tests by Navy Submarine Medical Research Lab, three informal evaluations by Navy SEALs and the U.S. Army Health Clinic, Fort Greely, AK, two technical feasibility tests by Cold Regions Test Center, TECOM, and one operational test each by 10th Special Forces, the Marine Corps Mountain Warfare Training Center, and the 6th Infantry Division. Results indicate that the prototype meets requirements, is more logistically supportable and acceptable than the MRE for cold weather feeding, but water discipline needs more command emphasis.
- Marine Corp Required Operational Capabilities (ROC) was approved in FY87.
- The U.S. Army identified a limited requirement for the RCW as a special purpose item and adopted the Marine Corp ROC in FY88.
- Current efforts include; providing the Defense Personnel Support Center with technical assistance for FY90 procurement of 120,000 rations. Newly revised entree specifications are due out this summer. The revised specifications are designed to produce products very similar to the highly acceptable Long Range Patrol entrees.

A Summary of the Relative Merits of the Meal, Ready-to-Eat  
with Supplemental Pack and the Ration, Cold Weather.

Factor	3 Meals, Ready-to-Eat + 1 Supplemental Pack	Ration Cold Weather
<u>Weight</u>	1995 g 4 lb 6 oz	1234 g 2 lb 11 oz
<u>Volume</u> (Approximately)	5300 cc 325 cu in	3400 cc 210 cu in
<u>Nutrition</u>		
Energy (kcal)	4604	4568
Protein (g)	166 (14%)	120 (11%)
Fat (g)	181 (35%)	159 (31%)
Carbohydrate (g)	579 (51%)	664 (58%)
Sodium (mg)	6870	4523
<u>Water</u>		
In the Food (g)	651	42
<u>Menus</u>		
	12 varieties ie 4 days	6 varieties
<u>Hot Drinks</u>		
Beverage Base (g)	102	60
Cocoa (g)	75	86
Lemon Tea (g)	---	28
Cider Mix (g)	---	50
Fruit Soup (g)	---	50
Chx Ndl Soup (g)	---	18
Coffee (g)	9	---
<u>Susceptible to Freezing</u>	Yes	No

## Menu Details of Supplemental Packs

---

Menu 1	Menu 2	Menu 3
<hr/>		
Pouched Bread	Pouched Bread	Pouched Bread
Beverage Base	Beverage Base	Beverage Base
Tabasco Sauce	Tabasco Sauce	Tabasco Sauce
 Beef Jerky	 Raisin Nut Mix	 Granola Bar
M & Ms	M & Ms	M & Ms
or	or	or
Charms	Charms	Charms

---

## **APPENDIX C**

### **24-HOUR DIETARY LOGS**

# RATING OF FOOD

Name: \_\_\_\_\_ Group # \_\_\_\_\_

Circle the number that best describes how much you Liked or Disliked each food item you ate.

For example: If you Liked the Chicken, Slightly, circle 6.

Subject No. \_\_\_\_\_ Day/Date \_\_\_\_\_

## FOODS EATEN

Circle how much of each item you ate.  
For Example: Circle 1/2 if you ate half the Chicken Stew issued.

CODE	FOOD ITEM	AMOUNT EATEN							DISLIKE Extremely DISLIKE Very Much DISLIKE Moderately DISLIKE Slightly Neither DISLIKE/LIKE LIKE Slightly LIKE Moderately LIKE Very Much LIKE Extremely									Water Added Y or N
<u>BREAKFAST</u>																		
61	Oatmeal (Apple & Cinnamon)	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
62	Oatmeal (Maple & Brown Sugar)	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
63	Oatmeal (Strawberry)	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
<u>ENTREES</u>																		
64	Chicken Stew	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
65	Beef & Vegetable Stew	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
66	Escalloped Potatoes and Pork	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
67	Chicken a la King	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
68	Vermicelli with Meat Sauce	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
69	Chicken and Rice	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
<u>DESSERTS AND CANDIES</u>																		
70	Chocolate Covered Cookie	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
71	Brownie	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
72	Chocolate Bar	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
73	Blueberry Bar	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
74	Fig Bar	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
75	Oatmeal Cookie	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
76	Nut Raisin Mix	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
77	Granola Bar	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
78	Chewing Gum	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
<u>BEVERAGES</u>																		
79	Chicken Noodle Soup	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
80	Strawberry Fruit Soup	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
81	Raspberry Fruit Soup	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
82	Cocoa	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
83	Coffee	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
84	Tea Mix, Lemon Flavor	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
85	Orange Beverage	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
86	Cider	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
87	Non Dairy Creamer	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
88	Sugar	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
	_____	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	
	_____	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	___	

### WATER CONSUMPTION

1. Write below the number of canteens of water you consumed at different times today for different purposes.

For example: write in    1/4    1/2    3/4    1    2    3.

#### TIME PERIOD

#### NUMBER OF CANTEENS

	Drunk as Plain Water	Drunk as Beverages eg. coffee, cocoa.	Mixed with Food
Morning	_____	_____	_____
Afternoon	_____	_____	_____
Evening	_____	_____	_____

2. What was the main source of this water ?    Please check only one.

Melted Snow	_____	'Jerry' Can	_____	CHECK ONE ONLY
Water Buffalo	_____	Other Sources	_____	

### PACKAGING

3. Were any of the pouches or other packaging damaged as a result of freezing?

Please write down the name of the pouch/package.

\_\_\_\_\_  
\_\_\_\_\_

## **APPENDIX D**

### **SAMPLE FINAL QUESTIONNAIRE**



# FINAL QUESTIONNAIRE

We would like to ask your final opinion about the Meal, Ready-to-Eat. A separate section at the end of this questionnaire will ask about the Supplement Pack. Your opinions will be very important in determining any changes that will be made in the ration. Your answers will be kept confidential. Please answer honestly and thoughtfully. Please use a number two pencil to fill in the bubbles. Thank you.

Please indicate your Social Security number.

Please indicate your subject number.

DO NOT WRITE  
IN THIS BOX


DO NOT  
WRITE IN  
THIS BOX


1. What is your rank?

E									
O									
WO									

2. What is your age? \_\_\_\_\_


DO NOT WRITE  
IN THIS BOX

3. How long have you been in the Armed Services? \_\_\_\_\_ YEARS \_\_\_\_\_ MONTHS


DO NOT WRITE  
IN THIS BOX

4. What is your height? \_\_\_\_\_ FT \_\_\_\_\_ IN


DO NOT WRITE IN THIS BOX

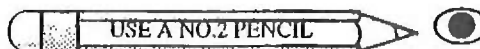
5. What is your weight? \_\_\_\_\_ LBS


DO NOT WRITE  
IN THIS BOX

6. What is your sex?

☐ Male  
☐ Female

Proper Mark



7. Were you trying to LOSE weight during this exercise?

☐ YES ☐ NO

8. Were you trying to GAIN weight during this exercise?

☐ YES ☐ NO

9. How would you describe your level of physical activity during this exercise? Fill in the bubble next to your answer.

- ☐ 1. Heavy daily physical activity  
☐ 2. Moderate daily physical activity  
☐ 3. Light daily physical activity  
☐ 4. Mixed activity day-to-day

10. Please use the following scale to indicate how much you like or dislike each of the items in the Meal, Ready-to-Eat by filling in the circle below the number that best describes your opinion of each item. For items you did not try during this exercise, fill in the circle under "0".

DIDN'T TRY	DISLIKE				NEITHER LIKE NOR		LIKE		LIKE	
	DISLIKE EXTREMELY	VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY	
0	1	2	3	4	5	6	7	8	9	
Pork with Rice in BBQ Sauce	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Corned Beef Hash	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Chicken Stew	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Omelet with Ham	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Spaghetti, Meat and Sauce	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Chicken à la King	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Beef Stew	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Ham Slice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Meatballs, Rice and Sauce	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Tuna with Noodles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Chicken and Rice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Escalloped Potatoes with Ham	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Potato au Gratin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Crackers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Cheese Spread	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Jelly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Peanut Butter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Apple Sauce	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Fruit Mix	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Peaches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Strawberries	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Pears	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Chocolate Covered Brownie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Cherry Nut Cake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Chocolate Covered Cookie Bar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Chocolate Nut Cake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Maple Nut Cake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Oatmeal Cookie Bar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Beverage Base Powder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Cocoa Powder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Coffee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Cream Substitute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Sugar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Tootsie Roll	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Charms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
M & Ms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Caramel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Gum	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Tabasco Sauce	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Other:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

11. Overall, how acceptable was the Meal, Ready-to-Eat? Fill in one bubble.

EXTREMELY UNACCEPTABLE    VERY UNACCEPTABLE    MODERATELY UNACCEPTABLE    SLIGHTLY UNACCEPTABLE    NEUTRAL    SLIGHTLY ACCEPTABLE    MODERATELY ACCEPTABLE    VERY ACCEPTABLE    EXTREMELY ACCEPTABLE

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

12. Do you think that any foods or beverages should be DROPPED from the Meal, Ready-to-Eat?

☐ YES ☐ NO

If YES, please list item(s). \_\_\_\_\_

\_\_\_\_\_

13. Do you think that any foods or beverages should be ADDED to the Meal, Ready-to-Eat?

☐ YES ☐ NO

If YES, please list the item(s). Please be realistic. \_\_\_\_\_

\_\_\_\_\_

14. Please rate how much you like or dislike components of the Meal, Ready-to-Eat for breakfast, lunch, dinner and as a snack. Fill in one bubble for each.

DIDN'T TRY	DISLIKE				NEITHER		LIKE								
	EXTREMELY	VERY MUCH	MODERATELY	SLIGHTLY	DISLIKE	LIKE	SLIGHTLY	MODERATELY	VERY MUCH	EXTREMELY					
0	1	2	3	4	5	6	7	8	9						
Entrees:	breakfast					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	lunch					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	dinner					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	as a snack					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Starches:	breakfast					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	lunch					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	dinner					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	as a snack					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spreads:	breakfast					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	lunch					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	dinner					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	as a snack					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit:	breakfast					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	lunch					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	dinner					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	as a snack					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(continued on next page)

(continued)

		0	1	2	3	4	5	6	7	8	9
Dessert:	breakfast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	lunch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	dinner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	as a snack	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beverages:	breakfast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	lunch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	dinner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	as a snack	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Candies:	breakfast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	lunch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	dinner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	as a snack	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. What did you think of the AMOUNT of food provided by each part of the Meal, Ready-to-Eat. Was it too small, too large, or just the right amount? Please fill in one bubble for each part. For items that you did not try during this exercise, fill in the circle under "0".

NEVER TRIED 0	MUCH TOO SMALL 1	MODERATELY TOO SMALL 2	SLIGHTLY TOO SMALL 3	JUST RIGHT 4	SLIGHTLY TOO LARGE 5	MODERATELY TOO LARGE 6	MUCH TOO LARGE 7
Entrees	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Starches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spreads	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dessert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beverages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Candies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. What did you think about the amount of VARIETY in the Meal, Ready-to-Eat? Please fill in the bubble under the number which best expresses your opinion.

NEVER TRIED 0	VARIETY IS FINE AS IS 1	NEED SOMEWHAT MORE VARIETY 2	NEED MODERATELY MORE VARIETY 3	NEED MUCH MORE VARIETY 4
Entrees	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Starches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spreads	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dessert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beverages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Candies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. When did you usually eat during the exercise? Fill in one bubble.

- ☐ 1. At specified meal times imposed by command.  
☐ 2. At specified meal times by your own choice.  
☐ 3. Throughout the day, as time permitted.  
☐ 4. Both 1 and 3.  
☐ 5. Both 2 and 3.

18. How many meals did you usually eat a day?

- ☐ Less than One      ☐ Three      ☐ Six  
☐ One      ☐ Four      ☐ Seven  
☐ Two      ☐ Five      ☐ More than Seven

19. Where did you USUALLY eat each part of the ration. Please fill in one bubble for each part of the ration.

NOT EATEN 0	ON THE MOVE 1	IN THE FIELD (NO SHELTER) 2	IN A HEATED SHELTER 3	IN AN UNHEATED SHELTER 4	ALL OF THE OPTIONS 5
				0	1 2 3 4 5
Entrees				<input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
Starches				<input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
Spreads				<input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
Fruit				<input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
Dessert				<input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
Beverages				<input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
Candies				<input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>

20. How often were you HUNGRY during the field exercise? Fill in one bubble.

- NEVER      ALMOST NEVER      SOMETIMES      FAIRLY OFTEN      ALMOST ALWAYS      ALWAYS  
☐      ☐      ☐      ☐      ☐      ☐

21. For what reasons did you NOT eat enough during this exercise? Fill in all bubbles that apply. If you ALWAYS ate enough during this exercise, fill in "p" only.

- ☐ a. Disliked the food in the Meal, Ready-to-Eat  
☐ b. Not enough food provided in the Meal, Ready-to-Eat  
☐ c. Not enough time to prepare the Meal, Ready-to-Eat  
☐ d. Too much trouble to prepare the Meal, Ready-to-Eat  
☐ e. Too cold to eat  
☐ f. Not enough time to eat the Meal, Ready-to-Eat  
☐ g. No heat source to heat the Meal, Ready-to-Eat  
☐ h. Poor Heat source to heat the Meal, Ready-to-Eat  
☐ i. Not enough water to prepare the Meal, Ready-to-Eat  
☐ j. Got bored with the food in the MRE-not enough variety  
☐ k. Meal, Ready-to-Eat packaging was damaged  
☐ l. Meal, Ready-to-Eat was frozen  
☐ m. Tried to avoid having to go to the bathroom  
☐ n. Did not feel hungry  
☐ o. Other: \_\_\_\_\_  
☐ p. Always ate enough during this exercise

22. If you chose more than one reason for not eating enough in question #21, fill in the bubble under the letter of the most frequent reason for not eating enough.

a b c d e f g h i j k l m n o p

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

23. How often were you THIRSTY during the field exercise? Fill in one bubble.

NEVER ALMOST NEVER SOMETIMES FAIRLY OFTEN ALMOST ALWAYS ALWAYS

☐ ☐ ☐ ☐ ☐ ☐

24. For what reasons did you NOT drink enough during this exercise? Fill in the bubble next to ALL reasons that apply. If you ALWAYS drank enough during this exercise, fill in "s" only.

- ☐ a. Too much trouble to get water
- ☐ b. Too much trouble to melt snow or ice
- ☐ c. Not enough time to melt snow or ice
- ☐ d. Not allowed to melt snow or ice
- ☐ e. Hands got too cold while preparing water
- ☐ f. Water source was too far from site
- ☐ g. No equipment (pots, pans) to melt snow or ice
- ☐ h. Not enough equipment to melt snow or ice
- ☐ i. No heat source or stove
- ☐ j. Not enough heat sources or stoves
- ☐ k. Water in canteen kept freezing
- ☐ l. Water in 5 gallon cans kept freezing
- ☐ m. Not enough beverages (cocoa, coffee, etc) in Meal, Ready-to-Eat
- ☐ n. Water buffalo/water supply was empty
- ☐ o. Tried to avoid having to go to the bathroom
- ☐ p. Did not feel thirsty
- ☐ q. Did not feel I needed more water
- ☐ r. Other: \_\_\_\_\_
- ☐ s. Always drank enough during this exercise

25. If you chose more than one reason for not drinking enough in question #24, fill in the bubble under the letter of the most frequent reason for not drinking enough.

a b c d e f g h i j k l m n o p q r s

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

26. How did you obtain water? Fill in the bubble next to ALL the reasons that apply. If you choose more than one reason, please mark an "X" next to the most frequent way you obtained water.

- ☐ a. Melted snow
- ☐ b. Melted ice
- ☐ c. From an unfrozen stream
- ☐ d. From an unfrozen lake or pond
- ☐ e. 5 gallon cans
- ☐ f. Water buffalo
- ☐ g. Other: \_\_\_\_\_

☐ ☐ ☐ ☐ ☐ ☐



27. How easy or difficult was it for you to obtain water? Fill in one bubble.

EXTREMELY EASY	VERY EASY	MODERATELY EASY	SLIGHTLY EASY	NEUTRAL	SLIGHTLY DIFFICULT	MODERATELY DIFFICULT	VERY DIFFICULT	EXTREMELY DIFFICULT
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

28. How often were you able to get enough water to prepare fruits and beverages? Fill in one bubble.

NEVER	ALMOST NEVER	SOMETIMES	FAIRLY OFTEN	ALMOST ALWAYS	ALWAYS
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

29. How often did you add water to the Meal, Ready-to-Eat foods and beverages? Fill in the bubble under the number that best expresses your answer next to each food or beverage.

NEVER	ALMOST NEVER	SOMETIMES	FAIRLY OFTEN	ALMOST ALWAYS	ALWAYS
1	2	3	4	5	6
			1	2	3
Entrees			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beverages			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

30. What was the typical temperature of the Meal, Ready-to-Eat foods and beverages you consumed, during this exercise? Fill in the bubble under the number that best describes the average temperature next to each food and beverage.

	VERY COLD	COLD	COOL	NEUTRAL	WARM	HOT	VERY HOT
	1	2	3	4	5	6	7
					1	2	3
Entrees					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Starches					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spreads					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dessert					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hot Beverages					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cold Beverages					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Candies					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

31. What method of heating did you use to prepare parts of the Meal, Ready-to-Eat? Fill in the bubble under the letter of ALL methods you used for each part of the ration.

- a. Canteen cup stand and heating tabs
- b. ZestoTherm ration heater pads
- c. Squad stove
- d. Yukon stove
- e. Optimus III Hiker or "Ranger" stove
- f. Mounted vehicle heater
- g. Personal stove (please specify: \_\_\_\_\_)
- h. Sterno
- i. Did not heat
- j. Other: \_\_\_\_\_

	a	b	c	d	e	f	g	h	i	j
Entrees	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Starches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spreads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fruit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dessert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water for beverages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plain water for washing etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

32. If you chose more than one heating method for any part of the ration in question #31, please fill in the bubble below the BEST method of heating for each ration part.

	a	b	c	d	e	f	g	h	i	j
Entrees	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Starches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spreads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fruit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dessert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water for Beverages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plain water for washing etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

33. Were the Meal, Ready-to-Eat instructions helpful? Fill in one bubble.

DIDN'T READ THEM	NOT AT ALL HELPFUL	SLIGHTLY HELPFUL	SOMEWHAT HELPFUL	MODERATELY HELPFUL	VERY HELPFUL	EXTREMELY HELPFUL
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



34. Please rate how EASY or DIFFICULT you found each of the following aspects of preparing the Meal, Ready-to-Eat. Fill in one bubble for each.

EXTREMELY EASY 1	VERY EASY 2	MODERATELY EASY 3	SLIGHTLY EASY 4	NEUTRAL 5	SLIGHTLY DIFFICULT 6	MODERATELY DIFFICULT 7	VERY DIFFICULT 8	EXTREMELY DIFFICULT 9

35. How often did the following problems occur during the field exercise? Fill in one bubble under the appropriate number for each item.

NEVER 1	ONCE 2	A FEW TIMES 3	ABOUT EVERY OTHER DAY 4	DAILY 5	MORE THAN ONCE A DAY 6

36. Overall, how easy or difficult was the Meal, Ready-to-Eat to use? Fill in one bubble.

EXTREMELY DIFFICULT	VERY DIFFICULT	MODERATELY DIFFICULT	SLIGHTLY DIFFICULT	NEUTRAL	SLIGHTLY EASY	MODERATELY EASY	VERY EASY	EXTREMELY EASY
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

37. Prior to this exercise, have you ever eaten Ration, Cold Weather's (RCW's) during a COLD WEATHER field exercise? Please compare the EASE OF USE of the Ration, Cold Weather with that of the Meal, Ready-to-Eat. Please fill in one bubble. If you've never used the RCW in the cold, fill in the bubble under "Never used RCW".

NEVER USED RCW	MRE LESS EASY	MRE SOMEWHAT LESS EASY	MRE SLIGHTLY LESS EASY	NEUTRAL	MRE SLIGHTLY MORE DIFFICULT	MRE SOMEWHAT MORE DIFFICULT	MRE MORE DIFFICULT
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

38. Compare the ACCEPTABILITY (taste, looks, etc.) of the Meal, Ready-to-Eat in COLD WEATHER with the acceptability of the Ration, Cold Weather. Please fill in one bubble. If you've never eaten the RCW in the cold, please fill in the bubble under "Never used RCW".

NEVER USED RCW	MRE MUCH WORSE	MRE SOMEWHAT WORSE	MRE SLIGHTLY WORSE	NEUTRAL	MRE SLIGHTLY BETTER	MRE SOMEWHAT BETTER	MRE MUCH BETTER
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

39. Below is a list of possible ways of improving the Meal, Ready-to-Eat. Please write the number "1" next to the improvement you think is MOST important, the number "6" next to the improvement you think is LEAST important and rate the leftover ones from "2" to "5".

- \_\_\_\_\_ Make the rations taste better
- \_\_\_\_\_ Increase the variety of the ration
- \_\_\_\_\_ Make the ration easier to prepare
- \_\_\_\_\_ Include more breakfast foods in the ration
- \_\_\_\_\_ Make the portion sizes larger
- \_\_\_\_\_ Other: \_\_\_\_\_

DO NOT  
WRITE  
IN THIS  
BOX


40. Please write additional comments on the Meal, Ready-to-Eat or on problems associated with cold weather eating/drinking here.

The following questions refer to the Supplement Pack that was included with your Meal, Ready-to-Eat. Your answers to these questions will help determine if the Supplement Pack will be standard issue in the future.

41. When did you eat the following items from the MRE Supplement Pack?

	NEVER	WITH BREAKFAST	WITH LUNCH	WITH DINNER	AS A SNACK
Beef Jerky	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Raisin Nut Trail Mix	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Granola Bar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pouched Bread	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Charms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
M & Ms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beverage Base Powder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

42. How OFTEN did the following problems occur with the MRE Supplement Pack?

	NEVER 1	ONCE 2	A FEW TIMES 3	ABOUT EVERY OTHER DAY 4	DAILY 5	MORE THAN ONCE A DAY 6
The food was frozen					<input type="radio"/>	<input type="radio"/>
The outer bag was torn or damaged					<input type="radio"/>	<input type="radio"/>
The food packets were torn or damaged					<input type="radio"/>	<input type="radio"/>

43. Using the following scale, please fill in the circle below the number that best describes your opinion of each MRE supplement item.

	DIDN'T TRY 0	DISLIKE EXTREMELY 1	DISLIKE VERY MUCH 2	DISLIKE MODERATELY 3	DISLIKE SLIGHTLY 4	NEITHER LIKE NOR DISLIKE 5	LIKE SLIGHTLY 6	LIKE MODERATELY 7	LIKE VERY MUCH 8	LIKE EXTREMELY 9
Beef Jerky	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Raisin Nut Trail Mix	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Granola Bar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pouched Bread	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Charms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
M & Ms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beverage Base Powder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

44. Please use the following scale to rate the PORTION SIZE of the Supplement items. Please fill in one bubble for each item.

MUCH TOO SMALL	MODERATELY TOO SMALL	SLIGHTLY TOO SMALL	JUST RIGHT	SLIGHTLY TOO LARGE	MODERATELY TOO LARGE	MUCH TOO LARGE
1	2	3	4	5	6	7
Beef Jerky						
Raisin Nut Trail Mix						
Granola Bar						
Pouched Bread						
Charms						
M & Ms						
Beverage Base Powder						

45. How important do you think it is to include the Supplement Pack with the MRE?

EXTREMELY UNIMPORTANT	MODERATELY UNIMPORTANT	SLIGHTLY UNIMPORTANT	NEUTRAL	SLIGHTLY IMPORTANT	MODERATELY IMPORTANT	EXTREMELY IMPORTANT
1	2	3	4	5	6	7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

46. Which items do you think should be dropped from the Supplement Pack, and which items do you think should be included with some or all of the MREs?

	DROP	ADD TO SOME MRE MEALS	ADD TO MOST MRE MEALS	ADD TO ALL MRE MEALS
Beef Jerky	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Raisin Nut Trail Mix	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Granola Bar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pouched Bread	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Charms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
M & Ms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beverage Base Powder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

47. Are there any items that you would like to see ADDED to the Supplement Pack? Please be realistic.

48. Are there any other comments or suggestions you would like to make about the Supplement Pack?

49. Please use this space for any other general comments you may have.

○ THANK YOU! ○

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