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THE ROLE OF WATER CONSUMPTION ON CONSUMPTION OF THE RATION, COLD WEATHER

U S ARMY RESEARCH INSTITUTE
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ENVIRONMENTAL MEDICINE
Natick, Massachusetts

UNITED STATES ARMY
MEDICAL RESEARCH & DEVELOPMENT COMMAND

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periods of low consumption was the lack of hot water for hydrating ration components when the Yukon stove was not operating. The results of this study indicate that zinc and folacin need to be increased in the RCW. To use the RCW as a stand alone ration for the Light Infantry, modifications are necessary in the delivery of water and in methods of heating water to allow individuals to produce hot water. Water consumption needs to be encouraged and containers issued to allow the troops to carry water inside their clothing to prevent freezing.

DISCLAIMER STATEMENT

The views, opinions, and findings contained in this report are those of the authors and should not be construed as an official Department of the Army position, policy, or decision, unless designated by other official documentation.

Human subjects participated in these studies after giving their free and informed consent. Investigators adhered to AR 70-25 and USAMRDC Regulation 70-25 in Use of Volunteers in Research.

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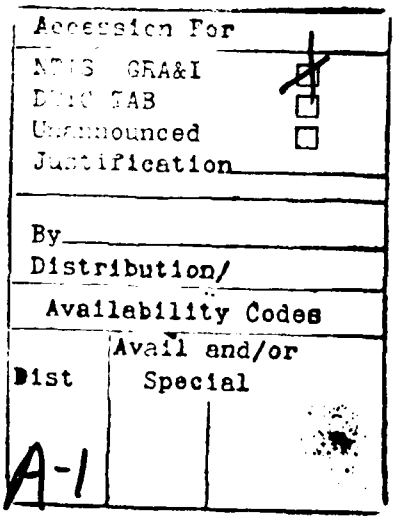

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The Role of Water Consumption on Consumption of the Ration, Cold Weather

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ABSTRACT

Two squads of Light Infantry volunteered to test the role of water consumption on consumption of the Ration, Cold Weather (RCW). One squad was encouraged to drink at least 4 L/man/day (Group 1) while the other served as the control (Group 2). The test was conducted in February 1988 in conjunction with the 6th ID winter warfare training (Callous Warrior). Pre and post measurements were taken along with daily monitoring of food intake, water intake, body weight, and hydration status. Both groups consumed water in excess of 3 L/man/day and their hydration status could be described as high normal (elevated specific gravity and decreased sodium/potassium ratios). There were no significant differences in the energy intakes of the 2 groups, but they only consumed 54% of the energy required (4700 kcal) to maintain body weight (Group 1 lost 3.2% and Group 2 lost 4.1%). Group 1 and 2 consumed a total of 2734 and 3029 kcal, respectively. The main reason for periods of low consumption was the lack of hot water for hydrating ration components when the Yukon stove was not operating. The results of this study indicate that zinc and folacin need to be increased in the RCW. To use the RCW as a stand alone ration for the Light Infantry, modifications are necessary in the delivery of water and in methods of heating water to allow individuals to produce hot water. Water consumption needs to be encouraged and containers issued to allow the troops to carry water inside their clothing to prevent freezing.

INTRODUCTION

The U.S. Marine Corps has established a required operational capability (ROC) for an operational cold weather ration (designated the Ration, Cold Weather or RCW). Natick Research, Development and Engineering Center (NRD&EC) has developed a ration which will provide 4500 kcal per day, will be non-freezing, and lighter in weight (2.75 pounds in two flexible pouches) than the presently approved Meal, Ready-to-Eat (MRE). The average weight of the MRE is 1.5 pounds per meal and four meals are required to provide 4800 kcal.

The U.S. Army has a draft letter requirement, but no ROC, for the RCW. The present operational ration (MRE) has experienced problems concerning freezing of the ration which has caused the pouches to leak (appendix 1) and these problems may be exacerbated in MRE VIII, which has a higher water content that makes it more susceptible to freezing.

Previous field tests (9,10,11,14) of the RCW have identified suboptimal caloric intakes, hypohydration, and body weight loss as potential problems when the RCW is considered for use as the operational cold weather ration. In both the test in Norway (19) and the test with Special Forces (14), hypohydration existed before deployment even though the troops were isolated for three days before deployment and encouraged to hydrate. The relationship between water intake and caloric intake is not clear, but Engell (2) has reported that 70% of all fluid is consumed

with meals and when fluid is restricted at meal times, food intake is reduced. This was a short term chamber study and it is not clear if these results would be applicable to troops on a long term field operation. Given that troops often enter the field (pre-deployment) with hydration problems (14,19), and during the first phase of any operation a soldier will have only those supplies that he carries, the role of hydration on food consumption is a concern.

The purpose of this study was to examine the relationship of forced water consumption (4 L/man/day) and calorie consumption during cold weather field operations while consuming a dehydrated (non-freezing) ration. Since all prior testing had been confined to small unit operations that functioned without outside support, a test involving a company of soldiers operating within a divisional framework was needed.

METHODS

A technical feasibility test of the RCW was conducted with members of the 6th Infantry Division (light) at Ft. Wainwright, Alaska during their divisional winter warfare training (Feb-Mar 1988). This test was designed to collect blood and urine samples pre- and post-field training exercise (10 days) and to collect urine samples, body weight, and food and fluid intake records daily. This data would permit an evaluation of energy balance and nutrition status while the

RCW was consumed in the field. A description of the RCW is enclosed as Appendix 1.

Rations

The Ration, Cold Weather (RCW) is composed of dehydrated food items. The macronutrient composition of the RCW is shown in Table 1. One RCW containing two food packets

Table 1

Macronutrient composition of Ration, Cold Weather.

	PROTEIN (gm)	CHO (gm)	FAT (gm)	WATER (gm)	CALORIES (kcal)
Menu # 1	120.3	656.2	152.1	41.1	4475
Menu # 2	122.1	667.1	144.2	42.4	4454
Menu # 3	115.5	659.5	156.2	43.1	4506
Menu # 4	124.1	651.0	154.6	39.7	4492
Menu # 5	127.3	663.0	144.4	42.9	4461
Menu # 6	112.2	672.0	144.2	42.4	4435
Average	120.2	661.5	149.3	41.9	4470

(providing an average of 4470 kcal) was issued to the company supply officer for each test subject for each day. Approximately three days of rations were supplied at a time in order to better control usage of the RCW.

Test Subjects

Two platoons of Light Infantrymen volunteered to participate in the study. All subjects were briefed on the purpose of the test, signed volunteer consent forms, and were familiarized with the ration. Initially, there were 32

men assigned to two groups (15 to the forced fluid group (Group 1) and 17 to the control group (Group 2)). Data from one subject of the first group was not used as his non-RCW food consumption rate was extremely high and his RCW food consumption was minimal. One member of the second group was unable to participate in the study beyond the first day of data collection. The data presented in this report represent the means for 14 (Group 1) and 16 (Group 2) men except when missing data points required reporting of paired data. Mean anthropometric data for both groups are shown in Table 2.

Table 2

Mean Anthropometric Values

	AGE	HEIGHT-in	WEIGHT-lb	CE[a]
Group 1 (n=14)	22.0 ± 1.2	71.0 ± 0.6	170.7 ± 5.6	16.8 ± 1.0
Group 2 (n=16)	20.1 ± 0.7	70.6 ± 0.7	163.3 ± 3.9	16.2 ± 1.0

[a]CE=Classification of Cold Experience

Experimental Design

The field test was conducted during the 6th Infantry Division (light) Callous Warrior Winter Warfare Training Operation conducted in the Ft. Wainwright area in Fairbanks, Alaska from 24 February to 4 March 1988. During preparation for departure, the troops were encouraged to eat and to consume at least 4 L/day of fluid. The troops were not restricted to the area and no measure of compliance was

attempted. Twenty-four hours before deployment, a body weight, a blood sample, and a urine sample were obtained. The soldiers were instructed on the use of the ration and the method of reporting food and water consumption was clearly demonstrated (Appendix 2). The soldiers in the forced fluid group were encouraged to continue drinking at least 4 L/day of fluid in the field and the investigators provided extra water to this squad on a daily basis. No special instructions were given to the soldiers in Group 2 and they obtained their water through normal channels. Beginning with Day 2 in the field and for every day thereafter, a first morning urine sample was collected as were food and water records. The final sample of body weight, blood, and urine were obtained on the morning before removal from the field.

During deployment, soldiers were airlifted to an airfield 30 miles south of Ft. Wainwright (Airhead). Their initial position (activity consisted of setting up squad tents and building fortified positions) was set-up within 500 meters of the Airhead. The company-sized unit conducted winter training for the next 10 days which included four major movements: road march, cross country skiing, ski-joring behind Small Unit Supply Vehicle (SUSV), and helicopter airlift. They also built and defended positions. The terrain was mostly flat and largely forested with deep loosely packed snow. During movements, each soldier carried a 50 pound pack, weapons, and ammo. Their other gear was carried on the SUSV. During this operation, all water was

supplied from 5 gallon cans (metal with ceramic liner or plastic). Each soldier carried a single 1 quart Arctic canteen (usually outside the uniform), and a few carried a polyethylene bottle inside their uniform.

The activity levels of the teams were similar, but somewhat variable depending on the tactical movement of the two groups (Appendix 3). The activity levels were high during deployment and movement into new training areas due to the demands of skiing, snowshoeing, marching, and walking through loose snow. Energy expenditure could not be measured during the test, but was estimated at an average of 4700 kcal/man/day from daily interviews with the assigned squad leaders in each group. Information provided by Welch et al. (18) was used to estimate energy costs of different tasks.

The terrain was snow covered with depths ranging between 12 to 24 inches of snow. There were only trace amounts of new snow during the exercise. Temperatures were unseasonably warm ranging from $8^{o}F$ at night to $44^{o}F$ during the day with a mean of $27^{o}F$.

Anthropometry

Subjects were weighed in standard clothing for the climate with outer garments removed and pockets emptied. Body weights were obtained before, during, and after the 10-day field exercise. Two calibrated electronic digital balances, accurate to 0.1 lb, were used for the data collection. These scales were calibrated with a known

weight prior to use each day. A record was kept of sizes and articles of clothing, and size of boots worn by each subject. Weights of similar clothing articles and boots were then subtracted from the subjects' weights each day to arrive at their nude weight. Pre- to post-changes in body weight were calculated and the change was used as an indicator of nutritional and hydration status of the two groups.

Height was measured prior to deployment and age obtained from the background questionnaire (Appendix 4).

Food and Water Intake

Food consumption, water intake, hedonic ratings of food items, and reasons for not finishing a food item were self-recorded daily on individual 24-hour food record cards (Appendix 2), and are shown in Figures 2,3,4,5,7, and 8 as Day 1 - Day 8. Similar record keeping systems had been used in previous packaged ration field studies and require minimum time and effort on the part of the test subject. The test subject selected the food item he had just consumed from a list of component ration food items on the card and circled his estimate of the amount eaten (1/4, 1/2, 3/4, or all). Water used for rehydration of food items and water drunk/mixed with drinks were separately estimated in terms of canteen cups. Water consumption was then calculated as water used or needed to consume the ration (FDWATER) and fluid drunk (ADWATER). Total water consumption (TOTALWATER) was calculated by summing the two together. These cards were

collected daily by trained dietitians, who reviewed the previous day's record each morning with each test subject in order to probe for any omissions and to resolve any ambiguities in the records. To improve the accuracy of the 24-hour food card, food waste (empty wrappers, left-overs, and unfinished food items) was collected from each subject for each 24-hour dietary collection period in plastic trash bags. Information on food waste was later compared to food intake on the dietary records, discrepancies were noted, and resolved with the individual on the following day. The soldiers participating in the study were supposed to eat only RCW foods during the 8 days during which dietary data were collected. However, tray-pack rations (T-rations) and MREs were served to other members of their platoons and therefore were readily available. If a test subject did eat other foods, he was asked to record these foods on his food intake record. These entries were also reviewed by the dietitians to determine origin of food (heated T-rations, MRE, or other), portion sizes, and accuracy of reporting. Food consumption data were coded and entered into a computer file for analysis.

Nutrient Intakes

The nutrient data base to analyze the food consumption data was created from nutrient composition data provided by NRD&EC, the University of Massachusetts Nutrient Data Bank, and USDA food composition tables. Micronutrient data was

just recently made available for the RCW. The components were analyzed by a commercial laboratory, but its scope is still restricted because of the limited number of components that were analyzed, missing data (i.e., zinc and cholesterol) for certain components, because the analysis is based on only one sample of each component by one laboratory, and because present methods of analyzing for nutrients are not reliable (i.e., folacin assay). Comparison of the commercial laboratory data to other analyses by chemists at NRD&EC showed that the nutrient contents of fat, iron, zinc, and vitamin C may actually be higher. Since the RCW components are presently being modified to correct known deficiencies and more analyses of the RCW components are being conducted, these values should be considered accordingly.

The food consumption data were analyzed on a VAX 780 computer by employing a computerized nutrient analysis system developed by the U.S. Army Research Institute of Environmental Medicine (USARIEM) for the 1985 CFFS-FDTE (20). Daily means of nutrient intakes were determined by group and by pooled subjects and compared to the Military Recommended Dietary Allowances (MRDA) found in AR 40-25 (1). All nutrient intakes are reported as the mean value/man/day for the time period indicated or as 8-day group means.

Food item consumption was factored against known values for kilocalories (kcal), macronutrients (protein, fat, and carbohydrate), micronutrients (vitamin A, vitamin C, thiamin, riboflavin, niacin, vitamin B6, and folacin),

minerals (calcium, phosphorus, magnesium, zinc, iron, and sodium), and water. The RCW was fortified to meet the Nutritional Standard for Operational Rations (NSOR) of AR 40-25 (1) with the exception of sodium, which was purposely set at a low level (4500 mg) to reduce the water burden of this ration. Protein percentage was also minimized (but was within the NSOR levels) in order to reduce the physiological water requirement to excrete the waste products from excessive protein intake.

Nutritional Status

Venous antecubital blood samples were taken after an overnight fast at pre-deployment (Pre) and on the morning of Day 9 (Post) (Appendix 3). After clotting had occurred, the serum was separated for a standard clinical panel of blood chemistry measurements (see Hydration Status section for a detailed list). Daily first void urine samples were collected and analyzed for ketone bodies and urinary proteins (N-Multistix, Ames Division, Miles Laboratories) as indices of negative energy balance.

Hydration Status

Hydration status was assessed by examination of blood and urine profiles. Following overnight fasting, a venous blood sample (24 ml) was collected from each subject pre-deployment and on the ninth day of the 10-day field operation (exfiltration occurred on the following day). The following

parameters were measured on these blood samples:

1. Hematocrit
2. Hemoglobin
3. Osmolality
4. Protein
5. Albumin
6. Globulin
7. Total Bilirubin
8. SGPT
9. SGOT
10. Alkaline Phosphatase
11. Lactate Dehydrogenase
12. Blood Urea Nitrogen
13. Creatinine
14. Uric Acid
15. Calcium
16. Inorganic Phosphorus
17. Cholesterol
18. Triglycerides
19. Glucose
20. CO_2 Content
21. Sodium
22. Potassium
23. Chloride

Hematocrit was determined by use of heparinized capillary tubes and read after spinning for 5 minutes on a Damon/IEC micro hematocrit centrifuge. Hemoglobin was determined by the cyanmethemoglobin method using a Gilford Stasar III spectrophotometer. Serum osmolality was determined by the vapor pressure method using the Wescor model 5500. All other parameters were analyzed in a blood chemistry panel provided by Smith-Kline Bioscience Labs.

A first-void-in-the-morning urine sample was collected at the same time the blood sample was taken on the pre-deployment day. This urine sample was analyzed for:

1. Potassium
2. Sodium
3. Specific Gravity

Urinary sodium and potassium concentrations were

measured on an Instrumentation Laboratory model 443 flame photometer. Urine specific gravity was determined with a Reichert total solids meter. During the 10-day field test, a daily first void urine sample was collected along with body weight and food consumption data and the same measures were made on these daily urine samples as on the pre- and post-field exercise samples.

Ration Acceptability

A questionnaire (prepared by the Science and Advanced Technology Directorate, US Army Natick Research, Development & Engineering Center) (Appendix 5) was given to each subject on the last morning in the field and again within a week of his return to base. The subject was given time to carefully consider his answers (several included comments). This questionnaire had been used in other field tests (3,11) involving the RCW. These previous tests used small teams of highly trained soldiers, so a comparison to previous data will reflect the difference in setting (company-sized unit vs a 10 man team).

Classification of Cold Experience (CE)

The classification of cold experience is an arbitrary measure in which individuals are placed into "little", "moderate", or "much" CE categories based on the amount of prior cold weather exposure or experience an individual has had. A cold experience score is calculated from answers to 6

questions (#15,16,22,23,26,27) on the Cold Environment Background Survey Form (Appendix 4). The questions pertain particularly to the area where the individual has spent most of his life, to types (classroom instruction and field training) of cold weather exposures, to the amount of time spent in cold weather regions, and to a subjective rating of how one feels about living in cold climates. Scores are derived from "weights" given to each of the multiple choice answers from questions 16,22,23,26, and 27. Each question will therefore give a score of 1 to 4. Question 15 is given a weight from 1 to 4 depending upon the length of time an individual has spent in a particular zone (Appendix 6). Zone 1 has a score of 4, zone 2 rates a 3, zone 3 rates a 2, and zone 4 is given a 1. When the total score from the 6 questions is compiled, it will range from 6 to 24. Arbitrarily, a classification of "little" carries a score of 6 to 12 points, "moderate" carries a score of 13 to 18 points, and "much" ranges from 19 to 24 points.

Statistical Methods

Nutrient intakes were analyzed by a MANOVA program across the eight test days and between the two study groups. When significant main effects of days or groups were noted, a Student-Newman-Keuls post hoc test was conducted. The $P<0.05$ statistical significance level was used throughout this report. Anthropometric, blood, and urine data were tested according to group affiliation (Group 1 or Group 2) and

analyzed by either paired t-test or ANOVA with repeated measures. All values shown represent the mean $\pm$ SEM ($\hat{\sigma}$).

RESULTS

Body Weight Changes

A comparison of body weight changes for the two groups is shown in Table 3. Data were excluded for Group 1 for the final two days because the scale could not be calibrated. Each group suffered from some members being on scout or driver duty and away from the squad area during the time weights were taken and therefore there are some missing data points. By Day 6, the soldiers in Group 1 had lost 3.2 % (5.4 lbs) of body weight and those in Group 2 had lost 4.1 % (6.7 lbs). While the weight loss was significant from pre-deployment to Days 6 and 8 for Groups 1 and 2, respectively, there was no significance difference between groups. The statistical differences shown for groups 1 and 2 in Table 3 are based on paired samples wher as the average for Group 1 (n=14) was 171.6 lbs, but this was not used for comparison purposes.

The body weight increase for Group 2 from Day 6 to Day 8 could be an artifact of different group sizes or it could be due to changes in mission (Appendix 3). The final two days in the field for Group 2 were spent in one location, and while the work (building fortifications) was not easy, the

troops had more time to prepare hot water and to eat the RCW.

TABLE 3

MEAN BODY WEIGHTS--LBS

	Group 1	(n)	Group 2	(n)
Pre	170.1 ± 8.7[a]	10	163.2 ± 4.8	16
Day 1				
Day 2	169.5 ± 6.3	13	160.0 ± 4.7	16
Day 3	169.6 ± 5.8	14	160.8 ± 4.9	15
Day 4	170.3 ± 5.8	14	159.7 ± 4.7	16
Day 5	164.5 ± 8.3	11	159.5 ± 4.7	16
Day 6	164.7 ± 7.7 *	10	156.5 ± 4.6	13
Day 7			158.3 ± 4.7	16
Day 8			158.2 ± 4.6 *	16

[a]Mean±SEM (n)
* Significantly different from Pre measurement when using paired samples, $P < 0.05$

Nutrient Intake

In Figure 2 and for all other daily nutrient intakes (Figures 2-5), the bar graphs show two types of intake. The darkened portion is the contribution of the RCW and the light portion is contribution from other food sources with the bar height indicating the total nutrient intake. Since one of the objectives of the study was to determine actual consumption of the RCW, the following discussion is divided into nutrient intakes from total nutrient intakes (RCW + Other foods) (Table 4) and from the RCW only (Table 5). The means shown in Tables 4 and 5 are across time for 8 24-hour food collection periods during the 10-day field exercise.

The mean energy intake from the RCW only is shown in

Figure 1. The energy consumption for both groups of soldiers from the RCW only was similar at 2392 and 2658 kcal for Groups 1 and 2, respectively, and less than 400 kcal higher for the total energy intake at 2734 and 3029 kcal, respectively (Tables 5 and 4). Both the RCW only and total energy intakes were well below the 4500 kcal available in the RCW and that recommended in the MRDA for work in the cold. AR40-25 suggests that the energy requirements of soldiers performing heavy work in a cold environment may be increased by 25% above that of soldiers who are moderately active and living in a temperate climate (1). The MRDA for energy intake is 4500 kcal/day for a soldier in a cold environment wearing cold weather clothing, heavy footgear, and rucksacks, and maneuvering for prolonged periods on foot, snowshoes, and skis (1).

No significant difference exists between the two groups for energy intake, but there were significant differences between days. The daily mean values of total energy intake and RCW intake for both groups are shown in Figure 2. On those days of movement (1,3,5,6,7), the energy intake was significantly less than on those days when movement was minimal. Group 2 movement pattern on Day 3 was quite different from that of Group 1 which explains the difference indicated on Figure 2. These significant differences between days can be attributed directly to activity level and to availability of water. Day 1 and Day 7 were extreme movement days for both groups, the water supply was limited, and

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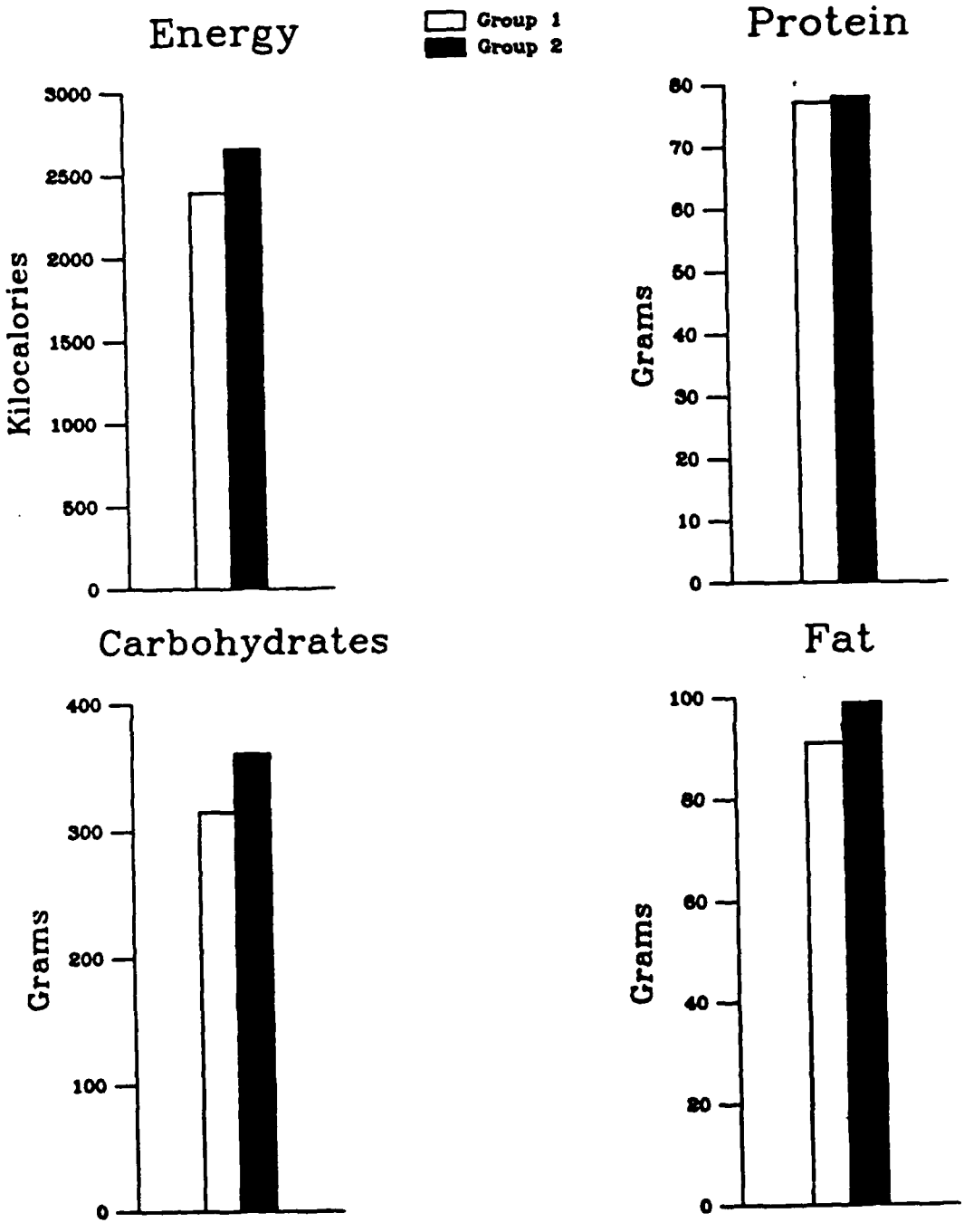

Figure 1. Mean values (across 10 day exercise) for both groups for energy and micronutrient intake from RCW only.

TABLE 4

Total mean nutrient intake for eight days

		Group 1				Group 2			
Nutrient	MRDA	mean	±	SEM	%MRDA	mean	±	SEM	%MRDA
Energy, kcal	4500[a]	2734	±	110	61[b]	2029	±	101	67[b]
Protein, g	100.0	90.0	±	4.3	90[b]	93.4	±	3.5	93[b]
Carbohydrate,g		357.6	±	15.3		411.7	±	14.4	
%[c]	50-55	52				54			
Fat,g		105.4	±	5.6		112.4	±	4.1	
%[c]	<35	35				3[illegible]			
Vitamin A,mcg RE	1000.0	1249.9	±	75.7	125	1248.5	±	66.5	125
Ascorbic Acid, mg	60.0	67.8	±	6.5	113	64.2	±	5.1	107
Thiamin, mg	1.6	2.8	±	0.1	175	2.8	±	0.1	175
Riboflavin,mg	1.9	1.4	±	0.07	74[b]	1.3	±	0.06	68[b]
Niacin, mg NE	21.0	24.4	±	1.3	116	24.8	±	1.1	118
Vitamin B6,mg	2.2	2.4	±	0.1	109	1.7	±	0.1	77[b]
Folacin,mcg	400.0	158.7	±	8.0	40[b]	172.1	±	6.7	43[b]
Calcium,mg	800-1200	951.9	±	52.0		862.3	±	41.8	
Phosphorus,mg	800-1200	1490.4	±	75.1		1558.5	±	56.1	
Magnesium,mg	350-400	372.0	±	24.1		402.6	±	14.2	
Iron,mg	10-18	12.1	±	0.6		13.0	±	0.5	
Zinc,mg	15.0	8.9	±	0.5	59[b]	10.1	±	0.5	67[b]
Sodium,mg	<5500.0	3472.2	±	198.8		3260.5	±	127.7	
Potassium,mg[d]	1875-5625	2846.6	±	132.0		3066.0	±	113.3	

[a]MRDA for energy intake increased to 4500 kcal/day for cold environments.
[b]Inadequate intake
[c]MRDA levels are not available for this nutrient, however a percentage of the total energy is suggested.
[d]MRDA levels are not available for this nutrient, however safe and adequate levels are suggested.

TABLE 5

RCW contribution to nutrient intake

Nutrient	MRDA	Group 1 mean ± SEM	%MRDA	Group 2 mean ± SEM	%MRDA
Energy, kcal	4500[a]	2392 ± 96.0	53[b]	2658 ± 98.9	59[b]
Protein, g	100.0	77.3 ± 3.8	77[b]	78.3 ± 3.3	78[b]
Carbohydrate,g		315.1 ± 13.2		361.6 ± 14.4	
%[c]	50-55	53		54	
Fat,g		91.3 ± 3.8		99.8 ± 3.9	
%[c]	<35	34		34	
Vitamin A,mcg RE	1000.0	1171.3 ± 76.4	117	1086.6 ± 65.7	109
Ascorbic Acid, mg	60.0	60.8 ± 4.8	101	56.2 ± 5.1	94[b]
Thiamin, mg	1.6	2.6 ± 0.1	163	2.5 ± 0.1	156
Riboflavin,mg	1.9	1.0 ± 0.05	53[b]	1.0 ± 0.04	53[b]
Niacin, mg NE	21.0	21.8 ± 1.2	104	21.1 ± 1.1	100
Vitamin B6,mg	2.2	1.7 ± 0.1	77[b]	1.6 ± 0.1	73[b]
Folacin,mcg	400.0	129.1 ± 5.6	32[b]	138.5 ± 5.4	35[b]
Calcium,mg	800-1200	744.4 ± 34.1	[b]	680.9 ± 29.1	[b]
Phosphorus,mg	800-1200	1256.0 ± 58.9		1332.6 ± 53.7	
Magnesium,mg	350-400	314.7 ± 13.8	[b]	353.4 ± 13.6	
Iron,mg	10-18	9.6 ± 0.4	[b]	10.4 ± 0.4	
Zinc,mg	15.0	7.6 ± 0.4	51	8.2 ± 0.4	55
Sodium,mg	<5500.0	2871.5 ± 141.4		2656.8 ± 118.8	
Potassium,mg[d]	1875-5625	2463.7 ± 115.9		2619.0 ± 108.9	

[a]MRDA for energy intake increased to 4500 kcal/day for cold environments.
[b]Inadequate intake
[c]MRDA levels are not available for this nutrient, however a percentage of the total energy is suggested.
[d]MRDA levels are not available for this nutrient, however safe and adequate levels are suggested.
NOTE: Based on consumption of RCW. Does not include nutrients from extra food.

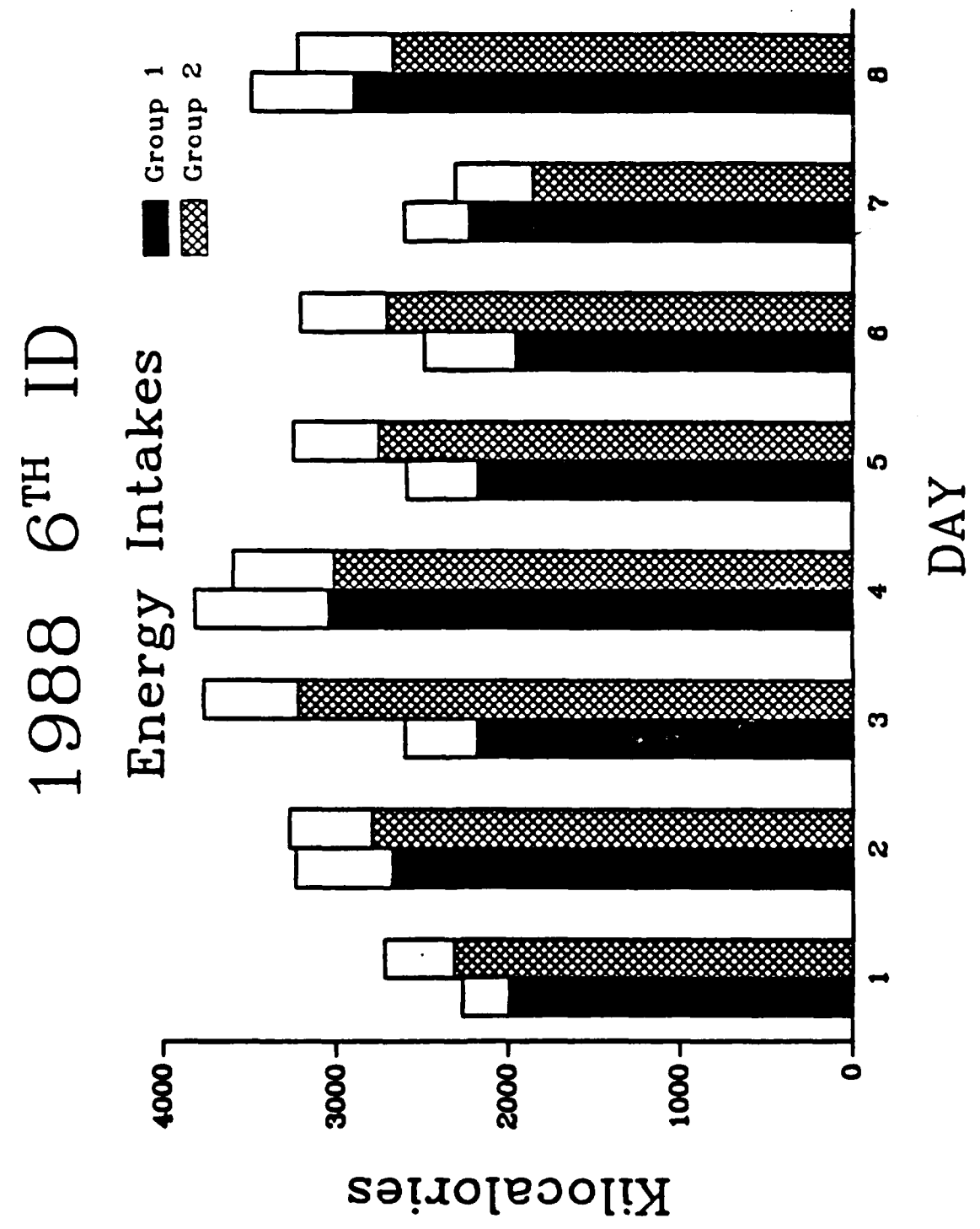

Figure 2. Daily energy intake for both groups with the RCW contribution in dark and the total represented by the height of the bar.

energy intake was decreased. Extreme differences in movement patterns between groups could also be seen in total energy consumption on Days 3 and 5. On the days that the soldiers did not move, their energy intakes increased (Days 2,4,8 for Group 1; Days 2,3,4,8 for Group 2).

Macronutrients

The mean intake of the macronutrients from the RCW averaged across the entire study is shown in Figure 1 and Table 5. Daily mean nutrient intakes (showing total intake and intake from RCW) of carbohydrate, protein, and fat are shown in Figures 3,4 and 5 respectively. Although there is no MRDA for carbohydrate, AR40-25 recommends that 50-55% of the total dietary energy come from carbohydrate (%CHO). The two groups of soldiers were consuming an average of 53 and 54 %CHO from the RCW alone (Table 5) and the amount of carbohydrate consumed was significantly different for the two groups. Consumption of carbohydrate from the RCW reached a maximum of 400 g/man/day on Day 4 only. Total carbohydrate consumption was greater than 400 g/man/day for both groups on 3 days. Soldiers consumed an average of 77 gms of protein from the RCW (Table 5) which is well below the MRDA level (100 g/man/day). The total intake of protein met or exceeded the MRDA only on three days (Figure 4), which coincided with days of little movement (Days 2,4,8). A possible reason for the overall low consumption of protein is the erratic consumption of the entrees, which contain most of the protein

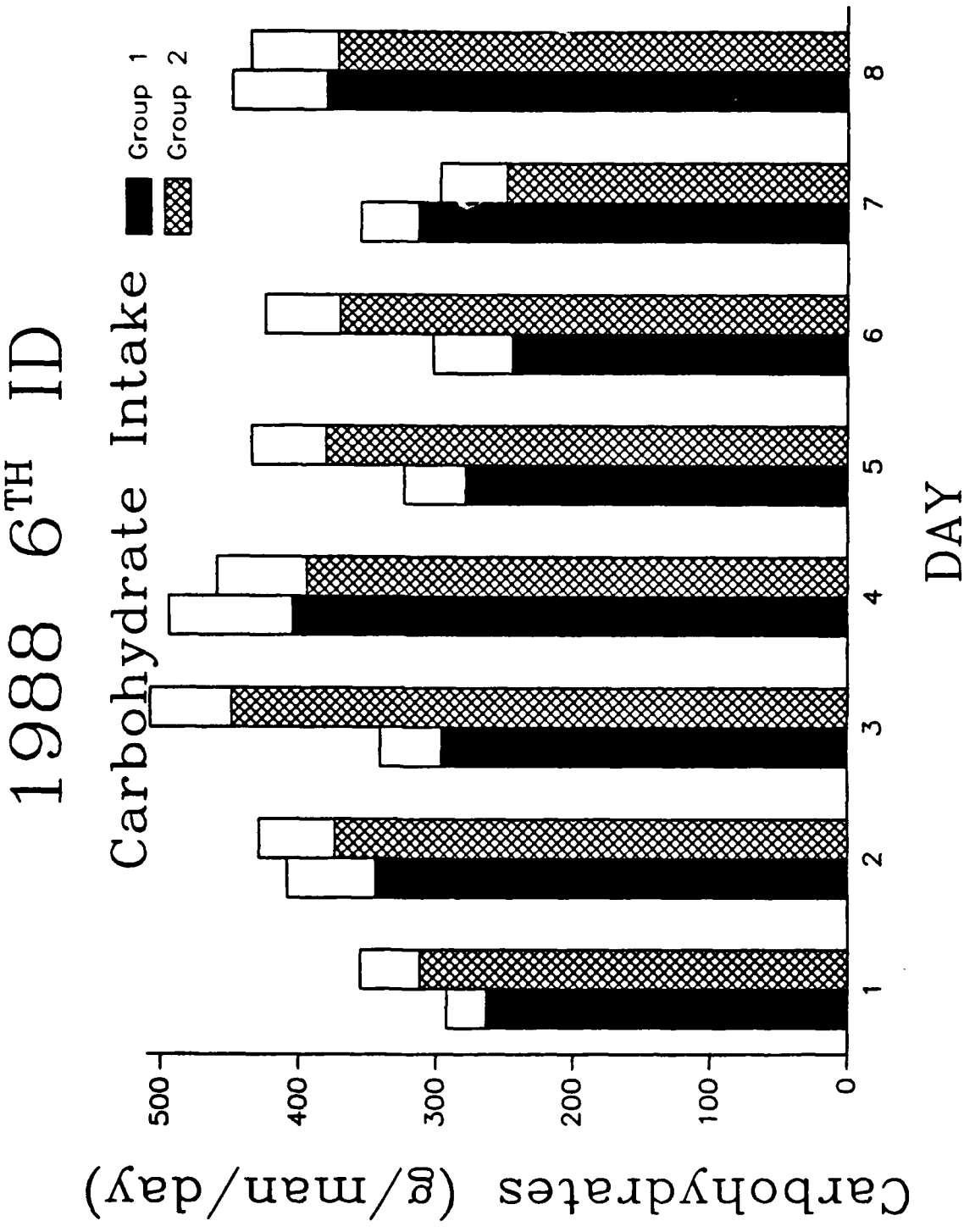

Figure 3. Daily carbohydrate intake for both groups with the RCW contribution in dark and the total represented by the height of the bar.

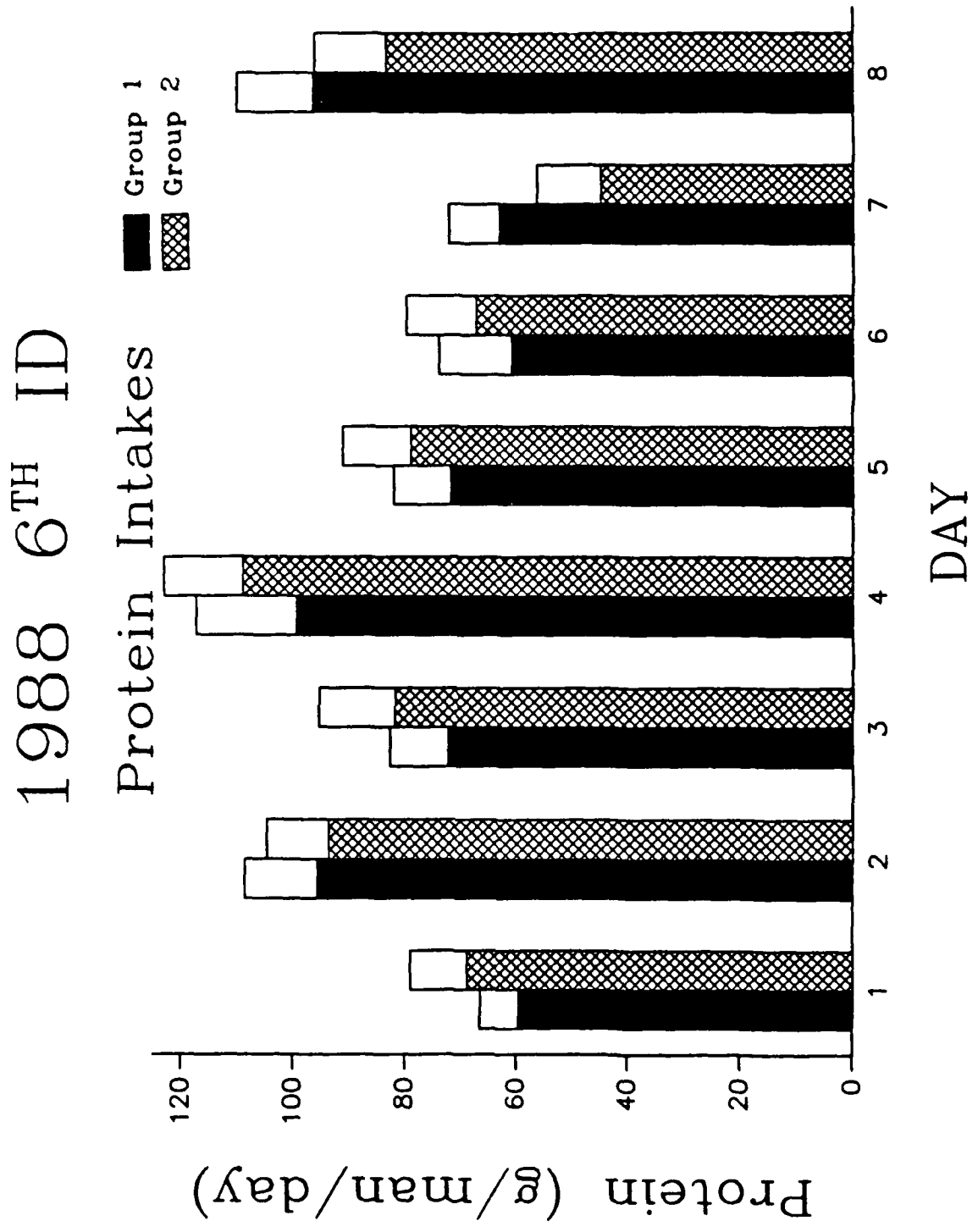

Figure 4. Daily protein intake for both groups with the RCW contribution in dark and the total represented by the height of the bar.

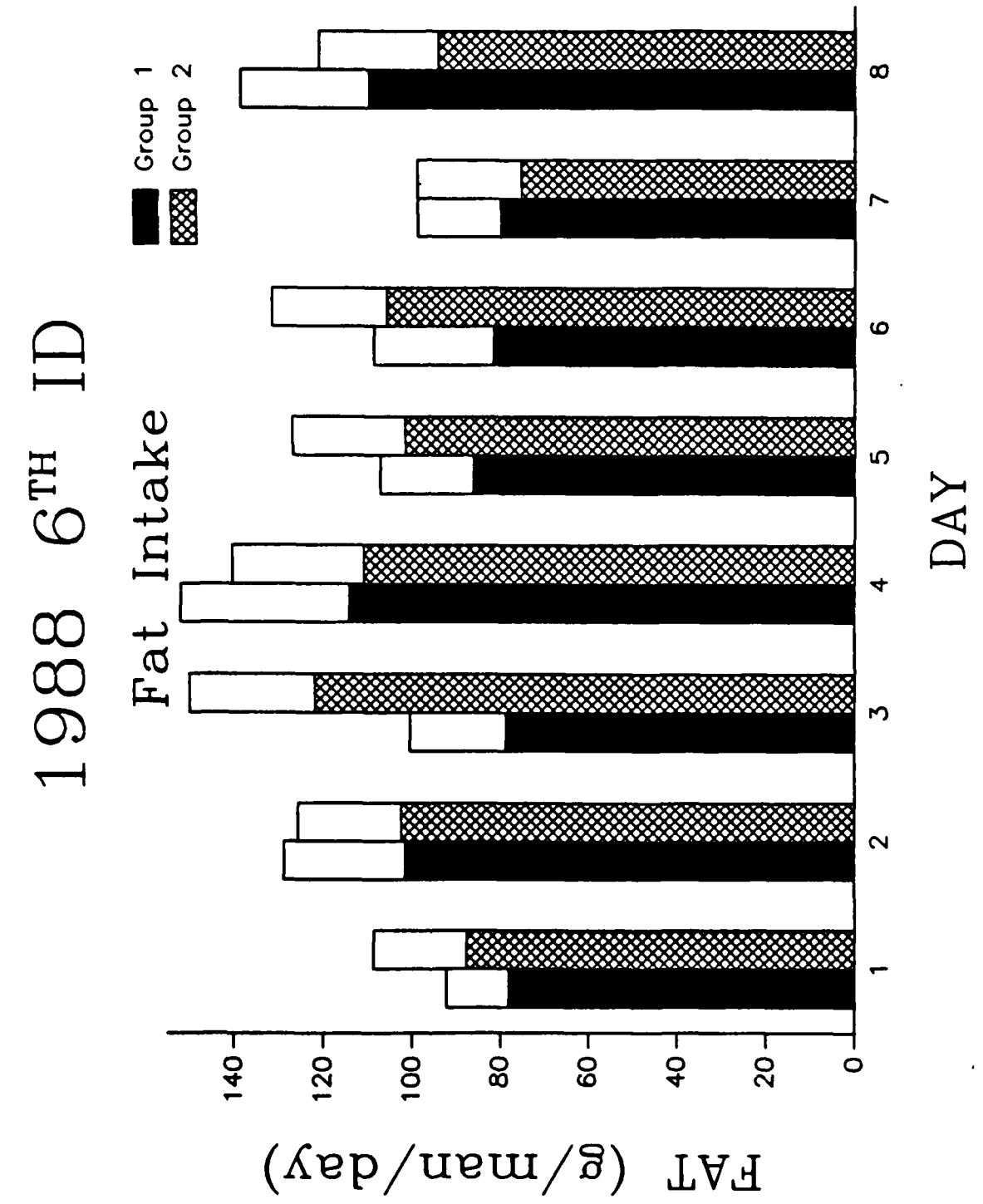

Figure 5. Daily fat intake for both groups with the RCW contribution in dark and the total indicated by the height of the bar.

but require hot water for preparation, on the days of heavy movement. AR40-25 recommends that calories derived from dietary fat (%FAT) should not exceed 35%, which is equal to a maximum of 175 g fat for the RCW. Average fat consumption never reached the maximum recommendation for total fat or RCW only. The mean intake for Group 1 was 91.3 g/man/day or 34%FAT and 99.8 g/man/day (34%FAT) for Group 2 from the RCW only.

Micronutrients

Total nutrient intakes for both groups of soldiers met the MRDA for all micronutrients except riboflavin and folacin. Folacin intakes were inadequate because adequate amounts were not available in the RCW (Appendix 7). In general, the soldiers were receiving sufficient vitamins from the total foods eaten during the study. However, mean nutrient intakes from the RCW only met the MRDA for both groups for vitamin A, niacin, and thiamin only. The soldiers in Group 1 ingested enough ascorbic acid (60.8 mg) to meet the MRDA, however those in Group 2 ingested inadequate amounts (i.e., nutrient intakes were below the MRDA). For all other micronutrients (riboflavin, vitamin B_6, and folacin), mean intakes from the RCW only were inadequate (Table 5) for both groups. Vitamin A intake contributed by the RCW was adequate for the total mean intakes for both groups (1171.3 and 1086.6 mcg RE) but some high activity days (leading to decreased food intake) showed daily values below

the MRDA (1000 mcg RE/man/day) for both groups.

Minerals

Phosphorus was the only mineral whose intakes met or exceeded the MRDA. Total and RCW sodium intakes (Tables 4 & 5) were excellent and well below the maximum MRDA of 5500 mg/day. Sodium intakes were also well below the 4500 mg upper limit that evolved from the work of Tappan (17) for cold environments. Potassium intakes were within the MRDA. The MRDA were not met for both groups for calcium, magnesium, and iron when only the RCW was considered but were met when total food intakes were summed. Mean intakes of zinc from the RCW were about half the MRDA (15 mg/man/day) but this inadequacy could be a function of missing information in the nutrient data bank since many values for this particular nutrient were left blank. Another reason could be that inadequate levels of zinc were available in the RCW (range 7.08-16.18 mg/RCW) depending on the menu.

Ration consumption

Appendix 8 shows that all the study subjects were consuming from 0.4 to 90.2% of the RCW components. Less than 25% of the following RCW components were eaten: gum (0.4%), cream, sugar, coffee, cocoa, fruit soup, chicken noodle soup, cider, and orange beverage base. The troops appeared to like the dessert type items since they consumed 90.2% of the brownies and chocolate covered cookies and the next highest

percentage was 74.3 and 71.5% for the raisin nut crunch and chocolate toffee bar, respectively. The consumption pattern shows the soldiers did not like or were not able to consume the items that required hot water for preparation such as cocoa, fruit soup, chicken noodle soup, etc but the reasons for the low consumption cannot be determined. Only 70% of the entrees were consumed which reflects the inadequate protein intakes (Table 5).

Nutritional status

The results of the pre- and post-field exercise blood chemistries are reported in Table 6. Pre- vs. post-field exercise changes in blood chemistries within both groups were compared using a paired t-test with each group serving as its own control. Significant differences were found in some pre-to-post comparisons within both groups but all levels remained well within normal physiological ranges. The post-field exercise values may not have been an accurate reflection of the worst state of the soldiers. The final blood samples were taken two days after a difficult overnight movement (ski-joring and helicopter airlift). However, both groups had consumed greater quantities of RCW and other foods on Day 7, two nights before the post-exercise blood samples were taken. Of special interest is the fact that post-field exercise blood values decreased significantly for both groups for cholesterol, triglycerides, A/G ratio, and glucose and significantly increased for protein and globulin.

Table 6

Blood Chemistries

	Group 1		Group 2		
	Pre	Post	Pre	Post	Normal
Protein, gm/dl	6.7	7.1*	6.7	7.0*	6.0-8.5
Albumin, gm/dl	4.6	4.7	4.5	4.5	3.2-5.5
Globulin, gm/dl	2.2	2.4*	2.2	2.5*	1.5-3.8
A/G ratio	2.2	2.0*	2.1	1.9*	1.0-2.7
Bilirubin-T, mg/dl	0.5	0.7	0.5	0.5	0.2-1.2
SGPT, IV/L	23.0	18.0*	26.0	16.0*	0.0-55
SGOT, IV/L	18.0	28.0*	22.0	27.0*	0.0-50
Alkal Phos, IV/L	87.0	80.0	93.0	90.0	20-140
Lactic Deh, V/L	128.0	180.0*	142.0	187.0*	0.0-250
Urea Nitrog, mg/dl	13.0	14.0	14.0	16.0	7.0-25
Creatinine, mg/dl	0.9	1.0	1.0	1.0	0.7-1.4
BUN/Creatinine	13.0	13.0	13.0	16.0	10-24
Uric Acid, mg/dl	6.2	6.2	5.8	6.1	2.5-8.5
Calcium, mg/dl	9.7	10.1*	9.8	9.9	8.5-10.6
Inorg Phosph, mg/dl	4.5	4.1*	4.4	4.4	2.5-4.5
Cholesterol, mg/dl	175.0	148.0*	172.0	140.0*	140-250
Triglycerides,mg/dl	132.0	60.0*	100.0	55.0*	20-160
Glucose, mg/dl	100.0	84.0*	98.0	83.0*	70-115
Sodium, mEq/L	142.0	141.0	142.0	139.0	135-148
Potassium, mEq/L	4.4	4.5	4.6	4.5	3.5-5.3
Chloride, mEq	104.0	105.0	104.0	104.0	96-112
CO_2 Content,mEq/L	31.0	29.0*	31.0	28.0*	20-34

* $P < 0.05$

Trace amounts of urinary acetoacetone (ketone) were detected by use of urinary dipsticks. These data are snown in Figure 6. The presence of small amounts of ketone in the urine indicates a caloric deficit requiring body fat mobilization and oxidation. Although there were slight differences in the incidence of soldiers with ketosis between the two groups (notably Days 2,5,6), the differences were not significant. The differences on the days mentioned above could be explained by the different movement and

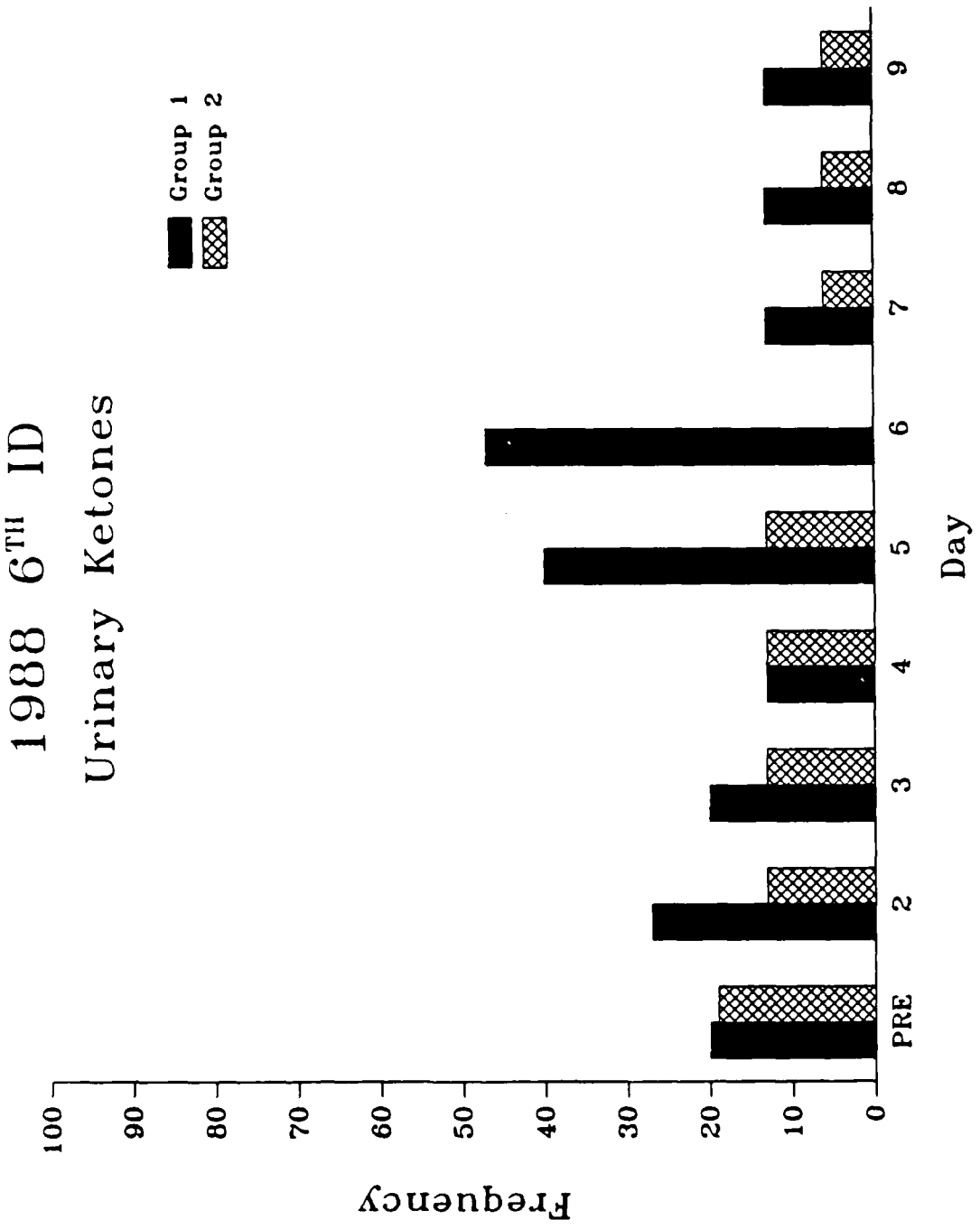

Figure 6. The frequency of subjects in both groups testing positive for urinary acetoacetone.

hydration patterns of the two units in the time preceding the urine collection. Group 1 suffered from frozen water supplies on Day 1, had a hard move (12 miles) into a new area to prepare for an ambush on Day 4, and did not get supplied until late on Day 5. This would not normally cause a problem with consumption of the RCW since this ration was carried on the soldier, but the troops could not make their own water and therefore did not have water to rehydrate their food. Group 2 moved on Day 5, but the new area had been supplied with water by that time. The entire company had a difficult move on the night of Day 6, but Group 1 performed this movement (ski-joring and helicopter airlift) with little or no water. The energy intake data (Figure 2) did not decrease on Day 6 which does not appear to support this theory but the figure shows data accumulated over a 24-hour period while early morning urine collections show physiological status for a shorter and more recent period of time. The incidence of ketone production decreased when food and water were consumed.

The serum proteins (albumin and globulin) can be indicators of malnutrition in long term starvation. Elevated albumin is a moderately good indicator of protein status while elevated globulin is an indicator of hypohydration, especially when the albumin/globulin ratio is constant. The pre- to post-field exercise levels of protein and globulin were significantly elevated in both groups. Albumin was essentially constant for both groups. The A/G ratio was

significantly decreased in both groups. This could be an indication that there was a modest decline in the protein status of the subjects which could have become more significant over a greater time frame. It is possible but unlikely, that hypohydration was a confounding factor in the protein profile since the specific gravities (Figure 9) of the subjects, pre- and post-field exercise, were fairly normal.

Elevated levels of blood urea nitrogen (BUN) are indicative of increased protein breakdown or dehydration while decreased levels are associated with decreased protein ingestion and overhydration. In both groups, there was a slight, but insignificant increase in BUN, but all values were within the normal range. An analysis of the urinary specific gravities indicate that both groups were hydrated when blood was collected.

Small amounts of protein were detected in the urine of the soldiers. In healthy individuals, up to 0.1 g/day of protein can appear in the urine. The larger amounts of protein in the urine were probably due to the severe muscular exertion that the troops underwent in the field exercise. There were no indications of renal disease causing protein to appear in the urine.

Blood glucose levels were within the normal range (70-115 mg/dl), but dropped significantly pre- to post-field exercise in both groups. The decrease appeared to reflect the low dietary carbohydrate intake for the 8 days. Glucose

regulation appeared to be working well and hypoglycemia was not a problem even in the face of the reduced carbohydrate intake (<400 gms/day) and heavy activity (increased demand).

Elevated levels of both cholesterol and triglycerides are considered risk factors in atherosclerotic heart disease. Cholesterol and triglyceride levels can vary greatly in blood, but are usually dependent on dietary intake of animal fat and exercise levels. The data for triglycerides and cholesterol are shown in Table 6. The values are within the range of normal for both constituents for both pre- and post-field exercise samples, but they also show a significant decrease from pre- to post-field exercise, which was probably a reflection of the reduced level of fat consumption (Figure 5) and the increased physical exertion associated with the operational training. The low cholesterol consumption from the RCW probably contributed to the low blood cholesterol. The analysis of cholesterol in the RCW is incomplete but analysis of major sources of cholesterol such as the meat entrees and cookies show only 183 mg of cholesterol available in an entire day's ration.

Water Intake

The data for water intake (Figures 7 and 8) were obtained from the 24-Hour Food and Fluid Record cards (Appendix 2) and verified daily by interview. This technique has been utilized in prior studies and has shown a high correlation when compared to more controlled laboratory

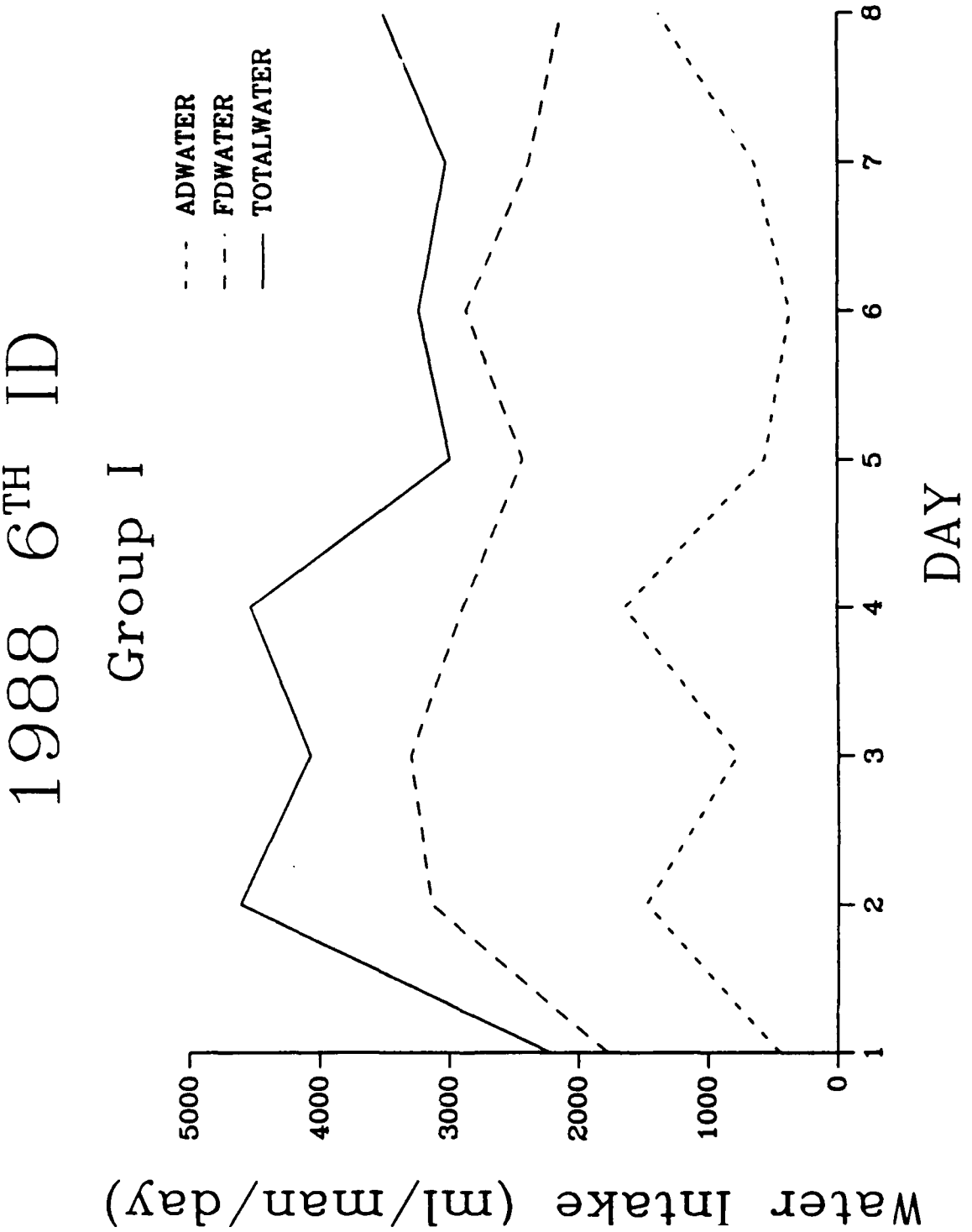

Figure 7. Total water intake for Group 1 showing the components of water mixed with RCW and water consumed by itself.

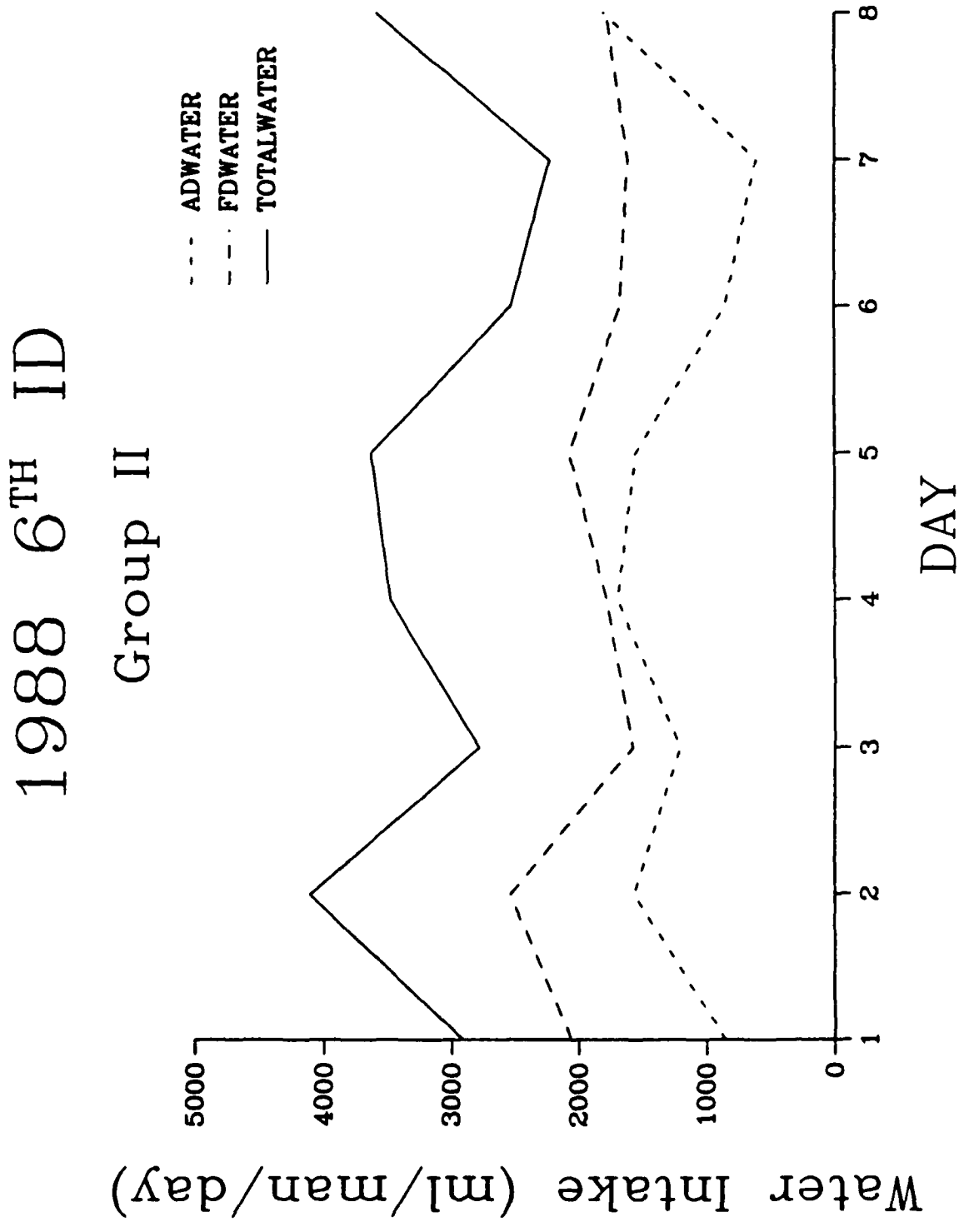

Figure 8. Total water intake for Group 2 showing the components of water mixed with RCW and water consumed by itself.

methods (3).

The 6th ID (L) has an operational standard that each soldier should consume at least 4 L/day of water. On this operation, all water was supplied to the company units in 5 gallon cans carried by the SUSV. The source of the water was an approved supply point (portable water purification plant or water storage unit), and the individual soldier was not allowed to melt snow or ice. This company consisted of 120 soldiers and would require at least 480 L (approximately 26 cans) of unfrozen water each day.

For the entire study, the soldiers in Group 1, who were forcing fluids, ingested an average of 3.68 $\pm$ 0.14 L/day of water. The daily water intake data for Group 1 are shown in Figure 7. The data consist of the water mixed with the ration components (FDWATER) and that consumed as drinking water or mixed with drinks (ADWATER). Day 1 was a problem for this group since their water cans were frozen on the trip to the Airhead and therefore their intake was reduced. Starting on Day 2, an additional 15 gallons of water was made available to Group 1 to ensure hydration. They maintained their intake levels above the operational standard for the next three days and then leveled off around 3 L/day for the rest of the exercise. In the last half of the study, they still met the minimum water intake (3 L/day) recommended for consumption of this ration by the US Marine Corps (7,17). Although the soldiers in Group 1 were supposed to be forcing fluids and were provided with extra water, their mean intake

did not reach the operational standard of 4 L/day.

Group 2 (Figure 8) started the field exercise drinking more water (about 500 ml) than Group 1 because they arrived at the Airhead without their water supply being frozen. However, their average water intake only reached 4 L/day on Day 2. For the duration of the study, their intake hovered between 2.5 and 3.5 L/day. The soldiers in Group 2 did not meet the minimum recommendation of 3 L/day on a daily basis; however, their mean water intake of 3.36 $\pm$ 0.15 L/day was sufficient to maintain a hydration status that was in the high normal range (by specific gravity measurement) during the study. The difference in water intake between the two groups was less than 0.32 L/day and not statistically significant. In past studies (7,14,19), voluntary consumption of water was insufficient to maintain hydration. In light of this past data, the question should be asked about whether the troops in both groups were maintaining hydration because they were being tested or was this level of hydration normal for the Arctic troop? Specific gravity measurements of first-void urine collected from soldiers not involved with the RCW test had an average value of 1.030 on the two days (Day 7, n=10; Day 10, n=25) it was taken (Figure 9). This indicates that the level of hydration of the test subjects was higher than that of most of the soldiers that were not part of the test.

Hydration Status

The state of hydration was inferred from measures of urinary specific gravity, analysis of urinary sodium and potassium, as well as pre- and post-measures of hematocrit (Hct) and serum osmolality (Osm).

The mean values for urinary specific gravity (SG) are shown in Figure 9. A "normal" range for urinary specific gravity values for an overnight urine for a well hydrated subject is 1.015 to 1.022. Values of 1.030 or greater are indicative of hypohydration (4). In general, the means show that the troops in both groups were in the high normal range of hydration status by SG measurements. Various individuals were hypohydrated (SG $\geq$ 1.030), but no individual was consistently hypohydrated for the entire study. In the 24 hours preceding the exercise, Group 1 (encouraged to force fluids) had an average SG value (1.022) at the upper limit of normal with no subjects with SG $\geq$ 1.030. Group 2 had an overall higher average (1.024) with 2 subjects (12%) having SG $\geq$ 1.030. There were no urine collections on the morning of Day 1. On the morning of Day 2, the mean values switched, with the SG value for Group 1 increasing to 1.027 and 6 subjects (40%) have SG values $\geq$ 1.030. The SG in Group 2 decreased, but 4 subjects (25%) still had SG above 1.030. The switch in hydration status on Day 2 was probably due to the water supplies being frozen for Group 1, whereas Group 2 had water available right after deployment. The degree of hypohydration was very indicative of the uneven

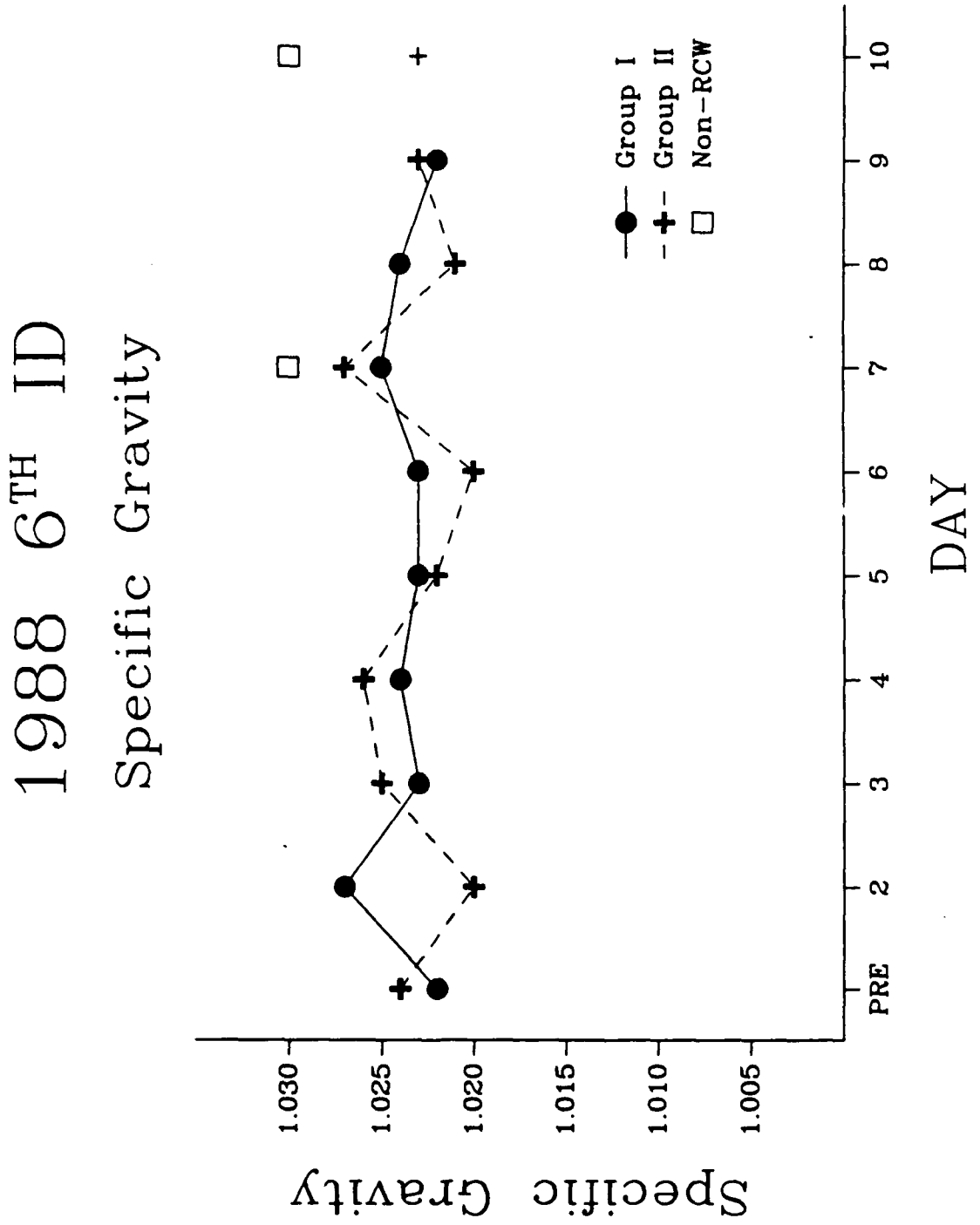

Figure 9. Mean daily urinary specific gravity for both groups.

distribution of the water resources on hand. The higher level of water intake by Group 1 (Figure 7) reduced the level of hypohydration (down to 20%) by Day 3 and Day 4 and even lower on Day 5. Because Group 2 had an overall lower water intake (Figure 8), they maintained a high normal specific gravity with 15 - 20% of troops having SG greater than 1.030. The incidence of high SG was low on Day 7, which followed a night movement, but the mean increased for Group 2. The last day in a stationary position produced lower SG readings.

Other indices of hypohydration are the sodium/potassium ratio (Figure 10), hematocrit (Table 7), and serum osmolality (Table 7) measurements (6). The hematocrit values were normal and did not change across the study. The same relationship was true for the serum osmolality values.

Table 7

Hemoglobin, hematocrit, and serum osmolality

	Group 1		Group 2	
	Pre	Post	Pre	Post
Hgb	16.06 ± 0.05	15.95 ± 0.09	16.30 ± 0.10	16.08 ± 0.15
Hct	44.6 ± 0.4	44.5 ± 0.3	45.3 ± 0.3	44.0 ± 0.4
Osm	284.2 ± 1.2	286.3 ± 1.1	286.7 ± 1.0	286.3 ± 1.1

The urinary sodium/potassium ratio decreased from the

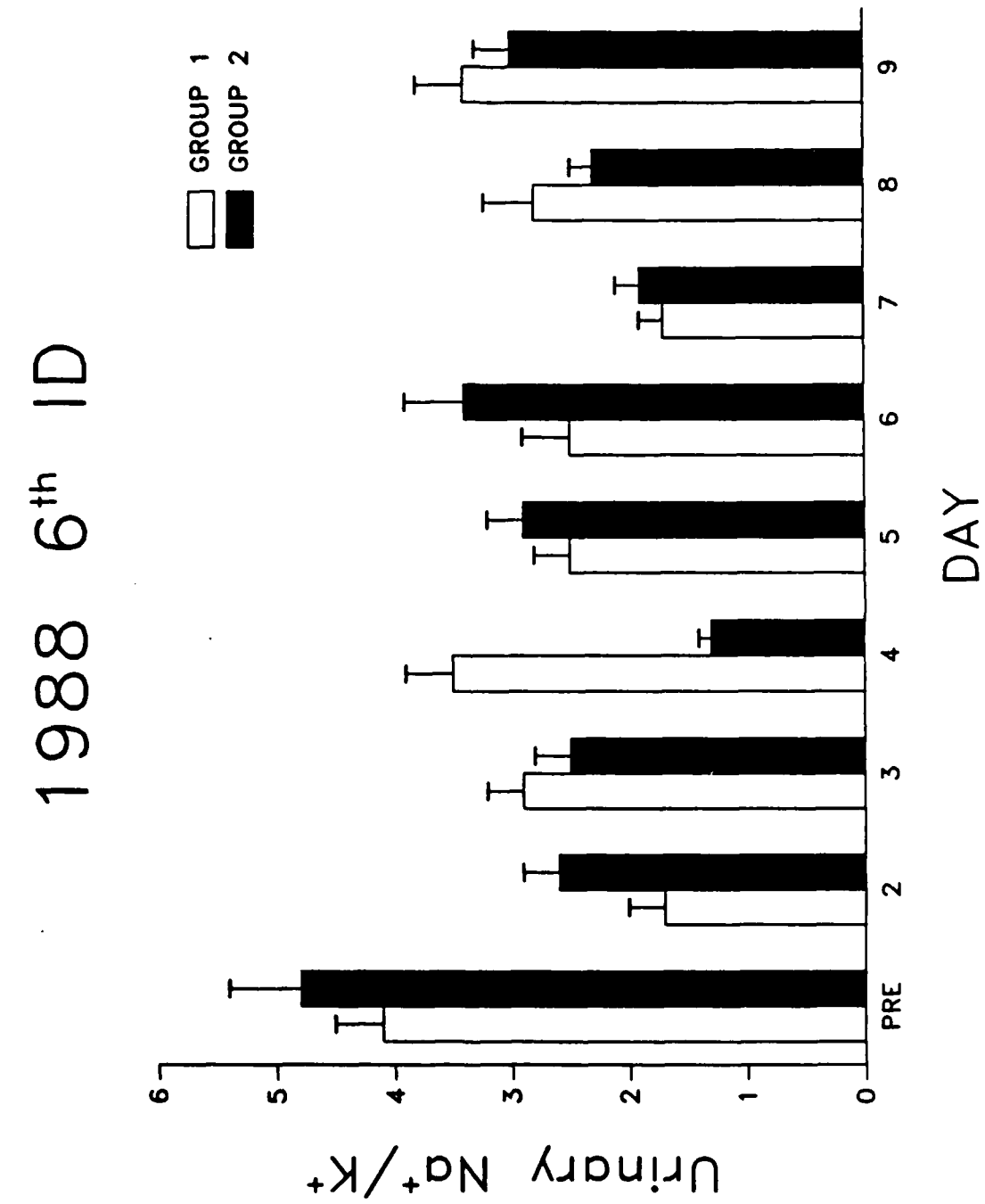

Figure 10. Mean daily urinary sodium and potassium expressed as a ratio.

pre-field exercise measures to Day 2 and remained low thereafter. This is consistent with hypohydration and the body weight loss reported. The large decrease may be due to an abnormally heavy salt load due to "junk" food loading prior to departure for the field.

Ration Acceptability

A total of 29 soldiers were asked to fill out questionnaires rating the Ration, Cold Weather (Appendix 5) after consuming the ration for 8 days under field conditions. Of these, 23 were E-2s, 1 was an E-4, two were E-5s, one was an E-6, and two were O-2s. These respondents had an average age of 21.1 years and had served an average of 1.9 years in the Armed Forces.

The first section of this questionnaire asked these soldiers to indicate how much they liked each of the various RCW components. The results can be seen in Table 8. In general, with but one exception (granola bar), the mean ratings were on the positive side of the nine-point hedonic scale. However, almost half of the items (11 each) were rated only slightly above, or within one point of, the neutral point of 5 on the scale. Fourteen of the items were rated above point 6 (like slightly) on the scale. The items with the highest ratings were mostly in the sweet dessert category, including the fig bar (8.1), the blueberry bar (7.7), raisin-nut crunch (7.6), chewing gum (7.3), and chocolate-covered cookies (7.2). This rating was supported

by the soldiers consuming higher percentages of the sweet dessert items.

Table 8

Mean Acceptance of RCW Items

Item:	Hedonic Rating*	Previous Rating[a]
Oatmeal (Apple & Cinnamon)	6.7	7.9
Oatmeal (Maple & Brown Sugar)	7.0	7.8
Oatmeal (Strawberry)	5.9	8.1
Chicken Stew	5.7	7.2
Beef & Vegetable	5.5	7.3
Pork & Escalloped Potatoes	5.4	7.7
Chicken a la King	5.4	7.9
Spaghetti & Meat Sauce	6.2	8.1
Chicken & Rice	5.8	7.3
Chicken Soup	6.6	8.2
Fruit Soup (Strawberry)	5.1	5.4
Fruit Soup (Raspberry)	5.2	4.6
Lemon Tea	6.8	6.7
Orange Beverage	5.4	5.9
Cocoa	7.0	7.2
Coffee	5.5	5.7
Cider	6.2	---
Cookies (Chocolate Covered)	7.2	7.0
Cookies (Oatmeal)	5.7	5.7
Brownie	6.1	5.6
Granola Bar	4.9	5.3
Blueberry Bar	7.7	8.0
Fig Bar	8.1	7.2
Chocolate Bar	7.0	6.3
Raisin-Nut Crunch	7.6	7.4
Chewing Gum	7.3	---

*Items were rated on a nine-point hedonic scale where 1 corresponds to "dislike extremely", 5 is "neutral", and 9 corresponds to "like extremely."
[a]Previous ratings are from reference 3.

In comparison with a previous evaluation of the RCW (3), the ratings of the same items in the present study were generally lower, often one to two points lower. Specifically, 16 items were rated lower, one the same as, and 7 higher than before. In general, the entrees were rated lower in the present study while the desserts were rated higher than in the previous study. Since these rations were made at the same time as those in the previous RCW studies (3,11), a reason for the lower rating could be deterioration of the RCW quality. However, Morgan et al. (11) used rations from the same lot (packed January 1986) and conducted their study at the same time (January 1988) and the hedonic ratings for those RCW components were much higher than in the present study and about the same as the 1986 study (3).

Table 9 presents the subjects' ratings of the RCW by the time of the meal. The RCW was less well accepted at breakfast, with a mean rating of 4.7, where numbers below the neutral point of 5 indicate increasing dislike. The RCW was rated somewhat more favorably at lunch and dinner, though these mean ratings did not exceed a rating of 6 (like slightly). Apparently, these soldiers did not like these kinds of foods for breakfast as they did for other meals. Since oatmeal was the only breakfast-type component and it received fairly good ratings (5.9 - 7.0), the scarcity of breakfast type items could be a contributing factor to the low breakfast rating.

Table 9

Rating of RCW by Meal Time

Meal:	Hedonic Rating*
Breakfast	4.7
Lunch	5.5
Dinner	5.9

*Items were rated on a nine-point hedonic scale where 1 corresponds to "dislike extremely", 5 is "neutral", and 9 corresponds to "like extremely."

Table 10 reveals the evaluation of these soldiers regarding the amount of food provided by various RCW items. On this rating scale, the number 5 indicates "just right", while lower numbers indicate that items are too small. Six of the categories were given ratings under 5, though none were much under 4, which equates to "slightly too small." Two categories were rated above 5--beverages (5.3) and fruit soups (5.8)--where 6 refers to "slightly too large."

Table 10

Evaluation of Ration Serving Size

Item:	Mean Evaluation*
Entree bars (chicken, beef, etc.)	4.7
Oatmeal	4.7
Desserts (cookies, brownies, bars, etc.)	4.5
Beverages (cocoa, tea, cider, etc.)	5.3
Fruit soups (strawberry, raspberry)	5.8
Chicken soup	4.7
Candies	4.4
Nut and raisin mix	3.9

*Items were rated on a nine-point scale where 1 equals "very much too small", 5 means "just right", and 9 refers to "very much too large."

Table 11 reveals the soldiers' judgments about variety in the RCW. The rating scale for these items differed from the previous ones in that the midpoint was not a neutral

Table 11

Evaluation of Variety in the RCW

Item:	Mean Evaluation*
Entree bars (chicken, beef, etc.)	3.3
Breakfast foods (oatmeal, etc.)	3.2
Desserts (cookies, brownies, etc.)	3.2
Beverages (cocoa, tea, Kool-Aid, etc.)	2.9
Fruit Soups (strawberry, raspberry, etc.)	2.3
Traditional Soups (chicken, beef, veg)	2.8
Candies	3.5
Nut and raisin mix	3.5

*Items were rated on a six-point scale where 1 indicates "variety now enough", 3 means "needs somewhat more variety", and 6 equals "needs very much more variety."

point on the scale. Instead, the number 1 refers to the present variety being enough, while higher numbers indicate a desire for more variety. The presumption was that no one would ask for less variety than already existed. The average scores for all RCW categories hovered around 3, or that "somewhat more variety" was desired. It appears that soldiers would like more variety among all RCW categories.

Soldiers were also asked to rate how satisfied they were with various aspects of this new ration system. The results can be seen in Table 12. On this rating scale, the number 5 was the neutral point, with lower numbers expressing increasing dissatisfaction. All but one aspect earned

ratings below 5. Three aspects earned ratings below 4, which represents "slightly dissatisfied." These soldiers were dissatisfied with ease of ration preparation (3.9), variety from pack to pack (3.8), and amount of food (3.6).

Table 12

Mean Ratings of Satisfaction with the RCW

Ration Aspect:	Satisfaction	Previous Rating[a]
Ease of Preparation	4.3	5.4
Ease of Heating	3.9	---
Taste of Food	5.1	6.2
Appearance of Food	4.6	6.3
Amount of Food per Daily Pack	3.6	4.6
Variety per Daily Pack	4.3	5.3
Variety for Pack to Pack	3.8	4.6

*Satisfaction was rated on a nine-point scale where 1 equals "extremely dissatisfied", 5 equals neutral, and 9 indicates "extremely satisfied."
[a]Previous rating information is obtained from reference 3.

The item with the highest rating, the taste of the food (5.1), was only marginally above the neutral point. Therefore, it appears that these soldiers were, in general, slightly dissatisfied with most aspects of the RCW. Compared to a previous evaluation of the RCW (3) by different troops, the soldiers in the present study were less satisfied with every attribute of the RCW. In fact, on the nine-point scale of satisfaction, their ratings were generally about a point lower than those of the previous study.

As just noted, the amount of food available in the RCW received the lowest satisfaction rating in Table 12. The

answers to these questions support the data in Table 10 in which the soldiers rated the serving size of the components as too small. However, soldiers were also asked why they did not get enough to eat during the exercise. Their responses are listed in Table 13 in order of decreasing frequency of response.

Table 13

Reasons for Not Getting Enough to Eat

Item:	Frequency:	Per Cent:
Insufficient time for preparation	21	72.4
No heat source for heating.	21	72.4
Not enough water for preparation.	16	55.2
Insufficient time to eat.	15	51.7
Too much trouble to prepare.	14	48.3
Disliked the food in the RCW.	13	44.8
Not enough food provided.	10	34.5
Too cold to eat.	7	24.1
Poor heat source for heating.	7	24.1
Boredom due to insufficient variety.	5	17.2

As this table illustrates, the most common reasons for not getting enough to eat had little to do with the quality or quantity of the ration itself. Rather, they dealt with environmental factors such as insufficient time, heat sources, or water for food preparation. However, the sixth and seventh most common responses, disliking the food (44.8%) and insufficient quantity (34.5%), did refer to the ration itself. Therefore, when these soldiers did not get enough to eat, the problem was due most commonly to environmental conditions, and in less than half of the cases, it was due to

the quality or quantity of the ration itself. Overall, the problem of too little to eat was apparently widespread for not one soldier circled the answer option, "always ate enough during this exercise."

Soldiers were also given the opportunity to cite the reasons why they did not get enough to drink during the exercise. The results are in Table 14, listed in order of decreasing frequency of response. Apparently, the problem

Table 14

Reasons for Not Getting Enough to Drink

Item:	Frequency:	Per Cent:
Insufficient time to melt snow or ice.	14	48.3
No heat source or stove.	10	34.5
Not enough heat sources for the group.	9	31.0
Water in canteen kept freezing.	8	27.6
Too much trouble to melt snow or ice.	5	17.2

of getting enough water to rehydrate the powdered beverages was quite widespread. Only three soldiers circled the option, "always drank enough during exercise." As Table 14 shows, the most common problems dealt with insufficient time or heat to melt snow or ice. Since soldiers have trouble procuring their own water, perhaps water supplies should be made more readily available or additional opportunities should be provided for soldiers to melt ice or snow. The answers to the questions concerning melting of snow and ice are misleading since these troops were not allowed to melt

snow or ice and were not supplied with the means to do so.

These soldiers were asked additional questions about how often they had trouble getting enough to eat and drink, and the results are in Table 15. On this scale, most of the results hovered around point 4, or "fairly often." In other words, these soldiers said that they fairly often went both hungry and thirsty in the field. However, they also said that they fairly often had enough water for food preparation.

Table 15

Frequency of Deprivation

Item:	Mean Frequency*
How often hungry in the field?	4.5
How often thirsty in the field?	3.8
How often had enough water for food prep?	4.3

*Questions were answered on a seven-point scale in which 1 equals "never", 4 equals "fairly often", and 7 equals "always."

This supplements the finding in Table 13 that 55.2% of the soldiers reported at times not having enough water to prepare their rations. Apparently the frequency of that lack of water for food preparation was not too high. When asked in yet another way about the difficulty in obtaining water, the subjects' average response was 5.3 on a nine-point scale in which 5 is the neutral point and 6 equals "slightly difficult."

The need for water in rehydrating various components of

the RCW is more clearly seen in Table 16. These data indicate that entrees and oatmeal almost always were rehydrated (6 on the scale means "almost always"). Since it is normally expected that soups and drinks would be

Table 16

Frequency of Adding Water to Various RCW Components

RCW Component:	Mean Frequency*
Entrees	6.1
Oatmeal	5.7
Chicken soup	4.7
Cider	4.4
Tea	4.3
Fruit soups	4.3
Cocoa	4.0
Coffee	3.3
Orange beverage	2.5
Granola	1.5

*Items were answered on a seven-point scale in which 1 equals "never," 4 equals "fairly often," and 7 indicates "always."

rehydrated before consumption, the fact that they were fairly often rehydrated might be expected if they were not being consumed. No items were given the lowest rating of 1, which refers to absolutely never rehydrated. Thus plentiful water is clearly an important feature in using the RCW. Responses to other questions further elucidated the great need for water in the field. The average number of canteens of water used each day totaled 5.5, with 2.5 for drinking, 1.5 for use with the RCW, and 1.5 for other uses such as washing. All soldiers reported relying on water from the 5 gallon

cans, while 5 (17.2%) reported using melted snow and 1 (3.4%) reported using melted ice. When asked how often they had to melt snow or ice to obtain water, the average response for the entire group of soldiers was every fifth day.

The soldiers were asked at what approximate temperature they usually ate their RCW items. These assessments were meant to be subjective judgments only. The results can be seen in Table 17. Oatmeal, chicken soup, and entrees (all typically eaten hot at home) were given ratings around the point of 5 (warm) on this seven-point response scale. Drinks like coffee and cocoa, which are typically drunk hot at home, were also rated on the warm side of the scale in the field.

Table 17

Typical Temperature at Which RCW Items Were Consumed

Item:	Temperature Category*
Oatmeal	4.9
Chicken soup	4.9
Entrees	4.7
Cocoa	4.5
Coffee	4.3
Cider	3.6
Fruit soup	3.3
Tea	2.7
Orange beverage	2.5
Plain water	2.1

*Temperature was assessed subjectively on a seven-point scale in which 1 means "very cold", 4 equals "neutral", and 7 indicates "very hot."

Conversely, items typically consumed cool at home i.e., drinks such as cider, water, and orange drink, were consumed

cool in the field as well. In short, this table illustrates that troops tried to consume the RCW in the field under temperature conditions similar to those at home.

Trying to prepare warm food items in the field involves some effort. The next two tables relate to some of the problems involved in accomplishing RCW food preparation. Table 18 indicates how troops usually protected their hands while preparing and eating the RCW in a cold environment.

As Table 18 reveals, few soldiers (6.9%) were able to simply avoid the problem of eating outside. A total of 72.3% used some form of gloves for hand protection. However, gloves do cause some difficulty in handling food and so about a quarter of these soldiers simply did without hand protection while preparing and consuming the RCW. When asked how cold their hands got while preparing and eating the RCW,

Table 18

Methods of Protecting Hands While Handling the RCW in the Cold

Method:	Frequency:	Per Cent:
Wool glove insert	11	37.9
Wool mitten insert with trigger finger	9	31.0
Black leather outer glove	1	3.4
No protection	7	24.1
Did not eat outside	2	6.9

the average response for all subjects was 2.6 on a six-point scale where two means "slightly cold" and three means "somewhat cold." This is an average figure, and presumably

those who prepared their meals without gloves got colder than those who did.

Table 19 presents the methods of heating water for use in preparing the RCW. The vast majority of soldiers on this exercise (96.6%) used water heated on the Yukon stove in the heating tent. Other possible methods were used by none or only one of these troops. Exactly why these other methods are less used is unclear.

Table 19

Methods of Heating Water for the RCW

Method:	Frequency:	Per Cent:
Yukon stove	28	96.6
Squad stove	1	3.4
Canteen cup stand & heat tabs	1	3.4
Zestotherm heat bags	0	0
Mounted vehicle heater	0	0
Personal stove	0	0
Sterno	0	0

Soldiers were also asked to rate how easy or difficult it was to prepare each aspect of the RCW in the field. A wide variety of aspects were covered, including some previously discussed in detail and some new ones. This allowed an assessment not only of perceived absolute difficulty, but also of relative difficulty. In other words, it was possible to determine which of various potential problem areas the subjects thought were the worst. The results are in Table 20. These mean judgments were based on a nine-point scale in which 5 was the neutral point, with

lower numbers indicating an aspect was easy, and higher numbers indicating that it was difficult. Overall, only

Table 20

Difficulty of RCW Preparation

Item:	Difficulty*
Heating water in order to prepare food/drinks	6.1
Obtaining enough water for preparation	5.5
Eating more than one item at a time	5.1
Keeping hands warm	4.8
Opening the outer bags	4.5
Opening an individual packet	4.3
Avoiding spilling package contents	4.3
Mixing the right amount of water for rehydration	4.1
Locating a specific item in the outer bag	4.0
Sealing entree bag with plastic closure	3.8
Crumbling the ration before adding water	3.4
Understanding preparation instructions	2.3

*Items were answered on a nine-point scale in which 1 meant "extremely easy", 5 referred to "neither easy nor difficult", and 9 indicated "extremely difficult."

three aspects had average scores on the difficult side of the scale. The worst of these was heating water (6.1), where 6 on the scale means "slightly difficult." The other two items were obtaining enough water (5.5) and eating more than one item at a time (5.1). Other items had mean scores below 5, but this does not mean that preparation was easy for everyone. A mean of 4.8 for keeping hands warm, for instance, suggests that some individuals found it easy and gave it low scores while others found it difficult and gave it higher scores. On the average, however, it appears that heating water is the worst problem, obtaining water is also

serious, and keeping the hands warm and working with the RCW items are not terribly difficult.

That the RCW is somewhat difficult to work with is also seen in the soldiers' responses to a question about how convenient it was to use the RCW in the field in cold weather. The average score was 4.2 on a nine-point scale in which 4 means "slightly inconvenient" and 5 indicates "neutral." On a seven-point scale the RCW was compared in convenience with the MRE. The average score was 3.9 which is almost exactly the neutral point (4) and which means that the RCW was about as convenient as the MRE. Yet when asked about the acceptability of the RCW as compared to the MRE, the average answer was 4.7 on a seven-point scale in which 4 equals "neutral" and 5 means "RCW slightly better."

No matter how superior a system may be to its predecessors, there is always room for improvement. These soldiers were therefore asked to assign ranks to a number of possible ways of improving the RCW, with the number "1" indicating the most important, and larger numbers indicating less importance. The results in Table 21 are listed in order of decreasing importance. In other words, the most important improvement, as judged by these troops, would be to make the rations taste better. Increasing variety and adding more breakfast items tied for second in importance. Increasing portion size and making the ration easier to prepare were considered less important. It should be noted, however, that these mean ranks all hovered near the midpoint of 3,

indicating that there was little agreement among the soldiers as to which item should be ranked most important. In other

Table 21

Possible Ways of Improving the RCW

Method	Mean Rank*:
Make the rations taste better	2.6
Increase the variety of the ration	2.9
Include more breakfast foods	2.9
Make the portion sizes larger	3.1
Make the ration easier to prepare	3.3

*Scores are mean ranks based on the assignment of the number 1 to "the improvement you think is MOST important," the number 2 to "the improvement you think is SECOND in importance," and so on.

words, if all troops agreed exactly on the rank order of the five items, then the lowest mean score would have been 1 and the highest would have been 5. When all the mean scores hover around 3, some ranked the item very high while other ranked that same item very low.

The soldiers in this field study also rated how easy or difficult it was to rehydrate the various items of the RCW in hot and cold water. The results are in Table 22. On this nine-point answer scale, 1 means "extremely easy", 5 refers to "neither easy nor difficult", and 9 indicates "extremely difficult." The items are ranked in order of their ease in rehydration with hot water. Thus coffee, with a rating of 1.8, was ranked the easiest of all items to rehydrate in hot water. Generally, in hot water, the easiest

items to handle were the beverages, i.e., the items supposed to be entirely liquid. Soups were somewhat less easy to rehydrate, and the solid entrees had the worst rating of all. However, it should be noted that in hot water, all items were rated on the easy end of the scale, with even the entrees getting a rating of 3.0, indicating "moderately easy."

Table 22

Ease of RCW Rehydration

Item:	Ease with Hot Water*:	Rank:	Ease with Cold Water*:	Rank:
Coffee	1.8	1	3.5	2.5
Tea	2.0	2	2.5	1
Cider	2.2	3	3.5	2.5
Chicken soup	2.4	5	4.8	7
Cocoa	2.4	5	4.9	8
Fruit soup	2.4	5	4.5	5.5
Oatmeal	2.7	7	5.8	9
Orange beverage	2.8	8	4.3	4
Entrees	3.0	9	4.5	5.5

*Ease was rated on a nine-point scale in which 1 equals "extremely easy", 5 means "neither easy nor difficult", and 9 refers to "extremely difficult."

However, the picture was quite different when cold water was used to rehydrate the foods. Typically, using cold water raised the difficulty level by one to two points for each item. The worst change was for oatmeal, which went from a rating of 2.7 in hot water to 5.8 (slightly difficult) in cold. Even with cold water, however, oatmeal was the only item which was rated on the difficult side of the scale. The rankings changed when items were ranked in terms of relative

difficulty of preparation in cold water. In other words, some items which were considered relatively easy to rehydrate with hot water, e.g., chicken soup with a rank of 5, were difficult to rehydrate with cold water (rank 7). Conversely, some ranked low in the list with hot water, e.g., entrees with rank 9, were ranked better with cold water (rank 5). Overall, however, it is clear that using cold water does reduce the ease of handling RCW items. This could represent a fairly serious problem in light of the often reported difficulty in obtaining sufficient hot water.

Cold Experience

Information taken from the Cold Environment Background Survey Form (Appendix 4) was used to assign a number (based on cold weather training and exposure) to the ability of a subject to perform in a cold environment. The data for these groups are reported in Table 2. There was no difference between the groups, but this was expected since the 6th ID (L) uses cohort units with only the senior non-commissioned officers and officers being newcomers to the group. Since the group was formed, all subjects received the same training and were assigned as a group to Alaska. Their mean value of 16 put them in the moderate CE category, which was lower than expected since this group had been heavily trained in cold weather problems. The value of 16 was comparable to average values from 61 subjects at Ft. Campbell, KY (8), who had not received as much cold weather

training, but tended to have a more favorable opinion toward living in a cold climate.

DISCUSSION

The purpose of this test was to examine the hypothesis that adequate water intake (forced intake of 4 L/man/day) would alter consumption of a dehydrated ration (RCW) under field conditions. In prior studies (14,19), water had been a problem in that the subjects did not have sufficient supplies or they did not consume a sufficient quantity (decreased thirst) to maintain hydration. This study imposed the additional problem of obtaining an adequate supply of hot water within a large military (company-sized) operation.

In the three previous field studies in which the RCW has been used, the caloric intake has been similar (2710 - 3182 kcal or about 60-73% of available calories) while the water intake has varied from 3 to 5 L/day (7,9,11). In each of these studies, daily water intake has been sufficient to reduce long term sodium loading as recommended in the original studies which tested the RCW (7,17). In all of these studies, the body weight loss has exceeded 3%, which has been set as the upper limit for safe body weight loss (20). It should be noted that other field rations (MRE and RLW) have not proved to be any better at maintaining body weight under similar cold weather conditions (11). If inadequate water consumption has not been the primary reason

for inadequate calorie consumption, then other factors need to be examined. It has been proposed by other investigators (13) that there are "environmental and/or situational factors" that preclude the adequate intake of calories when the rations contain sufficient calories. Environmental or situational factors that impact on calorie consumption include: the distribution of water supplies, timing of water availability, physical stress, menu boredom, and psychological stress.

In each of the prior studies (small units) involving use of the RCW and other rations, the subjects were trained and equipped to obtain water by melting snow or ice. While this required extra effort, it gave these troops more flexibility in eating rations requiring hydration, i.e., RCW. The troops used in the present study were members of a full company (125 men) operating as part of a division. These troops were not equipped with individual stoves, and were not allowed to melt snow or ice to obtain drinking water. All water supplied to these troops was carried into the troop area (from approved water supply points) in 5 gallon cans (which were freezing and required up to 8 hours to thaw). In this situation, access to hot water for rehydration of entrees and drinks (coffee, tea, cocoa) was limited by the need to leave combat positions to return to the squad tent (water heated on Yukon stove). This caused problems for some of the troops due to the time lost (time required to undress, heat water, eat, and then redress) from normal military duties. A greater problem

occurred during movements or simulated combat when the squad tent was not set up and hot water was not available. One solution to the problem of water supply during movements is to allow the soldier to carry more water and to provide a method of heating the water. In a cold environment, water should be carried under the uniform to prevent freezing. A recommended approach is to issue the troops polypropylene bottles or the 2 qt. soft canteen. The RCW includes high calorie snack components which allow for consumption while moving, but adequate nutrition requires consumption of all parts of the ration.

The problems encountered with consumption of a ration (i.e. RCW) which requires hot water are detailed in Table 23. The data shown are the averages for both groups which tends to mask some of the effects of movements. Day 1 was the deployment day for both groups, but one group deployed with frozen water supplies. Both groups suffered from low consumption rates which was due to the reduction in time for preparing meals after a late start in setting up the camps. On Days 2 and 3, movements were short or non-existent and the consumption of foods (entrees) requiring hydration increased. Consumption of the entrees is important since they contain most of the protein. A large amount of the sodium is located in the soups (chicken) which was poorly consumed (less than 1/3). On Day 4 and 5, movement of one group or the other occurred, but the other group was stationary with the major difference being in the type of camp. On Day 4,

TABLE 23

Consumption levels for the combined groups

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Total Calories RCW	2157	2725	2711	3020	2446	2308	2043	2718
Total Water ml	2564	4356	3410	4019	3333	2869	2638	3494
% Entrees consumed	51	74	72	88	65	49	43	85
% Soups consumed	19	30	19	23	18	9	17	28
% Drink mix consumed	13	29	20	32	18	14	18	29
% Snack Bars consumed	50	62	70	69	62	67	57	69
Troop Movement	Deploy	Short Move	Short Move	G1-long G2-none	G1-none G2-long	overnight Move	Long Move	no Move

Group 2 did not move and rested in their previous camp and consumed 100% of their entrees. On Day 5, Group 2 moved, and Group 1 was stationary, but their camp was in an ambush position with only one tent per company which decreased the percentage of entree consumption. On Day 6 (overnight move) and Day 7 (move to hilltop), supplies of water were low and the opportunity to hydrate troops as well as to prepare meals was reduced. On Day 8, the troops were stationary with tents set-up and an increase in consumption was observed.

Since the nutrient content is not evenly spread throughout the ration, selective consumption of only the snack bars (easily consumed without rehydration) results in problems in dietary balance. It is evident that troops must be given the chance to adequately consume nutrients and water. Greater emphasis must be placed on giving time and supplies to ensure adequate nutrition even during times of intense movement.

Nutritional Status

The mean energy intakes between Groups 1 and 2 were not significantly different for the RCW or total food intake. Significant differences of energy intake were observed between days. These differences could be attributed largely to the level of activity (energy consumption being lower on troop movement days) and to the availability of water. Since the mean energy intakes for the two groups were not significantly different, the RCW intakes of both groups were

pooled (Appendix 7). The average energy intake from the RCW only for the pooled group was 2534 ± 69 kcal/day which is approximately 57% of the available energy in one RCW. This percent consumed was lower than all previous studies (7,9,11) by 3 to 16%. An estimated energy expenditure of 4700 kcal was calculated from activity data, however consumption of the RCW accounted for only 54% of the caloric intake required for energy balance. This would predict a body weight loss of about 5.7 pounds over an 8-day period, assuming one pound of body weight lost for every 3500 kcal below energy requirements. Actual body weight losses were very similar to this prediction at 5.4 lb and 6.7 lb in 6 days for Groups 1 and 2, respectively. Accurate field measurements of body weight were difficult to obtain due to differences in clothing, moisture content in clothing, uneven ground, and sloping Arctic tent roofs forcing a crouching maneuver for weighing.

Subjects consumed an average of 340 ± 10 gm/man/day of the 661.5 grams of carbohydrate available in the RCW. This represented 54% of the total energy intake and 51% of the available CHO. Consumption varied with the time available to eat and with the ability to heat water to prepare the RCW components. High carbohydrate snacks were eaten extensively when water was unavailable.

Protein contributed an average of 78 ± 3 gm/man/day, 12% of the total RCW energy intake, and 65% of the available protein in the RCW. This protein intake is below the 100

gm/man/day recommendation of the MRDA, but meets the current RDA recommendations (21). Protein and sodium are both limited in the RCW, compared to other operational rations, as these nutrients are known to increase metabolic requirements for water (11,14). Over 50% of the protein provided in the RCW is found in the entree component. The entrees were often left unconsumed if hot water was not available, but in general, a greater percentage of this nutrient was consumed than the other macronutrients i.e., calories, carbohydrate, or fat since about 70% of all issued entrees were consumed. However, only about 40% of the soldiers in Group 1 ate their entree for 4 days of the study. This situation occurred on 2 days for the soldiers in Group 2. The erratic consumption of protein is detailed in Appendix 8. While the average consumption (73.3%) was high, the daily intake varied widely. This reflects the difficulty of consuming entrees (which contain most of the protein) when hot water is not available.

Fat contributed 96 $\pm$ 3 gm/man/day to the diet or 34% of the total RCW energy intake which is excellent because this intake of fat falls below the maximum of 35%FAT recommended in the MRDA. But, it accounts for a greater percentage of the total energy in the RCW than the original configuration (30%). About 64% of the fat in the RCW were consumed. The large contributors of fat were the snack bars that could be consumed without water for rehydration.

Inadequate micronutrient intakes were more prevalent during consumption of the RCW in the present study compared

to reports by Morgan et al. (11). Considering that the soldiers were eating 57% of the total energy and 51-65% of the available macronutrients available in the RCW, it is not surprising that their intake of available micronutrients were lower (Appendix 7). The consumption of available micronutrients ranged from a low of 21.6% for vitamin C to a high of 71.7% for zinc for the subjects in Group 2. The consumption patterns of micronutrients was affected by the distribution of vitamins and minerals among the different RCW components. Certain components which were heavily fortified with micronutrients e.g., vitamin C (41% of total available) and riboflavin (26% of total available) in the orange beverage bar, were not eaten on a regular basis. The mean nutrient data indicated that the RCW ration did not contain sufficient nutrients to meet the MRDA for folacin and zinc even if the soldiers had eaten all of the ration.

Sodium intake from the RCW components averaged 2757 $\pm$ 92 mg/day. This level of sodium intake was within the range recommended in the MRDA which was probably due to the reduced level of sodium in the ration and to the reduced intake of RCW compared to the amount that was available. Sodium excretion levels in the urine were high on the 2nd morning in the field and decreased thereafter. Examination of the dietary records for the period prior to deployment indicated that high sodium foods were widely consumed before the troops entered the field to account for the high excretion on the 2nd morning. The decrease in sodium excretion after Day 2

probably reflected the body's attempt to conserve sodium with decreased dietary sodium intakes.

In summary, the energy intake may have been inadequate (54% of energy requirements), but the soldiers were eating a balanced diet in terms of the percent distribution of energy from carbohydrate (%CHO), protein (%PRO), and fat (%FAT). The soldiers in the present study were consuming 54%CHO, 12%PRO, and 34%FAT compared to the 59%CHO, 11%PRO, and 30%FAT available in the present configuration of the RCW. Nutrient intake data showed that the soldiers in both groups were ingesting inadequate quantities of a majority of the micronutrients. The percent consumption of available nutrients ranged from a low of 22% to a high of 72%. Vitamin A, phosphorus, sodium, and potassium intakes were adequate when only RCW consumption was considered. If the consumption of the RCW had been higher for the 12 (out of 19) components that had consumption percentages lower than 50%, then the troops would have had much less trouble consuming adequate amounts of nutrients. When total nutrient intake was calculated, the soldiers were eating a fairly balanced diet with only energy, riboflavin, folacin, and zinc intakes being inadequate. As stated before, the folacin and zinc intakes were probably inadequate because the RCW contained inadequate amounts.

Ketone bodies were seen in the urine of subjects on the morning of Day 2. This could be an indication of increased fat metabolism which could be triggered by excessive use of

caffeine (not applicable to this study) as well as an inadequate carbohydrate supply. Ketone bodies appeared more frequently on the days when food consumption was low and the activity level was high. Since the energy (72 - 78% of MRDA) intakes were inadequate to maintain energy balance, it appeared that the soldiers were metabolizing body fat for energy. Ketosis could have affected the ability of the soldiers to perform mental tasks if the conditions had become too severe or continued for too long a period of time. Unfortunately, mental performance tests were not conducted.

Blood chemistries showed significant changes from pre- to post-field exercise for several variables, but all values remained within normal ranges. These changes were probably due to changes in diet and work levels, but the changes were of little significance. The reduction in cholesterol and triglyceride levels indicated that the ration would be acceptable in reducing coronary heart disease risk. The increase in blood proteins and changes in BUN possibly indicated a breakdown of body protein due to insufficient protein and/or energy intake.

In terms of actual food consumption, the RCW was not ingested in sufficient quantities to meet the energy needs of soldiers working in the cold. Only 57% of the energy available in the RCW were consumed. In 6 days, the soldiers in Groups 1 and 2 had lost 3.2 and 4.1% body weight, respectively. Considering that the caloric intake was so much lower than energy expenditure (2534 vs 4700 kcal for the

pooled subjects), the weight loss was probably due to the inadequate caloric intake. Nutrient intake data showed that the soldiers in both groups were ingesting inadequate quantities of a majority of the nutrients. Only vitamin A, CHO, fat, sodium, potassium, and phosphorus intake met the MRDA when only RCW consumption was considered.

Hydration Status

There were no significant differences in water intake between the two groups. Group 1 was supposed to be forcing water intake to ensure hydration during the study and consistently drank more water, but Group 2 was able to obtain and drink enough water so the difference in mean water intake was only 324 ml/day. It was not possible to fully test the hypothesis that forced fluids would affect food consumption in the cold.

There is widespread acceptance that hypohydration exists in cold climates as well as hot climates and that thirst alone is not sufficient to compensate for water loss from perspiration, respiration, and diuresis (12). There is also agreement on some of the consequences of inadequate hydration in the cold (15,16). The problems relating to the assessment of level of hydration in a field situation comes down to the methodology used. Francesconi et al. (5) have reported that the usual means of measuring hypohydration (urinary specific gravity, urinary sodium/potassium ratios, hematocrit, serum osmolality, body weight loss, and urinary

nitrogen/creatinine ratios) may not be in agreement and may not be a measure of frank hypohydration, but more a measure of the body's attempt to prevent hypohydration. The results reported by Francesconi et. al. highlight the problem of inferring hydration status of an individual from a single urine sample rather than from a daily average over the duration of the field exercise.

The weight loss that occurred in this study could be explained by insufficient food intake and while the sodium/potassium ratios and the incidence of occurrence of SG > 1.030 would be indicative of hypohydration in some subjects, the pre and post serum osmolality and hematocrit data were contradictory. The pre and post samples were taken after quiet times and might be more indicative of steady state. This data coupled with the water intake data (estimated from questionnaires) indicated that these subjects maintained an almost constant physiological adjustment to avoid hypohydration. The effect of the constant adjustment to changing levels of hydration on food intake is unclear, but increasing food consumption is not as simple as increasing water intake. The trend of daily energy intake appears to follow trends in water intake for Group 1, but not for Group 2. However, it cannot be determined whether the food intake was increasing with increasing water intake because of a psychological signal; whether having more water available allowed the soldiers to prepare and eat more of the dehydrated ration; or whether the high water days were rest

days and the soldiers had time to eat.

It appears that adequate consumption of water is possible in cold environments, but methods of distribution and methods of obtaining water for large scale operations need to be examined. A major issue that continues to reoccur is the failure of troops to take advantage of water availability before deployment. The first 24 hours of an operation could be very important, but the troops continue to deploy with hydration problems which may be further exacerbated by alcohol consumption (dehydration producing substance) prior to deployment. In this particular study, certain members of the command staff required medical assistance for hydration problems within the first 24 hours because their work schedule did not allow time to eat and drink prior to deployment. The problems of frozen water cans and uneven distribution of water and food adversely affected those soldiers who were not part of this test group. Measurements of urine specific gravity from soldiers consuming the normal field rations (T-rations and MREs) indicated that they consumed less water than the subjects in the test. The fact that the test subjects consumed more water is not surprising and was probably due to the briefings and reinforcement of seeing the research team on a daily basis.

Ration Acceptability

On the average, the 29 soldiers in this study rated all

but one item (the granola bar) of the Ration, Cold Weather (RCW) on the positive side of the hedonic scale. This indicates at least minimum acceptance of the ration. However, most average ratings were in the range of "like slightly," which indicates considerable room for improvement. And when the troops were asked to rank order possible ways of improving the ration, the item with the highest overall rank was to improve the taste of the RCW. It is suggested, therefore, that further work be done on improving the taste and appeal of the RCW.

Another of the most significant problem areas dealt with the use of water with this ration. Soldiers experienced trouble in obtaining sufficient water, properly heating the water, and in rehydrating the ration components. This problem area suggests that more work should be done on the problems of providing adequate amounts of water and methods of heating water in a cold environment if the RCW is to be used as the cold weather ration.

Another significant problem area dealt with the total amount of food provided by an individual ration. About 4500 kcal were available each day, the soldiers felt satisfied generally with the size of individual components, and they only consumed 51-65% of the available macronutrients; but they felt they did not get enough food to eat overall. When asked to cite the reasons they sometimes went hungry, the reasons that were most often mentioned dealt with the various difficulties encountered in preparing the ration for

consumption (i.e. obtaining water). The provision of suitable amounts of hot water was again implicated, but improvements might also focus on increasing the quantity of food and allowing more time for preparation. There were minor, but not significant complaints regarding the size of the individual ration components, the variety of items within the ration system, and overall ease of preparation. Therefore, research on improving the ration should not excessively emphasize these areas.

SUMMARY and CONCLUSIONS

A technical feasibility test was conducted in the Blair Lakes Training Area, Ft Wainwright, AK for ten days in February and March, 1988 using volunteers from Alpha Co 5/9, 6th ID (L). The purpose of the test was to determine if increased consumption of water (4 L/man/day) would result in an increase in consumption of the Ration, Cold Weather.

Hydration status was assessed by pre and post exercise blood sample measurements and by daily measurement of urinary specific gravity and body weight changes. Nutrient intake was assessed by questionnaire and interview. Water consumption was assessed by questionnaire.

The results of the hydration measures indicate that the groups maintained a high level of hydration, but did not consume the desired level of 4 L/man/day except in a few cases. Total caloric intake from all sources (RCW and other) was below the estimated requirement of 4700 kcal/day which

resulted in a body weight loss of greater than 3 % for both groups. The consumption pattern was erratic and reflected the availability of hot water for rehydration of ration components and the time to consume the rations with greater consumption occurring on those days when movement was minimal.

It is apparent that other factors besides hydration influenced the intake of the Ration, Cold Weather. The ration requires certain modification before it should be considered for use as a stand-alone cold weather ration for light infantry troops who have no access to individual water heaters.

The biggest problem in use of this ration is access to hot water. In all prior tests, subjects had individual heaters, but the troops of the Light Infantry are not equipped with individual heaters. Therefore, access to hot water was limited to those times when they were in the squad tent which was unavailable during movements or combat situations. The use of this ration by Light Infantry (which would enable individual companies to operate away from their support) would require a restructuring of the mode of water supply to the troops and provision of individual heating devices.

In spite of the difficulties of using the ration, the troops expressed a desire to use the ration as long as a single hot meal could be provided on a daily basis. This would help the troops during those times when food delivery

more desirable ration than the MRE currently in use.

Another secondary issue is the problem of water in canteens freezing. A solution to this problem is to carry water inside the uniform which can be done by use of plastic bottles or by use of the US Army 2 quart canteen. This would have the benefit of doubling the volume of water carried at about the same weight as the 1 quart arctic canteen which does freeze.

RECOMMENDATIONS

1. Divide the RCW entree into two separately packaged portions to allow for having two entrees available for two meals.
2. Increase the riboflavin, folacin, and zinc content of the RCW ration by fortification of several items.
3. Replace unpopular RCW beverage items such as fruit soups and orange beverage bar with a palatable high carbohydrate supplement powder.
4. Package the entrees in shorter bags with an "add liquid" line to avoid having to measure quantities. The addition of a longer spoon would facilitate better sanitation.
5. Because of the difficulties experienced with obtaining hot water, fortification should not be concentrated in those items that require rehydration. The vitamins and minerals should be spread among as many items as

possible. Because of the differences in water policies, food items that work well with Special Forces may not be practical for the Light Infantry. The inclusion of some high protein entrees (reduced sodium) that could be eaten with or without rehydration may be desirable for the Light Infantry.

6. Command emphasis should be directed to increasing the availability of water and time to utilize water and rations. In cold climates, water must be carried inside the uniform to remain unfrozen, so a larger canteen of lighter weight should be issued to arctic troops.

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APPENDIX 1

Description of Ration, Cold Weather

INFORMATION PAPER

STRNC-WTP
23 Mar 88

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

1. In January 1983, a program was established at Natick RD&E Center to develop an operational cold weather ration. The requirement originated with the Marine Corps, which annually deploys 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 excesive sodium and protein, or the high water content makes them susceptible to freezing, which affects consumption and may degrade packaging integrity.

2. 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.

3. 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.

4. Prototype testing includes 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 then the MRE for cold weather feeding, but water discipline needs more command emphasis.

5. The U.S. Army Quartermaster School (QMS) initiated the Army's requirement for a cold weather ration. A Joint Working Group (JWG) meeting held in April 1987 addressed a second draft of the Operational and Organizational (O&O) Plan and a final draft was approved in September 1988. The Army pursued the adoption of the U.S.M.C. ROC (Required Operational Capability); however at a Test Integration Working Group meeting held 16 March 88 to discuss large scale testing of the RCW. the QMS representatives stated that the Army may have no requirement for the RCW. QMS is currently revalidating the Army's requirement for a cold weather ration.

6. Current efforts include: Providing the Defense Personnel Support Center with technical assistance for the U.S.M.C. FY88 procurement (221,000 rations) and monitoring the U.S. Army's position on the RCW via close coordination with QMS.

MAJ Schilling/AV256-4050/

PHILIP BRANDLER
Director, Food Engineering Directorate

MENU 1	MENU 2	MENU 3	MENU 4	MENU 5	MENU 6
CHICKEN STEW	BEEF STEW	POTATO/PORK	CHIX ALAKING	CHICKEN/RICE	SPAG/MEAT SC
OAT/STRAWBER	OAT/APPLE/CN	OAT/APPLE/CN	OAT/MAPLE/BS	OAT/STRAWBER	OAT/MAPLE/BS
COOKIE CO/CH	BROWNIE CHCV	BROWNIE CHCV	COOKIE CO/CH	BROWNIE CHCV	COOKIE CO/CH
GRANOLA BAR	GRANOLA BAR	GRANOLA BAR	GRANOLA BAR	GRANOLA BAR	GRANOLA BAR
OATML COOKIE	OATML COOKIE	OATML COOKIE	OATML COOKIE	OATML COOKIE	OATML COOKIE
BLUEBERRY BR	FIG BAR	FIG BAR	FIG BAR	BLUEBERRY BR	BLUEBERRY BR
RAISIN/NUT	RAISIN/NUT	RAISIN/NUT	RAISIN/NUT	RAISIN/NUT	RAISIN/NUT
CHOC W/TOFFE	CHOC W/TOFFE	CHOC W/TOFFE	CHOC W/TOFFE	CHOC W/TOFFE	CHOC W/TOFFE
ORANGE BEV	ORANGE BEV	ORANGE BEV	ORANGE BEV	ORANGE BEV	ORANGE BEV
COCOA BEV PD	COCOA BEV PD	COCOA BEV PD	COCOA BEV PD	COCOA BEV PD	COCOA BEV PD
LEMON TEA	LEMON TEA	LEMON TEA	LEMON TEA	LEMON TEA	LEMON TEA
CIDER MIX	CIDER MIX	CIDER MIX	CIDER MIX	CIDER MIX	CIDER MIX
FR/SOUP/STRA	FR/SOUP/RASP	FR/SOUP/STRA	FR/SOUP/RASP	FR/SOUP/STRA	FR/SOUP/RASP
CHIX NDL SUP	CHIX NDL SUP	CHIX NDL SUP	CHIX NDL SUP	CHIX NDL SUP	CHIX NDL SUP

RECORD OF NUTRITIVE VALUES RATION COLD WEATHER

04/15/88

MENU 1	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
CHICKEN STEW	1.56	56.58	22.20	7.91	73	563	2.00	2296	928	85	5.32	1.20	125
OAT/STRAWBER	7.52	10.14	5.35	2.39	41	381	1.99	295	569	81	.27	1.25	
COOKIE CO/CH	1.06	2.71	12.17	.38	36		.73	82	104	20	.24	.43	21
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.05	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
BLUEBERRY BR	9.51	1.80	6.81	.53	10	25	.75	204	55	7	.35	.00	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.62	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/STRA	1.23	.13	.33	.08	12	1	.21	19	13	4	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	41.13	120.25	152.10	24.34	1088	2368	15.03	4887	4070	570	10.57	7.08	182

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
CHICKEN STEW		3.124	5210		.31	.28	24.6	.36	40	.24	5.40	31.75	553	120
OAT/STRAWBER	380	.021	420		.36	.09	.6	.06	25		2.75	99.60	487	125
COOKIE CO/CH	680		680		.20	.06	.2	.25	14		1.63	26.68	227	43
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1.12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
BLUEBERRY BR		.006	10		.05	.06	.9	.01	2		.36	41.35	234	60
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	.2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/STRA				6	.50	.02	.0	.01	2		.15	48.21	196	50
CHIX NDL SUP					.12	.06	1.9	.02	7		.13	10.09	69	18
SUM	9970	3.176	15270	259	6.05	1.81	38.6	4.18	220	.84	23.04	656.18	4475	994

RECORD OF NUTRITIVE VALUES RATION COLD WEATHER

04/15/88

TOTALS	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
1	41.13	120.25	152.10	24.34	1088	2368	15.03	4887	4070	570	10.57	7.08	182
2	42.35	122.08	144.16	23.30	1151	2418	18.86	4493	4793	602	9.53	16.18	129
3	43.06	115.52	156.23	24.64	1406	2556	16.62	4693	4735	593	10.07	13.78	174
4	39.68	124.08	154.62	22.64	1195	2355	15.33	4179	4762	588	9.39	8.91	268
5	42.94	127.33	144.38	23.34	1056	2400	14.96	4642	4002	567	9.88	7.15	195
6	42.40	112.19	144.24	23.17	1238	2338	18.70	4386	4962	597	9.88	15.53	149
MEAN	41.93	120.24	149.29	23.57	1189	2406	16.58	4547	4554	586	9.89	11.44	183
MEAL REQUIREMENTS 1/3 AR 40-25		33.33	53.3		267	267	6.0	1667-2334	625-1825	133		5.0	

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
1	9970	3.176	15270	259	6.05	1.81	38.6	4.18	220	.84	23.04	656.18	4475	994
2	9740	4.130	16630	260	6.22	2.04	28.9	4.25	218	1.44	18.03	667.11	4454	999
3	10100	.062	10210	262	6.91	2.24	24.8	4.20	196	1.08	17.96	659.54	4506	999
4	10330	.064	10440	259	6.07	2.00	38.4	4.25	221	.84	22.42	650.98	4492	992
5	9740	.052	9830	260	6.20	1.81	38.9	4.23	200	.84	19.48	663.02	4461	1001
6	9970	.791	11290	261	6.16	2.06	26.7	4.19	239	1.92	19.97	671.99	4435	994
MEAN	9975	1.379	12278	260	6.27	1.99	32.7	4.22	216	1.16	20.15	661.47	4470	997
MEAL REQUIREMENTS 1/3 AR 40-25			1670	20	0.60	0.73	8.0(N.E.)	0.73	133	1.0	3.3	146.7	1200	

PERCENT OF CALORIES FROM: PROTEIN - 11 PERCENT
FAT - 30 PERCENT
CHO - 59 PERCENT

RECORD OF NUTRITIVE VALUES RATION COLD WEATHER

04/15,88

MENU 2	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
BEEF STEW	1.49	55.74	10.14	6.52	100	514	4.55	1876	1050	85	4.14	8.40	76
OAT/APPLE/CN	7.87	10.99	6.21	2.22	49	399	2.19	284	1041	96	.32	2.50	
BROWNIE CHCV	3.12	3.97	16.29	.54	34	72	1.44	78	121	30	.16	.50	16
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.05	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
FIG BAR	8.35	2.41	5.78	.88	40	36	1.15	251	164	14	.53	.58	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.62	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/RASP	1.27	.09	.50	.09	13	1	.19	14	17	3	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	42.35	122.08	144.16	23.30	1151	2418	18.86	4493	4793	602	9.53	16.18	129

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
BEEF STEW		4.068	6780		.29	.38	14.2	.37	47	.84	.84	46.12	499	120
OAT/APPLE/CN	380	.027	430		.38	.09	.8	.09	24		2.50	97.70	491	125
BROWNIE CHCV	450		450	1	.40	.09	.4	.27	6		1.55	26.08	267	50
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1.12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
FIG BAR		.010	20		.03	.15	1.3	.02	2		.29	40.58	224	58
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	.2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/RASP				6	.50	.02	.0	.01	2		.10	48.04	197	50
CHIX NDL SUP					.12	.06	1.9	.02	7		.13	10.09	69	18
SUM	9740	4.130	16630	260	6.22	2.04	28.9	4.25	218	1.44	18.03	667.11	4454	999

RECORD OF NUTRITIVE VALUES RATION COLD WEATHER

04/15/88

MENU 3	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
POTATO/PORK	2.24	49.14	22.38	7.86	356	652	2.28	2070	996	76	4.68	6.00	121
OAT/APPLE/CN	7.87	10.99	6.21	2.22	49	399	2.19	284	1041	96	.32	2.50	
BROWNIE CHCV	3.12	3.97	16.29	.54	34	72	1.44	78	121	30	.16	.50	16
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.05	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
FIG BAR	8.35	2.41	5.78	.88	40	36	1.15	251	164	14	.53	.58	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.62	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/STRA	1.23	.13	.33	.08	12	1	.21	19	13	4	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	43.06	115.52	156.23	24.64	1406	2556	16.62	4693	4735	593	10.07	13.78	174

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
POTATO/PORK	360		360	2	.98	.59	10.1	.32	24	.48	.72	38.38	551	120
OAT/APPLE/CN	380	.027	430		.38	.09	.8	.09	24		2.50	97.70	491	125
BROWNIE CHCV	450		450	1	.40	.09	.4	.27	6		1.55	26.08	267	50
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1.12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
FIG BAR		.010	20		.03	.15	1.3	.02	2		.29	40.58	224	58
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	.2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/STRA				6	.50	.02	.0	.01	2		.15	48.21	196	50
CHIX NDL SUP					.12	.06	1.9	.02	7		.13	10.09	69	18
SUM	10100	.062	10210	262	6.91	2.24	24.8	4.20	196	1.08	17.96	659.54	4506	999

RECORD OF NUTRITIVE VALUES RATION COLD WEATHER

04/15/88

MENU 4	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
CHIX ALAKING	1.38	58.50	24.60	5.99	130	530	1.80	1606	892	80	3.78	1.20	210
OAT/MAPLE/BS	7.37	11.49	6.32	2.25	61	390	2.11	235	1185	98	.46	2.50	
COOKIE CO/CH	1.06	2.71	12.17	.38	36		.73	82	104	20	.24	.43	21
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.05	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
FIG BAR	8.35	2.41	5.78	.88	40	36	1.15	251	164	14	.53	.58	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.62	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/RASP	1.27	.09	.50	.09	13	1	.19	14	17	3	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	39.68	124.08	154.62	22.64	1195	2355	15.33	4179	4762	588	9.39	8.91	268

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
CHIX ALAKING	360		360		.31	.36	23.8	.41	31	.24	5.40	29.53	574	120
OAT/MAPLE/BS	380	.029	430		.40	.10	.9	.07	34		2.25	97.56	493	125
COOKIE CO/CH	680		680		.20	.06	.2	.25	14		1.63	26.68	227	43
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1 12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
FIG BAR		.010	20		.03	.15	1.3	.02	2		.29	40.58	224	58
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	.2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/RASP				6	.50	.02	.0	.01	2		.10	48.04	197	50
CHIX NDL SUP					.12	.06	1.9	.02	7		.13	10.09	69	18
SUM	10330	.064	10440	259	6.07	2.00	38.4	4.25	221	.84	22.42	650.98	4492	992

RECORD OF NUTRITIVE VALUES RATION COLD WEATHER

04/15/88

MENU 5	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
CHICKEN/RICE	1.31	62.40	10.36	6.74	43	523	1.22	2056	844	72	4.72	1.20	142
OAT/STRAWBER	7.52	10.14	5.35	2.39	41	381	1.99	295	569	81	.27	1.25	
BROWNIE CHCV	3.12	3.97	16.29	.54	34	72	1.44	78	121	30	.16	.50	16
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.05	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
BLUEBERRY BR	9.51	1.80	6.81	.53	10	25	.75	204	55	7	.35	.00	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.62	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/STRA	1.23	.13	.33	.08	12	1	.21	19	13	4	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	42.94	127.33	144.38	23.34	1056	2400	14.96	4642	4002	567	9.88	7.15	195

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
CHICKEN/RICE					.26	.25	24.7	.38	28	.24	1.92	39.19	500	120
OAT/STRAWBLR	380	.021	420		.36	.09	.6	.06	25		2.75	99.60	487	125
BROWNIE CHCV	450		450	1	.40	.09	.4	.27	6		1.55	26.08	267	50
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1.12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
BLUEBERRY BR		.006	10		.05	.06	.9	.01	2		.36	41.35	234	60
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	.2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/STRA				6	.50	.02	.0	.01	2		.15	48.21	196	50
CHIX NDL SUP					.12	.06	1.9	.02	7		.13	10.09	69	18
SUM	9740	.052	9830	260	6.20	1.81	38.9	4.23	200	.84	19.48	663.02	4461	1001

RECORD OF NUTRITIVE VALUES RATION COLD WEATHER

04/15/88

MENU 6	WATER (G)	PROTEIN (G)	FAT (G)	ASH (G)	CALCIUM (MG)	PHOS (MG)	IRON (MG)	SODIUM (MG)	POTASS (MG)	MAGNESIUM (MG)	NACL (G)	ZINC (MG)	CHOLESTROL (MG)
SPAG/MEAT SC	2.94	47.22	13.20	6.86	202	524	5.58	1860	1200	96	4.44	8.40	91
OAT/MAPLE/BS	7.37	11.49	6.32	2.25	61	390	2.11	235	1185	98	.46	2.50	
COOKIE CO/CH	1.06	2.71	12.17	.38	36		.73	82	104	20	.24	.43	21
GRANOLA BAR	3.24	7.90	18.32	1.16	40	223	1.92	25	294	77	.11	1.72	
OATML COOKIE	6.05	11.73	22.30	1.25	27	167	1.90	343	157	51	.58	1.00	37
BLUEBERRY BR	9.51	1.80	6.81	.53	10	25	.75	204	55	7	.35	.00	
RAISIN/NUT	5.87	14.73	30.24	1.81	81	211	1.30	485	459	104	.49	1.12	
CHOC W/TOFFE	1.27	4.70	16.35	1.11	85	116	1.15	103	217	39	.31		
ORANGE BEV	.70	.08	1.12	1.48	437	188	.62	22	167	4	.01	.00	
COCOA BEV PD	2.23	5.67	14.04	4.02	136	396	1.64	427	986	70	.86		
LEMON TEA	.06	.15	.86	.11	1	3	.07	8	38	18	.00	.00	
CIDER MIX	.08	.09	.56	.21	93	39	.17	2	1	2	.01	.00	
FR/SOUP/RASP	1.27	.09	.50	.09	13	1	.19	14	17	3	.02	.00	
CHIX NDL SUP	.74	3.82	1.45	1.90	17	56	.57	576	83	10	2.00	.36	
SUM	42.40	112.19	144.24	23.17	1238	2338	18.70	4386	4962	597	9.88	15.53	149

	A (IU)	CAROTENE (MG)	TOTAL A (IU)	C (MG)	B1 (MG)	B2 (MG)	NIACIN (MG)	B6 (MG)	FOLACIN (MCG)	B12 (MCG)	E (MG)	CHO (G)	CALORIES	WEIGHT (G)
SPAG/MEAT SC		.731	1220	2	.38	.52	12.5	.36	49	1.32	2.88	49.78	507	120
OAT/MAPLE/BS	380	.029	430		.40	.10	.9	.07	34		2.25	97.56	493	125
COOKIE CO/CH	680		680		.20	.06	.2	.25	14		1.63	26.68	227	43
GRANOLA BAR	260	.012	280		.26	.09	1.4	.06	27		1.12	55.38	418	86
OATML COOKIE	300	.013	320		.12	.11	1.2	.03	29		3.90	58.67	482	100
BLUEBERRY BR		.006	10		.05	.06	.9	.01	2		.36	41.35	234	60
RAISIN/NUT					.12	.13	6.3	.15	35		4.03	59.35	568	112
CHOC W/TOFFE	2460		2460	45	.90	.16	.2	.52	30		.45	32.56	296	56
ORANGE BEV				106	.44	.52	.8	.43	2		2.52	56.61	237	60
COCOA BEV PD	5890		5890	96	2.65	.23	.4	2.29	9	.60	.60	60.05	389	86
LEMON TEA				0								26.82	116	28
CIDER MIX				6								49.06	202	50
FR/SOUP/RASP				6	.50	.02	.0	.01	2		.10	48.04	197	50
CHIX NDL SUP					.12	.06	1.9	.02	7		.13	10.09	69	18
SUM	9970	.791	11290	261	6.16	2.06	26.7	4.19	239	1.92	19.97	671.99	4435	994

DEPARTMENT OF THE ARMY
HEADQUARTERS, 6th INFANTRY DIVISION (LIGHT)
FORT RICHARDSON, ALASKA 99505-5000

REPLY TO ATTENTION OF:

AFVR-AG-DSO

29 January 1987

SUBJECT: After Action Report (Medical) - Brimfrost '87

1. Concept of Operations: The division surgeon section was divided into two teams for this exercise. One team deployed to FGA with the division surgeon on 15 Jan to provide medical support to the units in that area prior to the arrival of the USAF Air Transportable Hospital (ATH). The second team headed by 1LT Collins moved with the G-1 section to the command bunker.

The team deploying to FGA departed at 0500 with a 172 Spt Bn convoy, arriving at FWA at 1800. During the convoy an accident was reported in a later serial. Two patients were medevaced to Valley Hospital in Palmer, Ak by a civilian ambulance. One HHC 6ID(L) ambulance was left to join the recovery element to respond to other emergencies.

One ambulance accompanied the 172d Spt Bn convoy to FGA on 16 Jan. The division surgeon remained at FWA to coordiante with the CAB, 6-327th Inf Bn and MEDDAC. The 6-327 medical personnel were not located, arrangements were made to meet the medical platoon leader or the battalion PA on 20 Jan. The personnel noted above were briefed on the medical support plan and given the appropriate medevac cards pertaining to their area of operations.

A stop was made at Eielson AFB to talk to the SF Group Surgeon (OPFOR) Maj Christensan to brief him on available medical assets and evacuation procedures. At the conclusion of this meeting he and his assistant group surgeon had no further questions concerning medical support for the FTX.

Upon arrival at FGA the two ambulances with freezable medical supplies were stored in the hangar at AAA. The section personel were billeted with the USAF advanced party from the 363 Tactical Hospital. The weather was moderate for the time of year. Temperatures ranged from about -10 to +30 degrees with winds gusting up to 52 knots. The road conditions were generally good.

On 17 Jan the HHC Aid Station was operational and began seeing sickcall from field units. 2LT Jardine coordindate with 2d Bde TOC, 6th Sig Bn, B FAST, C-Abn (6-327) and the MI Det informing them of available medical assets and medevac procedures. The first trauma treatment team deployed to Gamble, St Lawrence Island on 17 Jan.

The daily medical situation report was initially sent by priority message. This was found to exceed the time constraints imposed by command briefings. There exists a need to know about real world casualities as soon as possible. Due to the need for accurate information ASAP the confidential message reporting was disgarded and information was called over Class A telephone; in the clear. This was authorized in the JTF OPLAN and verbally through 6ID(L) G-2.

On 23 Jan the trauma treatment teams; medics from 6ID(L) and physicians from BAH, met at FGA and deployed to Barter Island and Oliktok. The HHC 6 ID(L) treatment team redeployed to FRA without incident. The following day I was informed that the water at Glenallen was not fit for consumption and water was being contracted for at Glenallen. A food service NCO, MSG(P) Johnson, was identified as the individual who declared the water not potable.

1LT Collins had considerable difficulty locating Maj (Dr) Maguire to inform him of his departure time. Although detailed information was finally presented to him he missed his designated aircraft. He did deploy on a later flight. Maj Maguire redeployed his team two days prior to the planned redeployment date. He had the consent of the company commander to leave the site. This was felt to be poor judgement on both the part of the physician and the company commander. Medical support should remain in place until the troops have deployed from a remote site such as this. The redeployment phase of an exercise has one of the greatest potentials for producing injuries. The temperatures at Lonely were anticiapted to be between -40 and -60 during redeployment, making the possibility of injury even greater. The other two physicians from the north slope also redeployed early with the consent of the unit commander on site. The medics for each team and their medical equipment remained in place to redeploy with the units.

The division surgeon or his representative presented a daily medical status to the division commander or the chief of staff at 1300 hours. Updated information was readily available on inpatients by contacting the fixed medical facilities each morning. Injury reports were a problem due to the conflicting information throughout the exercise. Accurate information was obtained once the attending medical officer was contacted.

The three trauma treatment teams deployed to the north slope encountered very few minor injuries or soldiers reporting to sickcall. Their facilities were adequate and meals were provided by civilian personnel at the sites. The treatment team on St. Lawrence Island was housed in two open rooms, approximately 1600 square feet, with sixty soldiers. They kept very occupied seeing individuals with a viral illness and several who sustained minor injuries; to include three superficial frostbite cases. Each of the frostbite injuries occurred while operating a snowmachine in temperatures of 0 to -10 degrees and all occurred on the face or neck. Two patients presented with nausea and vomiting; one reported to the unit with gastroenteritis and the second did not appear to be acutely ill, responding to compazine and clear liquids in twenty-four hours. There were several cases of viral illness, involving the upper respiratory tract, but there was no indication of foodborne disease. At the request of Health Services

Command all thirty seven SF 600s prepared on patients seen by the medical officer were reviewed by the division surgeon to verify that there was no evidence of a foodborne disease outbreak. This was necessitated by the numerous packages of rations (MREs) that were identified as leakers, bloaters or otherwise not fit for consumption. CW3 Peters found two meals putrified, four packages of beans with gas bubbles and two applesauce containers with gas bubbles. The report of seventeen "cases" of bad rations was first interpreted as seventeen cases (patients) of foodborne illness; causing considerable concern in headquarters elements and consideration for medical evacuation before the situation was clearly understood. The veterinary corps was notified and an extended inspection of field rations began at the troop issue support activity. Subsequently, several lots of MREs were identified with a higher than acceptable rate of unsealed packages. Many of these meals did not appear in any way unfit for consumption, however, seals were not completely closed and "pinholes" were found on compression of containers. What appeared to be a maggot was found in one meal. A complete report will be requested from the veteriary officers and attached to this afteraction report. MREs from another lot were supplied to the unit, however, this lot also produced MREs with the same problem as identified with the lot already on hand. There did not appear to be consistency in the type of meal involved or the manufacturing company as stamped on the packages. This may indicate a problem in the material used in the packaging process; a firm answer has not been estabilished at this time.

2. Discussion. The overall concept of medical operations, as outlined in the exercise directives and OPLAN, are considered to be adequate. The treatment teams attached to the 207th AKNG (Scout) were functional and stated to have been provided adequate equipment and supplies. The medical officer at St. Lawrence Island prevented evacuation of over 20% of that unit that suffered from viral illness and provided accurate information on the status of MREs.

Medical evacuation was a coordinated effort between the Army, USAF, USCG and the Civil Air Patrol. Due to the time required for evacuating casualities it is imperative that medical officers be located with treatment teams in the most remote locations.

There were a total of 462 soldiers and airmen seen on sickcall during the exercise, only 31 were admitted to a medical facility. There were no deaths as a result of this exercise.

Medical resupply was to be on an emergency basis only due to the length of the exercise. Two requests were initiated for Class VIII resupply. One from A Co 6-327 Infantry attached to the 207th AKNG at or near Kotzebue, the company medics were in excess of 250 miles from their supporting aid station and requested cold medications. An attempt was made to get the medicine aboard a C-130, scheduled supply run, but, appropriate forms were not completed and the effort failed. The unit redeployed to their home station the following day. A second request was made by the treatment team at Gamble, St Lawrence Island and the supplies were received two days later on a scheduled resupply aircraft.

AFVR-AG-DSO
SUBJECT: After Action BF 87

The treatment facility established by the USAF at Fort Greely consisted of temper tents designed for a desert environment. Erecting the A-frame tentage was complicated by the high winds; destroying one section of the hospital. The interior of the tentage was spacious and provided work space without poles or obstacles. The modules that were used for the lab, x-ray and surgery were excellent, but, weighed 3000 lbs or more in each case. The facility was placed within the main post area and there was no attempt made for light or noise discipline: the objective was to test this configuration and equipment in an arctic environment. The tent material allowed light to pass through making light discipline impossible. Flaps on the top of the tent were designed to allow hot air to escape, not desirable in a cold environment. The heating system was marginally adequate in moderate temperatures (above 0 degrees), also, there were no holes in the canvas that would allow stove pipes to extend through. With modifications these structures may be useful in the tactical environment as anticipated by Army forces. The "boxes" that expanded for the lab, x-ray and surgery (in particular) provided excellent work spaces. A similiar structure could be mounted on a 5-ton truck and provide an excellent expandable area for Corp Surgical Squads.

3. Recommendations: The concept of trauma treatment teams deployed in such a manner as to provide the earliest possible care is particularily useful in the Alaska Theater. The extended medical evacuation times and delays for weather have a great potential for causing extended morbidity and/or mortality.

Specific requirements for placing a package aboard a USAF aircraft need to be identified prior to the FTX phase.

Reporting procedures be identified separately for "real world" casualities/patients. The requirement of the commanders to know any and all information ASAP is not feasible with the tacticle play and the length of time required to obtain messages or encrypting such information does not satisfy the chain of command's requirement to stay abreast of the situation.

ROBERT M. GUM, D.D.
CPT, MC
Division Surgeon

TABS:
Exercise Directive
OPLAN
Map
Medevac freq (REDCOM Directive)
Medevac cards
Highway EMS handout
Ltr to OPFOR Surgeon
Ltr from IHS
Task Organization - Medical Teams
Treatment Team Formulary
Med Rpt Status
Accident Rpt
Veternarian Rpt (MREs)
Critique Comments

APPENDIX 2

Twenty-four Hour Food Record Card

NAME_____

ID Code_____ Day #_____

RATION COLD WEATHER CONSUMPTION
Circle the number that indicates how much of each item you ate today. If you ate an amount that is not listed, write it on the line to the right. All food items issued or traded for today should be fully accounted for in the columns below listed as "AMOUNT CONSUMED" "DID NOT EAT/FINISH".
Remember - each unit of "1" us equal to the total content of each food item in 1 MCW. For example, 4 bars of Spaghetti & Meat Sauce = 1 unit.

ADDED WATER
Please list the amount of water you added to each food or beverage item. Write in "0" if you did not add water to a food you ate.

REASONS FOR NOT EATING/FINISHING
Please write in the numbers of the primary reason that you didn't finish an item or did not eat the item at all. If your primary reason is not listed, write it in.

1. Spilled
2. Left behind
3. Feel full
4. Tasted bad
5. Dieting
6. Looked bad
7. Too bland
8. Traded
9. Unable to heat
10. Not enough water
11. Unfamiliar/strange food
12. Smelled bad
13. Too salty
14. Saved for later meal
15. Not enough time
16. Too much trouble

FOOD ITEM	CODE	AMOUNT CONSUMED					WATER (CANTEEN CUPS ie; 1/4,1/2, etc.)	DID NOT EAT/FINISH
ENTREES								
OATMEAL (APPLE & CINN)	212	1/4	1/2	3/4	1	___	_____	_____
OATMEAL (MAPLE/BRN SGR)	213	1/4	1/2	3/4	1	___	_____	_____
OATMEAL (STRAWBERRY)	214	1/4	1/2	3/4	1	___	_____	_____
CHICKEN STEW	203	1/4	1/2	3/4	1	___	_____	_____
BEEF & VEGETABLE	204	1/4	1/2	3/4	1	___	_____	_____
PORK & ESC. POTATO	205	1/4	1/2	3/4	1	___	_____	_____
CHICKEN ALA KING	206	1/4	1/2	3/4	1	___	_____	_____
SPAGHETTI W/MEAT SAUCE	208	1/4	1/2	3/4	1	___	_____	_____
CHICKEN & RICE	207	1/4	1/2	3/4	1	___	_____	_____
DRINKS/SOUPS								
LEMON TEA	223	1/4	1/2	3/4	1	___	_____	_____
ORANGE BEVERAGE	222	1/4	1/2	3/4	1	___	_____	_____
CHICKEN SOUP	210	1/4	1/2	3/4	1	___	_____	_____
FRUIT SOUP STRAWBERRY	227	1/4	1/2	3/4	1	___	_____	_____
FRUIT SOUP RASPBERRY	228	1/4	1/2	3/4	1	___	_____	_____
COCOA	201	1/4	1/2	3/4	1	___	_____	_____
COFFEE	224	1/4	1/2	3/4	1	___	_____	_____
CIDER	276	1/4	1/2	3/4	1	___	_____	_____
CREAM	202	1/4	1/2	3/4	1	___	_____	_____
SUGAR	225	1/4	1/2	3/4	1	___	_____	_____
SNACKS								
COOKIES, CHOC.CHP.	217	1/4	1/2	3/4	1	___		_____
BROWNIE	219	1/4	1/2	3/4	1	___		_____
RAISINUT CRUNCH	211	1/4	1/2	3/4	1	___		_____
GRANOLA	215	1/4	1/2	3/4	1	___		_____
OATMEAL COOKIE	216	1/4	1/2	3/4	1	___		_____
CHOCOLATE	226	1/4	1/2	3/4	1	___		_____
BLUEBERRY	218	1/4	1/2	3/4	1	___		_____
FIG	220	1/4	1/2	3/4	1	___		_____
CHEWING GUM	275	1/4	1/2	3/4	1	___		_____

WATER CONSUMPTION

Please estimate the number of canteen cups of PLAIN water (nothing in it) you drank during each time period listed below. If you drank more than 2 canteen cups during any one time period, write in the total amount on the line to the right of the number "2".

TIME PERIOD	NUMBER OF CANTEEN CUPS									
0400-1000	0	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	____
1000-1500	0	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	____
1500-2000	0	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	____
2000-0400	0	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	____

PLEASE ANSWER THE FOLLOWING QUESTIONS BEFORE GOING TO SLEEP. CIRCLE ONE NUMBER TO ANSWER EACH QUESTION.

1. How LIGHT or DARK is your urine today?

EXTREMELY LIGHT	MODERATELY LIGHT	SLIGHTLY LIGHT	NEITHER LIGHT NOR DARK	SLIGHTLY DARK	MODERATELY DARK	EXTREMELY DARK
1	2	3	4	5	6	7

1. Rate the COLOR of your urine as it has occurred today.

LIGHT YELLOW	DARK YELLOW	ORANGE	BROWN
1	2	3	4

3. Are you urinating more or less OFTEN than usual?

EXTREMELY LESS	MODERATELY LESS	SLIGHTLY LESS	NEITHER MORE NOR LESS	SLIGHTLY MORE	MODERATELY MORE	EXTREMELY MORE
1	2	3	4	5	6	7

4. Is the AMOUNT you are urinating more or less than usual?

EXTREMELY LESS	MODERATELY LESS	SLIGHTLY LESS	NEITHER MORE NOR LESS	SLIGHTLY MORE	MODERATELY MORE	EXTREMELY MORE
1	2	3	4	5	6	7

APPENDIX 3

Sample Collection Schedule and Unit Movement

Appendix 3. Sample collection schedule and unit movement

Day	Collections	Movement
0	pre blood sample initial urine sample	in base camp
1	no contact with troops	air deployment
2	day 1 food intake day 2 urine	in initial camp
3	day 2 food intake day 3 urine	G1 moved 1 mile G2 no change
4	day 3 food intake day 4 urine	G1 no change G2 joined G1
5	day 4 food intake day 5 urine	G1 moved 12 miles G2 no change
6	day 5 food intake day 6 urine	G1 no change G2 joined G1
7	day 6 food intake day 7 urine	both groups together after overnight move
8	day 7 food intake day 8 urine	both groups move to top of hill
9	day 8 food intake day 9 urine post blood sample	no change
10	no collections	both groups march to base (10 miles)

APPENDIX 4

Cold Enviroment Background Survey Form

Cold Environment Background Survey Form

NAME:_____ DATE:_____
(Last, First, Middle Initial) (Day/Mo./Yr.)

PART I: BASIC DEMOGRAPHIC INFORMATION

INSTRUCTIONS: For each of the items below FILL in the blank or CIRCLE the appropriate code number, answering each item to the best of your knowledge. Please make sure you have answered every item.

1. Age:_____

2. Gender: 1. Male 2. Female

3. Race: 1. White/Caucasian
2. Black/Negroid
3. Other:

4. Height:_____ (ft./in.)

5. Weight:_____ (lbs)

6. Marital Status: 1. Single
2. Married
3. Separated
4. Divorced
5. Widow/Widower

7. Indicate your highest level of formal civilian education:

1. Less than High School
2. Some High School
3. High School Graduate
4. G.E.D. Credit for H.S.
5. Some College
6. College Graduate
7. Some Graduate School
8. Advanced Graduate Degree

8. Civilian Occupation:_____

9. Rank: E-_____ WO-_____ O-_____

10. Years active military service:_____

11 Primary MOS:_____ Title:_____.

12. Duty MOS:_____ Title:_____.

13. Duty Station: (Post/Location):_____.

14. Unit:_____.

15. Name and location of the community in which you spent most of your life:

_____ Number of years spent there _____.
(Town/State/Nation)

16. Indicate the percentage of your life spent where during the coldest month:

___ usually didn't go below 50°F. (warm or hot all year, mild winters)

___ usually didn't go below 32°F. (warm or hot summers, cool winters)

___ usually didn't go below 14°F. (mild summers, cold winters)

___ usually went below 14°F. (mild summers, cold winters)

17. Indicate the percentage of your life spent in the following geographic locations:

___ Urban Area

___ Suburban Area

___ Rural Area

18. Indicate the amount of regular daily consumption:

	None	Small Amount	Moderate Amount	Large Amount	Specify number of cups/drinks per day
Caffeinated coffee or tea (without sugar)	0	1	2	3	_____
Caffeinated coffee or tea (with sugar)	0	1	2	3	_____
Colas	0	1	2	3	_____
Sugar free colas	0	1	2	3	_____
Other sugared soft drinks	0	1	2	3	_____
Alcoholic beverages	0	1	2	3	_____
Salt/Salty foods	0	1	2	3	
Cigarettes	0	1	2	3	
Pipes/cigars/chews	0	1	2	3	
Stimulant/drug medication	0	1	2	3	
Relaxant/drug medication	0	1	2	3	
Allergy/hay fever medication	0	1	2	3	
Cold medicines	0	1	2	3	
Other medication: _____	0	1	2	3	

19. How often do you take part in physical activity or sports?

1. Not at all 2._____ days per month

20. How would you compare yourself to others of your own sex and age in terms of physical ability and fitness?

1. Poor 2. Fair 3. Average 4. Above Average 5. Superior

21. Describe yourself in terms of physical activity.

1. Inactive 2. Active 3. Very Active

PART II: COLD ENVIRONMENT HISTORY
(Temperatures at freezing (32°F.) or below)

22. How much experience have you had with freezing weather or cold climates?

1. No Experience
2. A Slight Amount
3. A Moderate Amount
4. A Great Amount

23. In general, how do (would) you feel about living in a geographical area having cold winters?

1. I (would) really enjoy it.
2. I (would) tolerate it.
3. I don't (wouldn't) care for it.
4. I (would) dislike it very much.

24. Check the activities you have done in cold weather:

___ Snow Skiing
___ Snow Shoeing
___ Making a Snowman
___ Camping
___ Ice Fishing
___ Ice Skating
___ Ice Sailing
___ Snow Sledding
___ Snowmobiling
___ Shoveling Snow
___ Other:_____
___ None of these

25. Compared to others around you, in a cool or cold environment, how do you generally feel?

1. Colder than others
2. About the same as others
3. Warmer than others
4. Have no idea how I differ from others in this respect

26. How much military classroom instruction have you had for taking care of yourself in cold weather?

1. No Instruction
2. A Slight Amount
3. A Moderate Amount
4. A Great Amount

27. How much field training have you had on taking care of yourself in cold weather?

1. No Field Training
2. A Slight Amount
3. A Moderate Amount
4. A Great Amount

28. Do you have any special problem when you are exposed to cool or cold conditions?

1. No
2. Yes, specify:_____

_____

29. How many times have you been treated by medical personnel for any of the following cold related injuries? Please give exact number.

Frostnip_____ Chilblains_____ Check if none of these_____

Frostbite_____ Hypothermia_____ Other:_____

30. How many times untreated? Please give exact number.

Frostnip_____ Chilblains_____ Check if none of these_____

Frostbite_____ Hypothermia_____ Other:_____

APPENDIX 5

Ration, Cold Weather Questionnaire

RATION, COLD WEATHER (RCW) QUESTIONNAIRE

U.S. Army Natick Research, Development and Engineering Center
Natick, Massachusetts 01760

We are interested in your honest reactions to the Ration, Cold Weather (RCW) which you ate during the cold weather field test. Your responses to these questions are important to the development of this ration and are confidential.

Name _____ Number _____

1. How long have you been in the Armed Forces?_____years, _____months.

2. What is your rank? _____ Age? _____

3. Before this exercise, have you been in the field with only operational rations (like MRE, MCI, etc.) to eat?____If so, how many times? ____
What was the average length of the exercise? _____days

4. Please use the following scale to indicate how much you like or dislike each of the items in the RCW by marking the number that best expresses your opinion.

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

a.	Oatmeal (Apple & Cinn.)	0 1 2 3 4 5 6 7 8 9
b.	Oatmeal (Maple & Brn Sugar)	0 1 2 3 4 5 6 7 8 9
c.	Oatmeal (Strawberry)	0 1 2 3 4 5 6 7 8 9
d.	Chicken Stew	0 1 2 3 4 5 6 7 8 9
e.	Beef & Vegetable	0 1 2 3 4 5 6 7 8 9
f.	Pork & Esc. Potato	0 1 2 3 4 5 6 7 8 9
g.	Chicken Ala King	0 1 2 3 4 5 6 7 8 9
h.	Spaghetti w/Meat Sauce	0 1 2 3 4 5 6 7 8 9
i.	Chicken & Rice	0 1 2 3 4 5 6 7 8 9
j.	Lemon Tea	0 1 2 3 4 5 6 7 8 9
k.	Orange Beverage	0 1 2 3 4 5 6 7 8 9

PLEASE TURN OVER

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

l.	Chicken Soup	0 1 2 3 4 5 6 7 8 9
m.	Fruit Soup (Strawberry)	0 1 2 3 4 5 6 7 8 9
n.	Fruit Soup (Raspberry)	0 1 2 3 4 5 6 7 8 9
o.	Cocoa	0 1 2 3 4 5 6 7 8 9
p.	Coffee	0 1 2 3 4 5 6 7 8 9
q.	Cider	0 1 2 3 4 5 6 7 8 9
r.	Cookies, Choc. Cov.	0 1 2 3 4 5 6 7 8 9
s.	Brownie	0 1 2 3 4 5 6 7 8 9
t.	Raisinut Crunch	0 1 2 3 4 5 6 7 8 9
u.	Granola Bar	0 1 2 3 4 5 6 7 8 9
v.	Oatmeal Cookie	0 1 2 3 4 5 6 7 8 9
w.	Chocolate Bar	0 1 2 3 4 5 6 7 8 9
x.	Blueberry Bar	0 1 2 3 4 5 6 7 8 9
y.	Fig Bar	0 1 2 3 4 5 6 7 8 9
z.	Chewing Gum	0 1 2 3 4 5 6 7 8 9

5. Do you think that any foods or beverages should be DROPPED from the RCW? Circle one: YES/NO. If yes, list the item(s)._____

_____

6. Do you think that any items should be ADDED to the RCW? Circle one: YES/NO. If yes, list the item(s). Be realistic!_____

_____

7. Please rate how much you like or dislike the RCW for breakfast, lunch, and dinner. Circle one number for each of the three meals.

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

a. For breakfast	0	1	2	3	4	5	6	7	8	9
b. For lunch	0	1	2	3	4	5	6	7	8	9
c. For dinner	0	1	2	3	4	5	6	7	8	9

8. We would like to know what you think of the AMOUNT of food provided by each part of the RCW. Was there too little, too much or just the right amount? Please circle one number for each part of the ration.

VERY MUCH TOO SMALL	MUCH TOO SMALL	MODERATELY TOO SMALL	SLIGHTLY TOO SMALL	JUST RIGHT	SLIGHTLY TOO LARGE	MODERATELY TOO LARGE	MUCH TOO LARGE	VERY MUCH TOO LARGE
1	2	3	4	5	6	7	8	9

a. Entree bars (chicken, beef, etc.)	1	2	3	4	5	6	7	8	9
b. Oatmeal	1	2	3	4	5	6	7	8	9
c. Desserts (cookies, brownies, bars, etc)	1	2	3	4	5	6	7	8	9
d. Beverages (cocoa, tea, cider, etc.)	1	2	3	4	5	6	7	8	9
e. Fruit soups (strawberry, raspberry)	1	2	3	4	5	6	7	8	9
f. Chicken Soup	1.	2	3	4	5	6	7	8	9
g. Candies	1	2	3	4	5	6	7	8	9
h. Nuts and raisin mix	1	2	3	4	5	6	7	8	9

9. We would like to know your opinion of the amount of VARIETY in the RCW. Please circle number 1 if the amount of variety is sufficient. Circle one of the other numbers (2-6) to represent how much more variety should be increased. (List continued on next page).

VARIETY NOW ENOUGH	SLIGHTLY MORE VARIETY	SOMEWHAT MORE VARIETY	MODERATELY MORE VARIETY	MUCH MORE VARIETY	VERY MUCH MORE VARIETY
1	2	3	4	5	6

a. Entree bars (chicken, beef, etc.)	1	2	3	4	5	6

PLEASE TURN OVER

VARIETY NOW ENOUGH	SLIGHTLY MORE VARIETY	SOMEWHAT MORE VARIETY	MODERATELY MORE VARIETY	MUCH MORE VARIETY	VERY MUCH MORE VARIETY
1	2	3	4	5	6

b.	Breakfast foods (oatmeal, etc)	1 2 3 4 5 6
c.	Desserts (cookies, brownies, etc)	1 2 3 4 5 6
d.	Beverages (cocoa, tea, Kool-Aid,etc.)	1 2 3 4 5 6
e.	Fruit Soups (strawberry, raspberry, etc.)	1 2 3 4 5 6
f.	Traditional Soups (chicken, beef, vegetable)	1 2 3 4 5 6
g.	Candies	1 2 3 4 5 6
h.	Nuts and raisin mixes	1 2 3 4 5 6

10. Please rate how satisfied or dissatisfied you were with each of the following aspects of the RCW you ate. Circle one number for each aspect.

EXTREMELY DISSATISFIED	VERY DISSATISFIED	MODERATELY DISSATISFIED	SLIGHTLY DISSATISFIED	NEITHER SATISFIED NOR DISSATISFIED	SLIGHTLY SATISFIED	MODERATELY SATISFIED	VERY SATISFIED	EXTREMELY SATISFIED
1	2	3	4	5	6	7	8	9

a.	How easy the ration is to prepare	1 2 3 4 5 6 7 8 9
b.	How easy the ration is to heat	1 2 3 4 5 6 7 8 9
c.	How the food tastes	1 2 3 4 5 6 7 8 9
d.	How the food looks	1 2 3 4 5 6 7 8 9
e.	How much food there is in one day's pack	1 2 3 4 5 6 7 8 9
f.	How much variety there is within one day's meal pack	1 2 3 4 5 6 7 8 9
g.	How much variety there is from meal pack to meal pack	1 2 3 4 5 6 7 8 9

11. When did you usually eat during the exercise? Circle one number.

1 - At specific meal times (imposed by command)

2 - At specific meal times (my choice)

3 - Throughout the day, as time permitted

4 - Both 1 and 3

5 - Both 2 and 3

12. How many meals did you usually eat a day? _____

13. When did you usually drink the following beverages? Check the appropriate line or lines for each beverage.

	DID NOT DRINK	WITH BREAKFAST	WITH LUNCH	WITH DINNER	BETWEEN MEALS
a. Cider	___	___	___	___	___
b. Fruit Soup	___	___	___	___	___
c. Chicken soup	___	___	___	___	___
d. Cocoa	___	___	___	___	___
e. Coffee	___	___	___	___	___
f. Tea	___	___	___	___	___
g. Orange Beverage	___	___	___	___	___
h. Water (no flavor)	___	___	___	___	___

14. On a typical day, did you eat alone or in a group? Circle one.

a. alone
b. with one person
c. with two people
d. with more than two people

15. On a typical day, did you drink alone or in a group? Circle one.

a. alone
b. with one person
c. with two people
d. with more than two people

16. For what reasons did you NOT eat enough during the exercise? Circle ALL the the reasons that apply to you. If you ALWAYS ate enough during this exercise, circle "1" only.

a. Disliked the food in the ration.

b. Not enough food provided in the ration.

c. Not enough time to prepare ration.

d. Too much trouble to prepare ration.

e. Too cold to eat.

f. Not enough time to eat the ration.

g. No heat source to heat the ration.

PLEASE TURN OVER

h. Poor heat source to heat the ration.

i. Not enough water to prepare the ration.

j. Got bored with the food in the ration-not enough variety.

k. Other - please explain_____

l. Always ate enough during this exercise.

17. If you circled more than one reason in the preceding question (#16), what was the MOST FREQUENT reason you did not eat enough? Please write the letter from the list above. ____

18. For what reason did you not drink enough during the exercise? Circle ALL the reasons that apply to you. If you ALWAYS drank enough during this exercise, circle "k" only.

a. Too much trouble to melt snow or ice.

b. Not enough time to melt snow or ice.

c. Stream water too far from site.

d. No equipment (pots, pans) to melt snow.

e. Not enough equipment to melt snow.

f. No heat source or stove.

g. Not enough heat sources or stoves for the group.

h. Water in canteen kept freezing.

i. Not enough beverages (cocoa, cider, etc.) in RCW.

j. Other _____.

k. Always drank enough during exercise.

19. If you circled more than one reason in the preceding question (#18) what was the MOST FREQUENT reason you did not drink enough? Please write in the letter from the list above. _____

20. How often were you HUNGRY during the field exercise? Circle one number.

NEVER	ALMOST NEVER	SOMETIMES	FAIRLY OFTEN	OFTEN	ALMOST ALWAYS	ALWAYS
1	2	3	4	5	6	7

21. How often were you THIRSTY during the field exercise? Circle one number.

NEVER	ALMOST NEVER	SOMETIMES	FAIRLY OFTEN	OFTEN	ALMOST ALWAYS	ALWAYS
1	2	3	4	5	6	7

22. How often were you able to get enough water to prepare foods and beverages? Circle one.

NEVER	ALMOST NEVER	SOMETIMES	FAIRLY OFTEN	OFTEN	ALMOST ALWAYS	ALWAYS
1	2	3	4	5	6	7

23. How often did you add water to the RCW foods and beverages? Write the number that best expresses your answer next to each food or beverage.

NEVER	ALMOST NEVER	SOMETIMES	FAIRLY OFTEN	OFTEN	ALMOST ALWAYS	ALWAYS
1	2	3	4	5	6	7

a. ___ entrees (chicken, etc.)
b. ___ tea
c. ___ coffee
d. ___ chicken soup
e. ___ orange beverage
f. ___ oatmeal
g. ___ cocoa
h. ___ cider
i. ___ fruit soup
j. ___ granola

24. How easy/difficult was it to obtain water? Circle one.

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

23. On the average, how many canteens (one canteen = 32 ounces = 1 quart) of water did you use each day for drinking, eating, and other uses such as washing? Write your best estimate using whole numbers and fractions, if necessary.

Drinking ____ canteens/day

Eating ____ canteens/day

Other ____ canteens/day

PLEASE TURN OVER

26. How did you obtain water? Circle all the ways 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. If you circled more than one way of obtaining water, which was the MOST FREQUENT? Please write in the letter from the list above: ____

28. How many times did you have to melt snow or ice to obtain water during the exercise? Please circle one.

NEVER	EVERY FIFTH DAY	EVERY THIRD DAY	ONCE EACH DAY	EVERY OTHER DAY	TWICE EACH DAY	THREE TIMES EACH DAY	FOUR TIMES EACH DAY	FIVE OR MORE TIMES EACH DAY
1	2	3	4	5	6	7	8	9

29. If you had to melt snow or ice did you work alone or in teams? Circle one.

a. alone
b. one other person
c. two other people
d. more than two other people

30. If you melted snow or ice, did you do it by choice or were you commanded to melt it? Circle one.

a. by choice b. by command c. both d. other _____

31. What was the typical temperature of the RCW foods and beverages that you consumed? Write the number that 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

a. ___ entrees (chicken, beef, etc.)
b. ___ tea
c. ___ coffee
d. ___ chicken soup
e. ___ orange beverage
f. ___ oatmeal
g. ___ cocoa
h. ___ cider
i. ___ fruit soup
j. ___ plain water

32. How often did the water in your canteen freeze during the exercise? Circle one number.

WATER NEVER FROZE	EVERY FIFTH DAY	EVERY THIRD DAY	ONCE EACH DAY	EVERY OTHER DAY	TWICE EACH DAY	THREE TIMES EACH DAY	FOUR TIMES EACH DAY	FIVE OR MORE TIMES EACH DAY
1	2	3	4	5	6	7	8	9

33. How often did you use a beverage flavor (cocoa, beverage bar, tea, soup, coffee) with your water? Circle one number.

NEVER	ALMOST NEVER	SOMETIMES	FAIRLY OFTEN	OFTEN	ALMOST ALWAYS	ALWAYS
1	2	3	4	5	6	7

34. Were the RCW preparation instructions helpful? Circle one.

NOT AT ALL HELPFUL	SLIGHTLY HELPFUL	SOMEWHAT HELPFUL	MODERATELY HELPFUL	VERY HELPFUL	EXTREMELY HELPFUL
1	2	3	4	5	6

35. Which did you usually wear on your hands while preparing and eating the RCW OUTSIDE? Circle ALL that apply.

a. Wool mitten insert with trigger finger
b. Wool glove insert
c. Black leather outer glove
d. Arctic Mitten
e. Other _____
f. None
g. Did not eat outside

36. How did you heat the water to prepare the RCW items like entrees, oatmeal, and cocoa? Circle all that apply.

a. Canteen cup stand and heating tabs
b. Zestotherm heat bags
c. Squad stove
d. Yukon stove
e. Mounted vehicle heater
f. Personal Stove (specify in detail) _____
g. Sterno
h. Did not heat rations
i. Other (specify) _____

37. If you heated your ration more than one way which way was the BEST? _____ (Write letter from previous question).

PLEASE TURN OVER

38. How cold did your hands get while preparing or eating the RCW outside? Circle one number.

NOT AT ALL COLD	SLIGHTLY COLD	SOMEWHAT COLD	MODERATELY COLD	VERY COLD	EXTREMELY COLD
1	2	3	4	5	6

39. In the field, did you (circle one)

a. carry the ration in the outer bags provided.

b. open the outer bags and carry the contents separately.

40. You were issued one complete RCW per day. Did you bring ALL the items into the field? ___yes (go to #43) ___no (go to #41)

41. Primarily which items did you leave behind? Mostly (circle one)

a. oatmeal

b. entrees (meat, chicken, etc.)

c. fruit soup

d. chicken soup

e. beverages (tea, cocoa, etc.)

f. desserts (cookies, brownies)

g. snacks (raisinut crunch, granola)

h. some of everything

i. other (write in item or combination of items)

_____

42. What was the main reason you did not take everything in the RCW to the field? Circle only ONE answer.

a. Disliked the foods or drinks

b. Wanted to reduce the SPACE the ration takes up

c. Wanted to reduce the WEIGHT of the ration

43. Please rate how EASY or DIFFICULT you found each of the following aspects of preparing the RCW in the cold. Circle one number for each.

EXTREMELY EASY	VERY EASY	MODERATELY EASY	SLIGHTLY EASY	NEITHER EASY NOR DIFFICULT	SLIGHTLY DIFFICULT	MODERATELY DIFFICULT	VERY DIFFICULT	EXTREMELY DIFFICULT
1	2	3	4	5	6	7	8	9

a. Understanding preparation instructions	1	2	3	4	5	6	7	8	9
b. Opening the outer bags	1	2	3	4	5	6	7	8	9
c. Locating a specific item in the outer bag	1	2	3	4	5	6	7	8	9
d. Obtaining enough water to prepare foods or drinks	1	2	3	4	5	6	7	8	9
e. Opening an individual packet	1	2	3	4	5	6	7	8	9
f. Heating water in order to prepare foods or drinks	1	2	3	4	5	6	7	8	9
g. Mixing the right amount of water with the dry ration items	1	2	3	4	5	6	7	8	9
h. Eating more than one item at a time	1	2	3	4	5	6	7	8	9
i. Keeping hands warm	1	2	3	4	5	6	7	8	9
j. Crumbling the ration before adding water	1	2	3	4	5	6	7	8	9
k. Avoiding spilling package contents	1	2	3	4	5	6	7	8	9
l. Sealing entree bag with plastic closure	1	2	3	4	5	6	7	8	9

44. Overall, how convenient was the RCW to use in the field in cold weather? Please circle one number.

EXTREMELY INCONVENIENT	VERY INCON-VENIENT	MODER-ATELY INCON-VENIENT	SLIGHTLY INCONVENIENT	NEU-TRAL	SLIGHTLY CONVENIENT	MODER-ATELY CONVEN-IENT	VERY CONVEN VIENT	EXTREMELY CONVENIENT
1	2	3	4	5	6	7	8	9

PLEASE TURN OVER

45. Compare the CONVENIENCE of the RCW with the MRE (Meal, Ready to Eat). Please circle one number.

NEVER USED MRE	RCW MUCH LESS	RCW SOMEWHAT LESS	RCW SLIGHTLY LESS		RCW SLIGHTLY MORE	RCW SOMEWHAT MORE	RCW MUCH MORE
0	1	2	3	4	5	6	7

46. Compare the ACCEPTABILITY (taste, looks, etc.) of the RCW with the MRE. Please circle one number.

NEVER USED MRE	RCW MUCH WORSE	RCW SOMEWHAT WORSE	RCW SLIGHTLY WORSE		RCW SLIGHTLY BETTER	RCW SOMEWHAT BETTER	RCW MUCH BETTER
0	1	2	3	4	5	6	7

47. Below is a list of possible ways of improving the RCW. Please write the number "1" next to the improvement you think is MOST important, the number "2" next to the improvement you think is SECOND in importance, the number "3" next to the THIRD most important improvement, "4" next to the FOURTH, and "5" next to the FIFTH most important.

___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 (write in) _____

Please write additional comments on the RCW or on problems associated with cold weather eating/drinking in this space._____

_____

_____

_____

_____

_____

_____

THANK YOU

48. For each category of food, if you could replace (the most unpopular item), what would you replace it with?

49. If you could get rid of the entree you like least, what would you like to have replace it?

50. Did you use hot sauce while in the field? If so, would you like to have hot sauce included in the ration?

51. Please rate how EASY or DIFFICULT you found making a solution when preparing the following foods in the RCW. Please fill in the number for each item listed below.

EXTREMELY EASY 1	VERY EASY 2	MODERATELY EASY 3	SLIGHTLY EASY 4	NEITHER EASY NOR DIFFICULT 5	SLIGHTLY DIFFICULT 6	MODERATELY DIFFICULT 7	VERY DIFFICULT 8	EXTREMELY DIFFICULT 9

	WITH HOT WATER	WITH COLD WATER
a. entrees (chicken, etc.)	_____	_____
b. tea	_____	_____
c. coffee	_____	_____
d. chicken soup	_____	_____
e. orange beverage	_____	_____
f. oatmeal	_____	_____
g. cocoa	_____	_____
h. cider	_____	_____
i. fruit soup	_____	_____

52. Since the delivery of three hot meals a day in a Light Infantry field situation is not possible, please suggest the best feeding system.

APPENDIX 6

Categorization of States into 4 Temperate Zones

Categorization of States into 4 Temperature Zones

Zone 1 Cold States : (average temperature for the winter months is below 14 degrees Fahrenheit) score = 4.
Alaska, Wisconsin, Montana, North Dakota, South Dakota, Maine, Vermont, Michigan, Wyoming and Minnesota.

Zone 2 Cool States : (average temperature for the winter months is below 32 degrees Fahrenheit) score = 3.
New Hampshire, Massachusetts, Iowa, Illinios, Kansas, Idaho, Colorado, Connecticut, Nebraska, Nevada, New York and Utah.

Zone 3 Mild States : (average temperature for the winter months is below 50 degrees Fahrenheit) score = 2.
Missouri, New Jersey, Mew Mexico, Ohio, Pennsylvania, Rhode Island, District of Columbia, Kentucky, Maryland, Oklahoma, North Carolina, Virginia, Arkansas, Oregon, Tennessee, Washington, West Virginia and Delaware.

Zone 4 Warm States : (average temperature for the winter months is above 50 degrees Fahrenheit) score = 1.
Georgia, Arizona, Mississippi, South Carolina, Texas, Alabama, California, Louisiana, Florida and Hawaii.

APPENDIX 7

Percent Nutrient Intake of RCW

APPENDIX 7-1

Mean nutrient intake compared to nutrients available in the RCW

Nutrient	Available Nutrients	Group 1 Intake	Group 1 %Eaten	Group 2 Intake	Group 2 %Eaten
Energy,kcal	4470	2392	54	2658	59
Protein,g	120.2	77.3	64	78.3	65
Carbohydrate,g	661.5	315.1	48	361.6	55
Fat,g	149.3	91.3	61	99.8	67
Vitamin A,mcg RE	2455.6	1171.3	48	1086.6	44
Ascorbic Acid, mg	22	260.0	60.8	23	56.2
Thiamin,mg	6.3	2.6	41	2.5	40
Riboflavin,mg	2.0	1.0	50	1.0	50
Niacin,mg NE	32.7	21.8	67	21.1	65
Vitamin B6,mg	4.2	1.7	40	1.6	38
Folacin,mcg	216.0	129.1	60	138.5	64
Calcium,mg	1189	744.4	63	680.9	57
Phosphorus,mg	2406	1256.0	52	1332.6	55
Magnesium,mg	586	314.7	54	353.4	60
Iron,mg	16.6	9.6	58	10.4	63
Zinc,mg	11.4	7.6	67	8.2	72
Sodium,mg	4547	2871.5	63	2656.8	58
Potassium,mg	4554	2463.7	54	2619.0	58

NOTE: Based on consumption of RCW. Does not include nutrients from extra food.

APPENDIX 7-2

Mean nutrient intake for all soldiers compared to nutrients available in the RCW

Nutrient	MRDA	Available Nutrients	Pooled Intake	Soldiers %Eaten
Energy,kcal	4500[a]	4470	2534	57
Protein,g	100.0	120.2	77.8	65
Carbohydrate,g		661.5	339.9	51
Fat,g		149.3	95.8	64
Vitamin A,mcg RE	1000.0	2455.6	1126.1	46
Ascorbic Acid, mg	60.0	260.0	58.3	22
Thiamin,mg	1.6	6.3	2.5	40
Riboflavin,mg	1.9	2.0	1.0	50
Niacin,mg NE	21.0	32.7	21.5	66
Vitamin B6,mg	2.2	4.2	1.6	38
Folacin,mcg	400.0	216.0	134.1	62
Calcium,mg	800-1200	1189.0	710.5	60
Phosphorus,mg	800-1200	2406.0	1296.9	54
Magnesium,mg	350-400	586.0	335.3	57
Iron,mg	10-18	16.6	10.1	61
Zinc,mg	15.0	11.4	7.9	69
Sodium,mg	<5500	4547.0	2757.0	61
Potassium,mg[b]	1875-5625		4554.0	2546.5 56

[a]MRDA for energy intake increased to 4500 kcal/day for cold environments.
[b]MRDA levels are not available for this nutrient, however safe and adequate levels are suggested in AR40-25.

NOTE: Based on consumption of RCW. Does not include nutrients from extra food.

APPENDIX 8

Percent Consumption of RCW Components

PERCENT CONSUMPTION OF RCW BY ALL SOLDIERS

	n	PORTION SIZE (g)	INTAKE (g)	ISSUED (g)	%CONSUMED
Cider	48	50	2600	12000	21.7
Or Bev Bar	68	60	3668.4	14400	25.5
Cocoa	54	86	3719.5	20640	18.0
Tea	48	28	2362.64	6720	35.2
Coffee	7	3	48	720	6.7
Cream	4	4	16	960	1.7
Sugar	11	6	72	1440	5.0
Entrees	184	120	20145.6	28800	70.0
Oatmeal	155	125	18578.75	30000	61.9
Raisin Nut	194	112	19964	26880	74.3
Granola Bar	154	86	12341	20640	59.8
Oatmeal Bar	150	100	14225	24000	59.3
Blueb'y Bar	93	60	5782.2	14400	40.2
Brn/Cooky	205	46.5	10063.5	11160	90.2
Toffee	145	56	9604	13440	71.5
Fig Bar	101	58	6148	13920	44.2
Fruit Soup	51	50	2425	12000	20.2
Chix Soup	45	18	922.5	4320	21.4
Gum	1	1.7	1.7	408	0.4

PERCENT CONSUMPTION OF RCW BY GROUP 1 SOLDIERS

	n	PORTION SIZE (g)	INTAKE (g)	ISSUED (g)	%CONSUMED
Cider	13	50	662.5	5600	11.8
Orange Bev	29	60	1845	6720	27.5
Cocoa	30	86	1978	9637	20.5
Tea	14	28	798	3136	25.4
Coffee	1	3	3	336	0.89
Cream	0	4	0	448	0
Sugar	5	6	36	672	5.4
Entrees	86	120	9900	13440	73.7
Oatmeal	61	125	7375	14000	52.7
Raisin Nut	88	112	8960	12544	71.4
Granola Bar	64	86	4536.5	9632	47.1
Oatmeal Bar	66	100	5800	11200	51.8
Blueb'y Bar	43	60	2667.6	6720	39.7
Brownie/Cooky	82	46.5	4237	5208	81.4
Toffee	71	56	5012	6272	79.9
Fig Bar	48	58	2900	6496	44.6
Fruit Soup	20	50	987.5	5600	17.6
Chix Soup	32	18	711	2016	35.3
Gum	1	1.7	1.7	190.4	0.9

PERCENT CONSUMPTION OF RCW BY GROUP 2 SOLDIERS

	n	PORTION SIZE (g)	INTAKE (g)	ISSUED (g)	%CONSUMED
Cider	35	50	1937.5	6400	30.3
Orange Bev	39	60	1823.4	7680	23.7
Cocoa	24	86	1741.5	11008	15.8
Tea	34	28	1564.64	3584	43.7
Coffee	6	3	45	336	13.4
Cream	4	4	16	512	3.1
Sugar	6	6	36	768	4.7
Entrees	98	120	10245.6	15360	66.7
Oatmeal	94	125	11203.75	16000	70.0
Raisin Nut	106	112	11004	14336	76.8
Granola Bar	90	86	7804.5	11008	70.9
Oatmeal Bar	84	100	8425	12800	65.8
Blueb'y Bar	50	60	3114.6	7680	40.6
Brownie/Cooky	123	46.5	5826.5	5952	97.9
Toffee	74	56	4592.0	7168	64.1
Fig Bar	53	58	3248	7424	43.8
Fruit Soup	31	50	1437.5	6400	22.5
Chix Soup	13	18	211.5	2304	9.2
Gum	0	1.7	0	217.6	0.

DAILY RCW INTAKE (POOLED DATA)

NAME	DAY	GROUP 1 N	GROUP 1 INTAKE (g)	GROUP 2 N	GROUP 2 INTAKE (g)
Cider					
	1	1	50	4	200
	2	5	212.5	4	200
	3	2	100	6	300
	4	2	100	6	375
	5	1	50	4	200
	6	1	50	4	200
	7	1	100	3	162.5
	8	0	0	4	300
Orange Beverage					
	1	2	75	9	293.4
	2	6	345	8	300
	3	5	210	6	420
	4	3	195	5	270
	5	3	300	2	120
	6	3	240	1	30
	7	3	180	6	270
	8	4	300	2	120
Cocoa					
	1	1	43	3	107.5
	2	5	387	5	344
	3	2	86	3	172
	4	7	559	4	301
	5	3	129	2	172
	6	3	172	2	129
	7	4	172	1	86
	8	5	430	4	430
Tea					
	1	1	14	4	119
	2	2	140	6	283.6
	3	0	0	4	154
	4	4	252	4	196
	5	2	112	5	196
	6	2	56	3	140
	7	1	56	4	224
	8	2	168	4	252
Coffee					
	1	0	0	0	0
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	1	3
	5	0	0	1	6
	6	0	0	2	9
	7	0	0	1	12
	8	1	3	1	15

DAILY RCW INTAKE (POOLED DATA)

NAME	DAY	GROUP 1 N	GROUP 1 INTAKE (g)	GROUP 2 N	GROUP 2 INTAKE (g)
Cream					
	1	0	0	0	0
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	1	4
	5	0	0	1	4
	6	0	0	1	4
	7	0	0	1	4
	8	0	0	0	0
Sugar					
	1	0	0	1	6
	2	1	6	2	12
	3	1	12	0	0
	4	0	0	1	6
	5	1	6	1	6
	6	0	0	0	0
	7	1	6	1	6
	8	1	6	0	0
Entrees					
	1	7	840	11	1200
	2	16	1860	17	1800
	3	9	1050	10	1065.6
	4	14	1590	19	2220
	5	10	1140	13	1200
	6	8	960	6	720
	7	8	840	8	510
	8	14	1620	14	1530
Oatmeal					
	1	7	875	9	860
	2	6	687.5	10	1125
	3	11	1468.75	14	1718.75
	4	10	1156.25	13	1468.75
	5	4	500	16	1968.75
	6	4	406.25	12	1500
	7	11	1281.25	3	500
	8	8	1000	17	2062.5
Raisin Nut					
	1	9	700	13	1176
	2	13	1176	13	1148
	3	12	1064	15	1568
	4	12	1624	14	1568
	5	11	1008	14	1400
	6	11	1288	12	1456
	7	9	ø68	12	1344
	8	11	1232	13	1344

DAILY RCW INTAKE (POOLED DATA)

NAME	DAY	GROUP 1 N	GROUP 1 INTAKE (g)	GROUP 2 N	GROUP 2 INTAKE (g)
Granola Bar					
	1	10	731	12	903
	2	7	559	14	1161
	3	8	516	15	1333
	4	7	602	12	1032
	5	10	688	8	946
	6	7	344	12	1247
	7	8	645	10	731
	8	7	451.5	7	451.5
Oatmeal Bar					
	1	9	800	13	1050
	2	8	700	11	1100
	3	8	600	15	1500
	4	7	700	9	1000
	5	9	750	8	950
	6	7	450	10	1250
	7	9	850	10	800
	8	9	950	8	775
Blueberry Bar					
	1	3	180	2	120
	2	9	540	6	480
	3	5	360	7	420
	4	5	300	6	360
	5	3	139.8	7	399.6
	6	6	307.8	8	540
	7	6	480	7	375
	8	6	360	7	420
Brownie/Cooky					
	1	12	615	12	565
	2	12	544	11	558
	3	9	451	17	959
	4	13	601	16	699.5
	5	9	465	15	694
	6	9	465	19	866
	7	8	516	16	730
	8	10	580	17	755
Toffee					
	1	9	616	10	504
	2	8	560	11	616
	3	7	448	10	756
	4	8	728	11	616
	5	11	728	10	728
	6	10	728	9	560
	7	7	364	5	280
	8	11	840	8	532

DAILY RCW INTAKE (POOLED DATA)

NAME	DAY	GROUP 1 N	GROUP 1 INTAKE (g)	GROUP 2 N	GROUP 2 INTAKE (g)
Fig Bar					
	1	7	406	12	696
	2	3	174	5	290
	3	4	232	10	638
	4	9	580	4	290
	5	7	406	6	406
	6	6	348	9	522
	7	3	174	4	232
	8	9	580	3	174
Fruit Soup					
	1	2	100	4	200
	2	3	150	7	262.5
	3	2	87.5	4	200
	4	5	200	2	100
	5	1	50	4	200
	6	0	0	4	175
	7	4	250	1	50
	8	3	150	5	250
Chix Soup					
	1	1	18	4	72
	2	7	135	5	67.5
	3	4	72	1	18
	4	6	144	1	18
	5	4	90	2	36
	6	1	18	0	0
	7	3	54	0	0
	8	6	180	0	0

DAILY RCW INTAKE BY INDIVIDUAL COMPONENTS

NAME	DAY	GROUP 1 N	GROUP 1 INTAKE (g)	GROUP 2 N	GROUP 2 INTAKE (g)
Cider					
	1	1	50	4	200
	2	5	212.5	4	200
	3	2	100	6	300
	4	2	100	6	375
	5	1	50	4	200
	6	1	50	4	200
	7	1	100	3	162.5
	8	0	0	4	300
Orange Beverage					
	1	2	75	9	293.4
	2	6	345	8	300
	3	5	210	6	420
	4	3	195	5	270
	5	3	300	2	120
	6	3	240	1	30
	7	3	180	6	270
	8	4	300	2	120
Cocoa					
	1	1	43	3	107.5
	2	5	387	5	344
	3	2	86	3	172
	4	7	559	4	301
	5	3	129	2	172
	6	3	172	2	129
	7	4	172	1	86
	8	5	430	4	430
Tea					
	1	1	14	4	119
	2	2	140	6	283.6
	3	0	0	4	154
	4	4	252	4	196
	5	2	112	5	196
	6	2	56	3	140
	7	1	56	4	224
	8	2	168	4	252
Coffee					
	1	0	0	0	0
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	1	3
	5	0	0	1	6
	6	0	0	2	9
	7	0	0	1	12
	8	1	3	1	15

DAILY RCW INTAKE BY INDIVIDUAL COMPONENTS

NAME	DAY	GROUP 1 N	GROUP 1 INTAKE (g)	GROUP 2 N	GROUP 2 INTAKE (g)
Cream					
	1	0	0	0	0
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	1	4
	5	0	0	1	4
	6	0	0	1	4
	7	0	0	1	4
	8	0	0	0	0
Sugar					
	1	0	0	1	6
	2	1	6	2	12
	3	1	12	0	0
	4	0	0	1	6
	5	1	6	1	6
	6	0	0	0	0
	7	1	6	1	6
	8	1	6	0	0
Chix Stew					
	1	0	0	2	120
	2	2	240	3	360
	3	4	450	2	240
	4	2	240	3	480
	5	0	0	3	240
	6	1	120	1	120
	7	2	240	4	270
	8	2	240	1	120
Beef & Veg					
	1	4	480	2	240
	2	1	120	3	300
	3	1	120	1	120
	4	4	450	2	240
	5	2	240	2	210
	6	1	120	1	120
	7	0	0	1	60
	8	1	120	3	360
Pork & Esc Pot					
	1	1	120	2	240
	2	6	720	3	360
	3	0	0	3	360
	4	2	240	2	150
	5	2	240	1	30
	6	2	240	2	240
	7	0	0	1	120
	8	3	360	4	330

DAILY RCW INTAKE BY INDIVIDUAL COMPONENTS

NAME	DAY	GROUP 1 N	GROUP 1 INTAKE (g)	GROUP 2 N	GROUP 2 INTAKE (g)
Chix ala King					
	1	0	0	2	240
	2	3	360	3	300
	3	1	120	0	0
	4	2	240	3	360
	5	2	180	4	360
	6	1	120	1	120
	7	3	240	0	0
	8	2	240	4	480
Chix & Rice					
	1	1	120	0	0
	2	2	180	5	480
	3	3	360	1	90
	4	2	240	5	600
	5	3	360	0	0
	6	1	120	1	120
	7	1	120	0	0
	8	3	300	0	0
Spaghetti					
	1	1	120	3	360
	2	2	240	0	0
	3	0	0	3	255.6
	4	2	180	4	390
	5	1	120	3	360
	6	2	240	0	0
	7	2	240	2	60
	8	3	360	2	240
Oatmeal, Apple & Cinnamon					
	1	5	625	4	406.25
	2	3	312.5	2	250
	3	2	250	6	875
	4	5	625	3	312.5
	5	1	125	5	468.75
	6	1	125	4	500
	7	4	281.25	3	500
	8	1	125	6	750
Oatmeal, Maple & Brn Sugar					
	1	0	0	3	266.25
	2	1	125	3	343.75
	3	5	750	4	500
	4	1	125	7	875
	5	2	250	7	1000
	6	3	281.25	3	375
	7	3	375	0	0
	8	4	500	7	812.5

DAILY RCW INTAKE BY INDIVIDUAL COMPONENTS

NAME	DAY	GROUP 1 N	GROUP 1 INTAKE (g)	GROUP 2 N	GROUP 2 INTAKE (g)
Oatmeal, Strawberry					
	1	2	250	2	187.5
	2	2	250	5	531.25
	3	4	468.75	4	343.75
	4	4	406.25	3	281.25
	5	1	125	4	500
	6	0	0	5	625
	7	4	625	0	0
	8	3	375	4	500
Raisin Nut					
	1	9	700	13	1176
	2	13	1176	13	1148
	3	12	1064	15	1568
	4	12	1624	14	1568
	5	11	1008	14	1400
	6	11	1288	12	1456
	7	9	868	12	1344
	8	11	1232	13	1344
Granola Bar					
	1	10	731	12	903
	2	7	559	14	1161
	3	8	516	15	1333
	4	7	602	12	1032
	5	10	688	8	946
	6	7	344	12	1247
	7	8	645	10	731
	8	7	451.5	7	451.5
Oatmeal Bar					
	1	9	800	13	1050
	2	8	700	11	1100
	3	8	600	15	1500
	4	7	700	9	1000
	5	9	750	8	950
	6	7	450	10	1250
	7	9	850	10	800
	8	9	950	8	775
Blueberry Bar					
	1	3	180	2	120
	2	9	540	6	480
	3	5	360	7	420
	4	5	300	6	360
	5	3	139.8	7	399.6
	6	6	307.8	8	540
	7	6	480	7	375
	8	6	360	7	420

DAILY RCW INTAKE BY INDIVIDUAL COMPONENTS

NAME	DAY	GROUP 1 N	GROUP 1 INTAKE (g)	GROUP 2 N	GROUP 2 INTAKE (g)
Brownie					
	1	7	400	7	350
	2	4	200	5	300
	3	3	150	7	400
	4	6	300	7	312.5
	5	4	250	7	350
	6	4	250	7	350
	7	0	0	6	300
	8	3	150	7	325
Cooky					
	1	5	215	5	215
	2	8	344	6	258
	3	6	301	10	559
	4	7	301	9	387
	5	5	215	8	344
	6	5	215	12	516
	7	8	516	10	430
	8	7	430	10	430
Toffee					
	1	9	616	10	504
	2	8	560	11	616
	3	7	448	10	756
	4	8	728	11	616
	5	11	728	10	728
	6	10	728	9	560
	7	7	364	5	280
	8	11	840	8	532
Fig Bar					
	1	7	406	12	696
	2	3	174	5	290
	3	4	232	10	638
	4	9	580	4	290
	5	7	406	6	406
	6	6	348	9	522
	7	3	174	4	232
	8	9	580	3	174
Fruit Soup, Strawberry					
	1	1	50	3	150
	2	2	100	5	162.5
	3	1	37.5	3	150
	4	3	137.5	1	50
	5	0	0	3	150
	6	0	0	1	50
	7	3	200	1	50
	8	2	100	4	200

DAILY RCW INTAKE BY INDIVIDUAL COMPONENTS

NAME	DAY	GROUP 1 N	GROUP 1 INTAKE (g)	GROUP 2 N	GROUP 2 INTAKE (g)
Fruit Soup, Raspberry					
	1	1	50	1	50
	2	1	50	2	100
	3	1	50	1	50
	4	2	62.5	1	50
	5	1	50	1	50
	6	0	0	3	125
	7	1	50	0	0
	8	1	50	1	50
Chix Soup					
	1	1	18	4	72
	2	7	135	5	67.5
	3	4	72	1	18
	4	6	144	1	18
	5	4	90	2	36
	6	1	18	0	0
	7	3	54	0	0
	8	6	180	0	0

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