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TECHNICAL REPORT
NATICK/TR-86/027

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AN EVALUATION OF THE RATION, COLD WEATHER APRIL 1985

BY

A.C. MASTROMARINO
AND
V.A. LOVERIDGE

JUNE 1986

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PREFACE

This project was completed at the U. S. Army Natick Research, Development and Engineering Center (NRDEC) and at the Northern Warfare Training Center at the request of the U. S. Army Health Clinic at Fort Greeley, Alaska. These efforts were coordinated through the Food Engineering Directorate of the NRDEC under project number IL162724AH99.

The authors wish to thank CW3 Robert A. Wood, Medical Officer of the Northern Warfare Training Center, for coordinating the test and administrating the questionnaires. We would also like to thank those soldiers who were involved in the field evaluation, as well as those personnel in the Audio Visual and Reproduction Branches of the NRDEC for producing the questionnaires with rather short notice.

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AN EVALUATION OF THE RATION, COLD WEATHER
APRIL 1985

INTRODUCTION

The Ration, Cold Weather (RCW), known as the Arctic Ration at the time of this test, was developed in order to meet the needs of the U. S. Marine Corps Requirement Letter L S-4 (17 December 1982) for an operational cold weather ration for use under rigorous conditions. Initially consisting of two Emergency/Assault Food packets in combination with an Arctic supplement, the RCW has been condensed into two pouches with the following characteristics:

1. Provides 4500 kilocalories per menu;
2. Does not freeze;
3. Contains entrees, snacks, and numerous hot drinks (Appendix A);
4. Is in a flat, flexible waterproof package;
5. Requires little preparation;
6. Is lighter and smaller than four Meal, Ready-to-Eat, Individuals (MRE);
7. Has a reduced sodium content.

The purpose of this informal field test was to assess the following during a five-day period:

1. Acceptability
2. Consumption
3. Satisfaction
4. Convenience and Quality
5. Water Availability
6. Body Fluid Status.

MATERIALS AND METHODS

Troops from Charlie Company 6, 327th Infantry Battalion, Fort Wainwright, Alaska, participating in a Northern Warfare Training course, were utilized in this informal field evaluation of the prototype RCW from 12-16 April 1985. Fifty personnel ate the RCW, and 50 ate MRE's and B-type rations supplemented with Hot Chocolate, Soup, Granola, and Oatmeal. Both groups had been in the Army for an average of 36 months.

During the test period, the men consuming the RCW completed the following:

1. A general questionnaire concerning the RCW on Days 2 and 5 (Appendix B);
2. A daily consumption diary (Appendix C);
3. Wyant and Caron's Daily Body Fluid Status Questionnaire (Appendix D).

In addition, all test personnel were weighed on Days 1 and 5. The general questionnaire assessed acceptability, satisfaction, convenience, quality, and, to a lesser degree, consumption and water availability. The consumption diary assessed caloric consumption in detail. Wyant and Caron's questionnaire assessed body fluid status through urine characterization as a physiological indicator of dehydration. Due to the lack of sufficient test control, not all questionnaires were returned. As a result, cross-checking of food acceptability measures was impossible, and the number of responses varied from question to question.

The men engaged in the following activities during the course of the test period:

- Day 1 - Convoy movement of 100 miles, followed by an airborne drop and a four kilometer snowshoe movement.
- Day 2 - Small distance patrols and preparation of defensive positions.
- Day 3 - Defensive operations.
- Day 4 - A night movement of four kilometers.
- Day 5 - Airmobile movement and a four kilometer road march.

RESULTS AND DISCUSSION

Acceptability

On the whole, the RCW meal and its components were acceptable to the test subjects (Table 1 and Table 2). The only exceptions were the Apricot Fruit Soup at a hedonic rating of 4.5 and the Chocolate Bar with Toffee at 4.9 and 4.7. The ratings ranged from 4.5 (Apricot Fruit Soup) to 7.4 (Fig Bar) on Day 2 and from 4.5 (Apricot Fruit Soup) to 8.1 (Fig Bar) on Day 5. Although ratings in general

Table 1. Meal Acceptability, Mean Ratings
(7 point scale, 1=Dislike Very Much, 7=Like Very Much)

	DAY 2			DAY 5		
	N	\bar{X}	SD	N	\bar{X}	SD*
Breakfast	37	4.4	1.8	46	4.8	1.8
Lunch	37	4.7	1.7	46	4.1	1.5
Dinner	37	4.4	1.8	46	5.3	1.7

Table 2. Component Acceptability, Mean Ratings
(9 point scale, 1=Dislike Very Much, 9=Like Extremely)

	DAY 2			DAY 5		
	N	\bar{X}	SD	N	\bar{X}	SD
BREAKFAST						
Apple & Cinnamon Oatmeal	36	6.9	2.1	43	8.0	1.2
Maple & Brown Sugar Oatmeal	35	6.7	2.1	40	8.0	1.4
ENTREES						
Chicken Stew	29	5.9	2.3	35	6.7	2.2
Beef & Vegetable	31	5.8	2.2	33	6.8	1.6
Escalloped Potato & Pork	21	5.4	2.3	33	6.9	2.0
Chicken Ala King	24	6.2	1.6	35	7.0	1.8
Chicken & Rice	24	6.0	2.0	37	6.7	2.0
Spaghetti	21	6.2	1.6	35	6.2	1.5
SNACKS						
Orange Nut Cake	17	5.1	2.1	10	5.4	1.2
Brownie	34	5.3	2.4	18	5.6	2.2
Nut Raisin Mix	38	7.0	2.2	45	7.7	1.8
Granola Bars	36	5.4	2.2	44	5.1	2.6
Oatmeal Cookie Bar	35	6.5	2.0	44	7.1	1.9
Chocolate Bar with Toffee	34	4.9	2.3	42	4.7	2.3
Fig Bar	36	7.4	2.2	43	8.1	1.5
Caramels	37	6.2	2.3	45	7.3	1.9
DRINKS						
Lemon Tea	28	6.9	2.1	38	8.0	1.4
Orange Beverage	36	5.7	1.8	39	5.8	1.9
Apricot Fruit Soup	21	4.5	2.7	27	4.5	2.5
Strawberry Fruit Soup	18	5.1	2.2	25	5.5	2.7
Raspberry Fruit Soup	25	5.0	2.3	23	5.5	2.6
Cocoa	23	6.7	1.7	40	6.7	1.5
Chicken Soup, Reduced Sodium	34	6.4	1.8	43	7.2	1.7
Total Questionnaires Returned		38			45	

*N=Number of Responses, \bar{X} =Mean of Responses, SD=Standard Deviation, and %=Percent of Responses for all tables in this report.

increased by an average of a point over the test period, little change occurred in those for Orange Nut Cake, Brownie, Granola Bar, Orange Beverage, and the fruit soups. Spaghetti stayed at 6.2 and Apricot Fruit Soup stayed at 4.5. The Chocolate Bar with Toffee decreased slightly. A possible explanation for the increase in rankings over time could be that the men became more familiar and comfortable with the food types and preparation methods. It should be noted that the Day 5 rankings approach the favorable rankings of prior evaluations of the RCW by the Marine Corps and the Navy.^{2,3,4}

As a group, the breakfast items had the highest scores. The entrees showed the greatest variation in ratings--5.4 to 6.2 on Day 2 to 6.2 to 7.0 on Day 5--accompanied by a total turnover of individual entree rankings. The only exception was Chicken Stew whose ranking remained the same. Both Snacks and Drinks had acceptable rankings with the exceptions previously mentioned.

Two items should be noted. First, due to low consumption and acceptability on prior evaluations, the Orange Nut Cake was in the process of being phased out at the time of this test. As a result, it was not present in all rations, having been substituted by the Brownie. Second, the Chocolate Bar with Toffee procured for this field test was of inferior quality, suffering from bloom and poor flavor. Therefore, the acceptability of this item should not be based on this particular evaluation.

Consumption

According to the consumption diary (Table 3), caloric intake covered a wide range, 618-4364 kilocalories, with a mean daily intake between 2710 and 2939 kilocalories, or only 60-65 percent of the total calories available. Despite this, the RCW test group had no significant difference in weight gain/loss as compared to the control group (Table 4) for the five-day time period. Snack items had the highest level of consumption, followed by the breakfast items and the beverages. The entrees were the least consumed. The men's comments indicated this was due mainly to lack of time and water.

Table 3. Caloric Intake Diary Responses
N=26

	<u>X</u>	SD	RANGE
Day 1	2939	945	1115-4066
Day 2	2826	870	901-4267
Day 3	2710	785	618-3916
Day 4	2809	792	1183-4364
Day 5	2763	967	1287-3901

Table 4. Analysis of Weight Gain/Loss - Test Group and Controls
(Pounds)

RATION	N	<u>X</u>	SD	F RATIO	SIGNIFICANCE
RCW (Test)	39	-2.9	3.5	3.3	Not Significant
MRE/B (Control)	29	-1.3	3.6		

Despite the complaints concerning the difficulty of preparation and the lack of time, 56-62 percent of the responses (Table 5) claimed to have received enough to eat. The remaining 38-44 percent were "often hungry". The test group was almost equally split concerning eating times (Table 6): 50-55 percent ate throughout the day with the other 45 percent eating both at mealtimes and throughout the day.

Table 5. Presence of Hunger

	DAY 2		DAY 5	
	N	%	N	%
Got enough food	20	56	28	62
Often hungry	16	44	17	38

Table 6. Variation in Eating Times

	DAY 2		DAY 5	
	N	%	N	%
At designated mealtimes	2	5	0	0
Throughout the day, as time permitted	18	50	25	55
Both of the above	16	45	20	45

Satisfaction

In general, the men were slightly dissatisfied with certain characteristics of the RCW. According to Table 7, they were "moderately dissatisfied" with ease of preparation and "somewhat dissatisfied" with meal-to-meal variety (see also Table 8). Taste, appearance, quantity, and in-pack variety all received neutral scores. The men also felt that food amounts were too small in the breakfast items, entree bars, and beverages and soups (Table 9). Despite comments saying the amount of candies and cakes were too high, they received an "amount just right" rating.

Table 7. Attribute Satisfaction, Mean Ratings
(7 point scale, 1=Very Dissatisfied, 7=Very Satisfied)

	DAY 2			DAY 5		
	N	\bar{X}	SD	N	\bar{X}	SD
Ease of preparation	36	2.6	1.6	45	2.7	1.7
Taste	36	4.8	1.3	45	5.4	1.5
Appearance	34	4.7	1.3	45	5.0	1.4
Quantity	36	4.4	1.8	45	4.4	2.0
In-pack variety	36	4.9	1.6	44	4.5	2.0
Meal-to-meal variety	35	3.6	1.7	45	3.0	1.7

Table 8. Variety Satisfaction, Mean Ratings
(4 point scale)
(1=Variety Now Enough, 4=Should Be Much More Variety)

	DAY 2			DAY 5		
	N	\bar{X}	SD	N	\bar{X}	SD
Breakfast	35	2.4	1.1	46	2.4	1.0
Entree bars	35	2.3	1.1	46	2.4	1.1
Candies and cakes	35	2.2	1.2	46	2.4	1.8
Beverages and soups	35	2.5	1.1	45	2.5	1.1

Table 9. Food Amount Satisfaction, Mean Ratings
(7 point scale, 1=Amount Much Too Small, 7=Amount Much Too Large)

	DAY 2			DAY 5		
	N	<u>X</u>	SD	N	<u>X</u>	SD
Breakfast	35	3.4	1.3	44	3.1	1.2
Entree bars	30	3.9	1.1	47	3.8	1.1
Candies and cakes	39	4.5	1.3	46	4.9	1.5
Beverages and soups	35	3.6	1.2	46	3.7	1.4

Convenience and Quality

Tables 10 through 12 address the quality and convenience of the RCW. As the MRE was not as readily available as the MCI when the questionnaire was developed in 1981, the men were asked to compare the RCW to the MCI. The men felt that overall the RCW was "slightly inconvenient" (Day 2) to "neither convenient nor inconvenient" (Day 5). The same trend appeared in the comparison of the RCW to the MCI; however, when comparing quality, the RCW had slightly more quality than the MCI. The rankings of proposed improvements were consistent with the expression of inconvenience; easier preparation was highest priority followed by increased variety and more breakfast foods. Larger portions and improved taste were considered the least important. Again, in submitted comments, complaints concerning difficulty in preparation were the most frequent. Other comments expressed the need for another main meal (specifically another entree) and the presence of too many cakes and candies. It should be noted that not all comments were negative: 17 percent on Day 2 complimented the RCW, saying it was "good". Minor comments expressed concerns over thirst and dehydration, need for more toilet paper, variety in general, and complaints about packaging.

Table 10. Convenience and Quality, Mean Ratings

	DAY 2			DAY 5		
	N	\bar{X}	SD	N	\bar{X}	SD
Overall convenience (7 point scale, 1=Extremely Convenient) (7=Extremely Inconvenient)	35	5.4	1.7	41	4.7	1.7
Convenience - AR vs. MCI (7 point scale, 1=Much More, 7=Much Less)	35	5.2	1.5	41	4.5	1.7
Quality - AR vs. MCI (7 point scale, 1=Much Better, 7=Much Worse)	35	3.3	1.9	41	3.4	1.6

Table 11. Proposed Ration Improvement Rankings
(1=Most Desired Improvement, 5=Fifth Desired Improvement)

	DAY 2			DAY 5		
	N	\bar{X}	SD	N	\bar{X}	SD
Improved taste	30	3.8	1.1	38	4.1	1.2
Increased variety	32	3.0	1.1	42	3.0	1.1
Easier preparation	35	1.2	0.6	40	1.5	1.0
More breakfast foods	31	3.2	1.0	41	2.9	1.1
Larger portions	31	3.6	1.8	37	3.0	1.2

Table 12. Ration Comments Summary

	DAY 2		DAY 5	
	N	%	N	%
Too many cakes and candies	4	14	8	19
Need another main meal	6	21	11	29
Takes too much water	7	24	7	17
Lack of time and/or water	6	21	7	17
Creates thirst	0	0	1	2
Dangerous due to dehydration	0	0	2	4
Good	5	17	3	5
Needs more variety	1	3	1	2
Needs more toilet paper	0	0	1	2
Cut fingers on packaging	0	0	1	2

Water Availability

According to the data shown in Tables 13-15, water availability was low, or perhaps water discipline was lacking. Although the means show that fairly often there was sufficient water to rehydrate, 66 percent (Day 2) and 52 percent (Day 5) of the men responded with "sometimes" or "almost never". The same was true in their ability to satisfy their thirst--57 percent and 55 percent responded "sometimes" or "almost never". This was consistent with the responses to amount of water used per day--3 canteens (2.8 liters) and 6 canteen cups (2.9 liters). On Day 2, 56 percent used between 4 and 6 canteen cups (1.9-2.9 liters). When compared to the 3.0-3.5 liters recommended for cold weather intake⁵, the amount is slightly insufficient. A large percent of the men, 46 percent on Day 2 and 36 percent on Day 5, never melted snow/ice for water. The majority used canteen cups rather than larger vessels. This could be another indication of a lack of organized water procurement. Subsequent interviews with NWTC personnel indicated this particular exercise suffered a command structure breakdown, which resulted in a lack of test control and which may have affected water discipline.

Table 13. Water Availability, Mean Ratings

	DAY 2			DAY 5		
	N	<u>X</u>	SD	N	<u>X</u>	SD
Sufficient water to rehydrate (7 point scale, 1=Always, 7=Never)	35	4.5	1.4	44	4.5	1.3
Ability to satisfy thirst (7 point scale, 1=Always, 7=Never)	35	4.8	1.5	44	4.6	1.3
Difficulty in obtaining water (7 point scale, 1=Very Easy, 7=Very Hard)	35	5.0	1.3	45	5.0	1.3
Number of canteens used/day	39	3.3	1.3	42	3.0	1.3
Number of canteen cups used/day	36	6.5	2.7	44	5.7	2.4

Table 14. Frequency of Melting Snow
(7 point scale, 2=1 to 4 times/test period, 3=Once A Day)

	DAY 2			DAY 5		
	N	<u>X</u>	SD	N	<u>X</u>	SD
Number of times melted snow or ice	35	2.3	1.6	41	2.0	1.0

Table 15. Type of Snow Melting Containers (%)

	DAY 2 (N=31)	DAY 5 (N=40)
Canteen cup	55	58
Larger vesse!	6	9
Didn't melt	39	33

Body Fluid Status

Data gathered from the Body Fluid Questionnaire indicated the presence of dehydration (Table 16). Urine characterization did not generally indicate any significant presence of dehydration, although a small number of blatant cases were identified. The urine was characterized as being "light" to "dark yellow", the frequency of urination was "slightly more" to "no different", and the amount of urine was "neither more or less" to "slightly more". However, indication of dehydration did appear in the last three responses. Dryness in the mouth was "slight" to "somewhat dry", skin was "slightly" loose or limp, and thirst was "somewhat" present throughout the test period. As the data were collected by the individual test subject, the responses may tend to be inaccurate due to a lack of standard comparisons.

Table 16. Responses to Body Fluid Questionnaire
29 Questionnaires Returned

	DAY 1		DAY 2		DAY 3		DAY 4		DAY 5	
	<u>X</u>	SD	<u>X</u>	SD	<u>X</u>	SD	<u>X</u>	SD	<u>X</u>	SD
Darkness of urine (7 point scale) (1=Extremely Light, 7=Extremely Dark)	4.0	1.5	3.3	1.4	3.4	1.6	3.3	1.5	3.5	1.4
Color of urine (4 point scale) (1=Light Yellow, 4=Brown)	1.9	0.8	1.7	0.8	1.6	0.8	1.5	0.7	1.5	0.7
Urination frequency (7 point scale) (1=Extremely More, 7=Extremely Less)	4.2	1.0	3.9	1.4	3.9	1.3	3.4	1.2	3.9	1.4
Amount of urine (7 point scale) (1=Extremely More, 7=Extremely Less)	4.3	0.9	4.0	0.9	3.9	0.9	3.6	1.3	3.8	1.2
Dryness in mouth (6 point scale) (1=Not At All, 6=Extremely)	2.7	1.5	3.0	1.6	3.1	1.5	3.0	1.4	3.3	1.4
Skin loose or limp (6 point scale) (1=Not At All, 6=Extremely)	1.7	1.2	2.0	1.3	2.2	1.4	2.1	1.4	2.2	1.4
Thirst (6 point scale) (1=Not At All, 6=Extremely)	3.7	1.6	3.5	1.3	3.5	1.6	3.3	1.5	3.5	1.5

CONCLUSIONS

Based on the data of this field test the following can be concluded:

1. The RCW components were generally acceptable, with the exception of the Apricot Fruit Soup and the Chocolate Bar with Toffee.
2. Despite the low average caloric intake (2710-2939) attributed to the lack of time and water, RCW test subjects had no significant weight gain/loss as compared to the control group which consumed B Rations and MRE's.

3. In general, the men were slightly dissatisfied with ease of preparation, meal-to-meal variety, and portion sizes.
4. Although the RCW ranked higher in quality than the MCI, it was ranked as slightly inconvenient due to difficulty in preparation, lack of preparation and eating time, and low water availability.
5. Water availability and discipline were lacking, resulting in lack of water for rehydration and insufficient water intake (an average 2.8 liters where 3.0-3.5 liters are recommended).
6. Dehydration was present as indicated by the results of the Wyant and Caron Body Fluid Status Questionnaire.

ADDENDUM

The following adjustments/improvements to the RCW have been made since this field test:

1. The Orange Nut Cake and Apricot Fruit Soup have been eliminated from the menus due to low acceptability. The caramels have also been eliminated due to difficulty in opening the packages in cold environments.
2. The Chocolate Bar with Toffee is presently under study to investigate the use of encapsulated vitamins with the goal of improving flavor and shelf stability.
3. Increased effort is being taken to fully brief and educate officers concerning the importance of water discipline in arctic environments.
4. Entrees are now made using preconcentration methods which will facilitate rehydration. An added benefit will be reduced production costs.
5. Variety has been increased by providing Strawberry & Cream Oatmeal, Blueberry Bars, Chocolate Covered Cookies, and Apple Cider.
6. Portion sizes have been increased for the instant oatmeal.
7. The Granola Bar has been reformulated in order to improve flavor and acceptability.

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APPENDIX A
Ration, Cold Weather Menus

RATION, COLD WEATHER MENU 1

#1 Meal Pack	Calories	Protein (g)	CHO (g)	Fat (g)	Water (g)	Sodium (mg)	wt. of		No. of Packets	Total Wt. (g)
							Indiv. Item (g)	Items		
Chicken Stew Bars	528	34.4	54.4	19.3	0.9	2693	30	4	1	120
Oatmeal (Apple & Cin.)	348	8.0	55.8	5.3	6.0	477	96	1	1	96
Granola Bars	396	9.6	56.4	14.8	1.8	180	43	2	1	86
Oatmeal Cookie Bars	464	9.4	64.2	19.0	5.4	384	50	2	1	100
Orange Nut Cake	375	3.8	54.2	15.9	14.8	313	90	1	1	90
Nut & Raisin Mix	564	11.9	66.5	27.8	1.7	404	56	2	2	112
Fig Bars	206	2.3	41.2	3.7	9.9	256	29	2	1	58
Chocolate Bars	263	7.1	36.6	14.2	0.9	128	28	2	1	56
Caramels	273	3.9	52.2	5.5	5.2	180	11	6	1	68
Orange Beverage Bars	222	0.4	54.6	0.4	0.1	26	28	2	1	56
Cocoa Beverage	380	6.0	35.5	11.1	1.9	276	43	2	2	86
Lemon Tea	90	-	22.5	-	-	-	14	2	2	28
Fruit Soup	190	-	47.5	-	1.8	36	50	1	1	50
Soup, Chicken Noodle	77	3.6	9.8	2.6	0.8	637	18	1	1	18
	4376	100.4	651.4	139.6	51.2	5123			18	1024
Coffee, Cream, Sugar & Chewing Gum	60									
	4436									

RATION SUMMARY:

Menu #1	4436	100.4	651.4	139.6						5123
#2	4415	119.9	618.6	141.8						4766
#3	4431	101.6	626.5	147.6						5027
#4	4529	116.9	619.9	156.6						5437
#5	4504	100.4	613.8	148.2						5677
#6	4450	105.5	627.3	147.6						3710
\bar{x}	4461	107.5	629.6	146.9						4957

RATION, COLD WEATHER MENU 2

#2 Meal Pack	Calories	Protein (g)	CHO (g)	Fat (g)	Water (g)	Sodium (mg)	Wt. of Indiv. Item (g)	No. of Items	No. of Packets	Total Wt. (g)
Beef & Vegetable Bars	552	52.8	39.6	20.9	1.3	2380	30	4	1	120
Oatmeal (Maple & Br. Sugar)	408	10.0	64.5	5.3	(9.0)	593	101	1	1	101
Granola Bars	196	9.6	56.4	14.8	1.8	180	43	2	1	86
Oatmeal Cookie Bars	464	9.4	64.2	19.0	5.4	384	50	2	1	100
Brownie	270	2.9	27.5	16.5	2.6	69	50	1	1	50
Nut & Raisin Mix	504	11.9	66.5	27.8	1.7	404	56	2	2	112
Fig Bars	206	2.3	41.2	3.7	9.9	256	29	2	1	58
Chocolate Bars	263	7.1	36.6	14.2	0.9	128	28	2	1	56
Caramels	273	3.9	52.2	5.5	5.2	180	11	6	1	68
Orange Beverage Bars	222	0.4	54.6	0.4	0.1	26	28	2	1	56
Cocoa Beverage	380	6.0	35.5	11.1	1.9	276	43	2	2	86
Lemon Tea	90	-	22.5	-	-	-	14	2	2	28
Fruit Soup	190	-	47.5	-	1.9	36	50	1	1	50
Soup, Chicken Noodle	77	3.6	9.8	2.6	0.8	637	18	1	1	18
	4355	119.9	618.5	141.8	42.4	4766			18	989

Coffee, Cream, Sugar &
Chewing Gum
60
4415

RATION, COLD WEATHER MENU 3

#3 Meal Pack	Calories	Protein (g)	CHO (g)	Fat (g)	Water (g)	Sodium (mg)	Wt. of		No. of Packets	Total Wt.(g)
							Indiv. Item(g)	Items		
Pork & Esc.Pot. Bars	568	34.5	47.5	26.4	1.5	2101	30	4	1	120
Oatmeal (Maple & Br. Sugar)	408	10.0	64.5	5.3	(9.0)	593	101	1	1	101
Granola Bars	396	9.6	56.4	14.8	1.8	180	43	2	1	86
Oatmeal Cookie Bars	464	9.4	64.2	19.0	5.4	384	50	2	1	100
Brownie	270	2.9	27.5	16.5	2.5	69	50	1	1	50
Nut & Raisin Mix	564	11.9	66.5	27.8	1.7	404	56	2	2	112
Fig Bars	206	2.3	41.2	3.7	9.9	256	29	2	1	58
Chocolate Bars	263	7.1	36.5	14.2	0.9	128	28	2	1	56
Caramels	273	3.9	52.2	5.5	5.2	180	11	6	1	68
Orange Beverage Bars	222	0.4	54.6	0.4	0.1	26	28	2	1	56
Cocoa Beverage	380	6.0	35.5	11.1	1.9	276	43	2	2	86
Lemon Tea	90	-	22.5	-	-	-	14	2	2	28
Fruit Soup	190	-	47.5	-	1.8	36	50	1	1	50
Scup. Chicken Noodle	77	3.6	9.8	2.6	0.6	637	18	1	1	18
	4371	101.6	626.5	147.6	42.6	5027			18	989
Coffee, Cream, Sugar & Chewing Gum	60									
	4411									

RATION, COLD WEATHER MENU 4

#4 Meal Pack	Calories	Protein (g)	CHO (g)	Fat (g)	Water (g)	Sodium (mg)	Wt. of Indiv. Item (g)	No. of Items	No. of Packets	Total Wt. (g)
Chicken a la King Bars	621	50.9	22.9	36.3	1.7	2624	30	4	1	120
Oatmeal (Apple & Cin.)	348	8.0	55.8	5.3	6.0	471	96	1	1	96
Granola Bars	396	9.6	56.4	14.8	1.8	180	43	2	1	86
Oatmeal Cookie Bars	464	9.4	64.2	19.0	5.4	384	50	2	1	100
Orange Nut Cake	375	3.8	54.2	15.9	14.8	313	90	1	1	90
Nut & Raisin Mix	564	11.9	66.5	27.8	1.7	404	56	2	2	112
Fig Bars	206	2.3	41.2	3.7	9.9	256	29	2	1	58
Chocolate Bars	263	7.1	36.6	14.2	0.9	128	28	2	1	56
Caramels	273	3.9	52.2	5.5	5.2	180	11	6	1	68
Orange Beverage Bars	222	0.4	54.6	0.4	0.1	26	28	2	1	56
Cocoa Beverage	380	6.0	35.5	11.1	1.9	276	43	2	2	86
Lemon Tea	90	-	22.5	-	-	-	14	2	2	28
Fruit Soup	190	-	47.5	-	1.8	36	50	1	1	50
Soup, Chicken Noodle	77	3.6	9.8	2.6	0.8	637	18	1	1	18
	4469	116.9	619.9	156.6	52.0	5437			18	1024

Coffee, Cream, Sugar &
Chewing Gum
60
4529

RATION, COLD WEATHER MENU 5

#5 Meal Pack	Calories	Protein (g)	CHO (g)	Fat (g)	Water (g)	Sodium (mg)	Wt. of		No. of Packets	Total Wt. (g)
							Indiv. Item (g)	Items		
Chicken & Rice Bars	596	34.4	36.8	27.9	1.2	2169	30	4	1	120
Oatmeal (Apple & Cin.)	348	8.0	55.8	5.3	6.0	471	96	1	1	96
Granola Bars	396	9.6	56.4	14.8	1.8	180	43	2	1	86
Oatmeal Cookie Bars	464	9.4	64.2	19.0	5.4	384	50	2	1	100
Orange Nut Cake	375	3.8	54.2	15.9	14.8	313	90	1	1	90
Nut & Raisin Mix	564	11.9	66.5	27.8	1.7	404	56	2	2	112
Fig Bars	206	2.3	41.2	3.7	9.9	256	29	2	1	58
Chocolate Bars	263	7.1	36.6	14.2	0.9	128	28	2	1	56
Caramels	273	3.9	52.2	5.5	5.2	180	11	6	1	68
Orange Beverage Baro	222	0.4	54.6	0.4	0.1	26	28	2	1	56
Cocoa Beverage	380	6.0	35.5	11.1	1.9	276	43	2	2	86
Lemon Tea	90	-	22.5	-	-	-	14	2	2	28
Fruit Soup	190	-	47.5	-	1.8	36	50	1	1	50
Soup, Chicken Noodle	77	3.6	9.8	2.6	0.8	637	18	1	1	18
	4444	100.4	633.8	148.2	51.5	5677			18	1024

Coffee, Cream, Sugar &
Chewing Gum
60
4504

RATION, COLD WEATHER MENU 6

#6	Meal Pack	Calories	Protein (g)	CHO (g)	Fat (g)	Water (g)	Sodium (mg)	Mt. of Indiv. Item(g)	No. of Items	No. of Packets	Total Mt. (g)
	Spaghetti w/Meat Sauce Bars	587	38.4	48.3	26.7	1.7	1831	30	4	1	120
	Oatmeal (Maple & Br. Sugar)	408	10.0	64.5	5.3	(9.0)	593	101	1	1	101
	Granola Bars	396	9.6	56.4	14.8	1.8	180	43	2	1	86
	Oatmeal Cookie Bars	464	9.4	64.2	19.0	5.4	384	50	2	1	100
	Brownie	270	2.9	27.5	16.5	2.6	69	50	1	1	50
	Nut & Raisin Mix	564	11.9	66.5	27.8	1.7	404	56	2	2	112
	Fig Bar	206	2.3	41.2	3.7	9.9	256	29	2	1	58
	Chocolate Bars	263	7.1	36.6	14.2	0.9	128	28	2	1	56
	Caramels	273	3.9	52.2	5.5	5.2	180	11	6	1	68
	Orange Beverage Bars	222	0.4	54.6	0.4	0.1	26	26	2	1	56
	Cocoa Beverage	380	6.0	35.5	11.1	1.9	276	43	2	2	86
	Lemon Tea	90	-	22.5	-	-	-	14	2	2	28
	Fruit Soup	190	-	47.5	-	1.8	36	50	1	1	50
	Soup, Chicken Noodle	77	3.6	9.8	2.6	0.8	637	18	1	1	18
		4390	105.5	627.3	147.6	42.8	3710			18	989
	Coffee, Cream, Sugar & Chewing Gum	60									
		4450									

APPENDIX B
Ration, Cold Weather Questionnaire
(Arctic Ration)

DAY TWO

ARCTIC RATION QUESTIONNAIRE

U.S. Army Natick Research & Development Center
Natick, Massachusetts 01760

During the past several days you were fed a new ration. We are interested in your honest reactions to these foods. Your responses to these questions are important to the future development of this ration and are strictly confidential.

1. How long have you been in the Armed Forces? _____ years, _____ months
2. What is your rank? _____
3. Please use the following scale to indicate how much you like or dislike each of the items in the Arctic Ration by marking the number that best expresses your opinion. If you never tried a particular item, please mark the "NEVER TRIED" category and leave the rating scale blank.

NEVER TRIED	DISLIKE				NEITHER LIKE NOR DISLIKE	LIKE		LIKE		9				
	DISLIKE EXTREMELY	VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY		LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH						
0	1	2	3	4	5	6	7	8						
a. Orange nutcake					0	1	2	3	4	5	6	7	8	9
b. Cocoa beverage					0	1	2	3	4	5	6	7	8	9
c. Beef and vegetable bars					0	1	2	3	4	5	6	7	8	9
d. Nut and raisin mix					0	1	2	3	4	5	6	7	8	9
e. Oatmeal with apple & cinnamon					0	1	2	3	4	5	6	7	8	9
f. Chicken stew bar					0	1	2	3	4	5	6	7	8	9
g. Orange beverage bar					0	1	2	3	4	5	6	7	8	9
h. Raspberry fruit soup					0	1	2	3	4	5	6	7	8	9
i. Chicken and rice bar					0	1	2	3	4	5	6	7	8	9
j. Chocolate bar with toffee					0	1	2	3	4	5	6	7	8	9
k. Oatmeal cookie bar					0	1	2	3	4	5	6	7	8	9
l. Pork and escalloped potato bar					0	1	2	3	4	5	6	7	8	9
m. Oatmeal with maple and brown sugar					0	1	2	3	4	5	6	7	8	9
n. Chicken noodle soup					0	1	2	3	4	5	6	7	8	9
o. Caramels					0	1	2	3	4	5	6	7	8	9
p. Spaghetti with meat sauce bars					0	1	2	3	4	5	6	7	8	9
q. Granola bars					0	1	2	3	4	5	6	7	8	9
r. Lemon tea					0	1	2	3	4	5	6	7	8	9
s. Fig bar					0	1	2	3	4	5	6	7	8	9
t. Strawberry Fruit Soup					0	1	2	3	4	5	6	7	8	9
u. Brownie					0	1	2	3	4	5	6	7	8	9
v. Chicken A La King bar					0	1	2	3	4	5	6	7	8	9
w. Apricot Fruit Soup					0	1	2	3	4	5	6	7	8	9

4. Please rate how much you like or dislike eating the Arctic Ration for breakfast, lunch and dinner. Circle one number for each of the three meals.

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

- | | | | | | | | |
|------------------|---|---|---|---|---|---|---|
| a. For breakfast | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| b. For lunch | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| c. For dinner | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

5. When did you eat? Circle one number.

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

6. Overall, did you get enough to eat or were you often hungry? Circle one number.

- 1 - Got enough to eat
- 2 - Was often hungry

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

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

- | | | | | | | | |
|----------------------------------------------------------|---|---|---|---|---|---|---|
| a. How easy the ration is to prepare | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| b. How the food tastes | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| c. How the food looks | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| d. How much food there is in one meal pack | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| e. How much variety there is within a meal pack | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| f. How much variety there is from meal pack to meal pack | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

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

	AMOUNT MUCH TOO SMALL	AMOUNT MODERATELY TOO SMALL	AMOUNT SOMEWHAT TOO SMALL	AMOUNT JUST RIGHT	AMOUNT SOMEWHAT TOO LARGE	AMOUNT MODERATELY TOO LARGE	AMOUNT MUCH TOO LARGE			
	1	2	3	4	5	6	7			
a. Entree bars				1	2	3	4	5	6	7
b. Breakfast (oatmeal)				1	2	3	4	5	6	7
c. Candies and cakes				1	2	3	4	5	6	7
d. Beverages and soups				1	2	3	4	5	6	7

9. We would like to know how satisfied you were with the variety in each part of the Arctic Ration. Was there enough variety or should there be more? Please circle one number for each component of the ration.

	VARIETY NOW ENOUGH	SHOULD BE SOMEWHAT MORE VARIETY	SHOULD BE MODERATELY MORE VARIETY	SHOULD BE MUCH MUCH VARIETY	
	1	2	3	4	
a. Entree bars		1	2	3	4
b. Breakfast (oatmeal)		1	2	3	4
c. Candies and cakes		1	2	3	4
d. Beverages and soups		1	2	3	4

10. a. Were you able to get enough water to rehydrate the food items that you wanted to rehydrate? Please circle one number.

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

b. Were you able to get enough water to satisfy your thirst? Please circle one number.

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

c. How difficult was it to obtain water? Please circle one number.

VERY EASY	MODERATELY EASY	SLIGHTLY EASY	NEUTRAL	SLIGHTLY HARD	MODERATELY HARD	VERY HARD
1	2	3	4	5	6	7

11. On the average, how many CANTEENS (one canteen = 32 ounces or one quart) of water did you use each day for drinking and eating?

Number of
canteens (Circle one): 1 2 3 4 5 6

12. On the average, how many canteen CUPS (one canteen cup = 16 ounces) of water did you use each day for drinking and eating?

Number of
cups (Circle one): 1 2 3 4 5 6 7 8 9 10 11 12

13. How many times did you have to melt snow or ice in order to obtain water? Please circle one number.

NEVER	ONE TO FOUR TIMES	ONCE EACH 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

14. If you melted snow or ice, did you melt it in a canteen cup or in a larger vessel? Please circle one number

CANTEEN CUP	LARGER VESSEL	DID NOT MELT SNOW
1	2	3

15. Overall, how CONVENIENT was the Arctic Ration to use in the field? Please circle one number.

EXTREMELY CONVENIENT	MODERATELY CONVENIENT	SLIGHTLY CONVENIENT	NEUTRAL	SLIGHTLY INCONVENIENT	MODERATELY INCONVENIENT	EXTREMELY INCONVENIENT
1	2	3	4	5	6	7

16. In comparison with the MCI (Meal, Combat Individual), if you have ever carried it into the field, how CONVENIENT was the Arctic Ration to use in the field? Please circle one number.

MUCH MORE	SOMEWHAT MORE	SLIGHTLY MORE	NEUTRAL	SLIGHTLY LESS	SOMEWHAT LESS	MUCH LESS
1	2	3	4	5	6	7

17. In comparison to the MCI (Meal, Combat Individual), if you have ever carried it into the field, how much better or worse was the QUALITY of the Arctic Ration? Please circle one number.

MUCH BETTER	SOMEWHAT BETTER	SLIGHTLY BETTER	NEUTRAL	SLIGHTLY WORSE	SOMEWHAT WORSE	MUCH WORSE
1	2	3	4	5	6	7

18. Below is a list of possible ways of improving the Arctic Ration. 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 improvement you think is THIRD in importance, the number "4" next to what is FOURTH, and the number "5" next to what is FIFTH. Do not mark an item if you do not think it will improve the ARCTIC RATION.

- _____ Make the rations taste better
- _____ Increase the variety in the rations
- _____ Make the rations easier to prepare
- _____ Include more breakfast foods in the ration
- _____ Make the portion sizes larger

19. Do you have any other comments on the Arctic Ration?

APPENDIX C
Product Consumption Diary

PRODUCT CONSUMPTION DAY ONE

Please circle the number that indicates how much of each of the following items you ate today. If there are 4 bars and you ate 3 you should circle 3/4. If there are 2 bars and you ate 1 1/2 of them you should circle 3/4.

		AMOUNT CONSUMED			
ENTREES					
OATMEAL (APPLE AND CINNAMON)	ALL	3/4	1/2	1/4	0
OATMEAL (MAPLE AND BROWN SUGAR)	ALL	3/4	1/2	1/4	0
CHICKEN STEW BARS (4)	ALL	3/4	1/2	1/4	0
BEEF AND VEGETABLE BARS (4)	ALL	3/4	1/2	1/4	0
PORK AND ESC. POTATO BARS (4)	ALL	3/4	1/2	1/4	0
CHICKEN ALA KING BARS (4)	ALL	3/4	1/2	1/4	0
SPAGHETTI W/MEAT SAUCE BARS (4)	ALL	3/4	1/2	1/4	0
CHICKEN AND RICE BARS (4)	ALL	3/4	1/2	1/4	0
DRINKS/SOUPS					
LEMON TEA (2)	ALL	3/4	1/2	1/4	0
ORANGE BEVERAGE BARS (2)	ALL	3/4	1/2	1/4	0
CHICKEN SOUP	ALL	3/4	1/2	1/4	0
FRUIT SOUP STRAWBERRY	ALL	3/4	1/2	1/4	0
FRUIT SOUP RASPBERRY	ALL	3/4	1/2	1/4	0
FRUIT SOUP APRICOT	ALL	3/4	1/2	1/4	0
COCOA (2)	ALL	3/4	1/2	1/4	0
SNACKS					
ORANGE NUT CAKE	ALL	3/4	1/2	1/4	0
BROWNIE	ALL	3/4	1/2	1/4	0
RAISINUT CRUNCH (2)	ALL	3/4	1/2	1/4	0
GRANOLA BARS (2)	ALL	3/4	1/2	1/4	0
OATMEAL COOKIE BARS (2)	ALL	3/4	1/2	1/4	0
ENRICHED SWEET CHOCOLATE (2)	ALL	3/4	1/2	1/4	0
FIG BARS (2)	ALL	3/4	1/2	1/4	0
CHEWING GUM	ALL	3/4	1/2	1/4	0

APPENDIX D
Body Fluid Status Questionnaire

BODY FLUID SCALE DRY ONE

1. How LIGHT or DARK is your urine today? (circle one):

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

2. Rate the COLOR of your urine as it has occurred today. (circle one):

LIGHT YELLOW	DARK YELLOW	ORANGE	BROWN
1	2	3	4

3. Are you urinating more or less OFTEN than usual? (circle one)

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

4. Is the AMOUNT you are urinating more or less than usual? (circle one):

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

5. Does your MOUTH feel DRY?

NOT AT ALL	SLIGHTLY	SOMEWHAT	MODERATELY	QUITE A BIT	EXTREMELY
1	2	3	4	5	6

6. Does your SKIN feel LOOSE or LIMP?

NOT AT ALL	SLIGHTLY	SOMEWHAT	MODERATELY	QUITE A BIT	EXTREMELY
1	2	3	4	5	6

7. Are you THIRSTY?

NOT AT ALL	SLIGHTLY	SOMEWHAT	MODERATELY	QUITE A BIT	EXTREMELY
1	2	3	4	5	6