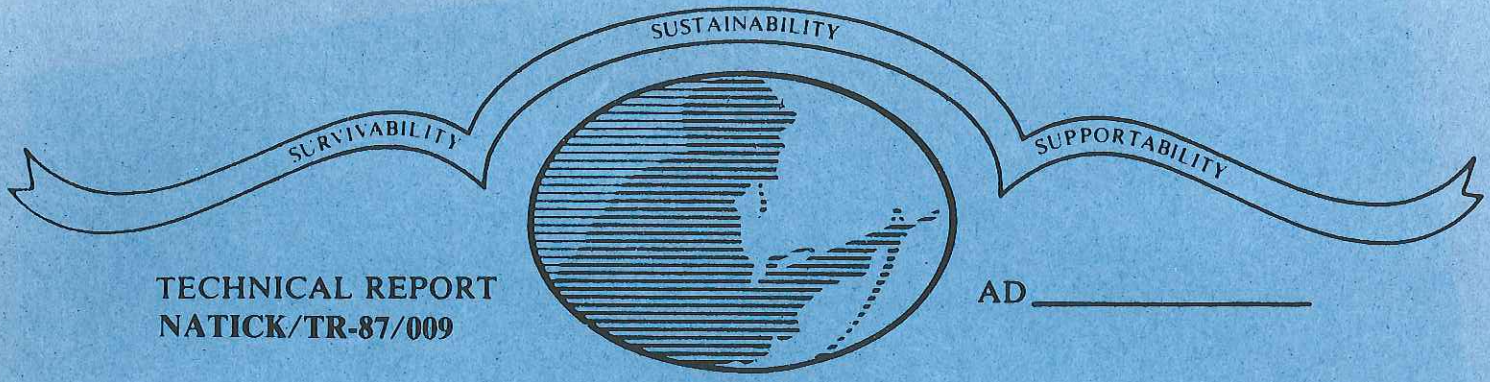

TECHNICAL REPORT
NATICK/TR-87/009

AD_____

DETERMINATION OF OPTIMAL PORTION SIZE FOR HOT COMBAT RATIONS

BY

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This project was conducted to investigate the effects of major situational, individual, and food-related factors on the determination of optimal portion sizes of Tray Pack menu items in order to increase consumer morale and decrease costs associated with plate waste. The results of several field tests and laboratory investigations revealed that portion size preference can be affected significantly by many variables which include age, weight, sex, rank, time in service, time in the field, level of physical activity, food preference, and others. The results of these investigations have been used to develop a set of guidelines for field feeding of Tray Pack meals. Keywords: → Food service, Rations, Acceptance tests, Ratings, Thermal processing. ←

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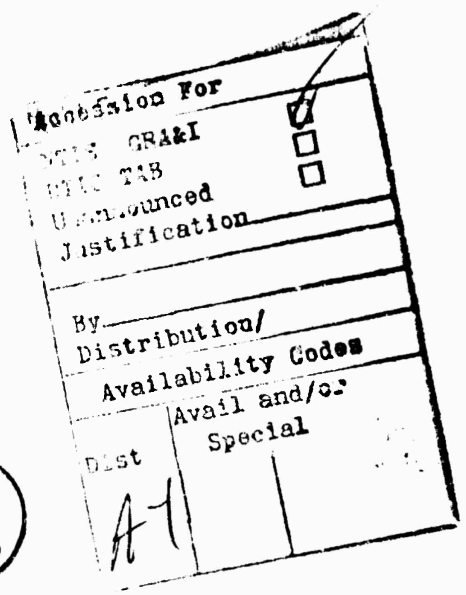
PREFACE

The present investigation on the determination of optimal portion size for hot combat rations was conducted by the Sensory Analysis Branch of the Behavioral Sciences Division, Science & Advanced Technology Directorate under work unit AMAF87-13 under project number OMA1113.

The authors wish to thank the many people who have been instrumental in seeing this project through to completion. Special thanks go to Jim Brodeur, Joan Kalick, Ruth Roth, and SSG Donald Ross of Sensory Analysis for their help in data collection and coding; Ed Baush, CW3 Stephen Gray, SGT Kniga and MSG Peterson of the Food Engineering Directorate for their help with field studies; and LTC Leary for his assistance in setting up field studies with members of the 10th Special Forces Group (Airborne) at Fort Devens, MA. The authors also wish to acknowledge the work done by the previous investigator, Dr. Barbara Edelman.



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INTRODUCTION

T rations, or Tray Pack meals, are thermally processed shelf-stable products which consist of fully prepared foods packaged in hermetically sealed, half-size steam table containers ready for heating and serving. The container serves as a package, a heating pan, and a serving tray for a single food item that typically serves 12 to 18 soldiers. A Tray Pack meal consists of portions of meats, vegetables, starches, and desserts supplemented with bread, beverages, and condiments. They were developed as part of the Combat Field Feeding System concept to provide nutritious hot meals to combat troops in the field.

Uncertainty exists as to what the optimal portion sizes are for components of Tray Pack meals. Consumer reports indicate dissatisfaction with designated serving sizes for certain food items. Some portions are felt to be too large and others too small. Appendix A shows current Tray Pack items with both old and new recommended portion sizes. In order to increase consumer satisfaction, and decrease costs associated with plate waste, a research project was initiated in FY85 to identify the food preference, situational, and individual factors that determine optimal portion sizes for Tray Pack field rations.

Technical Approach

A combination of field and laboratory studies was used to explore the relationships among food preference, situational and individual difference variables (see Appendix B) in the determination of optimal portion sizes for field feeding of Tray Pack meals.

Previous Studies

Perceived portion size is affected significantly by several diverse factors. For example, Edelman (1985a)[1] found that food type was more important than preference in intake of Tray Pack meats, starches, vegetables, and bread. In her study, subjects tended to increase their intake of relatively low preference meats compared to high preference desserts and vegetables. In examining the effects of time in service and gender on portion size preference, Edelman found that young men

with fewer than seven years service in the Army preferred meat portion sizes that were approximately 1 1/2 times the recommended serving size. Female military personnel and male military personnel with more than seven years service expressed concern over calories and fat and indicated that the current recommended portion sizes were adequate.

In a study of portion size preference Edelman (1985b)[2] presented enlisted Army subjects at Fort Devens, MA with six different combinations of Tray Pack meals using two different menus. Time in service was found to have a significant effect on preference for starch. Subjects with less time in service preferred larger starch portions than did subjects with more time in service.

These studies provide a background for the further development of additional data on optimal portion size.

METHOD

In total, eight studies were conducted, using more than 500 subjects from the Army, the Air Force, and the Marines Corps (Appendix B). All enlisted ranks were represented, as were warrant officers and commissioned officer ranks to O3.

The food preference questionnaires used in these studies were hand-scored and were based on the standard 7- or 9-point Likert-type scale used in previous work (Peryam and Pilgrim, 1957[3]; Moskowitz and Sidel, 1971[4]; Wyant and Meiselman, 1980[5]). Examples of the questionnaires are presented in Appendix C. The questionnaires allowed subjects to indicate perceived portion sizes and, depending on the questionnaire used, also indicate acceptability and provide demographic data. Questionnaire A was used for Experiments 1 & 2, questionnaire B was used for Experiments 3,4,& 8, and questionnaire C was used for Experiments 5,6,& 7.

All meals were either noon or evening meals, and studies 5, 6, and 7 included data collected from both meals. The menus for all studies are presented in Appendix D thru Appendix I. Portion size information for all studies is included in Appendix B. A food service advisor from Natick Research Development & Engineering Center (NRDEC) was also on hand to ensure proper preparation of the T rations. Field test meals (except for Experiment 2 which did not have the fresh fruit and salad component) were supplemented by items normally used by the units operating in the field, such as fresh fruit, fresh beverage or drink, cocoa, milk, salad, tea, and coffee. A full range of condiments, including salt, pepper, butter,

mustard, catsup, hot sauce, sugar, and coffee creamer, were available at all meals.

Subjects were briefed about the general nature of the study and were asked to fill out the questionnaires while they ate their meals. NRDEC personnel were available during the meals to answer questions and collect completed rating forms. Subjects were studied over a period of four days in each experiment resulting in more than 2000 questionnaires being completed.

Studies 1, 3, and 8 were experiments conducted in the experimental laboratories at NRDEC. All other studies were carried out in the field. Laboratory studies involved 12 to 15 subjects obtained from the human test subject platoon maintained at NRDEC. Field studies involved from 26 to 100 subjects per day.

Questionnaires were scored by hand, and the data were analyzed using analysis of variance, multiple regression, and correlation techniques. Portion size and acceptability ratings for selected experiments are presented in Tables 1 to 11.

RESULTS

Food Acceptability and Portion-Size Ratings *

The relationship between acceptability of food items and portion size ratings was examined in several studies. Data were collected on this question in both field and laboratory studies. However, only the laboratory study conducted at NRDEC yielded systematic and useful results. Unlike the field tests, this study was designed specifically to investigate the relationship between food acceptability and portion size ratings. The subjects were 12 enlisted soldiers who were given a lunch meal of Tray Pack items for four consecutive days. In order to examine the effects of food acceptability on preferred portion size, each menu contained both high and low acceptability items, as determined by acceptability ratings in previous field studies (see Table 12).[6-9] Specifically, each menu consisted of two high-acceptability items and two low-acceptability items, with each category of food represented. A correlation analysis of acceptability ratings and portion-size

* Portion-size and acceptability ratings for Tray Pack items are presented in Tables 1 to 11.

ratings revealed several inverse relationships (see Tables 10,11). For example, as acceptance ratings increased, portion size ratings decreased, for high and low acceptability vegetables and starches. A similar but weaker effect was found for high acceptability desserts, but the opposite effect, also weak, was found for low acceptability desserts. More will be said about this inverse relationship in the discussion.

Military Occupation and Level of Activity

Several studies dealt with the relations between military occupation, level of activity, or exertion, and portion size. Because military occupational specialty (MOS) and level of activity require various levels of exercise, they are related and will be discussed together.

MOS. In a study conducted at NRDEC, 15 enlisted subjects were studied during the noon meal for four consecutive days. Subjects were divided into groups based on MOS; combat arms and non-combat arms. Only soldiers in the combat arms rated the portion sizes of meats, vegetables and starches significantly smaller than the ideal. Notably, both groups rated the bread significantly larger than the ideal. In the study conducted at Fort Devens the subjects, Airborne Jumpmaster trainees, were divided into four groups according to MOS: tactical operations, clerical, maintenance, and technical/intelligence. Soldiers with a maintenance MOS rated the meat portions significantly larger than did all other soldiers, and those with a tactical operations MOS rated the bread portions significantly larger than did all other soldiers. In a related experiment, conducted at NRDEC, subjects were divided into the same four categories as in the previous study: tactical operations, maintenance, clerical, technical/intelligence. Soldiers with a maintenance MOS rated meat portions significantly larger than did soldiers with an MOS in tactical operations. Soldiers in the tactical operations MOS, on the other hand, rated the bread portions significantly larger than soldiers in either a clerical or a technical/intelligence MOS. This relationship between MOS and perceived portion size will be elaborated in the discussion.

Level of Activity. One factor which distinguishes one MOS from another is the level of activity required to complete a job in a particular occupational specialty. For example, maintenance or tactical MOSs typically require greater activity than a clerical MOS. The following two studies were designed to collect information about level of Activity as it affects preferred portion size.

In the study conducted with Airborne Jumpmaster trainees, the subjects were divided into two groups according to their level of activity. Classroom training was designated the low activity level, whereas the physical conditioning part of Airborne training was taken as the high level of activity. The high activity subjects rated the portion size of meats significantly larger than did the low activity subjects. Just the opposite was true for canned bread; that is, the low activity subjects rated the bread as significantly larger than did the high activity subjects. Both low and high activity subjects rated meats lower than the ideal (4.00), whereas all subjects rated bread portions higher than the ideal.

In a test carried out at NRDEC in the Climatic Chambers laboratories, 12 enlisted subjects were studied under two levels of activity. The subjects in the high activity condition engaged in 45 min. of intense aerobic exercise one hour prior to eating the noon meal. Under the low activity condition the subjects did not exercise in the morning. On days of high activity, portion sizes were rated significantly smaller for both meats and desserts. No effect was found for vegetables, starches, and bread.

There are several possible explanations for these apparently discrepant results. For example, it is possible that the time between exercise and eating, the level of exercise, or the expectation that exercise might follow the meal (for Airborne trainees) could significantly influence portion size rating.

Other Variables

Experience. Experience with MREs and hot rations, as well as time in service and time in the field, was examined in several studies. Prior experience with field rations had little reliable effect on perceived portion size. However, soldiers with more time in the field rated bread portion sizes larger, and vegetable and starch portions smaller, than did soldiers with less time in the field. Results from related experiments indicate that soldiers with less time in service rate starch and bread portions smaller than soldiers with more time in service. Also, soldiers with more time in service rate meat portions smaller, and bread, vegetable and starch portions, larger than soldiers with less time in service.

Rank. In a study on the relation between rank and preferred portion size, soldiers were divided into three groups. Group one consisted of Junior Enlisted members (E1-E4), group two consisted of noncommissioned Officers (NCOs)

(E5-E9), and group three consisted of all Officers. NCOs, in comparison to Junior Enlisted soldiers, rated meat portions smaller, and bread portions larger, than the other groups. There were no significant effects for Officers.

Age. The third variable in this group, age, also showed a significant relationship to perceived portion size. In the first experiment in which age was studied, older soldiers rated starch portions larger than younger soldiers. In a second study, older soldiers rated both vegetables and starches significantly more acceptable than did younger soldiers. However, older soldiers also rated portion sizes larger than ideal for vegetables and starches.

Possibly, where larger portion size ratings mean too much food, and smaller portion size ratings mean not enough food, older soldiers may prefer vegetables and starches but also be more concerned about calories consumed.

Gender. In one experiment the effect of gender on portion size rating was examined. Men rated meat portions significantly smaller than did women. One might expect body size to parallel these findings but, in the one study where body size was investigated, it was not found to have a significant effect on portion size ratings.

Plate size. Two sizes of five compartment trays were used on different days. The large size held approximately 25% more than the smaller size. Meat portion sizes were rated significantly larger on the small plate than on the large plate. Bread portions, however, were rated significantly larger on the large plate than on the small plate.

DISCUSSION

The technical plan for this project called for an examination of several individual, situational and food related variables, as they affect perceived portion size, in both laboratory and field studies. The studies reported here reveal that a number of such variables affect portion size ratings.

Probably the least surprising finding of this work, considering the differences in dietary requirements of males and females, is the confirmation that gender does make a difference in perceived portion size. Male soldiers rated meat portions smaller than ideal, and significantly smaller than females did. Females rated meat portions slightly larger than ideal.

Experience also plays an important role in the perception of portion size. Soldiers with more experience usually have more time in service, are older, and are higher in rank. Soldiers with more time in service perceived meat portions to be too small and bread portions to be too large. The same was true for NCOs, when compared to lower ranking enlisted soldiers. Older soldiers perceived starch and vegetable portions to be too large. These results are consistent and illustrate the importance of experience and/or age in the perception of portion size.

Two related variables, MOS and level of activity, were examined in several studies. Because MOSs differ widely in the amount of activity required to carry out missions, it is likely that activity is an important determinant of perceived portion size among different MOSs. However, a clear-cut relation between activity and portion size rating was not obtained. One variable which was not well controlled in these studies was the interval between exercise and eating. Portion sizes might be perceived as larger soon after exercise, when appetite is somewhat suppressed. Later, when appetite returns and may be increased, portion size ratings may be smaller. The last study in this sequence did control for the interval between exercise and eating by allowing a minimum of 45 minutes between aerobic exercise and eating the test meal. Under these conditions, when subjects had exercised, they perceived portion sizes as smaller than when they had not exercised. Thus, given sufficient time to recover from exercise, portion sizes tend to be perceived comparatively small.

Several of the variables investigated in these studies yielded useful information for achieving optimal portion size for hot combat rations. As a result of this work, we can define a profile of an older female soldier, with a clerical or technical MOS, who will prefer smaller than average portion sizes of most food items. In contrast, a young enlisted man (E1-E4), who maintains equipment or is engaged in tactical operations, will require larger than average portions. Therefore, it would be possible to establish an individual profile of preferred portion size for each soldier for each food type, and to serve each soldier his preferred portion size as he passes through the serving line. However, as the research above has shown, each soldier's preferred portion size profile will be different from the soldier in front of him in line. Consequently, the food server would have to serve different size portions to each soldier as he passed through the line. This is not a practical solution to optimizing portion size for all soldiers.

The alternative is not much better; to establish a set of fixed portion sizes for each food item which would hold for all soldiers. It is clear, from the research described above, that it is not ideal to establish one set of portion sizes for all soldiers. That approach perpetuates the situation in which some receive too much and others receive too little. A better approach is to devise a new strategy to optimize individual portion size. The elements of this strategy are presented below.

RECOMMENDATIONS

1. The most efficient way to incorporate the information obtained in these studies is to permit soldiers to self-serve selected items whenever possible. It should be possible to have food servers serve meat portions, typically the most expensive food, and permit the soldier to self-serve the vegetable, starch and bread portions of the meal. This approach would allow each soldier to take only as much food as he prefers to eat, and at the same time assure that the very hungry soldier gets enough food. Even if this strategy is used only for the least acceptable food items on the menu for that day, it would reduce the waste of items most likely to be wasted.

It is recognized that it takes longer to have soldiers serve themselves than to have food served by food servers. There is enough flexibility in this proposal for a compromise to be acheived between the benefits of reduced food waste and the cost of longer meal times.

2. When the strategy above is used, then the ordering of food supplies also should include consideration of the personnel composition of the unit. This does not mean that a demographic survey of each unit must be made and constantly updated, but information is available about positions (tactical, maintenance, clerical, etc.), proportion of females to males, and probably, the age range of personnel in the unit. A decision model, based on the available evidence, would include corrections for gender, military occupation and age. These corrections could then be used to adjust the amount of food which is ordered and more closely predict what will be consumed by soldiers who serve themselves.

Based on observations made during this research the following recommendations are made.

1. Recommended portion sizes should be specified in units of measure that make sense to those who serve food in the field. Units of measure should include cups or field feeding spoons, as appropriate, and ounces or some other unit of measure (e.g. weight) independent of the serving implement.

2. Portion sizes, defined in operational terms, should be printed clearly on each Tray Pack for the benefit of the server who is not familiar with the standard serving size.

TABLE 1. EXPERIMENT 2 PORTION SIZE RATINGS

ITEM	MEAN	S.D	N
MEATS	3.47	1.20	237
VEGETABLES	3.69	1.05	245
STARCHES	3.87	1.11	244
DESSERTS	3.34	1.11	243
CANNED BREAD	4.75	1.19	245

S.D. = STANDARD DEVIATION
N = SAMPLE SIZE
MIDPOINT = 4.00

TABLE 2. EXPERIMENT 4 PORTION SIZE RATINGS

ITEM	MEAN	S.D.	N
MEATS	5.43	1.48	347
VEGETABLES	5.98	1.44	346
STARCHES	5.93	1.46	347
DESSERTS	5.96	1.37	342
CANNED BREAD	5.65	1.46	342

TABLE 3. EXPERIMENT 4 ACCEPTABILITY RATINGS

ITEM	MEAN	S.D.	N
MEATS	5.62	1.73	347
VEGETABLES	5.68	1.88	342
STARCHES	5.06	1.85	345
DESSERTS	5.03	1.88	332
CANNED BREAD	3.43	1.99	345

S.D. = STANDARD DEVIATION
N = SAMPLE SIZE
MIDPOINT = 5.00

TABLE 4. EXPERIMENT 5 PORTION SIZE RATINGS

ITEM	MEAN	S.D.	N
MEATS	4.77	1.46	652
VEGETABLES	5.31	1.34	68
STARCHES	5.11	1.53	95
CAKES	5.24	1.16	159
PUDDINGS	5.78	1.61	64

TABLE 5. EXPERIMENT 5 ACCEPTABILITY RATINGS

ITEM	MEAN	S.D.	N
MEATS	6.33	1.76	652
VEGETABLES	5.29	2.25	68
STARCHES	5.38	2.01	95
CAKES	6.06	1.80	159
PUDDINGS	6.75	1.94	64

S.D. = STANDARD DEVIATION
N = SAMPLE SIZE
MIDPOINT = 5.00

TABLE 6. EXPERIMENT 6 PORTION SIZE RATINGS

ITEM	MEAN	S.D.	N
MEATS	4.98	1.53	498
VEGETABLES*	-	-	-
STARCHES	4.87	1.51	169
DESSERTS	4.83	1.33	343

TABLE 7. EXPERIMENT 6 ACCEPTABILITY RATINGS

ITEM	MEAN	S.D.	N
MEATS	6.70	1.62	498
VEGETABLES*	-	-	-
STARCHES	5.24	2.08	169
DESSERTS	5.69	2.13	343

*NO VEGETABLES WERE TESTED WITH THE ARMY
S.D. = STANDARD DEVIATION
N = SAMPLE SIZE
MIDPOINT = 5.00

TABLE 8. EXPERIMENT 7 PORTION SIZE RATINGS

ITEM	MEAN	S.D.	N
MEATS	4.45	1.80	612
VEGETABLES*	-	-	-
STARCHES	4.23	1.55	80
DESSERTS	4.52	1.49	258

TABLE 9. EXPERIMENT 7 ACCEPTABILITY RATINGS

ITEM	MEAN	S.D.	N
MEATS	6.22	1.93	612
VEGETABLES*	-	-	-
STARCHES	5.14	2.13	80
DESSERTS	5.80	2.18	258

*NO VEGETABLES WERE TESTED WITH THE MARINE CORPS
S.D. = STANDARD DEVIATION
N = SAMPLE SIZE
MIDPOINT = 5.00

TABLE 10. EXPERIMENT 8 PORTION SIZE RATINGS

	HIGH ACCEPTABILITY			LOW ACCEPTABILITY		
ITEM	MEAN	S.D.	N	MEAN	S.D.	N
MEATS	5.79	1.35	24	5.30	.82	23
VEGETABLES	5.71	1.20	24	6.83	1.47	23
STARCHES	5.91	1.28	23	6.00	1.35	23
DESSERTS	6.00	1.21	23	4.87	.69	23

TABLE 11. EXPERIMENT 8 ACCEPTABILITY RATINGS

	HIGH ACCEPTABILITY			LOW ACCEPTABILITY		
ITEM	MEAN	S.D.	N	MEAN	S.D.	N
MEATS	6.83	1.34	24	6.00	1.57	23
VEGETABLES	6.38	1.50	24	5.55	2.56	22
STARCHES	5.87	1.87	23	4.96	1.77	23
DESSERTS	5.86	1.91	21	4.96	2.06	23

S.D. = STANDARD DEVIATION
N = SAMPLE SIZE
MIDPOINT = 5.00

TABLE 12
Experiment 8

HIGH ACCEPTABILITY & LOW ACCEPTABILITY ITEMS

	USAF	ARMY	USMC	PHASE
HIGH ACCEPTABILITY				
FOOD ITEM				
BEEF/BBQ SAUCE	6.25	7.50	7.98	I
BEEF PEPPER STEAK	6.48	7.49	6.37	I
SPANISH RICE		6.60	7.00	III
WHITE RICE		7.07	6.59	II
CREAMED CORN		6.80	7.70	III
GREEN BEANS	6.24	7.02	7.22	I
CHOCOLATE PUDDING	6.73	6.80	6.92	IV
CHERRY DESSERT		7.00	7.20	III
LOW ACCEPTABILITY				
FOOD ITEM				
CHICKEN BREASTS/GRAVY	6.24	6.40	6.05	III & IV
ROAST BEEF	5.44	6.64		I
POTATOES/BUTTER SAUCE	6.10	6.27	6.15	II
SWEET POTATOES	4.81	6.24	4.97	II
LIMA BEANS	5.15	5.60	6.30	III & IV
SLICED CARROTS		6.17	6.59	II
POUND CAKE	5.80	5.38	5.00	IV
CHOCOLATE CAKE	6.30	4.37	5.02	IV

MIDPOINT = 5.00
Acceptability ratings were derived from the following Technical Notes: (I) Edelman, B. (1984)[6], (II) Edelman, B. et al,(1985)[7], (III) Stretch, R.,[9] & Kluter, R.(1985)[8], (IV) Stretch, R. & Kluter, R.(1986)[9].

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APPENDICES

APPENDIX A

TEN DAY BASIC CONCEPT MENU ITEMS AND ALTERNATE ITEMS [a]

Entree Items

Computer Code	10 Day Basic Concept Menu Items	No. Servings per Tray	Portion Size Unit, Pre 1986	'86 Army servings [d]
072	Roast Chicken/Gravy	20	2 slices	18
003	Beef/BBQ Sauce	18	2/3 slices	18
002	Beef Stew	12	1 cup	12
105	Chicken a la King	12	1 cup	12
028	Franks/Brine	22	2 franks	18
021	Ham Slices	18	2 slices	18
035	Meatloaf/Mushroom Gravy	20	2 slices	18
004	Beef Pepper Steak	18	2/3 cup	18
069	Roast Beef/Gravy	20	2 slices	18
017	Turkey Slices/Gravy	18	4 slices	18
071	Breakfast Bake	20	cut 2x10	18
042	Canadian Bacon/Brine	20	3 slices	18
058	Creamed Ground Beef	12	1 cup	12
062	Pork Sausage Links	30	3 links	18 [b]
073	Scrambled Eggs/Ham	20	cut 4x5 or scrambled	18 [c]
	Alternate Entree Items			
037	Pork/BBQ Sauce	18	2/3 cup	18
007	Beef Pot Roast/Gravy	14	2 slices	12
015	Chili Con Carne	12	1 cup	12
001	Pork Slices/Gravy	20	3 slices	18
027	Stuffed Peppers	8	2 peppers	NA
006	Swedish Meatballs	15	2 meatballs	12
106	Chicken/Noodles	12	1 cup	12
107	Chicken Cacciatore	16	3/4 cup	12
108	Chicken Breasts/Gravy	18	1 breast	12
109	Chicken Stew	10	1-1/4 cups	12
110	Beef Tips/Gravy	18	2/3 cup	18
111	Beef/Macaroni	8	1-1/2 cups	NA
005	Lasagna	12	cut 3x4	12
016	Spaghetti/Meatballs	8	1-1/2 cups incl. 2 meatballs	NA
036	Beef Swiss Steak/Gravy	14	1 slice	12
112	Meatballs/Rice/Cabbage	15	2 meatballs	12

[a] Prepared by Ration Design and Evaluation Branch, FED.

[b] When used as an entree, serve 5 links (18 servings).

[c] When scrambled, portion size is one cup.

[d] '86 Army Servings reflect a recent decision that all Tray Pack portion sizes would be either 12 or 18 servings per tray.

Starch Items

Computer Code	10 Day Basic Concept Menu Item	No. Servings Per Tray	Portion Size Unit, Pre 1986	'86 Army Servings
026	Beans/Bacon	18	2/3 cup	18
067	Buttered Noodles	18	2/3 cup	18
044	Macaroni/Cheese	18	2/3 cup	18
064	Potatoes/Butter Sauce	18	2/3 cup	18
078	Potatoes Salad	18	2/3 cup	18
023	Escalloped Potatoes	18	2/3 cup	18
070	Glazed Sweet Potatoes	18	2/3 cup	18
068	Rice/White	18	2/3 cup	18
	Alternate Menu Item			
079	Macaroni Salad	18	2/3 cup	18
084	Potatoes/Chicken Sauce	18	2/3 cup	18
030	Spanish Rice	18	2/3 cup	18

Vegetable Items

Computer Code	10 Day Basic Concept Menu Items	No. Servings Per Tray	Portion Size Unit, Pre 1986	'86 Army Servings
048	Green Beans	25	1/2 cup	18
060	Carrots/Brine	25	1/2 cup	18
059	Whole Kernel Corn	25	1/2 cup	18
063	Mixed Vegetables	25	1/2 cup	18
049	Peas/Mushrooms	25	1/2 cup	18
022	Three Bean Salad	25	1/2 cup	18
	Alternate Menu Items			
051	Creamed Corn	25	1/2 cup	18
041	Glazed Carrots	25	1/2 cup	18
065	Lima Beans	25	1/2 cup	18
053	Peas/Carrots	25	1/2 cup	18
085	Stewed Tomatoes	25	1/2 cup	18

Dessert Items

Computer Code	10 Day Basic Concept Menu Items	No. Servings Per Tray	Portion Size Unit, Pre 1986	'86 Army Servings
018	Applesauce	25	1/2 cup	18
031	Peaches/Syrup	25	1/2 cup	18
039	Pears/Syrup	25	1/2 cup	18
076	Pineapple/Syrup	25	1/2 cup	18
050	Fruit Cocktail/Syrup	25	1/2 cup	18
081	Chocolate Pudding	25	1/2 cup	18
024	Apple Dessert	25	1/2 cup	18
043	Apple Coffee Cake	20	cut 4x5	18
046	Blueberry Cake	20	cut 4x5	18
011	Cherry Nut Cake	20	cut 4x5	18
010	Orange Nut Cake	20	cut 4x5	18
013	Spice Cake	20	cut 4x5	18
014	Chocolate Cake	20	cut 4x5	18
	Alternate Menu Items			
020	Cherry Dessert	25	1/2 cup	18
019	Blueberry Dessert	25	1/2 cup	18
012	Fruit Cake	20	cut 4x5	18
009	Pound Cake	20	cut 4x5	18
008	Marble Cake	20	cut 4x5	18

APPENDIX B. LIST OF EXPERIMENTS & VARIABLES

EXPERIMENT	LOCATION	DATE	MEAL	PORTION	VARIABLES*
1 - LAB	NRDEC	AUG85	LUNCH	HALF=1 HALF=1.5	MOS TIS TIF AGE
2 - FIELD	FT.DEVENS, MASSACHUSETTS	AUG85	LUNCH	1	GENDER ACTIVITY LEVEL PLATE SIZE MOS RANK TIS
3 - LAB	NRDEC	DEC85	LUNCH	1	ACTIVITY LEVEL PLATE WASTE MOS
4 - FIELD	CAMP WILLIAMS, UTAH	FEB86	DINNER	2	FRE TIF AGE WEIGHT ACCEPTANCE
5 - FIELD	EGLIN AFB, FLORIDA (AIR FORCE)	JAN86	LUNCH DINNER	1 1	FRE ACCEPTANCE
6 - FIELD	FT POLK, LOUISIANA (ARMY)	FEB86	LUNCH DINNER	1 1	FRE ACCEPTANCE
7 - FIELD	FT BRAGG, NORTH CAROLINA (MARINES)	MAR86	LUNCH DINNER	1 1	FRE ACCEPTANCE
8 - LAB	NRDEC	MAY86	LUNCH	1	ACCEPTANCE

*MOS = MILITARY OCCUPATION SPECIALTY
TIS = TIME IN SERVICE
TIF = TIME IN FIELD (in past year)
FRE = FIELD RATION EXPERIENCE (previous experience with hot meals or Meals, Ready-to-Eat (MREs) in the field during the past year)

APPENDIX C.

QUESTIONNAIRE A. EXPERIMENTS 1,2

NAME_____
MOS_____
RANK_____
DATE_____

PLEASE RATE EACH OF THE FOLLOWING ITEMS IN TERMS OF THEIR PORTION SIZE

1. Please rate the <u>overall meal</u> for its <u>size</u>. (Circle the appropriate number)

1	2	3	4	5	6	7
MUCH TOO SMALL			NEITHER TOO SMALL/ TOO LARGE			MUCH TOO LARGE

2. Please rate the <u>vegetable portion</u> for its <u>size</u>.

1	2	3	4	5	6	7
MUCH TOO SMALL			NEITHER TOO SMALL/ TOO LARGE			MUCH TOO LARGE

3. Please rate the <u>starch portion</u> (white beans, potatoes, lasagna) for its <u>size</u>.

1	2	3	4	5	6	7
MUCH TOO SMALL			NEITHER TOO SMALL/ TOO LARGE			MUCH TOO LARGE

4. Please rate the <u>meat portion</u> for its <u>size</u>.

1	2	3	4	5	6	7
MUCH TOO SMALL			NEITHER TOO SMALL/ TOO LARGE			MUCH TOO LARGE

5. Please rate the <u>dessert portion</u> for its <u>size</u>.

1	2	3	4	5	6	7
MUCH TOO SMALL			NEITHER TOO SMALL/ TOO LARGE			MUCH TOO LARGE

OVER →

TIME ON ACTIVE DUTY_____YRS_____MONTHS
AGE_____
HEIGHT_____
WEIGHT_____
SEX____MALE____FEMALE

6. Please rate the bread portion for its size.

1	2	3	4	5	6	7
MUCH TOO SMALL			NEITHER TOO SMALL/ TOO LARGE			MUCH TOO LARGE

7. How did the size of this meal compare to what you usually eat for lunch?

1	2	3	4	5	6	7
MUCH SMALLER			ABOUT THE SAME			MUCH LARGER

8. In the past year, how many days have you spent in the field?_____

9. After finishing your meal did you want any second helpings?____Yes____No

10. If yes, which items did you want more of? (Circle all that apply)
    1. Vegetable
    2. Starch (white beans, potatoes, lasagna)
    3. Meat
    4. Dessert
    5. Bread

11. What suggestions do you have for improving the portion sizes in this meal?_____
_____
_____
_____
_____

PLEASE CHECK TO MAKE SURE THAT YOU HAVE ANSWERED ALL QUESTIONS.

THANK YOU FOR YOUR HELP!

QUESTIONNAIRE B. EXPERIMENTS 3, 4, & 8

Date_____ Meal Type_____

We would like your help in evaluating each of the following food items for how acceptable you find them and how satisfied you are with their appearance and portion size. For each of these characteristics, circle the number that best expresses your opinion. Please fill this in yourself without discussing it with your friends. Thank you.

1. Please rate the ACCEPTABILITY of each food item by circling the number that best expresses your opinion.

/	/	/	/
9 Extremely Good	9 Extremely Good	9 Extremely Good	9 Extremely Good
8 Very Good	8 Very Good	8 Very Good	8 Very Good
7 Moderately Good	7 Moderately Good	7 Moderately Good	7 Moderately Good
6 Slightly Good	6 Slightly Good	6 Slightly Good	6 Slightly Good
5 Neutral	5 Neutral	5 Neutral	5 Neutral
4 Slightly Bad	4 Slightly Bad	4 Slightly Bad	4 Slightly Bad
3 Moderately Bad	3 Moderately Bad	3 Moderately Bad	3 Moderately Bad
2 Very Bad	2 Very Bad	2 Very Bad	2 Very Bad
1 Extremely Bad	1 Extremely Bad	1 Extremely Bad	1 Extremely Bad

2. Please rate the PORTION SIZE of each food item.

/	/	/	/
9 Extremely Large	9 Extremely Large	9 Extremely Large	9 Extremely Large
8 Very Large	8 Very Large	8 Very Large	8 Very Large
7 Moderately Large	7 Moderately Large	7 Moderately Large	7 Moderately Large
6 Slightly Large	6 Slightly Large	6 Slightly Large	6 Slightly Large
5 Just Right	5 Just Right	5 Just Right	5 Just Right
4 Slightly Small	4 Slightly Small	4 Slightly Small	4 Slightly Small
3 Moderately Small	3 Moderately Small	3 Moderately Small	3 Moderately Small
2 Very Small	2 Very Small	2 Very Small	2 Very Small
1 Extremely Small	1 Extremely Small	1 Extremely Small	1 Extremely Small

3. Please rate your satisfaction with the APPEARANCE of each food item.

/	/	/	/
9 Extremely Satisfied	9 Extremely Satisfied	9 Extremely Satisfied	9 Extremely Satisfied
8 Very Satisfied	8 Very Satisfied	8 Very Satisfied	8 Very Satisfied
7 Moderately Sat.	7 Moderately Sat.	7 Moderately Sat.	7 Moderately Sat.
6 Slightly Satisfied	6 Slightly Satisfied	6 Slightly Satisfied	6 Slightly Satisfied
5 Neutral	5 Neutral	5 Neutral	5 Neutral
4 Slightly Unsat.	4 Slightly Unsat.	4 Slightly Unsat.	4 Slightly Unsat.
3 Moderately Unsat.	3 Moderately Unsat.	3 Moderately Unsat.	3 Moderately Unsat.
2 Very Unsatisfied	2 Very Unsatisfied	2 Very Unsatisfied	2 Very Unsatisfied
1 Extremely Unsat.	1 Extremely Unsat.	1 Extremely Unsat.	1 Extremely Unsat.

4. Please rate this MEAL for overall acceptability.
   9 Extremely Good
   8 Very Good
   7 Moderately Good
   6 Slightly Good
   5 Neutral
   4 Slightly Bad
   3 Moderately Bad
   2 Very Bad
   1 Extremely Bad

5. In the past year how many hot meals have you eaten in the field?_____ How many MREs?_____

QUESTIONNAIRE C EXPERIMENTS 5, 6, & 7

NAME_____ TIME ON ACTIVE DUTY_____YEARS_____MONTHS
MOS_____ AGE_____
RANK_____ HEIGHT_____
DATE_____ WEIGHT_____

We would like your help in evaluating each of the following food items in terms of their portion size and how acceptable you find them. After eating your meal, circle the number that best expresses your opinion for each characteristic. Please fill this in yourself without discussing it with your friends. Thank you.

1. Please rate the PORTION SIZE of each food item by circling the number that best describes how large or small you feel each item was.

MEAT	/ VEGETABLE	/ STARCH	/ DESSERT	/ BREAD
9 Extremely Large	9 Extremely Large	9 Extremely Large	9 Extremely Large	9 Extremely Large
8 Very Large	8 Very Large	8 Very Large	8 Very Large	8 Very Large
7 Moderately Large	7 Moderately Large	7 Moderately Large	7 Moderately Large	7 Moderately Large
6 Slightly Large	6 Slightly Large	6 Slightly Large	6 Slightly Large	6 Slightly Large
5 Just Right	5 Just Right	5 Just Right	5 Just Right	5 Just Right
4 Slightly Small	4 Slightly Small	4 Slightly Small	4 Slightly Small	4 Slightly Small
3 Moderately Small	3 Moderately Small	3 Moderately Small	3 Moderately Small	3 Moderately Small
2 Very Small	2 Very Small	2 Very Small	2 Very Small	2 Very Small
1 Extremely Small	1 Extremely Small	1 Extremely Small	1 Extremely Small	1 Extremely Small

2. Please rate the ACCEPTABILITY of each food item by circling the number that best describes how good or bad you feel each item was.

MEAT	/ VEGETABLE	/ STARCH	/ DESSERT	/ BREAD
9 Extremely Good	9 Extremely Good	9 Extremely Good	9 Extremely Good	9 Extremely Good
8 Very Good	8 Very Good	8 Very Good	8 Very Good	8 Very Good
7 Moderately Good	7 Moderately Good	7 Moderately Good	7 Moderately Good	7 Moderately Good
6 Slightly Good	6 Slightly Good	6 Slightly Good	6 Slightly Good	6 Slightly Good
5 Neutral	5 Neutral	5 Neutral	5 Neutral	5 Neutral
4 Slightly Bad	4 Slightly Bad	4 Slightly Bad	4 Slightly Bad	4 Slightly Bad
3 Moderately Bad	3 Moderately Bad	3 Moderately Bad	3 Moderately Bad	3 Moderately Bad
2 Very Bad	2 Very Bad	2 Very Bad	2 Very Bad	2 Very Bad
1 Extremely Bad	1 Extremely Bad	1 Extremely Bad	1 Extremely Bad	1 Extremely Bad

3. After finishing your meal did you want any second helpings?_____Yes_____No
   If yes, which items did you want more of? (Circle all that apply)
   1. Meat
   2. Vegetable
   3. Starch
   4. Dessert
   5. Bread
4. In the past year, how many hot meals have you eaten in the field?_____How many MREs?_____
5. What suggestions do you have for improving the PORTION SIZES in this meal?

_____

_____

_____

PLEASE CHECK TO MAKE SURE YOU HAVE ANSWERED ALL QUESTIONS. THANK YOU!

APPENDIX D

EXPERIMENT 1 TRAY PACK MENUS

DAY 1

BEEF STEW
PEAS AND MUSHROOMS
MARBLE CAKE
CANNED BREAD

DAY 2

HAM SLICES
SWEET POTATOES
CREAMED CORN
BLUEBERRY DESSERT
CANNED BREAD

DAY 3

BEEF TIPS/GRAVY
BUTTERED NOODLES
PEAS AND CARROTS
BLUEBERRY CAKE
CANNED BREAD

DAY 4

LASAGNA
GREEN BEANS
SPICE CAKE
CANNED BREAD

All meals were supplemented by a full range of condiments and commercial beverages such as kool-aid and coffee.

APPENDIX E

EXPERIMENT 2 TRAY PACK MENUS

DAY 1

TURKEY SLICES
SWEET POTATOES
PEAS AND MUSHROOMS
CHERRY DESSERT
CANNED BREAD

DAY 2

HAM SLICES
BBQ BEANS
LIMA BEANS
BLUEBERRY DESSERT
CANNED BREAD

DAY 3

PEPPER STEAK
ESCALLOPED POTATOES
MIXED VEGETABLES
CHERRY DESSERT
CANNED BREAD

DAY 4

LASAGNA
SPANISH RICE
PEAS AND MUSHROOMS
BLUEBERY DESSERT
CANNED BREAD

All meals were supplemented by a full range of condiments and commercial beverages such as kool-aid and coffee.

APPENDIX F

EXPERIMENT 3 TRAY PACK MENUS

DAY 1

PEPPER STEAK
WHITE RICE
MIXED VEGETABLES
BLUEBERRY CAKE
CANNED BREAD

DAY 2

BEEF TIPS/GRAVY
BUTTERED NOODLES
PEAS AND MUSHROOMS
MARBLE CAKE
CANNED BREAD

DAY 3

HAM SLICES
BEANS WITH BACON
PEAS AND CARROTS
SPICE CAKE
CANNED BREAD

DAY 4

TURKEY SLICES
SWEET POTATOES
GREEN BEANS
CHERRY DESSERT
CANNED BREAD

All meals were supplemented by a full range of condiments and commercial beverages such as kool-aid and coffee.

APPENDIX G

EXPERIMENT 4 TRAY PACK MENUS

DAY 1

ROAST BEEF/GRAVY
POTATOES IN BUTTER SAUCE
PEAS AND MUSHROOMS
CHOCOLATE CAKE
CANNED BREAD

DAY 2

HAM SLICES
BEANS WITH BACON
GREEN BEANS
APPLE DESSERT
CANNED BREAD

DAY 3

PEPPER STEAK
ESCALLOPED POTATOES
PEAS AND CARROTS
BLUEBERRY CAKE
CANNED BREAD

DAY 4

BEEF TIPS/GRAVY
BUTTERED NOODLES
MIXED VEGETABLES
POUND CAKE
CANNED BREAD

All meals were supplemented by a full range of condiments and commercial beverages such as kool-aid and coffee.

APPENDIX H
Experiment 5, 6, & 7
TRAY PACK MENU

DAY 1

LUNCH	DINNER
SWISS STEAK/GRAVY*	CHICKEN CACCIATORE*
POTATOES/CHICKEN SAUCE*	WHITE RICE
PEAS/CARROTS	CREAMED CORN
POUND CAKE*	CHOCOLATE PUDDING*
BREAD/BUTTER/MARGARINE	BREAD/BUTTER/MARGARINE
LEMONADE BEVERAGE	ORANGE BEVERAGE
COFFEE/TEA/MILK	COFFEE/TEA/MILK
CONDIMENTS	CONDIMENTS

DAY 2

LUNCH	DINNER
MEATBALLS/CABBAGE*	CHICKEN BREASTS/GRAVY*
POTATOES/BUTTER SAUCE	POTATO SALAD
PEAS/MUSHROOMS	GLAZED CARROTS
APPLE DESSERTS	MARBLE CAKE*
BREAD/BUTTER/MARGARINE	BREAD/BUTTER/MARGARINE
GRAPE BEVERAGE	ORANGE BEVERAGE
COFFEE/TEA/MILK	COFFEE/TEA/MILK
CONDIMENTS	CONDIMENTS

DAY 3

LUNCH	DINNER
BEEF/BBQ SAUCE	CHICKEN/NOODLES*
MACARONI SALAD**	POTATOES/CHICKEN SAUCE*
WHOLE KERNEL CORN	GREEN BEANS
CHERRY DESSERT	CHOCOLATE CAKE*
BREAD/BUTTER/MARGARINE	BREAD/BUTTER/MARGARINE
GRAPE BEVERAGE	LEMON-LIME BEVERAGE
COFFEE/TEA/MILK	COFFEE/TEA/MILK
CONDIMENTS	CONDIMENTS

DAY 4

LUNCH	DINNER
BEEF/MACARONI*	CHICKEN STEW*
POTATO SALAD	SPANISH RICE
LIMA BEANS*	GLAZED CARROTS
PEARS/SYRUP NO. 10 CN (HALVES)	CHOCOLATE PUDDING*
BREAD/BUTTER/MARGARINE	BREAD/BUTTER/MARGARINE
ORANGE BEVERAGE	LEMONADE BEVERAGE
COFFEE/TEA/MILK	COFFEE/TEA/MILK
CONDIMENTS	CONDIMENTS

* TEST ITEMS
** UNAVAILABLE FOR TEST

APPENDIX I

EXPERIMENT 8 TRAY PACK MENUS

DAY 1

BEEF/BBQ SAUCE (HA)
LIMA BEANS (LA)
SPANISH RICE (HA)
POUND CAKE (LA)
COMMERCIAL WHITE BREAD
APPLE OR CRANBERRY JUICE

DAY 2

ROAST BEEF/GRAVY (LA)
SLICED CARROTS (LA)
WHITE RICE (HA)
CHERRY DESSERT (HA)
COMMERCIAL WHITE BREAD
APPLE OR CRANBERRY JUICE

DAY 3

BEEF PEPPER STEAK (HA)
GREEN BEANS (HA)
POTATOES/BUTTER SAUCE (LA)
CHOCOLATE CAKE (LA)
COMMERCIAL WHITE BREAD
APPLE OR CRANBERRY JUICE

DAY 4

CHICKEN BREASTS/GRAVY (LA)
CREAMED CORN (HA)
SWEET POTATOES (LA)
CHOCOLATE PUDDING (HA)
COMMERCIAL WHITE BREAD
APPLE OR CRANBERRY JUICE

HA = High Acceptability
LA = Low Acceptability