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**PATTERNS OF FOOD UTILIZATION
IN THE DOD, VOLUME 1**

by

Philip Brandler

and

Ronald Deacon

November 1974

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SUMMARY

A survey of food utilization (quantity) and expenditure (cost) throughout the military has been conducted. Detailed data are presented for each military service and for DoD as a whole, and analyses are performed to provide understanding of food usage within major and minor food groups. Results indicate that differences among services do exist, although all services do provide nutritionally adequate, quality diets. Large disparities are noted between actual food utilization and that specified by the current Food Cost Index (FCI). A number of recommendations are made, including the suggestion that similar surveys be conducted on a regular basis and that the results of this particular survey and future surveys be used to revise the FCI.

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INTRODUCTION

During Fiscal Year 1974, the Operations Research/Systems Analysis Office conducted an investigation aimed at developing a Uniform Ration Cost System under Task 01 of Project No. IT762713AJ45, Identification of Existing Feeding Systems, System Components and Alternatives, of the DoD Food Research, Development, Test and Engineering Program. The major objective of this effort was to develop and evaluate a ration cost system which is directly related to known consumer requirements, furnish an appropriate standard of feeding, provide an improved approach to food allowances and cost controls and serve as a basis for a Uniform Ration Law (URL). Within this overall program, one subtask, the subject of this report, addressed the problem of determining and analyzing current food utilization patterns in the military services. In particular, this data was to be used in the derivation of the supporting method for the computation of a basic daily food allowance. This effort involved gathering data on issues to military dining halls of over 500 different food items served by the four services in a sample of almost 37.5 million rations. Due to the extreme wealth of information generated by the study, the report has been divided into two volumes. The first volume contains the summary data and discussion, while the second volume presents supplementary tables and listings considered useful for further research and analysis.

OBJECTIVES

The basic objectives of this study are to provide:

1. A quantitative basis for establishing a food cost index and consequent basic daily food allowance that is reasonable and consistent with present consumption patterns;
2. A quantitative basis for level of feeding comparisons between military and civilian populations; and,
3. Sufficient detailed tables of data so that operational use of the information and further research and analysis in this area are facilitated.

SURVEY METHODOLOGY

As should be the case in all studies, the survey methodology was a derivative of the objectives of the program. In this case, the ruling objective was the desired utilization of this data base for the development of a food cost index alternative which could be used to set the basic reimbursement level at the dining hall for its food purchases. Of necessity, then, one had to scrutinize food usage on an "as purchased" basis, associating it with the number of rations served. A question can be raised as to whether gathering data on an "as consumed" basis taking into consideration preparation and plate waste would not have been a better basis. A recognizable problem with that approach is that gathering "as consumed" data was not feasible because of the constraints on resources for this project. Even more to the point, however, is the fact that the data is to be applied in developing a cost control for food purchase and hence the "as purchased" frame of reference is the "real" one. Therefore, early into this project it was decided to gather data on food item issues to the dining hall and on the consequent number of rations served. Concerns as to the seasonality were to be avoided by gathering a full year's data. With the exception of the Navy (which uses quarterly data collection), data was gathered on a monthly basis in line with considerations of inventory and service reporting requirements. It was determined that no significant detail would be lost by gathering the data on that basis.

Initially, it was thought that the Defense Personnel Supply Center (DPSC) could provide the data. Two factors made this course of action impractical. First, DPSC records of shipments to base commissaries did not permit discrimination as to which portion was designated for use by appropriated fund dining halls. Second, because commissaries inventory items at varying time periods, records of DPSC shipments could not be associated with a particular number of rations served.

Given the targets as to the type of data required, the subsequent decisions, such as sample size, where it was to be drawn, and pertinent source documents, were to a great extent determined by the availability of this data within each service individually. Two of the services, the Navy and the Marine Corps, kept files of data of the sort that was required at the headquarters level, easing considerably the burden of data collection. In the case of the Army and Air Force, the required data was available only at the installation level. The burden of data collection in the case of the Air Force was further increased as Air Force dining halls have individual stock rooms. Therefore, in order to get data on stock issues for consumption purposes rather than for stock room inventory, data collection for the Air Force was at the individual dining hall level. In the case of the Army, consolidated data at the base level was available only at certain bases, and this more than any other factor determined the choice of Army data collection sites.

The Navy Food Service Systems Office in Washington had accumulated data (from a sample of about 14% of all rations served) by quarter on average food utilization per ration* for their Quarterly & Annual Food Consumption Studies. A continuous full year's data, however, was only available for the fiscal 1972 period (July 1971 through June 1972). Since this information contained the necessary detail, it was selected and then coded in a form useable by the system developed for the required analyses.

The Marine Corps Headquarters Food Service Office had on file copies of Monthly Subsistence Analysis Reports and Ration Fed Reports for all Marine bases in the United States. A quick analysis revealed that by choosing the four largest bases, 75% of the rations served to the Marine Corps in the United States could be covered. Table I contains a list of the bases selected. Data was compiled for the one-year period beginning July 1972.

As noted, the collection of the Air Force data was one of the more tedious and time-consuming tasks, necessitating visits to individual bases. The bases that were selected, as well as the dining halls sampled at each base and other related data are presented in Table I. Since Air Force dining halls were only required to retain the most recent 12 months of data and the data collection took a number of months, the one-year periods varied from base to base. The time periods covered at each base and dining hall in the sample are also presented in Table I. The five Air Force sites selected represented a reasonable cross section of command missions and geographical locations, as well as size. It was only the constraint of time, however, that limited the survey to five bases and 7 dining halls. At each base, food usage data was compiled from the Field Ration Dining Hall Stock Record (Air Force Form AF 147). Headcount data relating to numbers of rations served were extracted from Daily Dining Hall Summaries (Air Force Form AF 1650).

Finally, the source of data for the Army portion of the study was the individual base commissary office. Here, at certain bases, records of consolidated issues to the dining halls were kept on Commissary Consumption Cards (DA Form 3293). Data relative to the number of rations served were compiled from the Subsistence Report and Field Ration Request (DA Form 2970). As the Army did not have regulatory requirements concerning the collection and retention of all the data that was required, numerous bases were contacted before suitable sources were located. This factor as well as time, cost and personnel constraints limited the number of bases in the sample. Data was collected from the three bases listed in Table I. The total sample size, nevertheless, was comparable to that of the Navy in terms of the percentage of rations served in the United States. Table 2 presents some statistics on overall sample size, both as a percentage of each individual service as well as for DoD as a whole. As has already been noted, the Air Force represented the smallest sample, and the Marine Corps the largest. Overall, about 14% of all rations served in DoD were included in the survey.

*The number of "rations" served in a military dining hall is the sum of the weighted headcounts (number of attendees) at each type of meal served. For the period of this survey, the meal weighting factors were: breakfast 20%, dinner 45%, and supper 35%.

TABLE 1

DATA ACQUISITION SITES

	Total No. of Dining Halls	No. of D.H. Surveyed	% Total Rations Served Included in Survey	Time Period Spanned by Sample Data
Marine Corps:				
Camp Pendleton Marine Corps Base, CA			100	Jul 72— Jun 73
Camp Lejeune Marine Corps Base, NC			100	Jul 72— Jun 73
Paris Island Marine Corps Recruit Depot, SC			100	Jul 72— Jun 73
San Diego Marine Corps Recruit Depot, CA			100	Jul 72— Jun 73
Air Force:				
Hanscom AFB, MA (Systems Command)	1	1	100	Aug 72— Jul 73
Minot AFB, ND (SAC)	3	1	70	Aug 72— Jul 73
Lackland AFB, TX (ATC)	15	3	17	
Permanent Party Dining Hall				Sep 72— Aug 73
Basic Trainee Dining Hall				Aug 72— Jul 73
WAF Trainee Dining Hall				Aug 72— Jul 73
Nellis AFB (TAC), NV	3	1	27	Oct 72— Sep 73
Travis AFB (MAC), CA	3	1	40	Oct 72— Sep 73
Army:				
Fort Carson, CO			100	Jul 72— Jun 73
Fort Ord, CA			100	Nov 72— Oct 73
Fort Polk, LA			100	Jan 73— Dec 73

TABLE 2**MILITARY FOOD UTILIZATION SAMPLE DATA**

	No. of Installations	No. of Rations	Total Service (%)	Sample As % of		
				Service CONUS	Service AFLOAT	Service CONUS
AF	5	1,301,868	3.5	5.3	—	—
Army	3	10,546,982	11.0	20.0	—	—
Marine	4	12,741,571	56.0	75.0	—	—
Navy	141	12,899,613	14.0	13.0	15.0	10.0
DOD	153	37,490,034	14.0	23.0	15.0	1.0

DATA ANALYSIS METHODOLOGY AND ASSUMPTIONS

The presentation of the results of detailed analyses can be misleading unless one is supplied with some description of the particular techniques which were used, as well as a statement of the simplifying assumptions which were made to reduce the complexity of the analysis to a manageable level. The simplifying assumptions and methodology used in this analysis of military food utilization data can roughly be separated into seven categories.

1. Food items tracked.
2. Adjustments for seasonality.
3. Weighting of monthly data.
4. Weighting of data by base.
5. Reasonableness checks.
6. Choice of aggregation groups.
7. Measures of significant differences.

A discussion of each of these categories follows below.

With certain provisions, issues to the dining hall of all food items by form (whole versus cut-up) and process (fresh versus canned) were tabulated. While entries for different process forms of a food item were kept separate so that usage of fresh versus frozen versus canned versus dehydrated could be prepared, within each process the various package sizes were pooled. That is, while a statement regarding usage of canned peaches can be made, a statement regarding canned peaches in #10 cans versus canned peaches in #303 cans cannot. In addition, certain items which were utilized very infrequently were pooled with similar items in the data base. Table 3 presents a listing of those items not specifically listed and the item under which they were pooled.

Realizing that the usage of certain food items as well as particular forms of food items was often a function of the season of the year, it had been decided that gathering data for any period less than a year would present a biased picture. In order to avoid this, data was gathered by month for the 12 months of the year. This data was then aggregated into four calendar year quarterly periods so that in effect one had three monthly measures of the consumption for a given quarterly season. In all cases, the same months were included in a particular quarterly designation whether or not that month came from the same year. For example, quarter three was composed of the months of July, August, and September. For some bases, the data for these three months was all 1972 data. However, at another base data collection might have started in August of 1972 and therefore while August and September's data was 1972, July's data was from 1973. In both cases, however, the three month's data was pooled into quarter three.

TABLE 3**ITEMS USED IN THE MILITARY BUT NOT SPECIFICALLY LISTED IN THE DATA BASE**

Data Base Item	Item(s) Pooled Under: Data Base Item
1. Grill Steak	Sirloin Steak
2. Beef, Tenderloin	Porterhouse Steak T-Bone Steak
3. Ground Beef	Salisbury Steak
4. Oven Roast	Roast Beef
5. Pig's Feet	Pig Ears Pig Necks Pig Tails Pig Snouts
6. Chicken, Cut-up	Chicken, Whole Cornish Hen
7. Potatoes, White, Frozen, Fried	All Frozen Forms of Potatoes
8. Rolls, Bread, Fresh	Sandwich Buns, Dinner Rolls, Sub Rolls, Etc.
9. Rolls, Sweet, Fresh	Jelly Rolls, Turnovers, Cream Puffs, etc.
10. Cake, White, Fresh	All Cakes & Cupcakes
11. Pie, Apple, Fresh	All Pies
12. Cereal, Prepared, Ind.	Assortment of Individual Pre- packaged Servings
13. Cereal, Bran, Flakes	All Dry, Cold Bran Cereals
14. Cereal, Corn Flakes	All Dry, Cold Corn Cereals
15. Cereal, Oats, Puffed	All Dry, Cold Oat Cereals

TABLE 3**ITEMS USED IN THE MILITARY BUT NOT SPECIFICALLY LISTED IN THE DATA BASE (cont'd)**

Data Base Item	Item(s) Pooled Under Data Base Item
16. Cereal, Rice, Puffed	All Dry, Cold Rice Cereals
17. Cereal, Wheat, Flakes	All Dry, Cold Wheat Cereals
18. Cookies, Vanilla Wafer	All Cookies
19. Donuts	All Types of Donuts
20. Beverage Base, Pwd.	All Flavors
21. Beverage Base <ul style="list-style-type: none">- Cherry- Grape- Lemon- Lime- Orange	All flavors are sometimes listed under one of the 5 data base item flavors or dispersed randomly among the five
22. Flour, Wheat, Bread	All Hard Flours
23. Flour, Wheat, Cake	All Soft Flours
24. Ice Cream	Includes items such as Creamsicles Fudgesicles, Drumsticks, etc.
25. Luncheon Meat, Cnd.	Meat Spreads
26. Corned Beef, Cnd.	Beef Hash
27. Beef Chunks, Cnd.	Potted Meat
28. Pork Sausage, Cnd.	Vienna Sausage
29. Cheese, American, Proc.	Cheese Whiz, Cheese Spread
30. Ham, Chunked, Cnd.	Deviled Ham
31. Milk, White	Milk, Sterilized, Cnd.

TABLE 3**ITEMS USED IN THE MILITARY BUT NOT SPECIFICALLY LISTED IN THE DATA BASE (cont'd)**

Data Base Item	Item(s) Pooled Under Data Base Item
32. Milk, Nonfat, Dry	Milk, Whole, Dry
33. Eggmix, Dehy.	Eggs, Whole, Dried
34. Milk-Shake Mix, Dehy.	Ice Cream Mix, Dehy.
35. Cheese, Cheddar, Nat.	Cheese Cheddar, Proc.
36. Lobster, Frozen	Crawfish, Frozen
37. Polish Sausage	New England Sausage
38. Juice, Tomato	Juice, Vegetable
39. Jelly, Apple	Jelly, Asst.
40. Jam, Cherry	Jam, Asst.
41. Milk, Chocolate	Choc. Flavored Dairy Drink
42. Hot Sauce	Taco Sauce, Tabasco Sauce
43. Soup, Chicken-Noodle	Soup, Asst.
44. Desert Pwd., Van.	Tapioca
45. Macaroni	Rigatoni Shells
46. Spaghetti	Vermicelli
47. Topping, Ice Cream, Fudge	Topping, Ice Cream, Asst.
48. Peppers, Hot	Peppers, Banana Peppers, Cherry Peppers, Jalepno
49. Worcestershire Sauce	A-1 Sauce Barbeque Sauce

Once data regarding the quantity of a particular food item issued to the dining hall for a given month, and the number of rations served in that month had been secured, the average utilization per ration could be calculated by dividing the former by the latter. In the next step of the analysis, it was desired to aggregate this data in order to make statements regarding average utilization in a particular quarter or in the entire year. This was accomplished by summing the monthly utilization for that item over the number of months in the period of interest and dividing the former by the latter to get the average utilization per ration. This method of calculation was chosen over the method of adding up the monthly averages in the period of interest and then dividing by the number of months in that period because the latter method would have weighted the data from each month equally. By choosing the methodology that was utilized, each month's data was essentially weighted by the number of rations served in that month, thereby putting greater emphasis on the larger samples. Since the accuracy of the statistic is proportional to the size of the sample, all other things being equal, the chosen methodology was the more accurate of the two available.

Similarly, for three of the four services (Army, Navy and Marines) rather than adding the average utilization for each item from each base and dividing by the number of bases in the sample, all of the data for each service was pooled and total quantities issued by item for the total service sample was divided by total rations served for the entire service sample. Again, this procedure was equivalent to weighting the data from each base by the number of rations served at that base, thereby giving greater weight to the large sub-samples within each service.

In the case of the Air Force, a situation was encountered in which utilizing this same procedure would have biased the data. Two of the Air Force dining halls from which data was gathered possibly represented a typical feeding situation. Specifically, one dining hall catered predominantly to male basic trainees and one dining hall to WAF's. Since neither one of these groups comprises a large proportion of Air Force personnel, a schema was devised whereby the data from these dining halls would be weighted in proportion to the representation of each of these two groups in the Air Force as a whole. This was achieved by taking the average number of basic trainees in the Air Force and dividing that by the average number of rations served by the Air Force per day. Additionally, the average number of WAF enlistees in the Air Force was divided by the total Air Force enlisted strength. These factors for the two groups were then used to weight the data from these two dining halls. The rationale for this choice was as follows: First, basic trainees were all required to eat in the dining halls during training; hence, as a group of dining hall customers they were represented in greater proportion than was the case for other enlisted airmen, a large percentage of whom were on basic allowance for subsistence (BAS). Therefore, it seemed more appropriate to weight them as a percentage of rations served than as a percentage of average enlisted strength. In the case of the WAF's, no information existed to substantiate any claim that as a group they frequented the dining hall more often than enlisted airmen; therefore, their proportionate representation as a percentage of total Air Force enlisted strength was assumed to characterize their representation as a percentage of dining hall customers. For the remaining five Air Force

dining halls, the data was pooled in a fashion similar to that carried out for the other three services and then the results of this pooling were weighted by one minus the weighting factor for WAF's minus the weighting factor for male basic trainees.

The same problem was faced in trying to compute a combined DoD figure for average utilization per ration by item. The approach here was to take the average usage for a particular item from each service and weight that figure by a factor determined by dividing the total number of rations served by that service in FY 72 & 73 by the total number of rations served by DoD as a whole in that same period. In this way, the greatest emphasis was placed on data from the services whose operation constituted the largest proportion of total DoD food service. The resulting weighting factors were Army 41%, Navy 35%, Air Force 15%, and Marine Corps 9%.

As is apparent, a vast quantity of data had been gathered in the course of this survey. Despite extreme care in gathering and coding this data, there was a very real chance that misinformation would be interjected into the data base. One very strict constraint, however, imposed on food service provided a means to easily check the reasonableness of the results and thereby verify the validity of the data. This constraint was the one posed by the basic daily food allowance. Therefore, after the data had been processed to the point of presenting average usage per ration by food item by quarter and by year, these quantities were multiplied by their cost per pound as determined by Federal Supply Price Lists and these figures were summed giving a total food cost per ration. This figure was compared with the BDFA as calculated from pricing the Food Cost Index and any figures falling outside of a 5% tolerance resulted in a close scrutiny of the data to determine the cause for the anomaly. By this means, one was able to determine such things as misplaced decimals resulting from keypunch errors, etc. Before being utilized any further, all data was processed to the point that it passed this BDFA check, thereby insuring its reasonableness. The choice of 5% as a tolerance figure was based on a number of factors:

1. Certain supplemental allowances are allowed over and above the BDFA, mostly for smaller dining halls and ships.
2. Certain command decisions and orders had been made that required that the allowance be cut back from the BDFA level to make certain cost savings.
3. It was felt that a certain amount of random error was to be tolerated since the cost to get perfect accuracy was prohibitive.

In addressing the issue of making meaningful comparisons of expenditures (costs) per ration between services, it was realized that utilizing actual expenditure experience for each service would not be suitable. The time periods covered for each base or dining hall in the survey differed to some extent and the BDFA had fluctuated considerably due to inflation. In order to present a

picture which was generally unaffected by the fluctuations in the BDFA, utilization per ration figures were costed at DPSC prices for a single given period to yield an expenditure per ration figure suitable for comparison. In this case, all usage data was priced using the 1 April 1974 DPSC price list as revised by change notices 1 & 2 dated 1 May 1974 and 1 June 1974, respectively.

After the data had been processed to the point where the average utilization per ration for the approximately 500 items in the data base had been validated, the next step was to aggregate them in some meaningful fashion so that conclusions could be drawn. In choosing aggregation groups, it was decided to adopt a system somewhat similar to that used by the U. S. Department of Agriculture.⁽¹⁾ Basically, the data was arranged in a four-tier aggregation scheme. The grossest level of aggregation was in 12 major food groups, as presented in Table 4. Each of these 12 major food groups was further subdivided into a total of 51 minor subgroups. Within these minor subgroups, each item was further tagged as to process (fresh, frozen, canned, dehydrated). For meat, poultry and fish items, a further subdivision was made by segregating the various forms. The aforementioned groupings are listed in Tables 5 and 6. Using this aggregation scheme, the data on individual food items could be pooled into meaningful groups for purposes of analysis and comparison. Finally, having aggregated the data for each service and for DoD as a whole, comparisons could be made. The usage of any particular individual item within a particular service was not considered to be particularly significant, subject as it was to the vagaries of supply. Comparisons looking for significant differences were therefore restricted to comparisons between aggregated groups. The technique utilized was to carry out an analysis of variance to determine whether there existed any significant variance in the consumption of any particular food group between the services. For those food groups for which significant differences were indicated, a further Duncan's Multiple Range Test was carried out to determine which service or services were different from the remainder and from DoD as a whole. Figure 1 presents a flow chart of the data processing discussed above.

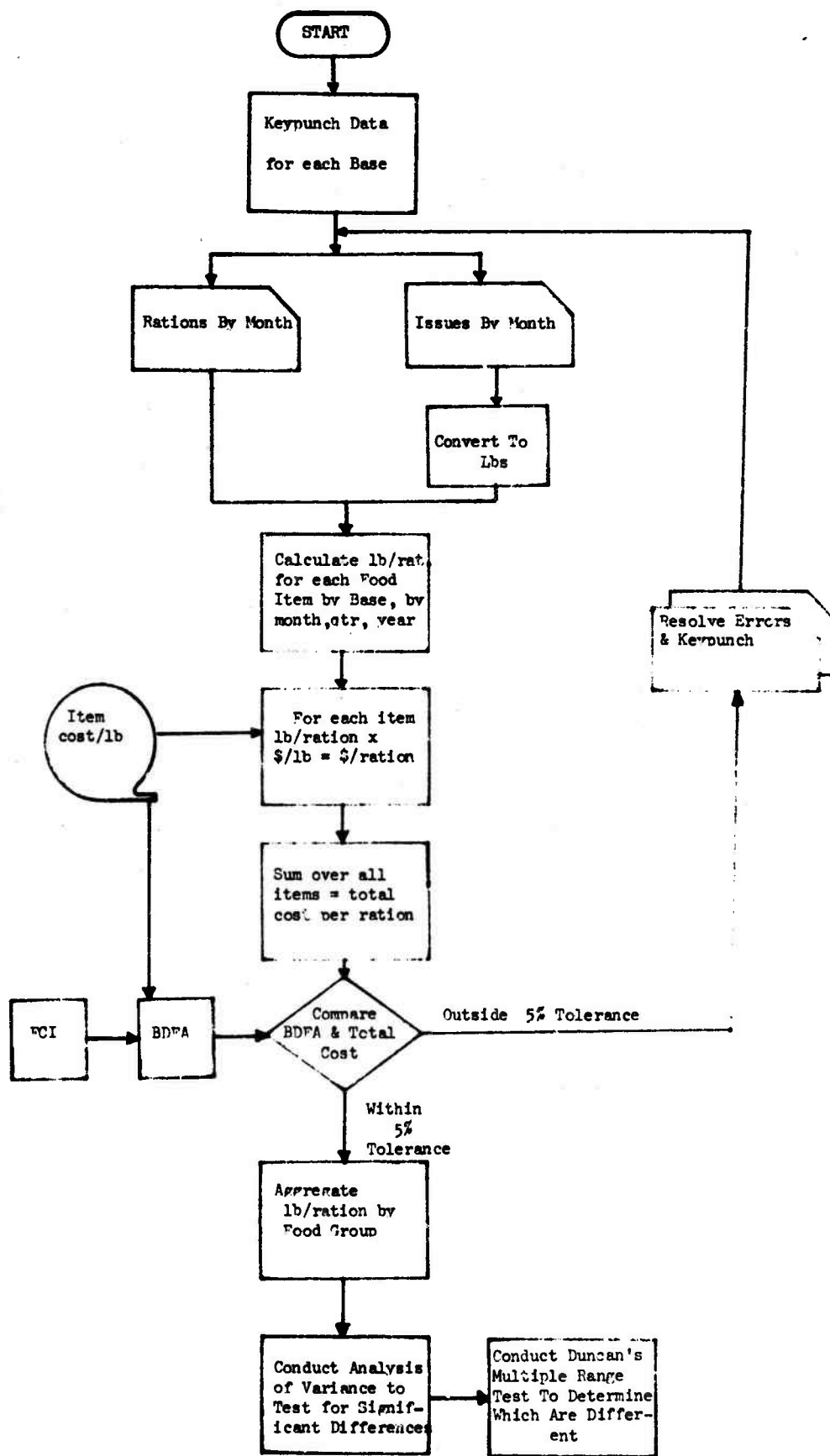


FIGURE 1 - FLOW CHART OF THE DATA PROCESSING FOR UTILIZATION DATA

TABLE 4

MAJOR FOOD GROUPS

- 01 Meat—Poultry—Fish**
- 02 Eggs**
- 03 Milk & Milk Products**
- 04 Beverages**
- 05 Vegetables**
- 06 Legumes & Nuts**
- 07 Grain & Cereal Products**
- 08 Fruits**
- 09 Fats, Oils, Salad Dressing**
- 10 Sugar & Sweets**
- 11 Condiments**
- 12 Miscellaneous**

TABLE 5

MINOR FOOD GROUP

Beef
Veal
Pork
Lamb
Poultry
Fish
Shellfish
Sausages, Cold Cuts
Eggs
Milk & Milk Drinks
Cream, Ice Cream
Cheese
Butter
Tea, Coffee, Cocoa
Juices
Soft Drinks
Potatoes, White
Tomatoes
Dark Green Vegetables
Deep Yellow Vegetables
Other Vegetables (Not Leafy)
Other Leafy Vegetables
Legumes
Nuts, Nut Butter
Bread, Rolls, Biscuits
Other Baked Goods
Spaghetti, Macaroni, Noodles, Pasta
Flour & Mixes
Cereals & Cereal Pastes
Rice & Barley
Citrus Fruits
Other Fruits
Margarine
Salad Oil & Dressings
Other Fats & Oils
Sugar
Syrup, Honey, Molasses

TABLE 5

MINOR FOOD GROUP (cont'd)

Jelly, Jam

Candy

Puddings, Pie Filling, Dessert Powder, Icings,
Toppings

Salts

Spices

Ketchup, Mustard, Relish, Horseradish

Pickles & Olives

Flavorings & Vinegars

Colorings

Mexican Food, Prepared

Yeast, MSG, Antiox, Baking Powder & Soda

Pizza, Prepared

Prepared Meat Soups & Gravy Bases

Prepared Vegetables Soups

TABLE 6

FORM

Ground

Diced

Cuts

Whole

Fillet

Portion & Stick

PROCESS

Fresh

Frozen

Canned or Bottled

Dried or Dehydrated

RESULTS & DISCUSSION

The data collected in this large scale effort offer many opportunities for abstraction and summary to enhance its use by interested organizations. With this in mind, a number of summary tables have been developed and are presented on the following pages. The principal objectives have been to permit meaningful interservice comparisons and to provide a basis for computations related to BDFA computations. These tables furnish a summary that should prove adequate for most users. For those relatively few organizations that require more detailed data, appendices are made available in a separate volume to present supplementary tables and listings considered useful for further research and analysis in this subject area.

Information relating to food utilization and expenditure are the two immediate products of this study; however, additional information on nutrition and food quality has also been derived. The major objective of this survey has been to investigate the food utilization patterns for each service and to synthesize the findings into a DoD pattern. In the pursuit of this goal, a number of data subsets have been prepared which are also worthy of comment. Specifically, a comparison of the DoD utilization data with the composition of the Food Cost Index, which provides the cost control for food purchases, as well as a comparison among three significant subgroupings of the Air Force (permanent party, basic trainee and WAF) have been included. It will be noted that the objectives expressed earlier emphasized that the survey of DoD food utilization provides a data base for Food Cost Index development and level of feeding comparisons with civilian organizations. A discussion of the data relative to these two areas of endeavor are to be found in separate reports. (1), (2) As in other tabulations of food utilization, such as the U. S. Department of Agriculture "Household Food Consumption Survey 1965-66," the data provided here is to a great extent self explanatory; hence, the textual discussion of results included in this report is a brief highlight of the findings. The task of scrutinizing and comparing the data for other elements of personal interest is left to the reader.

As will be apparent in tables to be discussed later, in every case over 70% of total food usage per ration is encompassed by four food groups: (1) Meat, poultry, fish; (2) Milk and milk products; (3) Vegetables; and, (4) Grain and cereal products. As a result, it seems quite logical to base the majority of the discussion on these groups. Occasional mention of other groups is provided when deemed necessary to round out the presentation.

(1) Brandler, P., "The Development of Alternative Food Cost Indexes", U. S. Army Natick Laboratories, Technical Report 75-67-OR/SA.

(2) Brandler, P., et. al., "The Basic Level of Feeding - A Comparison of Military and Comparable Civilian Food Utilization, "U. S. Army Natick Laboratories, Technical Report 75-43-OR/SA.

A. DoD Food Utilization and the Food Cost Index

The primary constraint on military food purchases is the Food Cost Index. The FCI is a list of 48 food items and the quantities of each allotted to feed 100 persons; the list is consistent with the Navy Ration Law (10 USC 6081-6082). In order to calculate the monetary value of the Basic Daily Food Allowance, these FCI quantities are multiplied by the unit price of each item as derived from the current Defense Personnel Supply Center price list and summed. To this is added an allowance for condiments not specifically listed, and the result is divided by 100 to provide the daily value of the food allowance for each person subsisted. It seems patently logical that some reasonable correlation exist between actual food purchase practices and the method used to provide the funds. Results, however, seem to indicate that this is usually not the case.

At the major food group level, Table 7, which provides the usage quantity in pounds per ration, indicates the particularly striking differences between DoD usage and FCI quantities in the utilization of eggs and beverages, where DoD usage is nearly twice the FCI allotment, and vegetables, where the FCI allowance is nearly twice the DoD utilization. In addition, DoD usage of the extremely important meat, poultry, fish food group is almost 17% greater than the FCI allotment, while grain and cereal products usage is about 15% lower. Milk and milk products usage and allotments listed in Table 7 are similar; however, within this major group, as indicated in Table 8, which provides the usage quantity at the minor food group level, milk and milk drinks usage is 12% lower and butter utilization almost 33% lower than the FCI allowances. Some of these discrepancies can be explained by the fact that neither the NRL nor the FCI provide for the serving of such commonly used items as ice cream or soft drinks or margarine; other differences are simply due to actual variations in the patterns of usage versus the allotment quantities. Table 9 makes this evident by showing the percentage distribution of usage quantity over the major food groups.

The differences in usage are reflected in similar differences in expenditures as is apparent in Tables 10, 11, and 12. DoD egg expenditures are almost double the FCI allotment, while DoD vegetable expenditures are almost 30% lower than the FCI allotment. The fact that vegetable usage was almost 50% lower than the allotment while expenditures were only 30% lower can probably be explained by the inclusion in the DoD usage figures of the more expensive frozen vegetables not accounted for in the FCI. DoD expenditures for meat, poultry, fish exceed the FCI by more than 13%; however, DoD expenses for the subgroup beef as presented in Table 11 are nearly 15% lower. This is additional evidence of the fundamental differences in the pattern of expenditure. Table 12, which provides the percentage distribution of expenditures, further highlights these pattern differences, as well as the importance of the meat, poultry, fish food group to the overall ration cost. As regards, total DoD expenditures and FCI allowances, one finds, as expected, rather close agreement.

TABLE 7**UTILIZATION PER RATION BY MAJOR
FOOD GROUP FOR DOD AND THE FCI
(All Units in Lbs. per ration)**

	FCI	DOD
Meat, Poultry, Fish	.838	.980
Eggs	.120	.220
Milk & Milk Products	2.281	2.108
Beverages	.200	.357
Vegetables	2.038	1.112
Legumes & Nuts	.144	.159
Grain & Cereal Products	.850	.724
Fruits	.588	.450
Fats, Oils, & Dressings	.129	.160
Sugar & Sweets	.350	.254
Condiments	.079	.125
Miscellaneous		.044

TABLE 8**FOOD UTILIZATION BY MINOR FOOD GROUP
FOR DOD AND THE FCI
(All Units in Lbs. per ration)**

	FCI	DOD
Beef	.463	.407
Veal		.032
Pork	.220	.249
Lamb		.002
Poultry	.115	.148
Fish	.040	.035
Shellfish		.028
Sausages, Cold Cuts		.079
Eggs	.120	.220
Milk & Milk Drinks	2.15	1.896
Cream, Ice Cream		.089
Cheese	.031	.055
Butter	.100	.068
Tea, Coffee, Cocoa	.125	.044
Juices	.075	.150
Soft Drinks		.162

TABLE 8 (cont'd)

**FOOD UTILIZATION BY MINOR FOOD GROUP
FOR DOD AND THE FCI
(All Units in Lbs. per ration)**

	FCI	DOD
Potatoes, White	.980	.463
Tomatoes	.275	.131
Dark Green Vegetables		.055
Deep Yellow Vegetables	.205	.118
Other Veg. (Not Leafy)	.300	.186
Other Leafy Veg.	.278	.159
Legumes	.144	.150
Nuts, Nut Butter		.009
Bread, Rolls, Biscuits	.375	.328
Other Baked Goods		.062
Pasta	.050	.032
Flour & Mixes	.375	.252
Cereal & Cereal Pastes	.020	.031
Rice & Barley	.030	.018
Citrus Fruit	.180	.092
Other Fruits	.408	.358

TABLE 8 (cont'd)**FOOD UTILIZATION BY MINOR FOOD GROUP
FOR DOD AND THE FCI
(All Units in Lbs. per ration)**

	FCI	DOD
Margarine		.015
Salad Oil & Dressing	.029	.067
Other Fats & Oils	.100	.077
Sugar	.313	.154
Syrup, Honey, & Molasses		.045
Jelly, Jam	.038	.023
Candy		.002
Pudding, Pie Filling, etc.		.030
Prepared Meat Soups & Gravy		.012
Prepared Vegetable Soups		.005
Salts		.018
Spices		.007
Ketchup, Mustard, Relish	.048	.063
Pickles & Olives		.017
Flavorings & Vinegar	.031	.020
Colorings		.

TABLE 8 (cont'd)

**FOOD UTILIZATION BY MINOR FOOD GROUP
FOR DOD AND THE FCI
(All Units in Lbs. per ration)**

	FCI	DOD
Mexican, Prepared		.020
Leavenings, Tenderizers		.005
Pizza, Prepared		.001
Popsicles		*
*Less than .001		

TABLE 9**UTILIZATION BY MAJOR FOOD GROUP AS A PERCENTAGE
OF TOTAL LBS /RATION FOR DOD AND THE FCI**

	FCI	DOD
Meat, Poultry, Fish	11.01	14.64
Eggs	1.58	3.29
Milk & Milk Products	29.95	31.50
Beverages	1.64	5.34
Vegetables	26.75	16.62
Legumes & Nuts	1.89	2.37
Grain & Cereal Products	11.16	10.81
Fruits	7.71	6.73
Fats, Oils, Dressings	1.69	2.39
Sugar & Sweets	4.60	3.79
Condiments	1.04	1.87
Miscellaneous		.65

NOTE: Percentages may not total 100.00% due to rounding.

TABLE 10**EXPENDITURES PER RATION BY MAJOR
FOOD GROUP FOR DOD AND THE FCI
(All Units in \$ per ration)**

	FCI	DOD
Meat, Poultry, Fish	.892	1.006
Eggs	.045	.086
Milk & Milk Products	.349	.384
Beverages	.139	.091
Vegetables	.306	.220
Legumes & Nuts	.029	.043
Grain & Cereal Products	.181	.177
Fruits	.096	.091
Fats, Oils, & Dressings	.057	.063
Sugar & Sweets	.090	.066
Condiments	.059	.035
Misc.		.020
	2.242	2.283

TABLE 11**FOOD EXPENDITURES BY MINOR FOOD GROUP
FOR DOD AND THE FCI
(All Units in \$ per ration)**

	FCI	DOD
Beef	.548	.468
Veal		.056
Pork	.236	.241
Lamb		.004
Poultry	.061	.098
Fish	.047	.036
Shellfish		.045
Sausages, Cold Cuts		.059
Eggs	.045	.086
Milk & Milk Drinks	.299	.258
Cream, Ice Cream		.031
Cheese	.033	.042
Butter	.025	.052
Tea, Coffee, Cocoa	.130	.048
Juices	.009	.032
Soft Drinks		.012

TABLE 11 (cont'd)**FOOD EXPENDITURES BY MINOR FOOD GROUP
FOR DOD AND THE FCI
(All Units in \$ per ration)**

	FCI	DOD
Potatoes, White	.127	.084
Tomatoes	.079	.036
Dark Green Vegetables		.016
Deep Yellow Vegetables	.030	.023
Other Veg. (not leafy)	.045	.045
Other Leafy Veg.	.025	.016
Legumes	.029	.038
Nuts, Nut Butter		.005
Bread, Rolls, Biscuits	.094	.082
Other Baked Goods		.016
Pasta	.022	.012
Flour & Mixes	.041	.047
Cereal & Cereal Pastes	.011	.013
Rice & Barley	.013	.008
Citrus Fruits	.023	.014
Other Fruits	.073	.077

TABLE 11 (cont'd)**FOOD EXPENDITURES BY MINOR FOOD GROUP
FOR DOD AND THE FCI
(All Units in \$ per ration)**

	FCI	DCD
Margarine		.008
Salad Oil & Dressing	.016	.026
Other Fats & Oils	.041	.029
Sugar	.077	.037
Syrup, Honey, Molasses		.009
Jelly, Jam	.013	.007
Candy		.001
Pudding, Pie Filling, etc.		.012
Prepared Meat Soups & Gravy		.005
Prepared Vegetable Soups		.004
Salts		.001
Spices		.008
Ketchup, Mustard, Relish	.009	.012
Pickles & Olives		.008
Flavorings & Vinegar	.057	.008
Colorings		*

TABLE 11 (cont'd)

FOOD EXPENDITURES BY MINOR FOOD GROUP
FOR DOD AND THE FCI
(All Units in \$ per ration)

	FCI	DOD
Mexican, Prepared		.009
Leavenings, Tenderizers		.002
Pizza, Prepared		.001
Popsicle		*
*Less than .001		

TABLE 12**EXPENDITURES BY MAJOR FOOD GROUP AS A PERCENTAGE OF
TOTAL \$/RATION FOR DOD AND THE FCI**

	FCI	DOD
Meat, Poultry, Fish	39.78	44.06
Eggs	2.01	3.75
Milk & Milk Products	15.55	16.81
Beverages	6.20	4.01
Vegetables	13.66	2.65
Legumes & Nuts	1.29	1.89
Grain & Cereal Products	8.05	7.76
Fruits	4.29	3.98
Fats, Oils, Dressings	2.52	2.75
Sugar & Sweets	4.01	2.91
Condiments	2.62	1.54
Miscellaneous		.89

NOTE: Percentages may not total 100.00% due to rounding.

Despite these differences in the patterns of food usage and expenses, Table 13 indicates that the nutrition provided by DoD purchases and that indicated by the FCI agree quite closely. In considering these nutritional figures, it should be kept in mind that they are based on "as purchased" food and do not reflect actual consumption, which must consider all nutrition losses such as serving and plate waste, and cooking losses (see B., Food Utilization in the Four Services for a further discussion of this issue).

B. Food Utilization in the Four Services

Before proceeding with the discussion of food utilization in the four services, it should be reiterated that some of the variation that will be noted is a result of the differences in data collection periods between services as well as differences in relative sample sizes. The Air Force data, in particular, representing as it does the smallest sample, provides the least reliable estimate of the mean food utilization of any service. Nevertheless, all data did fulfill the requirements posed for agreement with the BDFA (within $\pm 5\%$). Further, the DoD composite data agreed to within 2% of the BDFA.

An investigation of utilization by major food group as presented in Table 14 discloses, for example, the fact that the Marine Corps uses approximately 15% less meat, poultry, fish than either the Navy or Air Force, which possess the highest utilization per ration within this group. Usage by minor food groups is displayed in Table 15. Examination of this table reveals a low utilization in the meat, poultry, fish group of veal and even lower lamb utilization throughout DoD. These small values are likely due to the high cost of veal, and the low preference, and high cost associated with lamb. According to Table 14, the use of milk and milk products by the Navy, the lowest user, is roughly 25% less than the Marine Corps, whose utilization of dairy products is the greatest. This difference can partially be attributed to the inability to store large amounts of fresh dairy products aboard ship, hence, the increased utilization of powdered forms. The storage issue also apparently explains the low usage of purchased bread in the Navy. The widespread use of beverage base throughout the Air Force partly accounts for its high beverage usage (shown in Table 15 to be nearly 20 times greater than the Navy). Fruit utilization in the Air Force, however, is considerably less than the other three services. According to Table 14, total vegetable usage is quite similar throughout the military; but Table 15 illustrates the fact that the Army makes use of roughly 40% more white potatoes than the Air Force, indicating some differences in the pattern of usage by vegetable subgrouping. Margarine usage is quite low in the military and practically nil in the Navy, due primarily to the explicit specification of butter in the Navy Ration Law.

The pattern of food utilization as illustrated in Table 16, which presents the percentage distribution of usage quantities over the major food groups, adheres to the observations just made.

TABLE 13**NUTRITIONAL ANALYSIS OF DOD FOOD UTILIZATION
AND THE FCI FOOD COMPONENTS**

	FCI	DOD
Food Energy (Cal)	4844	4697
Protein (g)	181.2	184.5
Fat (g)	206.0	215.5
Calcium (mg)	1726	1816
Iron (mg)	28.0	36.2
Vitamin A IU	11870	10550
Thiamine (mg)	2.7	2.2
Riboflavin (mg)	3.5	3.5
Niacin (mg)	34.4	32.4
Ascorbic Acid (mg)	202.1	186.2

TABLE 14
UTILIZATION PER RATION BY MAJOR FOOD GROUP FOR THE FOUR SERVICES
AND DOD
(All Units in Lbs.)

	Navy	Army	Marine Corp	Air Force	DOD
Meat, Poultry, Fish	1.010	.969	.862	1.009	.980
Eggs	.217	.224	.243	.205	.220
Milk & Milk Products	1.719	2.242	2.709	2.287	2.108
Beverages	.237	.417	.241	.543	.357
Vegetables	1.125	1.170	1.050	.957	1.112
Legumes & Nuts	.166	.170	.125	.131	.159
Grain & Cereal Products	.627	.816	.724	.696	.724
Fruits	.497	.464	.490	.276	.450
Fats, Oils & Dressings	.155	.174	.160	.132	.160
Sugar & Sweets	.278	.281	.246	.129	.254
Condiments	.133	.130	.101	.107	.125
Miscellaneous	.040	.050	.026	.046	.044

TABLE 15

FOOD UTILIZATION PER RATION BY MINOR FOOD GROUP FOR THE FOUR SERVICES AND DoD
(All Units in Lbs.)

	Navy	Army	Marines Corps	Air Force	DoD
Beef	.440	.379	.335	.451	.407
Veal	.046	.029	.032	.008	.032
Pork	.229	.265	.228	.261	.248
Lamb	.002	.003	*	.001	.002
Poultry	.127	.167	.115	.165	.148
Fish	.035	.037	.025	.033	.035
Shellfish	.043	.021	.020	.020	.028
Sausages, Cold Cuts	.088	.068	.108	.070	.079
Eggs	.217	.224	.243	.205	.220
Milk & Milk Drinks	1.510	2.058	2.395	2.052	1.896
Cream, Ice Cream	.089	.062	.180	.109	.089
Cheese	.052	.053	.768	.056	.055
Butter	.068	.069	.057	.070	.068
Tea, Coffee, Cocoa	.055	.051	.019	.015	.044
Juice's	.157	.170	.108	.107	.150
Soft Drinks	.025	.196	.114	.421	.162
Potatoes, White	.420	.534	.449	.379	.463
Tomatoes	.131	.145	.104	.110	.131
Dark Green Vegetables	.049	.061	.041	.059	.055
Deep Yellow Vegetables	.139	.100	.122	.114	.118
Other Vegetables (Not Leafy)	.230	.157	.191	.159	.186
Other Leafy Vegetables	.157	.173	.144	.136	.159

*less than .001

TABLE 15

FOOD UTILIZATION PER RATION BY MINOR FOOD GROUP FOR THE FOUR SERVICES AND DoD (cont'd)

	Navy	Army	Marines Corps	Air Force	DoD
Legumes	.152	.162	.117	.129	.150
Nuts, Nut Butter	.013	.008	.008	.002	.009
Bread, Rolls, Biscuits	.246	.369	.403	.363	.328
Other Baked Goods	.072	.034	.023	.141	.062
Pasta	.033	.029	.031	.037	.032
Flour & Mixes	.231	.329	.210	.117	.252
Cereal & Cereal Pastes	.024	.036	.044	.024	.031
Rice & Barley	.020	.018	.013	.015	.018
Citrus Fruits	.117	.079	.114	.055	.092
Other Fruits	.380	.385	.376	.221	.358
Margarine	*	.029	.010	.018	.015
Salad Oil & Dressing	.064	.073	.060	.064	.067
Other Fats & Oils	.091	.072	.060	.050	.077
Sugar	.188	.164	.127	.065	.154
Syrup, Honey, Molasses	.034	.059	.042	.035	.045
Jelly, Jam	.016	.032	.042	.035	.045
Candy	.002	.002	.002	.001	.002
Pudding, Pie Filling, etc.	.038	.025	.049	.016	.030
Prepared Meat Soups & Gravy	.016	.011	.008	.007	.012
Prepared Vegetable Soups	.005	.007	.001	.003	.005
Salts	.016	.020	.016	.021	.019
Spices	.009	.007	.003	.004	.007

*less than .001

TABLE 15

FOOD UTILIZATION PER RATION BY MINOR FOOD GROUP FOR THE FOUR SERVICES AND DoD (cont'd)

	Navy	Army	Marine Corps	Air Force	DoD
Ketchup, Mustard, Relish	.069	.064	.052	.050	.063
Pickles & Olives	.020	.017	.017	.011	.017
Flavorings & Vinegar	.019	.021	.013	.021	.020
Colorings	*	*	*	*	*
Mexican, Prepared	.010	.026	.014	.032	.020
Leavenings, Tenderizers	.007	.004	.004	.002	.005
Pizza, Prepared	.001	.002	-	.002	.001
Popsicle	.001	-	-	-	*

*less than .001

TABLE 16

UTILIZATION BY MAJOR FOOD GROUP AS A PERCENTAGE OF TOTAL LBS./RATION
FOR THE FOUR SERVICES AND DOD

	Navy	Army	Marine Corps	Air Forces	DOD
Meat, Poultry, Fish	16.28	13.63	12.35	15.48	14.64
Eggs	3.50	3.15	3.48	3.15	3.29
Milk & Milk Products	27.71	31.55	38.83	35.07	31.50
Beverages	3.82	5.87	3.45	8.33	5.34
Vegetables	18.14	16.47	15.05	14.68	16.62
Legumes & Nuts	2.67	2.39	1.80	2.01	2.37
Grain & Cereal Products	10.11	11.48	10.38	10.68	10.81
Fruits	8.01	6.54	7.02	4.24	6.73
Fats, Oils, Dressings	2.50	2.45	2.30	2.02	2.39
Sugar & Sweets	4.48	3.95	3.52	1.98	3.79
Condiments	2.14	1.82	1.45	1.65	1.87
Miscellaneous	.64	.70	.38	.71	.65

Expenditures by major food group as a percentage of total cost per ration are presented in Table 17. The four major groups in terms of ration weight (as revealed in Table 15): (1) Meat, poultry, fish; (2) Milk and milk products; (3) Vegetables; (4) Grain and cereal products, account for over 75% of total expenditures in the military. The meat, poultry, fish category encompasses over 40% of total costs in every organization. Table 18 displays expenditures in dollars per ration for each service and DoD by major food group and Table 19 by minor food groups. As indicated here, the Marine Corps spends roughly 25% less for meat, poultry, fish items than the Navy, which spends the most on such items.

Figure 2 illustrates the equivalent cost per average DoD ration by quarter for a three year period beginning with first quarter 1972, and continuing through fourth quarter 1974. Prices per pound for every item were extracted from the Federal Supply Catalog price lists for each quarter included in the indicated time span. Each item price was then multiplied by the item's annual DoD utilization per ration value as determined by this survey to arrive at the equivalent cost for these same item quantities in each quarter. An item by item summation by quarter resulted in the values for the cost of the average DoD ration presented in Figure 2. Overall, this normalized cost per average DoD ration depicts a steady increase except for the decline from 4th quarter 1973 to 2nd quarter 1974. This decline in total cost per ration can be attributed to the general reduction in meat prices over this period.

Having determined usage quantity per ration by item, a listing was prepared ranking the items in descending order of usage. As shown in Table 20, no more than 20 items comprise the initial 50% of usage or expenditure for any service, and less than 60 items constitute the initial 75%. Table 21 specifically lists those items comprising the initial 50% of usage. As indicated, fresh milk is the premier usage item in the military; chocolate milk also appears among the top four items in all services. This is not unexpected since milk purchases are supported by a special authorization permitting the incorporation into the food cost index of a milk allotment in excess of that specified by the Navy Ration Law. Only three other items appear among the upper 50% of usage throughout DoD: (1) Eggs, (2) White potatoes; and, (3) White bread. Meat, poultry, fish items occurring most frequently are, not unexpectedly, ground beef and chicken.

As was the case for the entire range of over 500 items utilized, the subgroup of approximately 60 items comprising the initial 75% of usage is dominated, as indicated in Table 22, by items in four food groups: (1) Meat, poultry, fish; (2) Milk and milk products; (3) Vegetables; (4) Grain and cereal products. According to Table 23, in all cases approximately 50% of the entire cost represented by the items in the initial 75% of expenditure is included in the meat, poultry, fish category. Moreover, milk and milk products are responsible for about 20% of the total expenditure on this basis. Therefore, roughly 70% of the total cost of items comprising the initial 75% of overall expenditures consists of meat, poultry, fish, and milk and milk products.

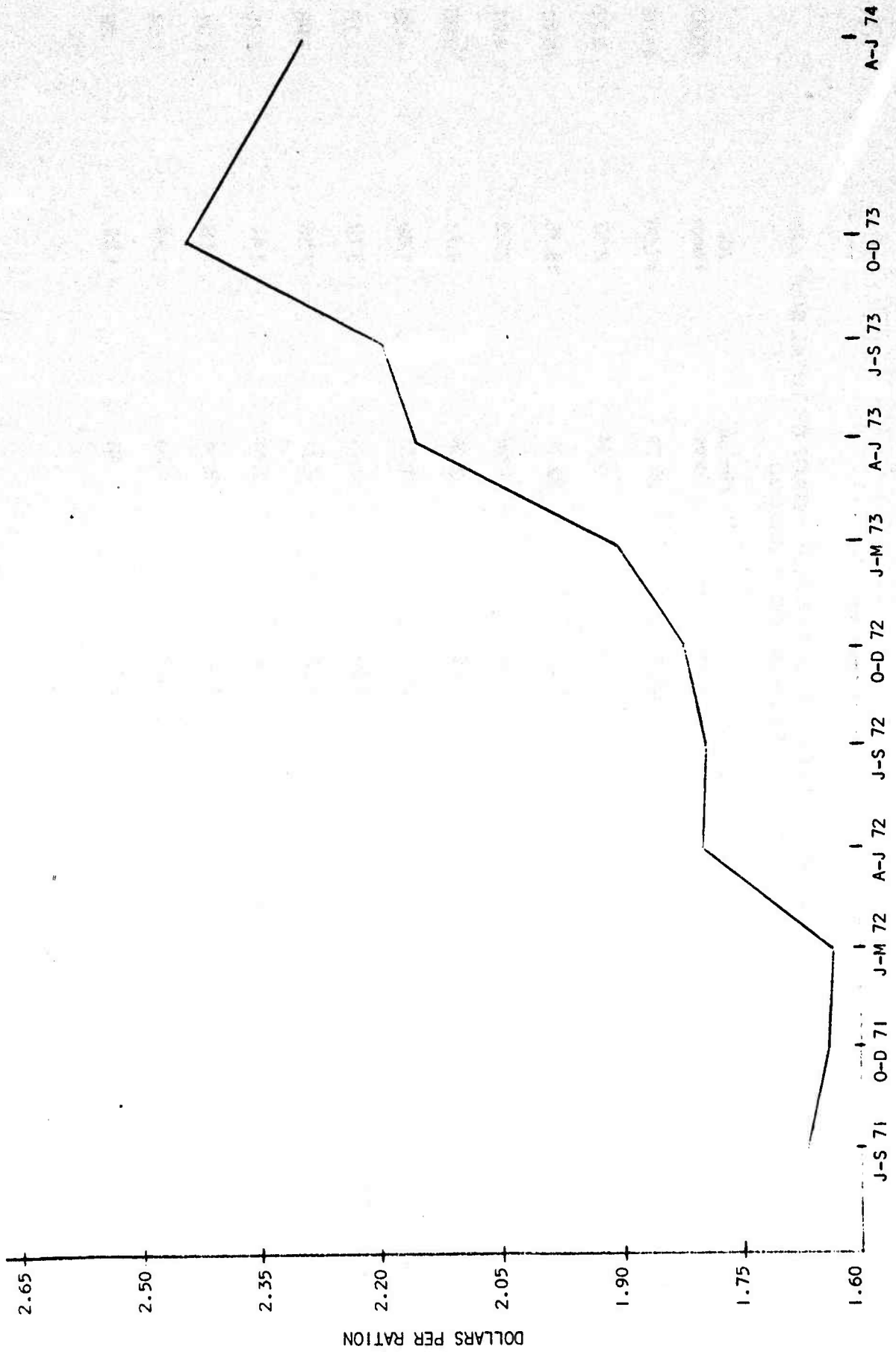


FIGURE 2 - Equivalent Cost Per Average Ration by Quarter Based on DoD Utilization

TABLE 17

EXPENDITURES BY MAJOR FOOD GROUP AS A PERCENTAGE OF TOTAL \$/RATION
FOR THE FOUR SERVICES AND DOD

	Navy	Army	Marine Corps	Air Force	DOD
Meat, Poultry, Fish	48.19	40.88	39.73	45.06	44.06
Eggs	3.66	3.71	4.34	3.67	3.75
Milk & Milk Products	14.29	17.20	22.16	18.75	16.81
Beverages	3.92	4.59	2.58	3.32	4.01
Vegetables	9.90	9.45	9.35	9.73	9.65
Legumes & Nuts	1.87	2.01	1.71	1.69	1.89
Grain & Cereal Products	6.00	9.00	8.44	8.13	7.76
Fruits	4.24	4.26	4.07	2.36	3.98
Fats, Oils, Dressings	2.36	3.19	2.74	2.44	2.75
Sugar & Sweets	3.13	3.10	3.14	1.58	2.91
Condiments	1.68	1.56	1.26	1.33	1.54
Miscellaneous	.8	1.04	.48	1.02	.89

TABLE 18
EXPENDITURES PER RATION BY MAJOR FOOD GROUP FOR THE FOUR SERVICES AND DoD
 (All Units in \$)

	Navy	Army	Marine Corps	Air Force	DoD
Meat, Poultry, Fish	1.138	.947	.862	.944	1.006
Eggs	.087	.086	.094	.077	.086
Milk & Milk Products	.337	.398	.481	.393	.384
Beverages	.093	.106	.056	.070	.220
Vegetables	.234	.219	.203	.204	.220
Legumes & Nuts	.044	.047	.037	.036	.043
Grain & Cereal Products	.142	.208	.183	.170	.177
Fruits	.100	.099	.088	.049	.091
Fats, Oils, & Dressings	.056	.074	.059	.051	.063
Sugar & Sweets	.074	.072	.068	.033	.066
Condiments	.040	.036	.027	.028	.035
Misc.	.018	.024	.011	.021	.020

TABLE 19

FOOD EXPENDITURES PER RATION BY MINOR FOOD GROUP FOR THE FOUR SERVICES AND DoD
(All Units in \$)

	Navy	Army	Marine Corps	Air Force	DoD
Beef	.543	.422	.373	.474	.468
Veal	.090	.044	.049	.013	.056
Pork	.238	.249	.222	.237	.241
Lamb	.004	.006	*	.002	.004
Poultry	.085	.108	.084	.111	.098
Fish	.037	.038	.028	.033	.036
Shellfish	.074	.028	.030	.028	.045
Sausages, Cold Cuts	.068	.051	.077	.046	.056
Eggs	.087	.086	.094	.077	.086
Milk & Milk Drinks	.209	.283	.328	.263	.258
Cream, Ice Cream	.032	.020	.063	.039	.031
Cheese	.043	.042	.045	.036	.042
Butter	.052	.053	.044	.054	.052
Tea, Coffee, Cocoa	.056	.058	.020	.017	.048
Juices	.034	.035	.028	.024	.032
Soft Drinks	.002	.014	.008	.029	.012
Potatoes, White	.083	.090	.078	.074	.084
Tomatoes	.039	.035	.029	.033	.036
Dark Green Vegetables	.014	.017	.014	.020	.016
Deep Yellow Vegetables	.025	.020	.024	.027	.023
Other Vegetables (Not Leafy)	.066	.039	.043	.036	.045
Other Leafy Vegetables	.016	.017	.014	.014	.016

*less than .001

TABLE 19
 FOOD EXPENDITURES PER RATION BY MINOR FOOD GROUP FOR THE FOUR SERVICES AND DoD (cont'd)
 (All Units in \$)

	Navy	Army	Marine Corps	Air Force	DoD
Legumes	.038	.042	.033	.035	.038
Nuts, Nut Butter	.006	.005	.004	.001	.005
Bread, Rolls, Biscuits	.063	.090	.100	.093	.082
Other Baked Goods	.017	.013	.009	.025	.016
Pasta	.013	.012	.012	.013	.012
Flour & Mixes	.034	.070	.036	.021	.047
Cereal & Cereal Pastes	.007	.017	.020	.011	.013
Rice & Barley	.008	.008	.005	.006	.008
Citrus Fruits	.017	.013	.016	.009	.014
Other Fruits	.083	.086	.072	.041	.077
Margarine	-	.014	.005	.009	.008
Salad Oil & Dressings	.024	.029	.022	.025	.026
Other Fats & Oils	.032	.030	.032	.018	.029
Sugar	.046	.039	.031	.016	.037
Syrup, Honey, Molasses	.007	.012	.009	.007	.009
Jelly & Jam	.005	.010	.008	.003	.007
Candy	.001	.001	.001	.001	.001
Pudding, Pie Filling, etc.	.015	.009	.019	.006	.012
Prepared Meat Soups & Gravy	.006	.006	.003	.003	.005
Prepared Vegetable Soups	.004	.005	.001	.002	.004

TABLE 19

FOOD EXPENDITURES PER RATION BY MINOR FOOD GROUP FOR THE FOUR SERVICES AND DoD (cont'd)
(All Units in \$)

	Navy	Army	Marine Corps	Air Force	DoD
Salts	.001	.001	.001	.002	.001
Spices	.008	.006	.003	.004	.006
Ketchup, Mustard, Relish	.013	.012	.010	.009	.012
Pickles & Olives	.009	.008	.008	.005	.008
Flavorings & Vinegars	.008	.006	.006	.007	.008
Colorings	*	*	*	*	*
Mexican, Prepared	.005	.011	.005	.014	.009
Leavenings, Tenderizers	.003	.001	.001	.001	.002
Pizza, Prepared	*	.001	-	.001	.001
Popsicle	*	-	-	-	*

*less than .001

TABLE 20

**NUMBER OF ITEMS MAKING UP THE TOP 50% AND
75% OF DOD UTILIZATION AND COST**

	Navy	Army	Marine Corps	Air Force	DOD
Top 50% of Usage	15	11	8	9	12
Top 75% of Usage	56	52	38	43	57
Top 50% of Expenditure	19	19	16	16	20
Top 75% of Expenditure	58	59	51	49	65

TABLE 21

ITEMS COMPRISING THE TOP 50% OF USAGE (IN LBS./RATION) FOR THE FOUR SERVICES AND DOD

	Navy	Army	Marine Corps	Air Force	DOD
1	Milk, White, Fresh	Milk, White, Fresh	Milk, White, Fresh	Milk, White, Fresh	Milk, White, Fresh
2	Potatoes, White, Fresh	Potatoes, White, Fresh	Milk, Chocolate, Fresh	Milk, Chocolate, Fresh	Potatoes, White, Fresh
3	Eggs, Shell	Milk, Chocolate, Fresh	Bread, White, Fresh	Beverage Base	Milk, Chocolate, Fresh
4	Milk, Chocolate, Fresh	Bread, White, Fresh	Potatoes, White, Fresh	Potatoes, White, Fresh	Bread, White, Fresh
5	Flour, Wheat	Eggs, Shell	Eggs, Shell	Bread, White, Fresh	Eggs, Shell
6	Sugar, Granulated	Flour, Wheat	Ice Cream	Eggs, Shell	Flour, Wheat, Bread
7	Bread, White, Fresh	Lettuce	Beef, Oven Roast	Beef, Ground, Frozen	Beef, Ground, Frozen
8	Beef, Ground, Frozen	Chicken, Cut-up	Flour, Wheat	Chicken, Cut-up	Sugar, Granulated
9	Lettuce	Potatoes, White, Frozen		Potatoes, White, Frozen	Lettuce
10	Shortening Compound	Sugar, Granulated			
11	Ice Cream	Beef, Ground, Frozen			Chicken, Cut-up, Frozen
12	Chicken, Cut-up				Potatoes, White, Frozen
13	Butter				Ice Cream
14	Tomatoes, Fresh				
15	Apples, Fresh				

TABLE 22

PERCENTAGE DISTRIBUTION BY MAJOR FOOD GROUP OF THE TOTAL LBS./RATION OF ITEMS
COMPRISING THE INITIAL 75% OF USAGE FOR THE FOUR SERVICES AND DOD

	Navy	Army	Marine Corps	Air Force	DOD
Meat, Poultry, Fish	15.41	11.35	9.40	14.29	14.70
Eggs	4.19	4.08	4.42	4.18	4.17
Milk & Milk Products	34.99	40.05	50.01	45.29	40.28
Beverages	2.62	6.60	1.76	8.80	5.33
Vegetables	18.30	16.64	14.70	13.03	16.29
Legumes & Nuts	.78		.64	.54	.59
Grain & Cere'al Products	9.49	10.97	9.70	9.29	8.46
Fruits	6.00	3.39	4.38	1.38	3.76
Fats, Oils, & Dressings	2.75	2.34	1.65	.97	1.88
Sugar & Sweets	4.39	3.70	2.58	1.68	3.56
Condiments					
Miscellaneous					

TABLE 23

PERCENTAGE DISTRIBUTION BY MAJOR FOOD GROUP OF THE TOTAL \$/RATION OF ITEMS
COMPRISING THE INITIAL 75% OF COST FOR THE FOUR SERVICES AND DOD

	Navy	Army	Marine Corps	Air Force	DOD
Meat, Poultry, Fish	57.76	47.08	46.31	54.32	51.03
Eggs	4.12	4.69	5.32	4.88	4.57
Milk & Milk Products	17.28	21.40	28.14	23.54	21.39
Beverages	2.88	3.72	1.13	2.59	2.96
Vegetables	7.40	7.38	6.57	6.94	6.78
Legumes & Nuts	.50	.47	.52		.43
Grain & Cereal Products	4.34	8.85	6.20	5.32	5.46
Fruits	.62		1.46		.88
Fats, Oils, & Dressings	2.46	2.86	2.41	1.62	3.19
Sugar & Sweets	2.11	2.22	1.93	.77	2.14
Condiments	.53	.51			.51
Miscellaneous					

As indicated in Table 24, white milk is also the principal expenditure item in the military. Furthermore, meat, poultry, and fish items comprise the majority of the top ten expense articles. Ground beef appears in the top three and grill steak in the top five for three of the services. In addition, butter and eggs are among the major expense items in every branch of the military.

Given the general association of higher quality feeding with the amounts of animal protein in the diet, one quantitative measure of quality relates to the utilization of such items both in terms of quantity and expenditure. Tables 25 and 26 present, respectively, the utilization of, and expenditures for animal protein foods by minor food group as a percentage of total utilization or expenditure. Generally speaking, such food items account for about 50% of the total usage and about 65% of total expenditures. Milk drinks and beef are the two most utilized sources of animal protein. These two groups of items also account for the highest percentage of total cost for all services with the exception of the Navy, which has a lower utilization of milk than the other services. Tables 25 and 26 further indicate that of the four services, the Marine Corps and the Air Force devote the highest percentage of total utilization and expenditure to animal protein foods. Inspection of Tables 27 and 28, which provide the absolute values of usage and expenditure per ration, indicates that these high percentages can be partially attributed to higher utilization of milk and eggs in the Marine Corps and beef and poultry in the Air Force. It should be noted that the lower utilization of milk in the Navy is offset by the higher usage of veal and shellfish. Further, while the Navy only has the second highest utilization of beef in lbs/ration, it is highest in expenditures for this group of items, indicating a higher usage of the expensive roasts and steaks.

Any judgement regarding quality of feeding is likely to be subjective since it presupposes a knowledge of preference patterns. However, certain meaningful quality indicative factors can be selected which are considered to be generally acceptable quality "yardsticks", e.g., steak better than ground beef, butter better than margarine, fresh vegetables better than canned. Tables 29 and 30 list the utilization quantities and expenditures respectively of a number of such quality yardsticks. While the absolute quantities are necessary to the quality assessment, it is the ratio of the more desirable food to the less desirable that is considered most indicative. Tables 31 and 32 present food quality indicative ratios based on quantity used and expenditure respectively. It may be noted from these tables that in the key meat, poultry, fish category the Marine Corps and the Navy present a higher quality picture than the Army or the Air Force. This judgement must be tempered in the case of the Marine Corps by the fact that Tables 29 and 30 indicate that the Marine Corps utilize lower absolute quantities of these items. It would seem, therefore, that the Navy represents a higher level of feeding in this particular food group both from the point of view of quantity as well as relative amount, while the Marine Corps makes up for the lower absolute amounts of meat, poultry, and fish by using proportionately higher quantities of the more desirable items. On the other hand, with respect to the use of canned as opposed to the more desirable fresh and frozen product items, storage limitations on-board ship in the Navy lead to a less attractive picture when compared to the other three services. Finally, although the Navy does not use an excessive amount of butter compared to the other services, the fact that it is used to the almost complete exclusion of margarine leads to the extraordinarily large ration of butter to margarine.

TABLE 24

ITEMS COMPRISING THE INITIAL 50% OF EXPENDITURES FOR THE FOUR SERVICES AND DOD

	Navy	Army	Marine Corps	Air Force	DOD
1	Milk, White, Fresh	Milk, White, Fresh	Milk, White, Fresh	Milk, White, Fresh	Milk, White, Fresh
2	Beef, Grill Steak	Beef, Grill Steak	Beef, Oven Roast	Beef, Ground, Frozen	Beef, Grill Steak
3	Beef, Ground	Beef, Ground	Eggs, Shell	Beef, Patties, Frozen	Beef, Ground
4	Veal, Sliced	Eggs, Shell	Bread, White, Fresh	Eggs, Shell	Eggs, Shell
5	Beef, Oven Roast	Bread, White, Fresh	Beef, Ground	Beef, Grill Steak	Beef, Oven Roast
6	Eggs, Shell	Bacon, Sliced, Frozen	Ice Cream	Beef, Pot Roast	Bread, White, Fresh
7	Beef, Swiss Steak	Chicken, Cut-up	Ham, Canned	Chicken, Cut-up	Chicken, Cut-up, Frozen
8	Beef, Pot Roast	Beef, Patties	Beef, Grill Steak	Butter	Butter
9	Butter	Coffee, Roasted	Butter	Bread, White Fresh	Beef, Pot Roast
10	Coffee, Roasted	Butter	Bacon, Sliced, Frozen	Bacon, Sliced, Frozen	Bacon, Sliced, Frozen
11	Ham, Canned	Potatoes, White, Fresh	Chicken, Cut-up	Ham, Canned	Ham, Canned
12	Beef, Diced	Ham, Canned	Pork, Sliced	Milk, Chocolate, Fresh	Coffee, Roasted
13	Chicken, Cut-up	Beef, Oven Roasted	Potatoes, White, Fresh	Ice Cream	Veal, Sliced
14	Potatoes, White, Frozen	Beef, Pot Roast	Turkey, Raw, Frozen	Pork, Spareribs	Potatoes, White, Fresh
15	Sugar, Granulated	Beef, Swiss Steak	Milk, Chocolate, Fresh	Turkey, Raw, Frozen	Beef, Swiss Steak
16	Bread, White, Fresh	Milk, Chocolate, Fresh	Shortening Compound	Beef, Oven Roast	Beef, Patties, Frozen
17	Pork, Roast	Pork, Slices			Beef, Diced, Frozen
18	Ham, Cooked, Smoked	Ham, Cooked, Smoked			Milk, Chocolate, Fresh
19	Shortening Compound	Sugar Granulated			Ice Cream

TABLE 25

ANIMAL PROTEIN FOOD UTILIZATION AS A PERCENTAGE OF TOTAL FOOD UTILIZATION
FOR THE FOOD SERVICES AND DOD

	Navy	Army	Marine Corps	Air Force	DOD
Beef	7.09	5.33	4.80	6.92	6.08
Veal	.73	.41	.46	.13	.48
Pork	3.70	3.73	3.27	4.01	3.72
Lamb	.03	.05	.004	.02	.03
Poultry	2.04	2.35	1.65	2.53	2.21
Fish	.57	.52	.35	.51	.52
Shellfish	.70	.29	.28	.31	.42
Sausages, Cold Cuts	1.42	.96	1.54	1.07	1.18
Eggs	3.50	3.15	3.48	3.15	3.29
Milk & Milk Drinks	24.34	28.97	34.31	31.48	28.33
Cream, Ice Cream	1.43	.87	2.58	1.67	1.33
Cheese	.84	.75	1.10	.85	.83
Butter	1.10	.97	.82	1.08	1.01
Total	47.49	48.35	54.64	53.73	49.43

TABLE 26

ANIMAL PROTEIN FOOD EXPENDITURES AS A PERCENTAGE OF TOTAL FOOD EXPENDITURES
FOR THE FOUR SERVICES AND DOD

	Navy	Army	Marine Corps	Air Force	DOD
Beef	23.01	18.22	17.17	22.65	20.50
Veal	3.80	1.89	2.24	.60	2.44
Pork	10.07	10.75	10.22	11.32	10.55
Lamb	.16	.26	.02	.09	.18
Poultry	3.59	4.65	3.88	5.28	4.28
Fish	1.56	1.66	1.26	1.59	1.58
Shell Fish	3.14	1.23	1.37	1.35	1.95
Sausages, Cold Cuts	2.88	2.21	3.56	2.18	2.57
Eggs	3.66	3.71	4.34	3.67	3.75
Milk & Milk Drinks	8.87	12.22	15.13	12.55	11.32
Cream, Ice Cream	1.38	.88	2.92	1.87	1.37
Cheese	1.83	1.82	2.08	1.74	1.84
Butter	2.22	2.28	2.03	2.58	2.28
Total	66.17	61.78	66.22	67.47	64.62

TABLE 27

ANIMAL PROTEIN FOOD UTILIZATION FOR THE FOUR SERVICES AND DoD
(All Units in lbs./Ration)

	Navy	Army	Marine Corps	Air Force	DoD
Beef	.440	.379	.335	.451	.407
Veal	.046	.029	.032	.008	.032
Pork	.229	.265	.228	.261	.249
Lamb	.002	.003	*	.001	.002
Poultry	.127	.167	.115	.165	.148
Fish	.035	.037	.025	.033	.035
Shellfish	.043	.021	.020	.022	.028
Sausages, Cold Cuts	.088	.068	.108	.070	.079
Eggs	.217	.224	.243	.205	.220
Milk & Milk Drinks	1.510	2.058	2.395	2.052	1.896
Cream, Ice Cream	.088	.062	.180	.109	.089
Cheese	.052	.053	.077	.056	.055
Butter	.068	.069	.057	.070	.068
Total	2.946	3.434	3.814	3.501	3.307

*less than .001

TABLE 28

ANIMAL PROTEIN FOOD EXPENDITURES FOR THE FOUR SERVICES AND DoD
(All Units in \$/Ration)

	Navy	Army	Marine Corps	Air Force	DoD
Beef	.543	.413	.373	.474	.468
Veal	.090	.044	.049	.013	.056
Pork	.238	.249	.222	.237	.241
Lamb	.004	.006	*	.002	.004
Poultry	.085	.108	.084	.111	.098
Fish	.037	.038	.027	.033	.036
Shellfish	.074	.028	.030	.028	.045
Sausages, Cold Cuts	.068	.020	.077	.046	.059
Eggs	.087	.086	.094	.077	.086
Milk & Milk Drinks	.209	.283	.328	.263	.258
Cream, Ice Cream	.032	.020	.063	.039	.031
Cheese	.043	.042	.045	.036	.042
Butter	.052	.053	.044	.054	.052
Total	1.562	1.431	1.437	1.414	1.475

*less than .001

TABLE 29

A COMPARISON OF SELECTED FOOD QUALITY INDICATORS FOR THE FOUR SERVICES AND DoD
(All Units in lbs./Ration)

	Navy	Army	Marine Corps	Air Force	DoD
Ground & Diced Meats	.246	.332	.219	.345	.294
Cuts of Meat	.425	.344	.376	.374	.396
Shellfish	.043	.021	.020	.020	.028
Fish	.035	.037	.025	.033	.035
Meat	.671	.676	.595	.719	.690
Poultry	.127	.167	.115	.165	.148
Frozen Orange Juice	.009	.028	.018	.030	.021
Canned Orange Juice	.020	.032	.011	*	.021
Frozen Juice	.017	.046	.038	.039	.034
Canned Juice	.138	.123	.070	.069	.115
Fresh Vegetables & Legumes	.766	.724	.651	.554	.706
Frozen Vegetables & Legumes	.141	.235	.272	.295	.235
Total Vegetables & Legumes	1.291	1.340	1.175	1.089	1.271
Fresh & Frozen Potatoes	.361	.490	.393	.337	.413
Instant Potatoes*	.215	.247	.206	.185	.223
Fresh & Frozen Fruit	.350	.254	.385	.178	.288
Total Fruit	.498	.464	.490	.276	.450

*Reconstituted at 6.5:1

TABLE 29

A COMPARISON OF SELECTED FOOD QUALITY INDICATORS FOR THE FOUR SERVICES AND DoD (cont'd)
 (All Units in lbs./Ration)

	Navy	Army	Marine Corps	Air Force	DoD
Rolls	.086	.081	.073	.088	.065
Bread	.160	.288	.330	.274	.245
Ice Cream	.083	.048	.164	.103	.079
Total Dairy Products	1.719	2.242	2.709	2.287	2.108
Butter	.068	.069	.057	.070	.068
Margarine	*	.029	.009	.018	.015

*less than .001

TABLE 30

A COMPARISON OF SELECTED FOOD QUALITY INDICATORS FOR THE FOUR SERVICES AND DoD
(All Units in \$/Ration)

	Navy	Army	Marine Corps	Air Force	DoD
Ground & Diced Meats	.233	.283	.188	.292	.259
Cuts of Meat	.645	.438	.455	.434	.510
Shell Fish	.074	.028	.030	.028	.045
Fish	.037	.038	.027	.033	.036
Meat	.878	.721	.644	.726	.768
Poultry	.085	.108	.084	.111	.088
Frozen Orange Juice	.003	.010	.006	.010	.007
Canned Orange Juice	.003	.004	.001	.006	.003
Frozen-Juice	.007	.018	.016	.015	.013
Canned Juice	.024	.016	.012	.009	.017
Fresh Vegetables & Legumes	.121	.102	.095	.087	.108
Frozen Vegetables & Legumes	.040	.080	.074	.082	.086
Total Vegetables & Legumes	.278	.265	.240	.239	.264
Fresh & Frozen Potatoes	.050	.073	.059	.053	.061
Instant Potatoes	.010	.013	.010	.009	.011
Fresh & Frozen Fruit	.065	.054	.067	.029	.055
Total Fruit	.100	.099	.088	.049	.091

TABLE 30

A COMPARISON OF SELECTED FOOD QUALITY INDICATORS FOR THE FOUR SERVICES AND DoD (cont'd)
 (All Units in \$/Ration)

	Navy	Army	Marine Corps	Air Force	DoD
Rolls	.040	.017	.018	.023	.020
Bread	.023	.073	.083	.070	.062
Ice Cream	.030	.017	.058	.037	.028
Total Dairy Products	.337	.388	.481	.493	.384
Butter	.052	.053	.044	.054	.052
Margarine	*	.014	.005	.009	.008

*less than .001

TABLE 31

SELECTED FOOD QUALITY RATIOS FOR THE FOUR SERVICES AND DOD
(Based on Lbs./Ration)

	Navy	Army	Marine Corps	Air Force	DCD
Cuts of Meat	1.73:1	1.04:1	1.72:1	1.09:1	1.35:1
to Ground & Diced Meats					
Shellfish	1.23:1	.56:1	.79:1	.61:1	.82:1
to Fish					
Meat	5.29:1	4.06:1	5.17:1	4.36:1	4.67:1
to Poultry					
Frozen Orange Juice	.46:1	.86:1	1.62:1	73.46:1	.97:1
to Canned Orange Juice					
Frozen Juice	.13:1	.37:1	.54:1	.57:1	.29:1
to Canned Juice					
Fresh & Frozen Vegetables & Legumes	.70:1	.75:1	.78:1	.78:1	.74:1
to Total Vegetables & Legumes					
Fresh & Frozen Potatoes	1.68:1	1.98:1	1.91:1	1.83:1	1.86:1
to Instant Potatoes*					
Fresh & Frozen Fruit	.70:1	.55:1	.79:1	.64:1	.64:1
to Total Fruit					
Rolls	.54:1	.28:1	.22:1	.32:1	.27:1
to Bread					
Ice Cream	.05:1	.02:1	.06:1	.05:1	.04:1
to Total Dairy Products					
Butter	3777:1	2.40:1	5.84:1	3.99:1	4.43:1
to Margarine					

*Reconstituted at 6.5:1

TABLE 32

SELECTED FOOD QUALITY RATIOS FOR THE FOUR SERVICES AND DOD
(Based on \$/Ration)

	Navy	Army	Marine Corps	Air Force	DOD
Cuts of Meat	2.76:1	1.54:1	2.42:1	1.48:1	1.97:1
Shellfish	2.02:1	.74:1	1.09:1	.85:1	1.23:1
Meat	10.35:1	6.69:1	7.64:1	6.57:1	7.84:1
Frozen Orange Juice	1.24:1	2.33:1	4.38:1	2.01:1	2.62:1
Frozen Juice	.30:1	1.11:1	1.30:1	1.62:1	.78:1
Fresh & Frozen Vegetables & Legumes	.57:1	.68:1	.70:1	.70:1	.65:1
Fresh & Frozen Potatoes	4.59:1	5.79:1	5.60:1	5.60:1	5.35:1
Fresh & Frozen Fruit	.65:1	.55:1	.76:1	.60:1	.61:1
Rolls	.57:1	.23:1	.21:1	.33:1	.33:1
Ice Cream	.09:1	.04:1	.12:1	.09:1	.07:1
Butter	58.17:1	3.69:1	8.99:1	6.15:1	6.82:1

The majority of the discussion thus far has been directed towards food utilization and expenditures. An inspection of the nutritional aspects of military feeding is also important. Table 33 presents nutritional data per ration with respect to calories, protein, fat, two minerals (calcium and iron) and five vitamins (A, B₁, B₂, Niacin, and C) for each of the four services and DoD. Except for food energy, calcium, and ascorbic acid, the four services are nutritionally comparable. The range in calcium content (roughly 500 mg higher in the Marine Corps than the Navy) can probably be attributed to the lower usage of milk in the Navy. The lesser utilization of fruit in the Air Force apparently explains its smaller ascorbic acid value.

A listing of the recommended daily allowances of certain nutrients established by the military for both men and women is presented in Table 34. It will be noted that the DoD nutritional values (Table 33) are higher relative to the Daily Dietary Allowances. Since the data collected in this study represents food utilization (i.e., food purchased per ration) and not food consumption (actual ingestion) it would be hazardous to draw any inferences from the indicated differences. This point cannot be overemphasized. The sense of the word "nutrition" in this case refers to the nutrients associated with a ration. A "ration" is defined as the food provided to a man by 3 meals for one day. In calculating the food utilized per ration and its nutrient content, the total quantity of food utilized is divided by the consequent numbers of rations served. The ration figures, as explained earlier, are derived by summing the weighted headcounts for each meal (weighting factors for the period covered - 20% for breakfast, 45% for dinner, and 35% for supper). By using this procedure one, therefore, does not calculate the food utilized by a specific individual but rather by a fictitious "composite" individual. Since attendance rates for military personnel in military dining halls in many situations is less than 50%, (that is, most servicemen who receive subsistence in kind only consume about two meals per day in the dining halls and, in fact, generally consume less than three meals per day in all.)⁽²⁾ The figures given in Table 33 cannot be used to draw inferences about military individual intakes. The data presented in this table are more related to what is made available in a 3 meal ration should personnel choose to go to the dining hall to consume 3 meals. The Daily Dietary Allowances and the ration entitlement specified by the NRL on the other hand refer to the individual rather than to an average or a fictitious "composite" individual.

The significance of the Table 33 figures can be found in two areas:

1. They permit a comparison between different organizations and, hence, a ranking. This has been carried out not only in the DoD but also (in other URCS report) between DoD averages and civilian feeding.

(2)

Branch, L.G., et al. "A Consumer Evaluation of Air Force Food Service", U.S. Army Natick Laboratories, Technical Report 75-22-FSL.

TABLE 33

NUTRITIONAL ANALYSIS OF FOODS UTILIZED IN THE FOUR SERVICES AND DOD

	Navy	Army	Marine Corps	Air Force	DOD
Food Energy (Cal)	4569	5220	4814	4637	4869
Protein (g)	168.1	178.4	174.8	167.3	172.8
Fat (g)	215.9	228.0	218.9	210.9	220.4
Calcium (mg)	1626	1972	2111	1756	1831
Iron (mg)	27.2	29.3	26.8	25.0	27.7
Vitamin A IU	10,316	11,151	10,220	10,489	10,676
Thiamine (mg)	2.1	2.3	2.2	1.9	2.1
Riboflavin (mg)	3.3	3.7	3.8	3.4	3.5
Niacin (mg)	31.6	33.4	29.8	29.9	31.9
Ascorbic Acid (mg)	168.0	187.7	163.3	150.9	173.1

TABLE 34**DAILY DIETARY ALLOWANCES*
(For Military Personnel Moderately Active
in a Temperate Climate)**

	Men	Women
Food Energy (Cal)	3400	2400
Protein (g)	100	80
Fat (g)	*	*
Calcium (mg)	800	800
Iron (mg)	14	18
Vitamin A (IU)	5000	5000
Vitamin B1 (mg)	1.7	1.2
Vitamin B2 (mg)	2.0	1.7
Niacin (mg)	22	16
Ascorbic Acid (mg)	60	60

*Fat should not exceed 40% of total caloric intake. Carbohydrates will provide those calories not furnished by protein and fat.

Fat = 9 Cal/g

Maximum Fat = 152 g (Men)

Maximum Fat = 107 g (Women)

*Department of the Army, Navy and Air Force, "Medical Services -- Nutritional Standards", AR 40-25/BUMED INST 10110.3D/AFR 160-95, August 1972.

2. They should exceed the DDA's by a significant margin in order to insure that despite preparation, serving, and plate food wastage, as well as cooking losses, the quantities actually made available to the customer provide the minimum daily requirements in a three meal per day situation, clearly this latter objective is being met.

C. Air Force Food Utilization

While this has not been intended as a major part of the analysis, an examination of three relevant subgroups of Air Force personnel may be helpful in providing an indication of the level of feeding for each of these subgroups throughout the DoD. The three groups are permanent party (permanent duty base personnel), personnel in basic training, and Womens Air Force (WAF) members. It must be pointed out, however, that the basic trainee and WAF data are based on the experience of a single dining hall in each case. Such a small sample is naturally much more subject to unique individual peculiarities than would be the case for a larger sample. It is, nevertheless, hoped that some indication of differences in the patterns of feeding between these groups will be of value.

Table 35 provides a summary of food usage by major food groups. The general pattern seems to be that food utilization is higher for the permanent party group than for the other two groups. In the meat, poultry, fish category usage levels for the WAF and permanent party are approximately equal, and slightly exceed the basic trainee usage level. Milk and milk product utilization is highest for permanent party and lowest for the WAF's. The permanent party lead in vegetables utilization as well, but now basic trainees occupy the lowest position. Basic trainees take the leadership in utilization of grain and cereal products, while the WAF's completely dominate in fruit utilization. WAF's similarly make use of the most fats, oils, and salad dressings; sugar and sweets; and condiments. This is a somewhat unusual finding in view of the generally assumed female preoccupation with weight; however, it may be partly explained by the compensating effect of lower utilization of high calorie grain and cereal products by the WAF's.

Table 36 presents the utilization data in Table 35 as a percentage of total food utilization. In all cases, milk and milk products and meat, poultry, fish are the two highest utilization food categories, encompassing about 50% of the total food utilization for the permanent party and basic trainees and more than 45% of the WAF food utilization. The food category with the third highest utilization for the WAF's and permanent party is vegetables, but grain and cereal products occupy this position in basic trainee food service. The very high fruit utilization in the WAF's places it in the fourth highest position, while it is the sixth highest category in terms of utilization for the permanent party and basic trainee.

TABLE 35**UTILIZATION PER RATION BY MAJOR
FOOD GROUP
(All Units in Lbs.)**

	USAF Permanent Party	USAF Basic Trainees	WAF
Meat, Poultry, Fish	1.017	.947	1.012
Eggs	.206	.212	.154
Milk & Milk Products	2.365	1.827	1.647
Beverages	.579	.306	.329
Vegetables	.989	.728	.857
Legumes & Nuts	.129	.143	.148
Grain & Cereal Products	.680	.860	.587
Fruits	.273	.214	.609
Fats, Oils & Dressings	.140	.061	.146
Sugar & Sweets	.130	.121	.133
Condiments	.109	.091	.122
Miscellaneous	.050	.019	.028

TABLE 36**UTILIZATION BY MAJOR FOOD GROUPS AS A PERCENTAGE
OF TOTAL LBS./RATION (USAF)**

	Permanent Party	Basic Trainees	WAF
Meat, Poultry, Fish	15.25	17.12	17.55
Eggs	3.09	3.84	2.66
Milk & Milk Products	35.46	33.04	28.54
Beverages	8.69	5.53	5.69
Vegetables	14.84	13.16	14.85
Legumes & Nuts	1.94	2.59	2.56
Grain & Cereal Products	10.20	15.55	10.17
Fruits	4.10	3.87	10.55
Fats, Oils, Dressings	2.10	1.11	2.53
Sugar & Sweets	1.95	2.18	2.30
Condiments	1.64	1.64	2.12
Miscellaneous	.75	.35	.49

Tables 37 and 38 present comparable expenditure per ration data in \$/ration and as a percentage of total ration cost respectively. Generally, the observations made with respect to the utilization data hold true for expenditures. One exception is the WAF expenditure for fruit which is now ranked after grain and cereal products due to the relatively lower cost per pound for fruit.

Table 39 indicates the number of items comprising the initial 50% and 75% of utilization and expenditure. The number of items comprising the top 50% or 75% of usage is one indication of menu variety. The table implies, therefore, that the WAF's dining hall offers the greatest variety and the permanent party's the least. Menu variety, however, is such a strong function of the individual in charge that, due to small sizes of the sample, this data may reflect the tendencies of the individual service supervisors rather than any general tendency. Table 40 presents the specific items making up the initial 50% of usage and Table 41 those making up the initial 50% of expenditure. It may be noted that while the top 50% of usage for the permanent party contains no meat items, the majority of the top 50% of expenditure items for this group are meat items. Table 40 also indicates that in the case of the WAF's the top 50% of usage includes two fresh fruits, as might be expected from the high utilization of fresh fruit by the WAF's, and both ice cream and skim milk. The latter observation indicates a certain ambivalence in the WAF's toward weight control. Table 42 gives the percentage distribution of the expenditures per ration of items in the top 75% of expenditure. As expected, meat, poultry, fish and dairy products account for over 78% of the top 75% of costs.

One indication of the quality of the diets of these three groups is the amount of animal protein incorporated in them. Tables 43 and 44 present animal protein food item utilization and expenditures, respectively. Both tables reveal the same pattern. With few exceptions, the permanent party represents the highest level and the basic trainee the lowest level of utilization and expenditure. The discrepancy is largest in the milk and milk drinks category where the permanent party exceeds the other two groups by a significant margin. Basic trainee utilization and expenditure exceed the other two groups only in the pork and egg food subcategories. It is interesting to note that the WAF's dominate the other two groups in the use of fish, shellfish, and ice cream while using significantly less eggs.

A more complete picture of the general quality level of the diets of each of the three groups can be ascertained from an inspection of the relative usage of and expenditures for items which represent a higher level of feeding to those which represent a lower level. For example, as mentioned earlier, it is generally agreed that steaks, roasts and other "cuts" of meat provide a higher level of feeding than hamburgers, beef stew and other items composed of ground and diced meats. Tables 45 and 46 provide the absolute amounts utilized of these quality indicative items and the associated ratios. Tables 47 and 48 provide the absolute expenditures and the ratios. The three personnel groups present reasonably balanced pictures with respect to the quality ratios. In terms of usage, each group dominates in four cases and in terms of expenditures permanent party dominates in four cases, WAF's in five cases and basic trainee in three cases. This picture is somewhat altered by inspecting the absolute quantities

TABLE 37**EXPENDITURES PER RATION BY MAJOR FOOD GROUP
(All Units in \$)**

	USAF Permanent Party	USAF Basic Trainee	WAF
Meat, Poultry, Fish	.950	.893	.952
Eggs	.077	.080	.058
Milk & Milk Products	.407	.293	.322
Beverages	.073	.050	.050
Vegetables	.209	.163	.183
Legumes & Nuts	.035	.040	.039
Grain & Cereal Products	.167	.203	.140
Fruits	.049	.039	.099
Fats, Oils & Dressings	.055	.023	.053
Sugar & Sweets	.033	.030	.034
Condiments	.028	.026	.030
Miscellaneous	.022	.012	.020
Total	2.106	1.851	1.980

TABLE 38**EXPENDITURES BY MAJOR FOOD GROUP AS A PERCENTAGE
OF TOTAL \$/RATION (USAF)**

	Permanent Party	Basic Trainee	WAF
Meat, Poultry, Fish	44.82	46.70	46.98
Eggs	3.64	4.18	2.87
Milk & Milk Products	19.22	15.30	15.88
Beverages	3.43	2.62	2.48
Vegetables	9.88	8.53	9.01
Legumes & Nuts	1.64	2.10	1.94
Grain & Cereal Products	7.89	10.64	6.93
Fruits	2.32	2.03	4.89
Fats, Oils, Dressings	2.58	1.19	2.60
Sugar & Sweets	1.58	1.54	1.66
Condiments	1.32	1.35	1.49
Miscellaneous	1.06	.61	.97

TABLE 39**NUMBER OF ITEMS COMPRISING THE INITIAL 50% AND
75% OF AIR FORCE UTILIZATION AND COST**

	Permanent Party	Basic Trainees	WAF
Top 50% of Usage	6	10	17
Top 75% of Usage	26	38	49
Top 50% of Expenditures	16	14	18
Top 75% of Expenditures	47	37	49

TABLE 40**ITEMS COMPRISING THE INITIAL 50% OF USAGE
AIR FORCE**

Permanent Party	Basic Trainee	WAF
1 Milk, White, Fresh	Milk, White, Fresh	Milk, White, Fresh
2 Milk, Chocolate, Fresh	Milk, Chocolate, Fresh	Milk, Chocolate, Fresh
3 Beverage Base	Eggs, Shell	Ice Cream
4 Potatoes, White, Fresh	Pie, Apple, Fresh	Beef, Ground, Frozen
5 Bread, White, Fresh	Beef, Ground, Frozen	Milk, Skim
6 Eggs, Shell	Bread, White, Fresh	Grapefruit, Fresh
7	Potatoes, White, Fresh	Eggs, Shell
8	Potatoes, White, Fresh	Potatoes, White, Fresh
9	Bread, French, Fresh	Potatoes, White, Frozen
10	Beef, Pot Roast, Frozen	Bacon, Sliced, Frozen
11		Pie, Apple, Fresh
12		Chicken, Cut-up, Frozen
13		Bread, White, Fresh
14		Bread, French, Fresh
15		Apples, Fresh
16		Lettuce
17		Beverage Base

TABLE 41

**ITEMS COMPRISING THE INITIAL 50% OF EXPENDITURES
AIR FORCE**

Permanent Party	Basic Trainee	WAF
1 Milk, White, Fresh	Milk, White, Fresh	Beef, Ground, Frozen
2 Beef, Ground, Frozen	Beef, Ground, Frozen	Milk, White, Fresh
3 Beef, Patties, Frozen	Beef, Pot Roast, Boneless, Frozen	Ice Cream
4 Beef, Grill Steak, Boneless, Frozen	Eggs, Shell	Bacon, Sliced, Frozen
5 Eggs, Shell	Bacon, Sliced, Frozen	Beef, Pot Roast, Boneless, Frozen
6 Chicken, Cut-up, Frozen	Beef, Grill Steak, Boneless, Frozen	Beef, Grill Steak, Boneless, Frozen
7 Beef, Pot Roast, Boneless, Frozen	Pork Chops, Frozen	Eggs, Shell
8 Butter	Turkey, Cooked, Boneless, Frozen	Beef, Patties, Frozen
9 Bread, White, Fresh	Beef, Diced, Frozen	Ham, Cooked, Smoked, Frozen, Boneless
10 Ham, Canned	Chicken, Cut-up, Frozen	Chicken, Cut-up, Frozen
11 Bacon, Sliced, Frozen	Ham, Cooked, Boneless, Frozen	Butter
12 Milk, Chocolate, Fresh	Bread, White, Fresh	Turkey, Raw, Boneless, Frozen
13 Ice Cream	Pork, Roast, Boneless, Frozen	Pork Chops, Frozen
14 Turkey, Raw, Boneless, Frozen	Pork, Spareribs, Frozen	Pork, Spareribs, Frozen
15 Beef, Oven Roast, Boneless, Frozen		Beef, Diced, Frozen
16 Pork, Spareribs, Frozen		Milk, Chocolate, Fresh
17		Beef, Swiss Steak, Boneless, Frozen
18		Beef, Oven Roast, Boneless, Frozen

TABLE 42
PERCENTAGE DISTRIBUTION BY MAJOR FOOD GROUP OF THE
TOTAL \$/RATION OF ITEMS COMPRISING INITIAL
75% OF COST (USAF)

	Permanent Party	Basic Trainee	WAF
Meat, Poultry, Fish	53.70	60.78	58.98
Eggs	4.84	5.54	3.75
Milk & Milk Products	24.25	18.53	20.30
Beverages	2.73	.85	.80
Vegetables	7.16	4.07	4.18
Legumes & Nuts			
Grain & Cereal Products	4.80	10.22	5.74
Fruits			2.37
Fats, Oils, Dressings	1.75		2.51
Sugar & Sweets	.77		.78
Condiments			.58
Miscellaneous			

TABLE 43**ANIMAL PROTEIN FOOD UTILIZATION (USAF)
(All Units in Lbs./Ration)**

	Permanent Party	Basic Trainee	WAF
Beef	.455	.415	.447
Veal	.010	*	—
Pork	.257	.285	.284
Lamb	.001	.001	.001
Poultry	.168	.140	.149
Fish	.033	.031	.042
Shell Fish	.019	.023	.029
Sausages, Cold Cuts	.072	.051	.061
Eggs	.205	.212	.154
Milk & Milk Drinks	2.124	1.676	1.726
Cream, Ice Cream	.110	.072	.224
Cheese	.057	.039	.084
Butter	.074	.040	.063
Total	3.587	2.986	3.263

*Less than .001

TABLE 44**ANIMAL PROTEIN FOOD EXPENDITURES (USAF)
(All Units in \$/Ration)**

	Permanent Party	Basic Trainee	WAF
Beef	.482	.416	.456
Veal	.014	*	—
Pork	.233	.263	.261
Lamb	.002	.002	.002
Poultry	.111	.110	.105
Fish	.018	.032	.043
Shell Fish	.027	.037	.043
Sausages, Cold Cuts	.047	.034	.042
Eggs	.077	.080	.058
Milk & Milk Drinks	.272	.215	.158
Cream, Ice Cream	.039	.026	.081
Cheese	.038	.021	.035
Butter	.057	.031	.048
Total	1.435	1.266	1.332

*Less than .001

TABLE 45**SELECTED FOOD QUALITY INDICATORS (USAF)
(All Units in Lbs./Ration)**

	Permanent Party	Basic Trainees	WAF
Cuts of Meats	.379	.339	.350
Ground & Diced Meats	.345	.358	.383
Shellfish	.019	.023	.042
Fish	.033	.031	.029
Meat	.724	.698	.733
Poultry	.168	.140	.149
Frozen Orange Juice	.031	.019	.022
Canned Orange Juice	.005	—	—
Frozen Juice	.039	.013	.039
Canned Juice	.073	.005	.037
Fresh Vegetables & Legumes	.587	.306	.466
Frozen Vegetables & Legumes	.292	.319	.290
Total Vegetables & Legumes	1.118	.871	1.005
Fresh & Frozen Potatoes	.346	.282	.258
Instant Potatoes*	.179	.246	.111

*Reconstituted at 6.5:1

TABLE 45 (cont'd)**SELECTED FOOD QUALITY INDICATORS (USAF)
(All Units in Lbs./Ration)**

	Permant Party	Basic Trainee	WAF
Fresh & Frozen Fruit	.176	.120	.444
Total Fruit	.273	.214	.609
Rolls	.082	.141	.070
Bread	.277	.275	.186
Ice Cream	.104	.067	.216
Total Dairy Products	2.365	1.827	1.647
Butter	.074	.040	.063
Margarine	.020	-	-

TABLE 46

SELECTED FOOD QUALITY RATIOS (USAF)
(Based on Lbs./Ration)

	Permanent Party	Basic Trainees	WAF
Cuts of Meat to Ground & Diced Meats	1.10:1	.94:1	.91:1
Shellfish to Fish	.59:1	.74:1	.69:1
Meat to Poultry	4.30:1	4.97:1	4.93:1
Frozen Orange Juice to Canned Orange Juice	66.92:1	**	**
Frozen Juice to Canned Juice	.54:1	.82:1	1.05:1
Fresh Vegetables & Legumes to Total Vegetables & Legumes	.53:1	.35:1	.46:1
Frozen Vegetables & Legumes to Total Vegetables & Legumes	.26:1	.37:1	.29:1
Fresh & Frozen Potatoes to Instant Potatoes*	1.93:1	1.15:1	2.32:1
Fresh & Frozen Fruit to Total Fruit	.65:1	.56:1	.73:1
Rolls to Bread	.30:1	.51:1	.37:1
Ice Cream to Total Dairy Products	.04:1	.04:1	.13:1
Butter to Margarine	3.65:1	-	-

*Reconstituted at 6.5:1

**No canned orange juice utilized

TABLE 47**A COMPARISON OF SELECTED FOOD QUALITY INDICATORS (USAF)
(All Units in \$/Ration)**

	Permanent Party	Basic Trainee	WAF
Cuts of Meat	.441	.384	.410
Ground & Diced Meats	.291	.297	.310
Shellfish	.027	.037	.043
Fish	.033	.031	.043
Meat	.732	.681	.719
Poultry	.111	.110	.105
Frozen Orange Juice	.011	.007	.008
Canned Orange Juice	.006	—	—
Frozen Juice	.015	.013	.015
Canned Juice	.010	.005	.005
Fresh Vegetables & Legumes	.093	.046	.073
Frozen Vegetables & Legumes	.082	.087	.081
Total Vegetables & Legumes	.244	.203	.222
Fresh & Frozen Potatoes	.054	.049	.043
Instant Potatoes	.009	.013	.006

TABLE 47 (cont'd)**A COMPARISON OF SELECTED FOOD QUALITY INDICATORS (USAF)
(All Units in \$/Ration)**

	Permanent Party	Basic Trainee	WAF
Fresh & Frozen Fruit	.030	.020	.065
Total Fresh & Frozen Fruit	.049	.039	.099
Rolls	.021	.042	.019
Bread	.070	.071	.048
Ice Cream	.037	.024	.077
Total Dairy Products	.407	.293	.0322
Butter	.057	.031	.048
Margarine	.011	-	-

TABLE 48

SELECTED FOOD QUALITY RATIOS (USAF)
(Based on \$/Ration)

		Permanent Party	Basic Trainees	WAF
Cuts of Meat	to Ground & Diced Meat	1.52:1	1.30:1	1.32:1
Shellfish	to Fish	.80:1	1.18:1	1.01:1
Meat	to Poultry	6.60:1	6.21:1	6.88:1
Frozen Orange Juice	to Canned Orange Juice	1.82:1	—	—
Frozen Juice	to Canned Juice	1.54:1	2.45:1	3.11:1
Fresh Vegetables & Legumes	to Total Vegetables & Legumes	.38:1	.23:1	.33:1
Frozen Vegetables & Legumes	to Total Vegetables & Legumes	.33:1	.43:1	.36:1
Fresh & Frozen Potatoes	to Instant Potatoes	5.85:1	3.89:1	7.61:1
Fresh & Frozen Fruit	to Total Fruit	.60:1	.51:1	.65:1
Rolls	to Bread	.30:1	.60:1	.39:1
Ice Cream	to Total Dairy Products	.09:1	.08:1	.24:1
Butter	to Margarine	5.34:1	—	—

in Tables 45 and 47 which indicate that, as has been noted before, the permanent party generally uses the most and the basic trainees the least amount of each group of items. The general conclusion seems to be that while permanent party troops are eating more and basic trainees are eating less, the relative proportions of higher quality to lower quality food items are not radically different.

Table 49 presents a nutritional analysis of the food utilized by the three groups. As might be expected, nutritional levels are highest in the permanent party and lowest in the basic trainee situation. However, referral back to Table 34, which lists The Surgeon General's nutritional requirements, indicates that in all cases the nutrition provided on an "as purchased" basis more than meets the dietary allowances.

TABLE 49

NUTRITIONAL ANALYSIS (USAF)

	Permanent Party	Basic Trainees	WAF
Food Energy (Cal)	4725	4072	4091
Protein (gm)	169.4	155.5	149.6
Fat (gm)	215.3	179.4	195.9
Calcium (mg)	1805	1463	1366
Iron (mg)	25.3	23.0	22.4
Vitamin A (IU)	10836	7901	9678
Thiamine (mg)	2.0	1.8	1.7
Riboflavin (mg)	3.4	2.9	2.7
Niacin (mg)	30.3	27.9	27.0
Ascorbic Acid (mg)	154.4	119.5	161.4

CONCLUSIONS

1. So far as is known, this is the first comprehensive analysis of DoD wide food utilization patterns. This information has relevance for use in designing a uniform ration cost system, for comparisons of military and civilian feeding, for logistics planning, and for varied applications by military food service management in ration administration.
2. The following conclusions are found to apply for all services:
 - a. Meat, poultry, and fish; dairy products; vegetables; and grain and cereal products constitute over 70% of total utilization and expenditure.
 - b. The top 75% of both usage and expenditure is accounted for by approximately 50 items.
 - c. Of those items comprising the top 75% of expenditure, meat, poultry, and fish are responsible for 50% of expenditure and dairy products 20%.
 - d. Milk is the number one item both in terms of utilization quantity and expenditure.
 - e. Animal protein food constitute more than 65% of total expenditures. This can be construed as an indicator of a generally high level of feeding throughout DoD.
3. Nutritional levels for food utilized in all services exceed The Surgeon General's Daily Dietary Allowances by a sufficient margin to ensure despite preparation, cooking, and serving losses as well as plate wastage. The quantities made available to the customer provide the minimum daily requirements of nutrients in a three meal per day situation.
4. DoD food usage differs widely from that specified by the components of the FCI but the expenditure per ration only differs from the BDFA by 2%. This indicates that while the services remain within their BDFA, they are expending their monetary resources differently than the quantitative food distribution indicated in the FCI and the NRL.
5. While Air Force base personnel (permanent party) seem to be eating more than either WAF's or basic trainees on the same base, the relative proportions of higher quality to lower quality food items are not radically different.
6. Consumption patterns for female military personnel seem to differ from male counterparts in that the diet of the former include both greater amounts of such non-fattening and weight reducing items as fish, shell fish, fresh fruit and skim milk as well as greater amounts of such fattening items as ice cream, sugar and sweets, and salad dressings.

RECOMMENDATIONS

1. A periodic survey to determine the level of military feeding be conducted on a regular basis (e.g., every 4 years). Such a survey should:
 - a. Adopt the broad view of the level of feeding taken by this survey; and,
 - b. Utilize the diversity of criteria and the general approach suggested in this analysis.
2. The current FCI be revised to reflect closer agreement with the actual pattern of DoD food utilization. Because of the fact that this FCI conforms to and is constrained by the NRL (Section 6082, Title 10, U.S. Code), the law should also be revised to permit the most appropriate FCI to be developed.
3. The data contained within this survey be utilized in an effort to determine the level of military feeding relative to comparable civilian operations.
4. In the event that future efforts are directed toward improving inventory control of food items within military organizations, the practicability of concentrating on those few items comprising the bulk of expenditures be explored.
5. A study be conducted to extend this analysis of food utilization, which is on an "as purchased" basis, to an "as consumed" basis to provide greater understanding of the usage of food products after purchase and to relate this usage to human nutritional intake and consumer morale.

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