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TECHNICAL REPORT

75-7-ORSA

A NUTRITIONAL EVALUATION OF THE EXPERIMENTAL FOOD SERVICE SYSTEM AT TRAVIS AFB, CALIFORNIA

by

Mark M. Davis

July 1974

UNITED STATES ARMY
NATICK LABORATORIES
Natick, Massachusetts 01760

Operations Research
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ABSTRACT

A nutritional evaluation of the meals served during a food service experiment at Travis AFB, California was performed. The purpose of this evaluation was to determine the levels of selected nutrient elements provided by these meals and to compare them with established nutritional standards. In addition, the data provide for a comparison of the nutritional profiles of the meals served in the dining halls with those served in two new experimental food outlets.

It is concluded that the meals served during the experiment were nutritionally adequate as compared to Air Force requirements (Reference 1), and that the meals served in the two new experimental food outlets did not differ significantly from comparable meals in the dining halls.

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INTRODUCTION

During FY 1973-74, the Operations Research and Systems Analysis Office conducted an investigation of Air Force Food Service under Task 03, Project No. 1J662713AJ45, Analysis and Design of Military Feeding Systems, of the DOD Food Research, Development, Testing and Engineering Program. This effort was directed primarily towards defining, developing, and evaluating broad improvements to the existing food service system at Travis AFB, California, selected as the study site since it best represented characteristics of Air Force Food Service Operations.

After completing the initial studies at Travis AFB, a variety of proposed changes aimed at increasing the performance and effectiveness of food service were implemented and evaluated in an experiment conducted between 1 November 1973 – 31 January 1974. Since these changes included modifications to the Air Force World-wide Menu and new food service operations, the nutritional adequacy of the experimental system was a question of concern. This report provides a detailed nutritional evaluation of the meals, as selected by the customers, in the different facilities, and compares the resulting nutritional profiles with established standards to determine any dietary surpluses or deficiencies.

The specific objectives of the nutritional evaluation are to:

1. Determine the values for various nutritional components for each type of meal selected.

2. Compare these values with established standards as published in Reference 1, and determine if any deficiencies or surpluses exist.

3. Identify significant differences in nutritional values for the different types of meals served.

4. Identify significant differences in nutritional values between meals served in the dining halls and those served in the new experimental facilities, i.e., the Modular Fast Food Unit and the Flight Line Facility.

SURVEY METHODOLOGY

During the experiment there were three dining halls in operation at Travis, each serving breakfast, dinner, and supper meals. One of these dining halls also served a midnight meal, from 2300–0100, and another served a specialty meal (i.e., ethnic menu), from 1900–2100, following the regularly scheduled supper period. In addition to the dining halls, there were two experimental facilities; the Modular Fast Food Unit, operated from 1100–2100 and the Flight Line Facility, open between 1630–1900 and 2230–0200.

Data were collected over a period of three months (November 1973 – January 1974), while the experiment was in progress. A systematic sampling plan was designed to cover every meal period in each dining facility in order to provide sufficient data to accurately reflect differences in menu, operating hours, meals served, and other relevant factors. A minimum of 35 randomly chosen meals, as selected by the customers, were sampled during each scheduled observation period (the one exception was the Dinner Short Order, where a minimum of 25 observations was required). The total sample size for each type of meal is summarized in the following table:

MEAL	SAMPLE SIZE	MEAL	SAMPLE SIZE
Breakfast	962	Midnight Meal	331
Dinner Regular	2530	Specialty Meal	296
Dinner Short Order	1588	Modular Unit	267
Supper	2292	Flight Line Facility	496

For each meal sampled, the individual food items, selected by the customer, comprising that meal were recorded on the form shown in Figure 1. It should be noted that the data collection procedures made no provisions for obtaining information on multiple or second servings and plate waste. All of the items on the menu for a particular meal and a three digit numerical code uniquely identifying each food item, were entered in the two left columns. Each of the numbered columns represents a meal that was sampled. For each particular food item selected a 1 was recorded in the appropriate box. Otherwise the box was left blank. Also recorded on the form were the date, location, and type of meal from which the sample was taken.

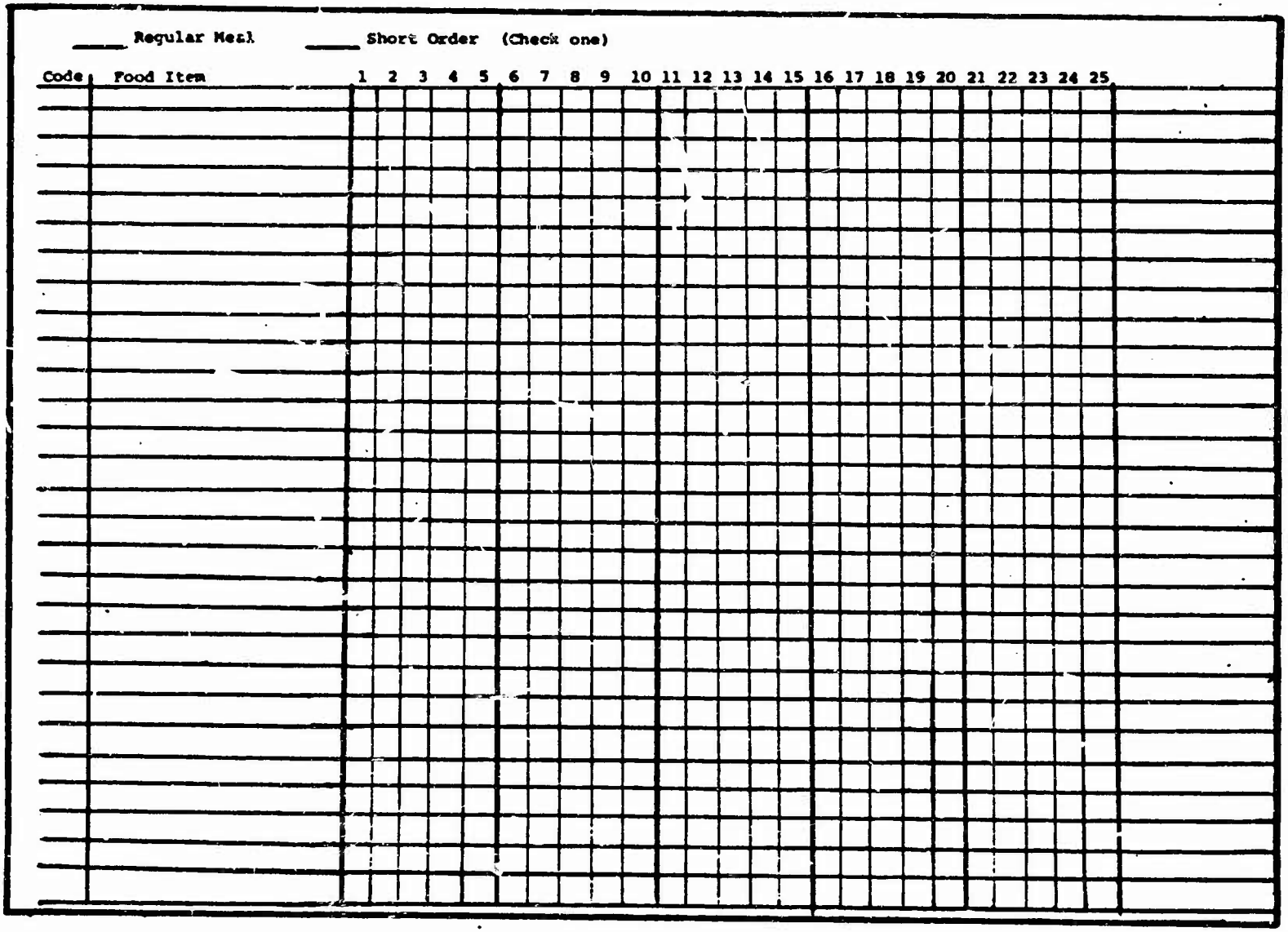


Figure 1

DATA COLLECTION FORM

RESULTS AND CONCLUSIONS

Data processing consisted essentially of obtaining a nutritional profile for each meal sampled, and then performing statistical analyses of the profiles, as shown in Figure 2. The information on the data collection forms was keypunched onto cards and then transferred to magnetic tape. Nutritional values were calculated for each food item using the Armed Forces recipe service formulations and USDA Handbook No. 8 food composition data, and summed over all food items comprising an individual meal. The resulting profiles were then grouped by type of meal for subsequent analysis.

Table 1 shows the average nutritional values for each type of meal served during the experiment. Each value is compared with the DDA (i.e., daily dietary allowances for male personnel as prescribed by Reference 1). The same data are presented graphically in Figure 3 to illustrate how the average values of the nutritional elements vary for the different types of meals. It is emphasized that the DDA is for an entire day. To better evaluate each meal, DDA/3 is used as a standard level, represented by the horizontal line in each graph. The bars below the line are meal averages that are less than DDA/3, while the bars above the line are meal averages that are in excess of DDA/3 (the one exception is FAT where the reverse is true, i.e., the line represents a maximum allowable value).

The data described thus far relate solely to average meal values. The graphs in Figure 4 show the actual histograms for each nutritional element by meal. The distributions vary considerably for each nutrient, (i.e., normal, bimodal, etc.) but tend to remain very similar among the meals within a given component.

Still another way of viewing the data is presented in Table 2. Each entry represents the percentage of trays sampled, for each type of meal, that satisfies the DDA/3 requirement (e.g., 22.2% of the breakfasts sampled equalled or exceeded the DDA/3 requirement.

In general, the average nutritional component values, for all types of meals served, were near to or exceeded the DDA/3 requirement, with two important exceptions. The average niacin intakes were low for the breakfast and midnight meals (also a breakfast type meal), which is not a problem if tryptophan equivalents are considered. Also, average

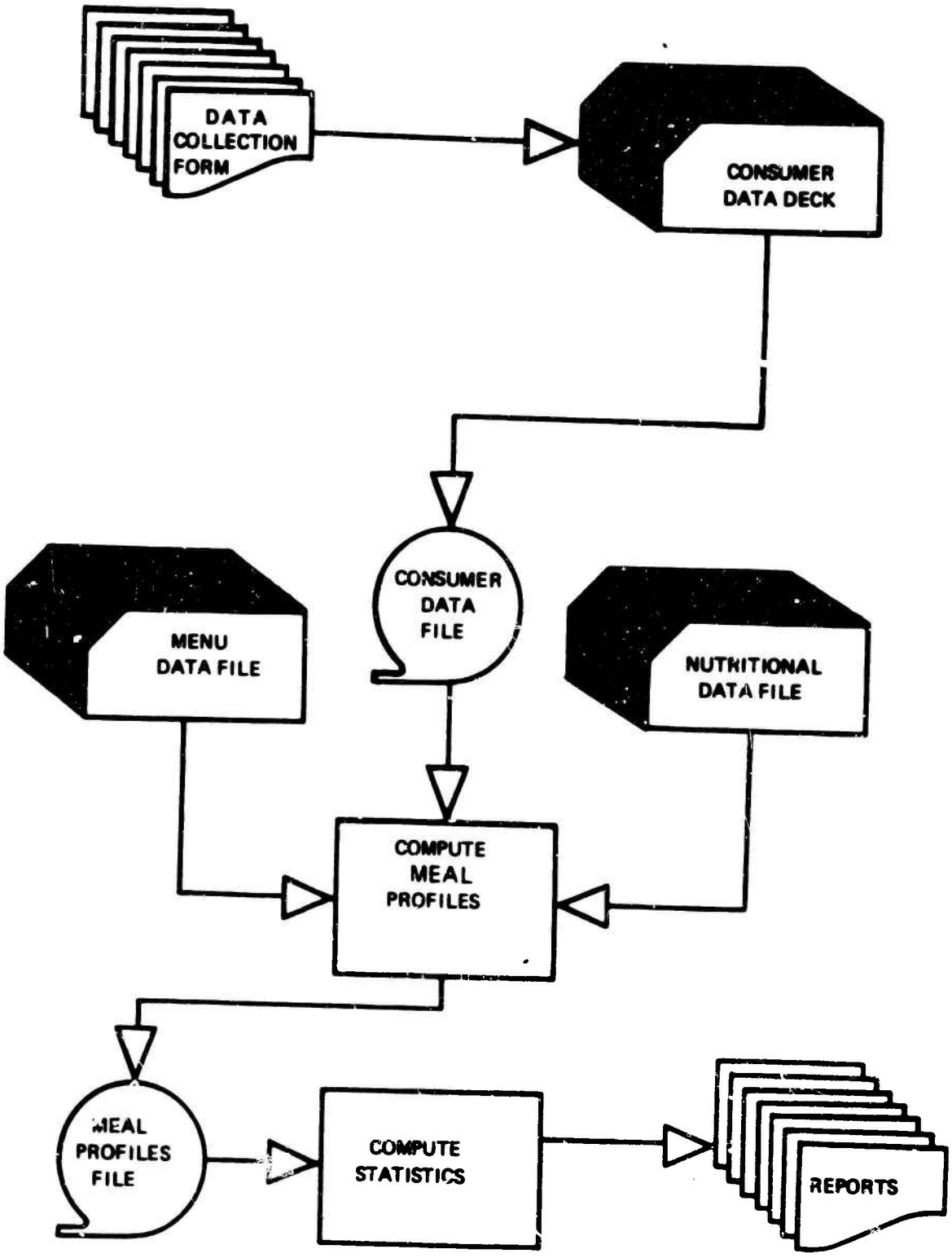


FIGURE 2

DATA PROCESSING FLOW CHART

vitamin A values vary widely as a function of meal type, and are deficient in half of the different types of meals served. It is apparent from Table 3 however, that nutrition levels offered by three meals a day in the experimental system are more than sufficient.

Table 1

AVERAGE NUTRITIONAL VALUES FOR EACH TYPE OF MEAL

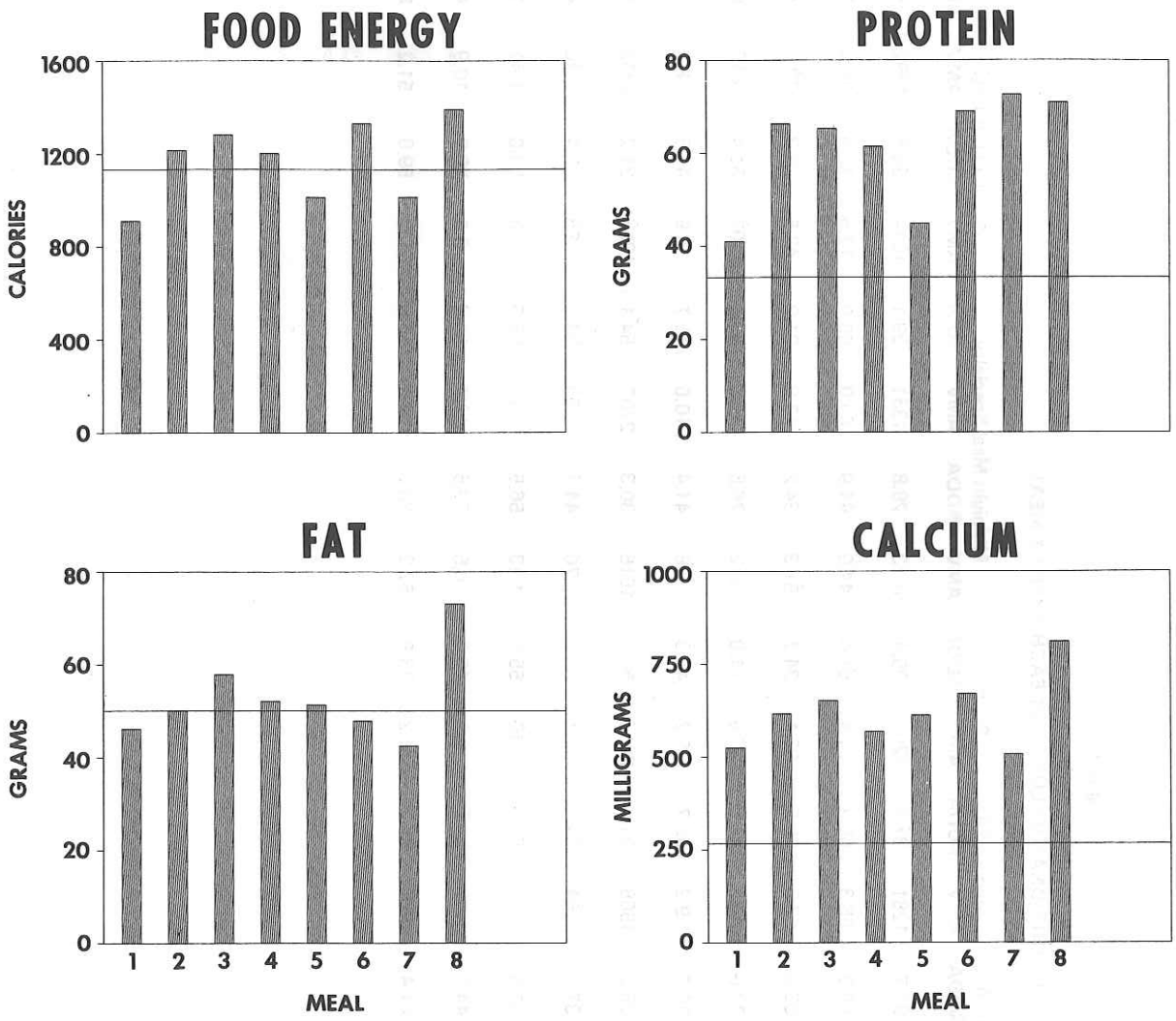
Nutritional Component	Units	DDA	Breakfast		Dinner - A		Dinner - S/O		Supper		Midnight Meal Specialty		Modular Unit Flight Line					
			AMV*	%DDA	AMV	%DDA	AMV	%DDA	AMV	%DDA	AMV	%DDA	AMV	%DDA	AMV	%DDA	AMV	%DDA
Food Energy	Cal	3400	911	26.8	1215	35.7	1281	37.7	1202	35.4	1013	29.8	1331	39.1	1014	29.8	1392	40.9
Protein	g	100	41.0	41.0	66.3	66.3	65.3	65.3	61.4	61.4	44.9	44.9	69.0	69.0	72.6	72.6	70.9	70.9
Fat**	g	150	46.1	30.7	50.0	33.3	57.8	38.5	52.1	34.7	51.3	34.2	47.8	31.9	42.5	28.3	73.0	48.7
Calcium	mg	800	525	65.6	616	77.0	652	81.5	568	71.0	612	76.5	669	83.6	507	63.4	810	101.2
Iron	mg	14	5.4	38.8	7.1	50.7	9.2	65.7	6.2	44.3	5.8	41.4	10.6	75.7	6.9	49.3	8.8	62.8
Vitamin A	IU	5000	1481	29.6	3309	66.2	156[illegible]	31.4	2853	57.1	1516	30.3	2702	54.1	1055	21.2	2652	53.0
Thiamine	mg	1.70	.69	40.6	.63	37.1	.54	31.2	.61	35.9	.76	44.7	.63	37.1	.55	32.4	.70	41.2
Riboflavin	mg	2.00	1.02	51.0	1.23	61.5	1.01	50.5	1.10	55.0	1.13	56.5	1.11	55.5	1.08	54.0	1.41	70.5
Niacin	mg	22.0	5.5	25.0	9.7	44.1	11.2	50.9	9.9	45.0	6.5	29.5	12.9	58.6	8.7	39.5	10.9	49.5
Ascorbic Acid	mg	60.0	37.8	62.9	48.9	81.4	51.8	86.2	44.2	73.5	52.2	86.8	54.4	90.5	36.0	59.9	51.2	85.2

*Average Meal Value

**Should not exceed 40% of total caloric

Figure 3

COMPARISON OF NUTRITIONAL LEVELS AMONG MEALS SERVED



1 – BREAKFAST

2 – DINNER, A–RATION

3 – DINNER, SHORT ORDER

4 – SUPPER

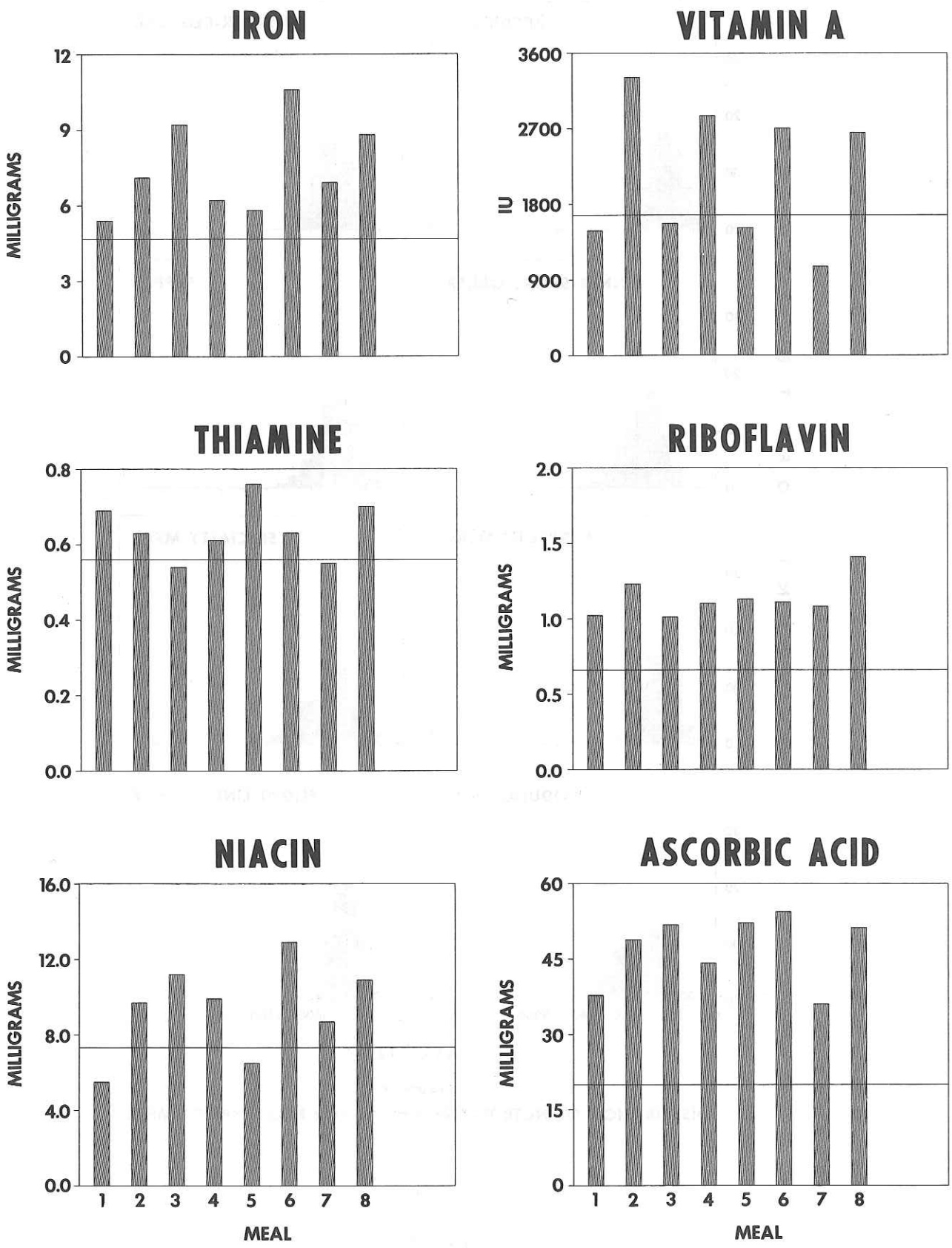
5 – MIDNIGHT MEAL

6 – FLIGHT LINE FACILITY

7 – MODULAR UNIT

8 – SPECIALTY MEAL

Figure 3 (cont'd)



FOOD ENERGY

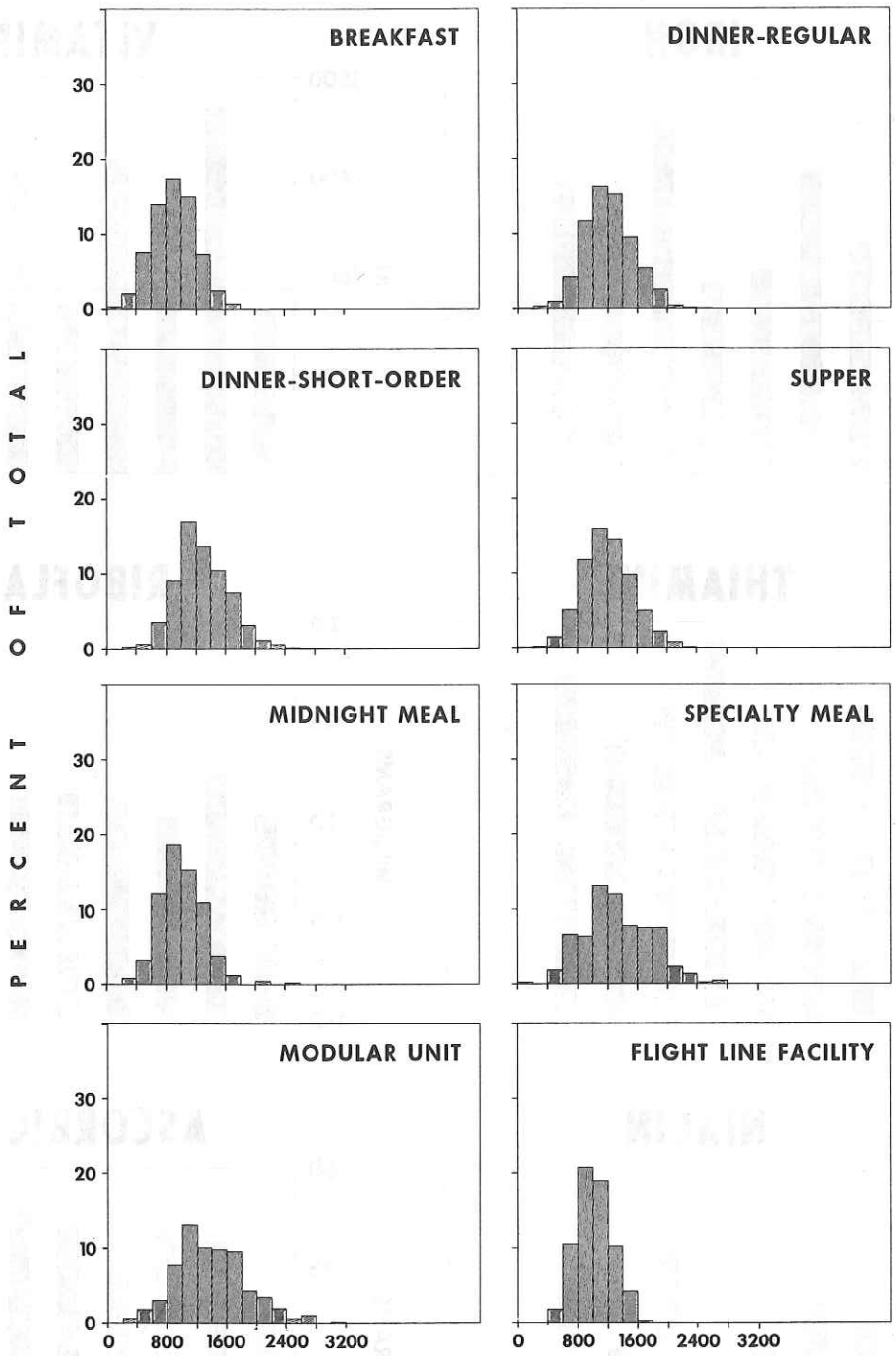


Figure 4

DISTRIBUTION OF NUTRITIONAL VALUES FOR EACH TYPE OF MEAL

PROTEIN

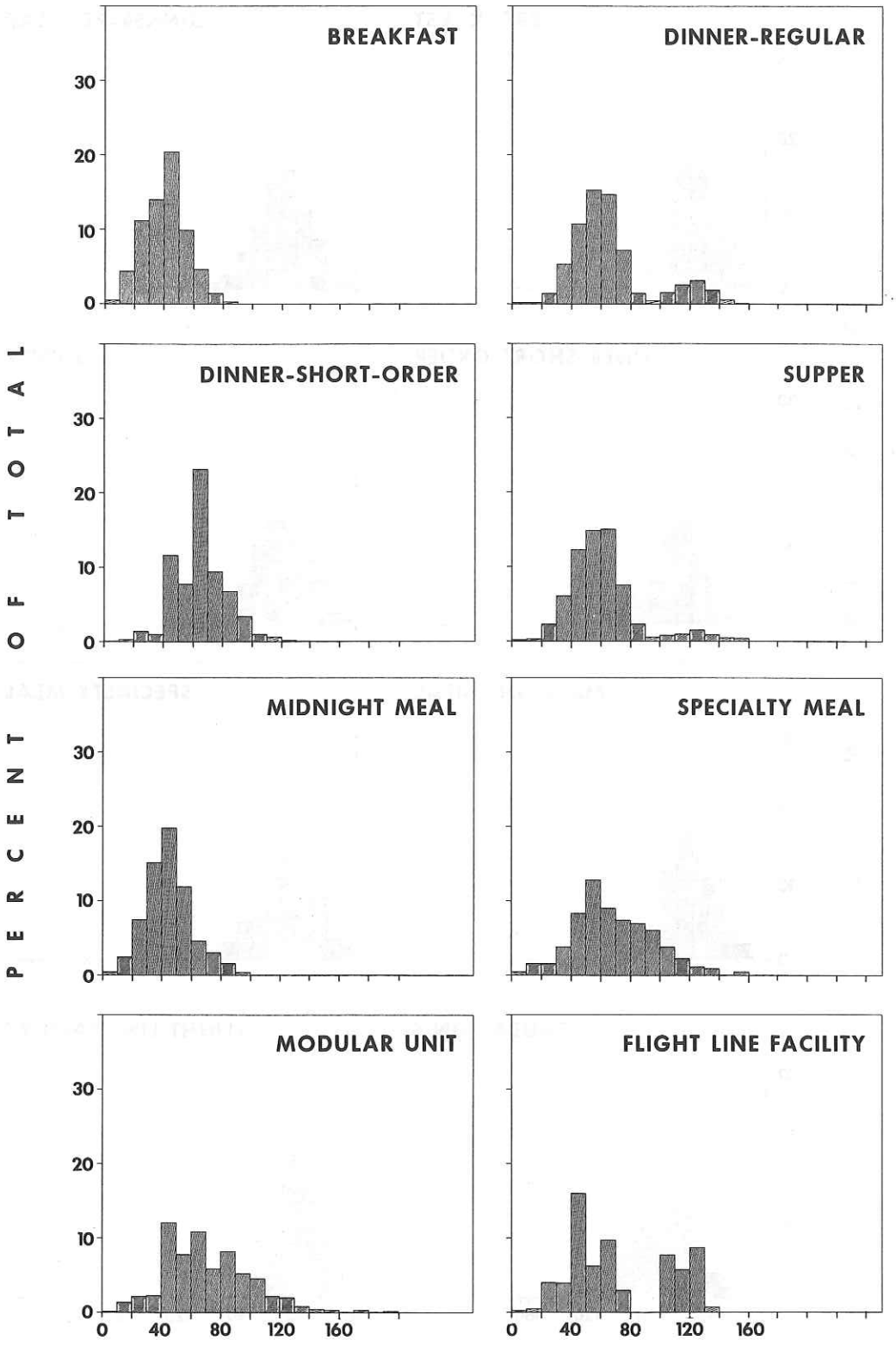


Figure 4 (cont'd)

FAT

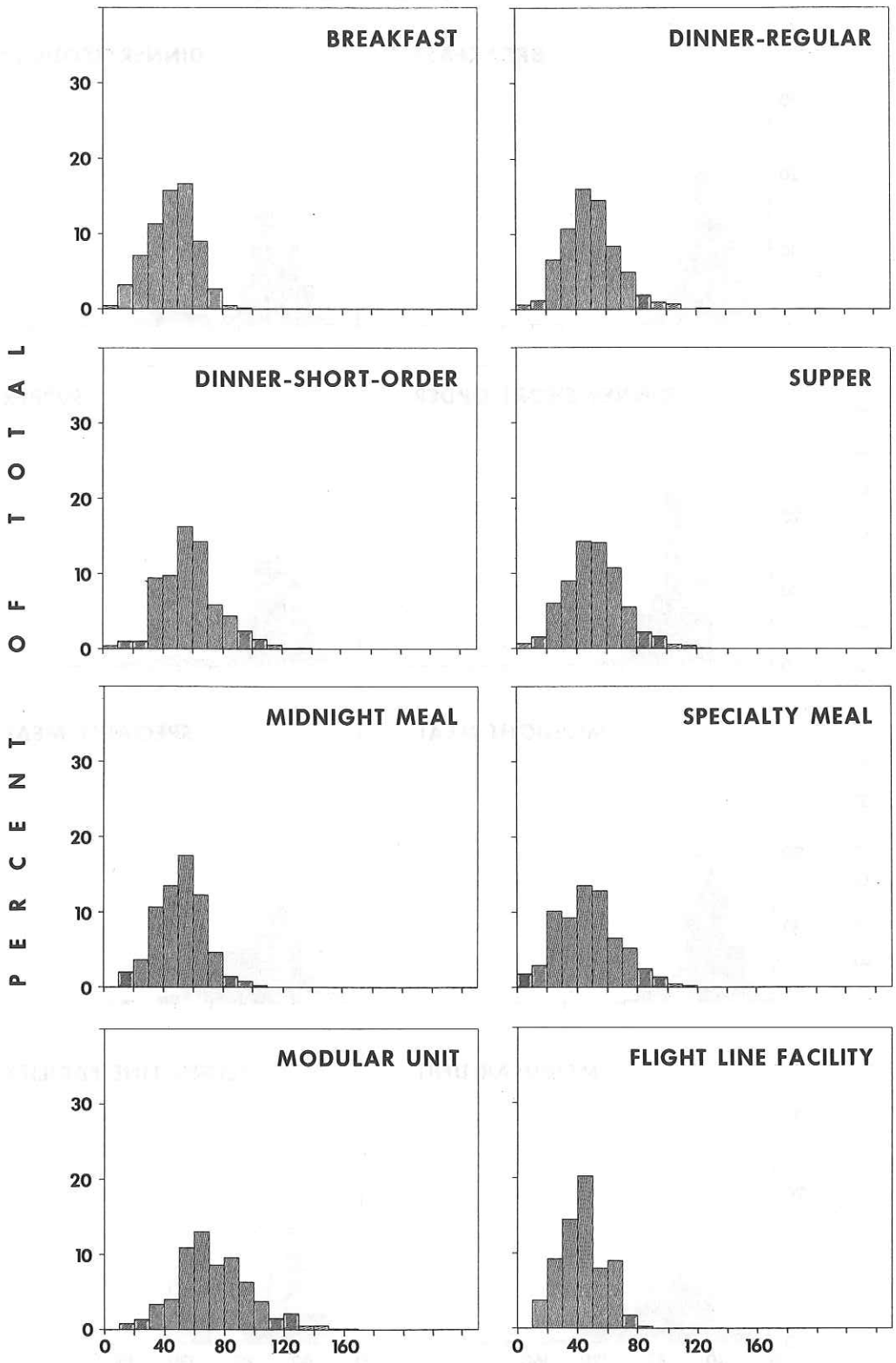
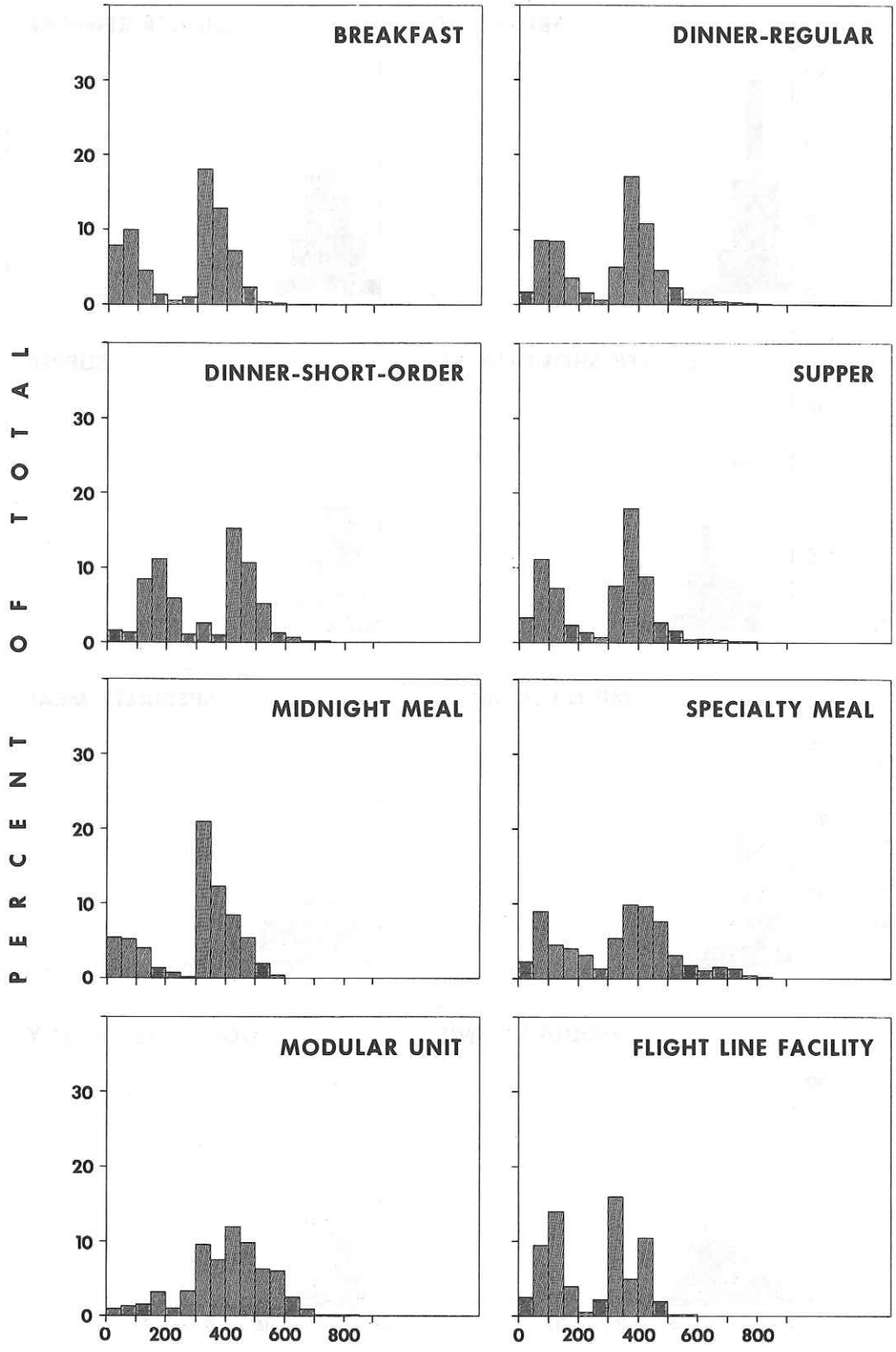


Figure 4 (cont'd)

CALCIUM



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IRON

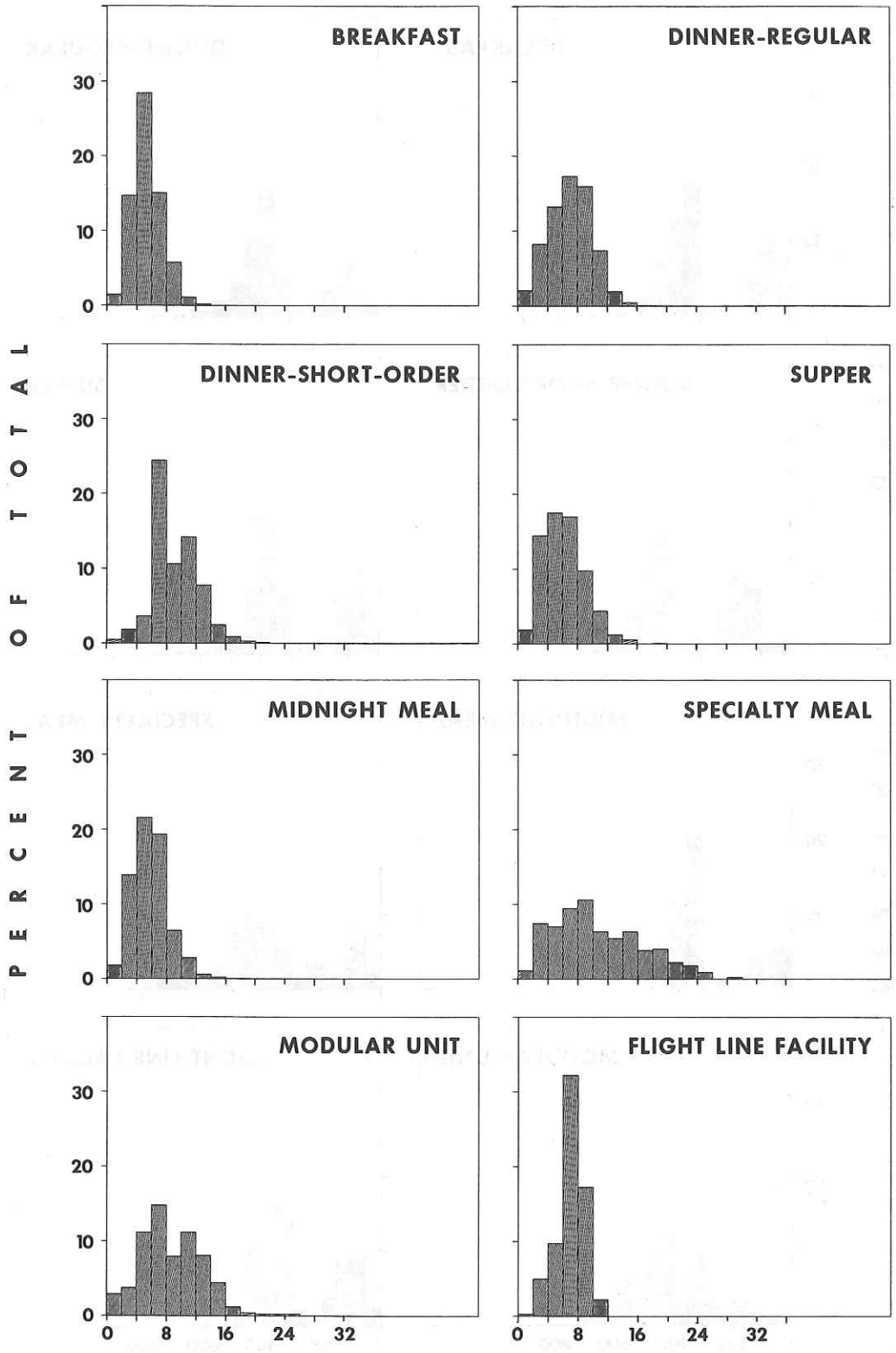

Figure 4 (cont'd)

VITAMIN A

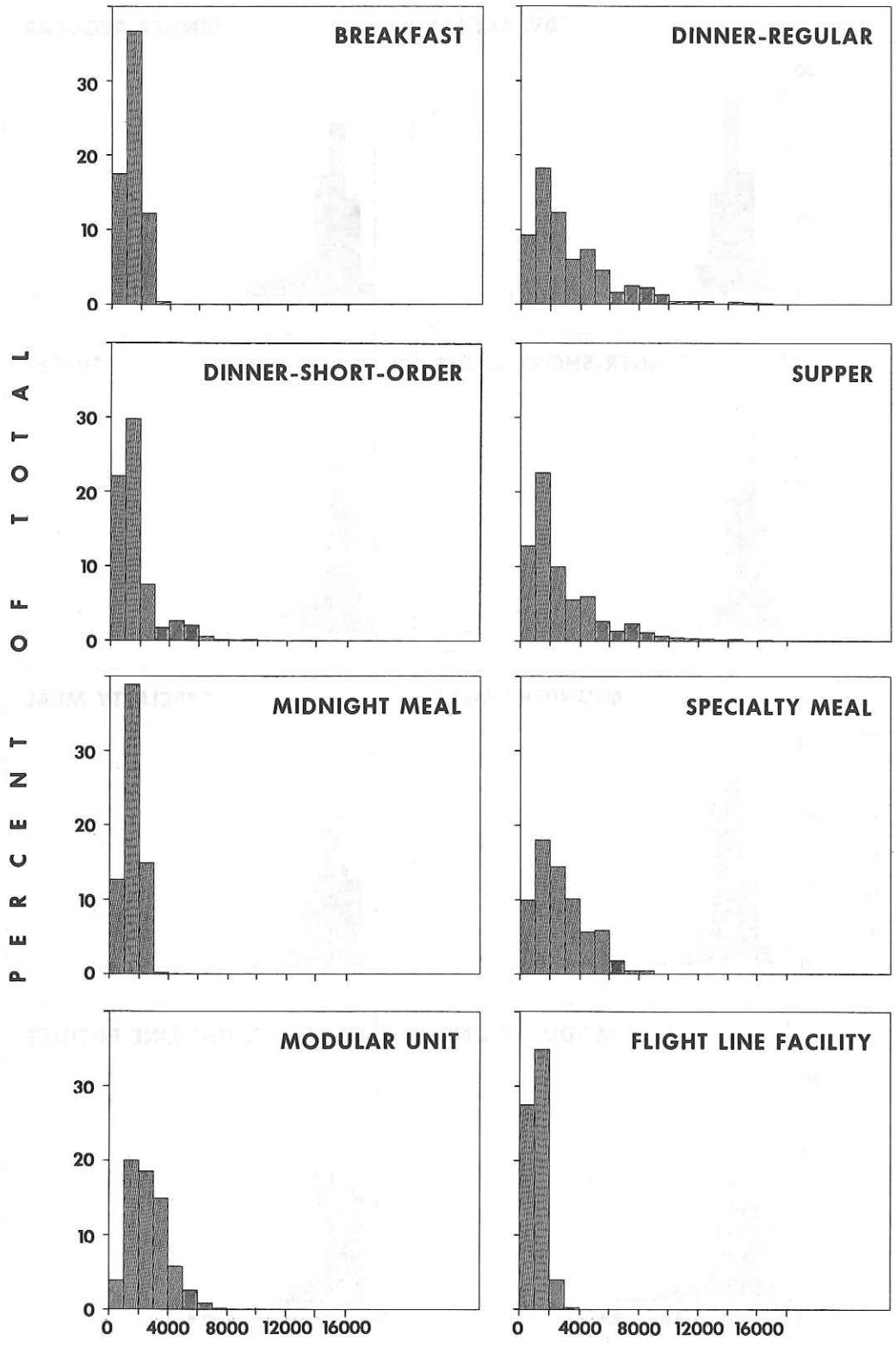

Figure 4 (cont'd)

THIAMINE

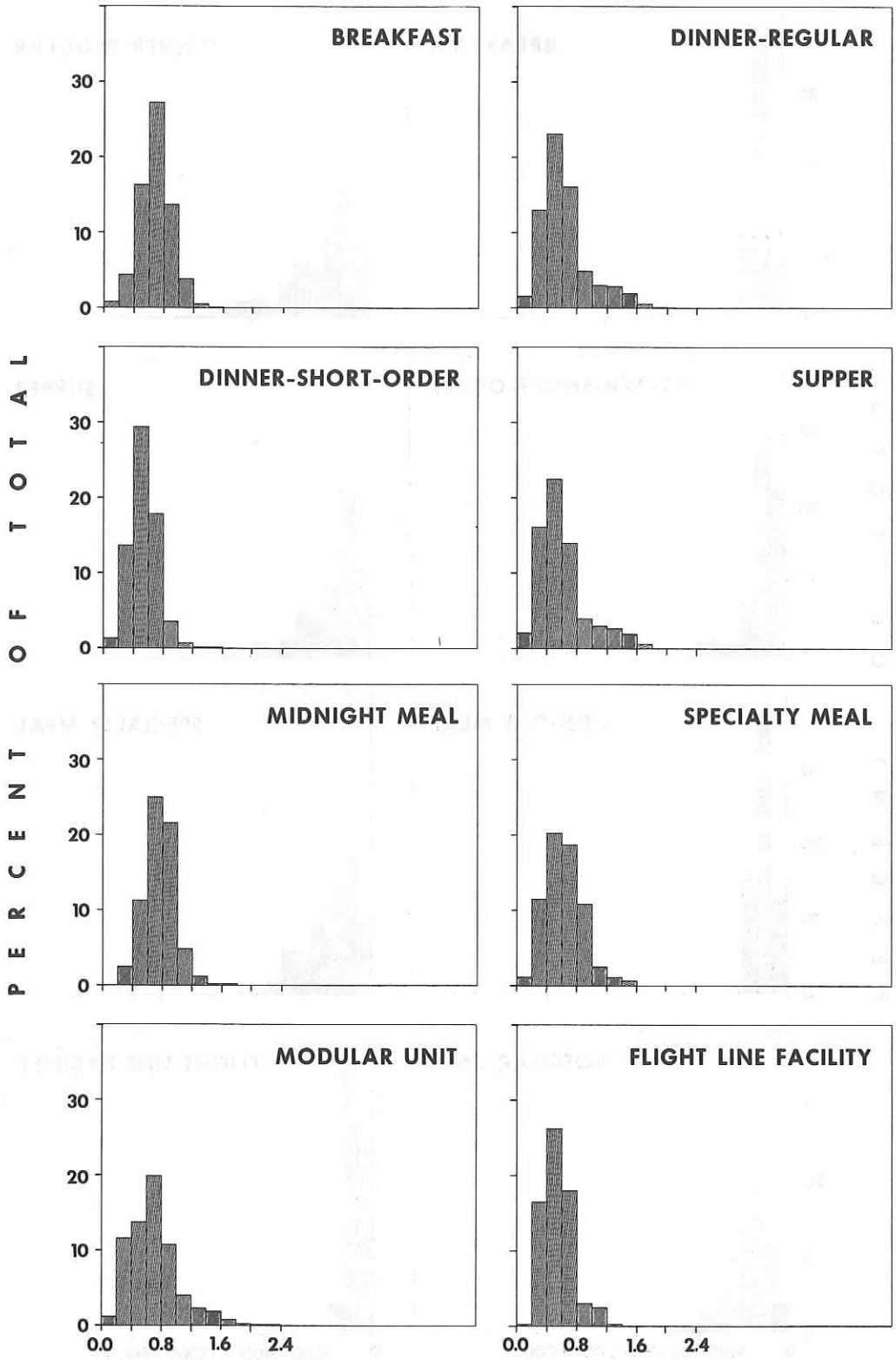

Figure 4 (cont'd)

RIBOFLAVIN

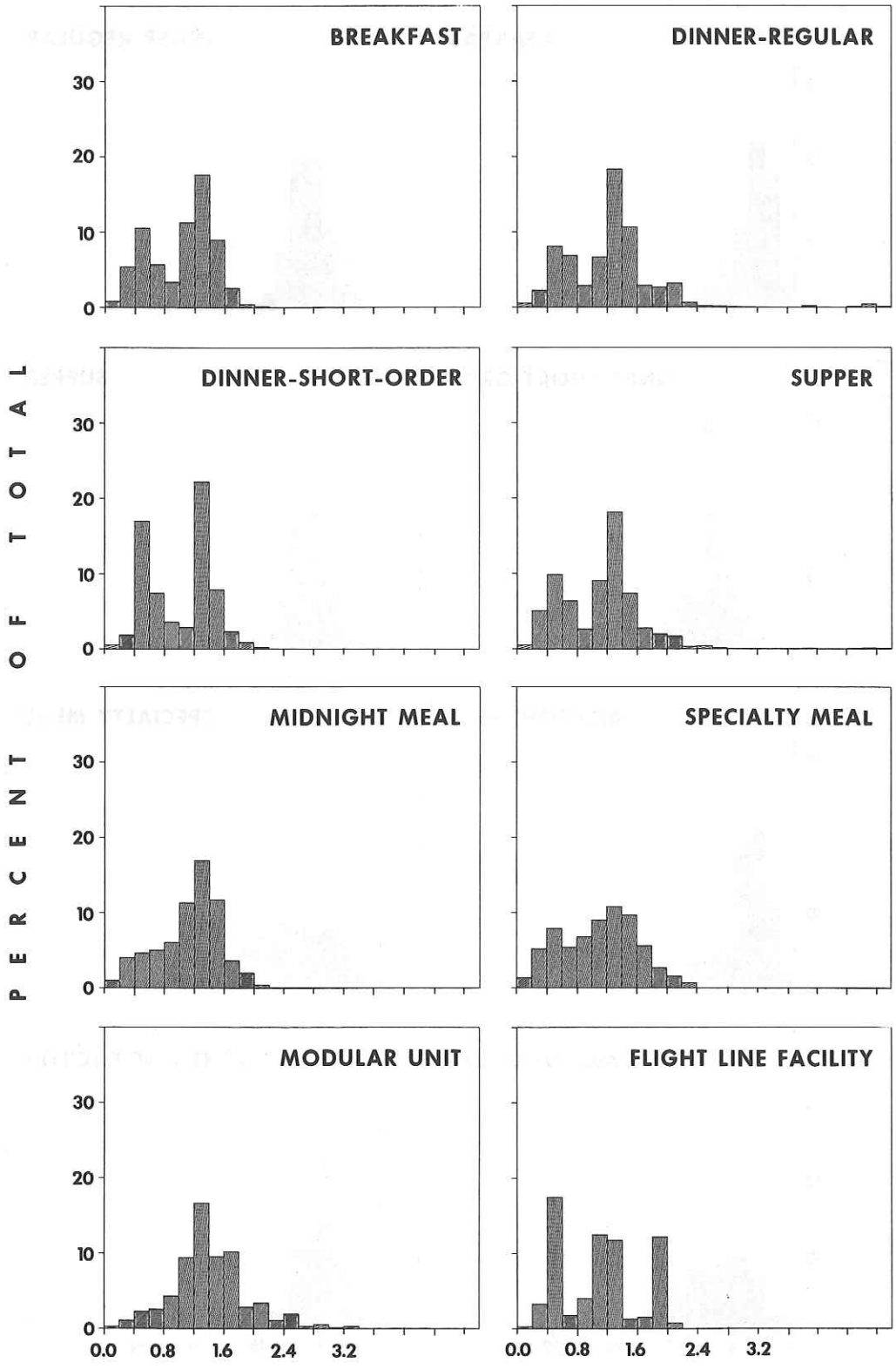

Figure 4 (cont'd)

NIACIN

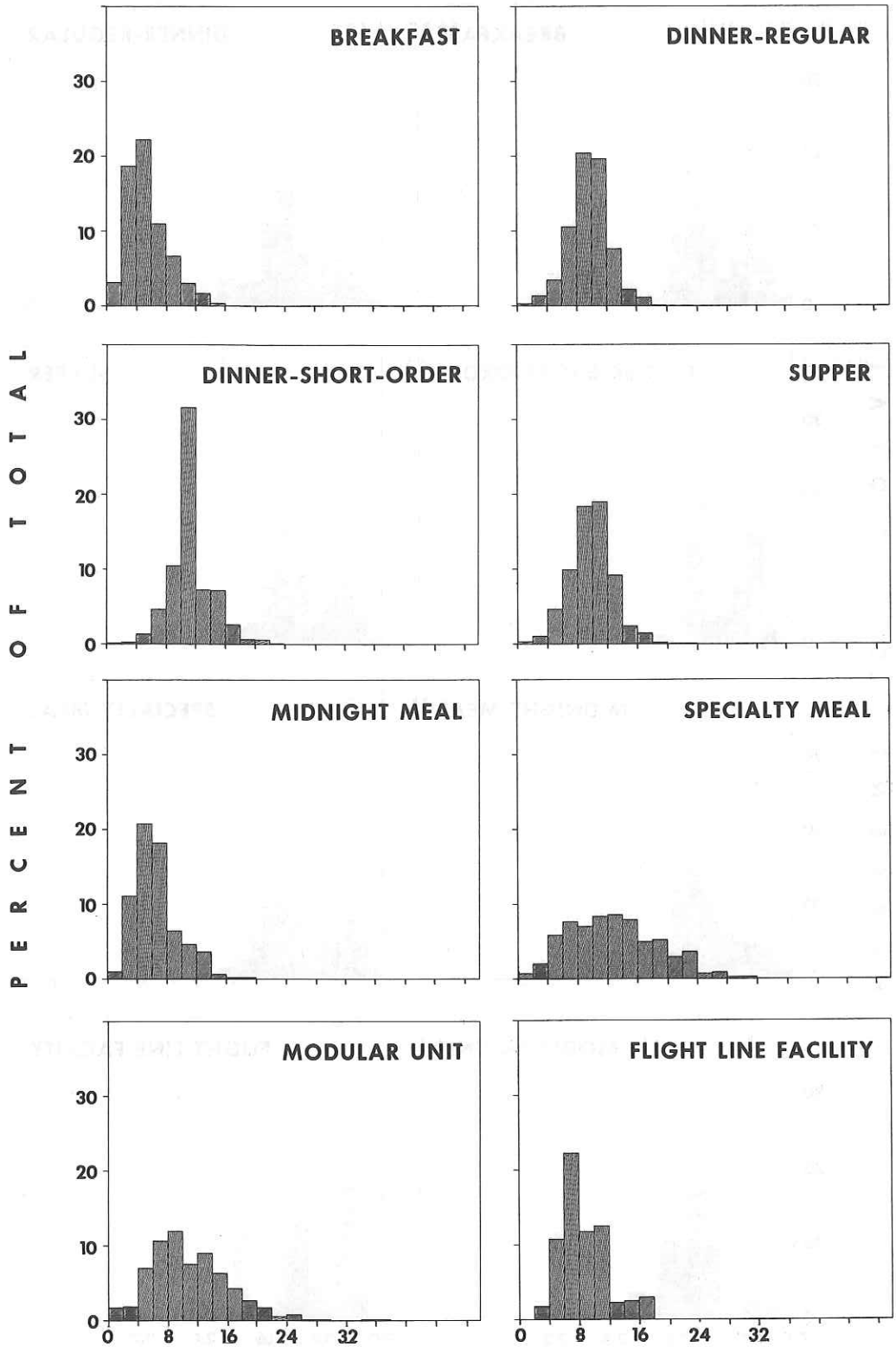

Figure 4 (cont'd)

ASCORBIC ACID

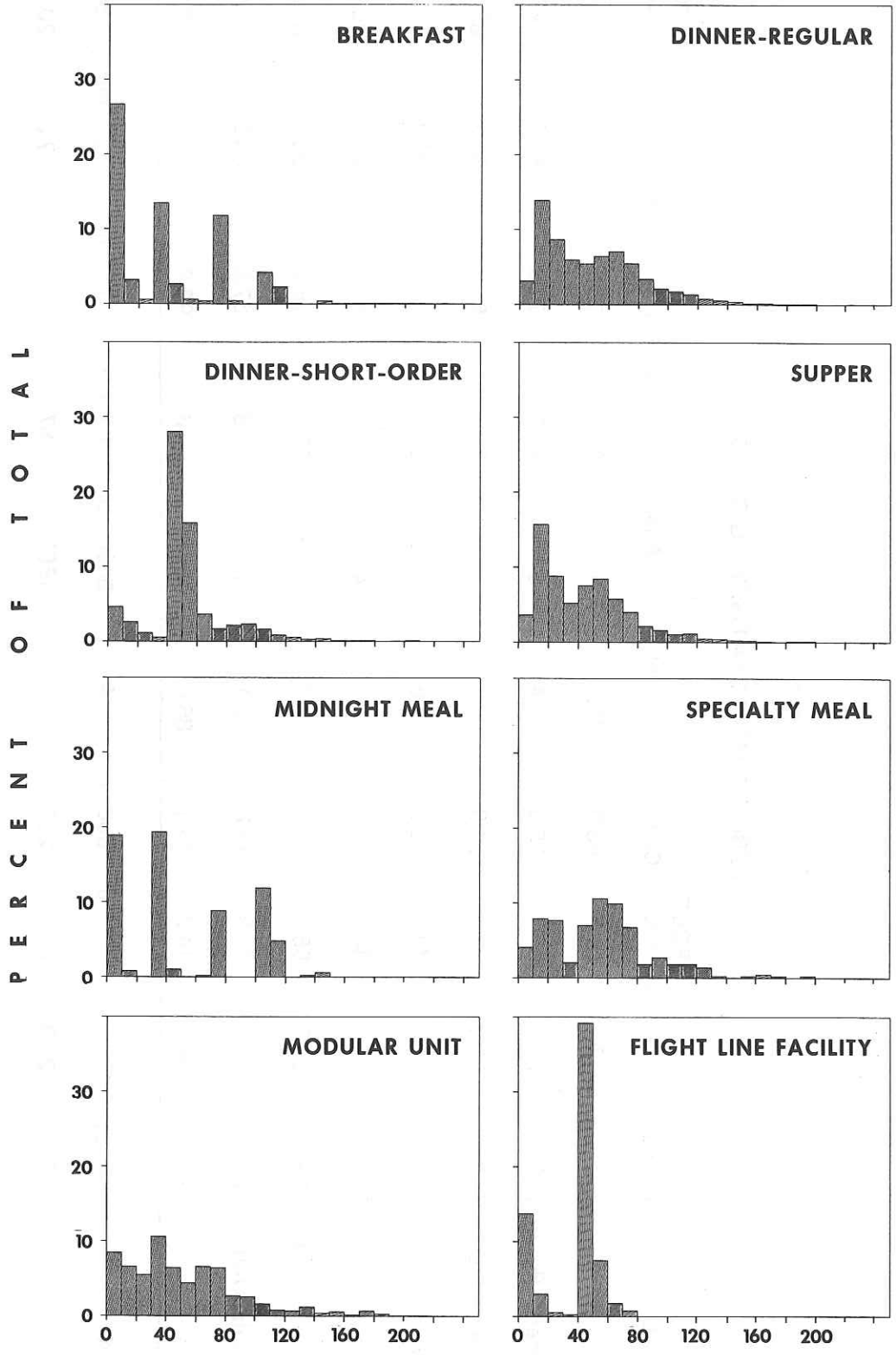

Figure 4 (cont'd)

Table 2

PERCENT MEALS SATISFYING DDA/3

MEAL	FOOD ENERGY	PROTEIN	FAT	CALCIUM	IRON	VITAMIN A	THIAMINE	RIBOFLAVIN	NIACIN	ASCORBIC ACID
Breakfast	22.2	73.2	56.6	68.0	60.7	43.8	67.9	70.1	23.0	55.1
Dinner-A-Rat	57.5	96.4	52.7	75.6	81.4	67.9	43.7	77.6	83.2	74.5
Dinner – S.O.	61.7	97.2	32.4	91.9	95.2	28.9	33.5	66.0	94.3	89.2
Supper	60.6	94.6	47.1	69.9	71.6	57.2	39.1	70.6	82.1	71.1
Midnight Meal	32.9	81.2	44.7	78.8	71.1	45.6	83.1	83.4	29.1	70.4
Specialty Meal	63.3	93.8	56.4	78.7	84.7	68.0	62.2	76.2	80.7	82.1
Modular Unit	31.0	89.5	71.5	74.6	88.1	14.9	42.8	67.5	66.2	74.9
Flight Line	69.8	94.0	14.2	95.1	86.6	75.3	63.8	93.8	74.7	77.5
DDA	3400 cal	100 g	150 g	800 mg	14 mg	5000 IU	1.7 mg	2.0 mg	22 mg	60 mg
DDA/3	1133	33.3	50.0	267	4.7	1667	.57	.67	7.3	20.0

Table 3

RATIO OF AVERAGE MEAL VALUES TO DDA/3

ELEMENT	UNITS	AVERAGE MEAL VALUE	DDA/3	RATIO TO DDA/3
Food Energy	Calories	1170	1133	1.03
Protein	Grams	61.4	33.3	1.84
Fat	Grams	52.6	50.0	1.05
Calcium	Mg	620	267	2.32
Iron	Mg	7.5	4.7	1.61
Vitamin A	IU	2142	1667	1.28
Thiamine	Mg	.64	.57	1.13
Riboflavin	Mg	1.14	.67	1.70
Niacin	Mg	9.4	7.3	1.28
Ascorbic Acid	Mg	47.1	20.0	2.35

REFERENCES

1. AFR No. 160-95, "Medical Services Nutritional Standards", HQ Department of the Air Force, Washington, DC, 10 August, 1972.

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