

A NUTRITION STUDY OF
GERIATRIC PATIENTS IN A
CITY - COUNTY CONVALESCENT HOME

A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF ARTS IN NUTRITION
IN THE GRADUATE DIVISION OF THE
TEXAS WOMAN'S UNIVERSITY
COLLEGE OF HOUSEHOLD ARTS AND SCIENCES

BY

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We hereby recommend that the thesis prepared under
our supervision by Barbara Luther Taylor

entitled A NUTRITION STUDY OF GERIATRIC
PATIENTS IN A CITY-COUNTY
CONVALESCENT HOME

be accepted as fulfilling this part of the requirements for the Degree of
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T A B L E O F C O N T E N T S

	Page
INTRODUCTION	1
PLAN OF PROCEDURE	6
SUBJECTS OF THE STUDY	6
MEDICAL DIAGNOSIS AND HISTORICAL BACKGROUND	7
TIME OF THE STUDY	8
GENERAL PLAN	8
DIETARY RECORDS	9
MEDICAL-NUTRITION OBSERVATIONS AND TESTS	9
EVALUATION OF SKELETAL DENSITY	9
BODY CHEMISTRY	10
HEMATOLOGY HEMOGLOBIN	10
HEMATOLOGY ERYTHROCYTE COUNTS	11
MEAN CORPUSCULAR HEMOGLOBIN	11
PRESENTATION OF DATA	13
DISCUSSION OF FINDINGS	33
DIETARY INTAKE OF ENERGY AND OF MAJOR NUTRIENTS	33
ENERGY INTAKE	33
PROTEIN INTAKE	35
CARBOHYDRATE INTAKE	37
FAT INTAKE	37
CALCIUM INTAKE	38
PHOSPHORUS INTAKE	39

	Page
IRON INTAKE	39
VITAMIN A INTAKE	40
THIAMINE INTAKE	42
RIBOFLAVIN INTAKE	43
NIACIN INTAKE	45
ASCORBIC ACID INTAKE	46
VITAMIN D INTAKE	48
ACID-BASE BALANCE	48
MEDICAL OBSERVATIONS	49
HEMOGLOBIN CONCENTRATION	49
HEMATOLOGICAL CORPUSCULAR HEMOGLOBIN	50
SKELETAL DENSITY (OS CALCIS)	50
SUMMARY	52
BIBLIOGRAPHY	55

L I S T O F T A B L E S

Table	Page
I. SUMMARY OF DATA ON ENERGY CONTENT OF INITIAL AND FINAL DIETS	14
II. SUMMARY OF DATA ON PROTEIN CONTENT OF INITIAL AND FINAL DIETS	15
III. SUMMARY OF DATA ON AVERAGE INITIAL AND FINAL INTAKE OF CARBOHYDRATE AND FAT	17
IV. SUMMARY OF DATA ON CALCIUM CONTENT OF INITIAL AND FINAL DIETS	18
V. SUMMARY OF DATA ON AVERAGE INITIAL AND FINAL INTAKE OF PHOSPHORUS	19
VI. SUMMARY OF DATA ON IRON CONTENT OF INITIAL AND FINAL DIETS	20
VII. SUMMARY OF DATA ON VITAMIN A CONTENT OF INITIAL AND FINAL DIETS	21
VIII. SUMMARY OF DATA ON THIAMINE CONTENT OF INITIAL AND FINAL DIETS	22
IX. SUMMARY OF DATA ON RIBOFLAVIN CONTENT OF INITIAL AND FINAL DIETS	24
X. SUMMARY OF DATA ON NIACIN CONTENT OF INITIAL AND FINAL DIETS	25
XI. SUMMARY OF DATA ON ASCORBIC ACID CONTENT OF INITIAL AND FINAL DIETS	26
XII. SUMMARY OF DATA ON VITAMIN D CONTENT OF INITIAL AND FINAL DIETS	28
XIII. SUMMARY OF DATA ON EXCESS ACID AND BASE CONTENT OF INITIAL AND FINAL DIETS	29
XIV. SUMMARY OF DATA ON HEMOGLOBIN	30
XV. SUMMARY OF DATA ON SKELETAL DENSITY	32

A NUTRITION STUDY OF
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CITY - COUNTY CONVALESCENT HOME

CHAPTER I

INTRODUCTION

In recent years a new area of study has become important in the field of nutrition research. With the number of persons who reach the age of sixty-five constantly increasing, there develops the necessity of providing this group with nutrition adequate to maintain or improve their general state of health. At this time, comparatively little is known in the field of geriatric nutrition as to the specific requirements of all nutrients for this age group. The associated problem of the psychology of feeding also becomes of particular concern with those persons who have long established food habits, who are not readily amenable to change.

Among the first investigations to include the older person was that of the Pennsylvania Mass Nutrition Studies.

This included a study of entire families; and it indicated that adult men nutritionally ranked above adult women in numerous respects. These studies also included about 400 geriatric subjects, many of them in state and private institutions. Findings concerning these older subjects in many cases showed the cumulative effects of long time poor nutrition in the nature of deficiencies of many kinds. In other cases, excellent histories were found to be associated with excellent nutrition status even in those who were quite old.

The Pennsylvania studies have continued at Texas Woman's University under the same direction. Under the latter auspices, Annelise Thiemann¹² found that the attitude of geriatric subjects toward food can be altered favorably with a concurrent improvement in physiological and nutritional status.

Another study by June Gibbs² showed that education of the geriatric subject could be effectuated by means of conferences, demonstrations, and group meetings in such a way as to exert a favorable influence on meal planning, food selection, food preparation, and eating habits. Studies currently are in progress in certain institutions of the Board for Texas State Hospitals and Special Schools which are designed to show the influence of an improved diet on the physiological and mental health of the patients. This

research program in Texas has been conducted at the Nelda Childers Stark Laboratories for Human Nutrition Research in the College of Household Arts and Sciences at the Texas Woman's University, Denton, Texas.

The study described in the thesis involves establishing a satisfactory program for feeding geriatric patients on a low cost budget. The investigation of the nutritional needs of the geriatric patients was requested by the administrators of the Dallas Hospital District. Since the physical location of these patients was to be moved, the administration desired to make adequate preparation for better food service for this older age group before these subjects were transferred to a more desirable location. Therefore, before the move was to have been made a study was inaugurated to determine whether or not improved selection and preparation of food would result in improved physiological status in certain respects, with the hope that--when better kitchen and other food facilities would become available--the staff would be encouraged to utilize the new facilities to the best advantage.

This study deals with the patients of the Dallas City-County Convalescent Home currently located in Hutchins, Texas. The buildings were built in 1916 and the kitchen arrangement has remained relatively unchanged throughout this time. The kitchen personnel is composed of two cooks, a man and a

woman from the town of Hutchins, and three cook's helpers. A registered nurse is in charge of the home; and she has an assistant who helps with business matters, and who is in charge of the menu planning, food ordering, food preparation, and food service. A budget of one dollar per day per patient is allowed for food.

At the beginning of the study there were no standard pieces of serving equipment or recipes for large quantity cookery. Before the nutritional intakes were measured as a part of this study, each serving area was furnished with standard serving equipment; and the food server was taught how to use it properly and how to assist the author with the keeping of accurate records.

The dietary intakes of the patients were recorded and the nutrient values were estimated from the food tables of Bowes and Church¹.

The major objectives of the study were:

1. To establish standard servings in a convalescent home operated by the Dallas City-County Hospital District;
2. To prepare or provide large quantity recipes which are economical and nourishing for the geriatric patients in this home, preparatory to moving to a new location, and to evaluate the new menus and

recipes by making certain initial and final tests on the patients.

3. To analyze the diets of the patients and make recommendations for menu changes, so that the diets might fulfill or exceed the recommendations of the Food and Nutrition Board of the National Research Council;
4. To feed the improved menus to 28 patients and to evaluate the results by initial and final hemoglobin and bone density measurements on these subjects; and
5. To provide the dietitian in charge of the kitchen being established in the new location with the results of the study and with current information concerning geriatric nutrition and eating habits.

CHAPTER II

PLAN OF PROCEDURE

SUBJECTS OF THE STUDY

The subjects of this study were patients of the Dallas City-County Convalescent Hospital located at Hutchins, which is in Dallas County. The patients initially numbered 34, of whom 23 were men and 11 were women. Fifteen of the men were Anglo-American, five were Latin-American, and three were Negroes. All of the subjects were 52 to 87 years of age. The length of time during which the subjects had been in the hospital ranged from seven months to 30 years.

All of the patients were without families financially able to care for them. Most of them were bedfast.

During the study, two patients expired, two were discharged to other homes, and two were transferred to Parkland Memorial Hospital because they were suffering from heat strokes. Thus, the final studies dealt with 18 men and 10 women. Thirteen of the men who completed the study were Anglo-American and five were Latin-American. Of the women, nine were Anglo-American and one was a Negro.

The survey form used to obtain the medical diagnosis and historical background follows.

M E D I C A L D I A G N O S I S A N D H I S T O R I C A L
B A C K G R O U N D

Case Number	Age	Original Diagnosis	Date of Admission
1	55	Essential hypertension	8-10-55
2	79	Arrested tuberculosis, Senile	3-31-56
3	54	Thrombosis of internal carotid artery	9-20-52
4	63	Paralysis, Stroke	6- 1-56
5	52	Paraplegia	11-10-53
6	69	Arrested tuberculosis	3- 1-56
7	57	Arrested tuberculosis	7-11-52
8	71	Arrested tuberculosis	12-18-55
9	77	Arrested tuberculosis	7- 1-46
10	61	Cardio-vascular accident	9-27-55
11	61	Hypertensive vascular disease	5-18-56
12	54	Old head injury	12- 1-56
13	54	Amyotrophic lateral sclerosis	10- 6-55
14	59	Post apoplectic syndrome, Mental confusion	5-29-51
15	84	Chronic pulmonary emphysema	12-19-52
16	81	Bilateral amputation, Diabetic	4-29-40
17	68	Cardio-vascular accident with right hemiplegia	5-19-50
18	60	Rheumatoid arthritis	4-29-47
19	61	Psychosis, Osteo arthritis	6-21-37
20	59	Psychosis	8-12-52

Case Number	Age	Original Diagnosis	Date of Admission
21	82	Blind	10- 5-49
22	65	Fracture supracondylar left femur	12- 1-49
23	84	Tuberculosis, Senile	8-26-55
24	57	Taboparesis, Fracture left femur	9- 9-46
25	87	Decompensation	5-14-55
26	60	Arthritis	4-19-27
27	61	Rheumatoid arthritis	7- 2-43
28	75	Chronic infectious ulcer right leg, Senile psychosis	1- 2-48

TIME OF THE STUDY

The initial dietary records and tests were begun in February, 1957. The final tests and dietary records were completed the latter part of July, 1957, with a lapse approximately of six months between tests. The recommendations to the food supervisor and cooks were made immediately after the calculation of the initial dietary records.

GENERAL PLAN

X-rays were made by technicians of the Mobile X-ray Unit of the Nelda Childers Stark Laboratory for Human Nutrition Research, College of Household Arts and Sciences, Texas

Woman's University, at the beginning and close of the study. The blood tests were conducted by those in the Hematology Laboratory at Parkland Memorial Hospital, Dallas, Texas.

It was desired to ascertain the initial nutritional status of the patients so that menu recommendations and recipes could be prepared and evaluated on the basis of the apparent nutritional needs of the patients.

DIETARY RECORDS

A complete record of all foods consumed by each of the patients was kept for a one-week period initially and finally. This included between meal snacks as well as the meals furnished at the convalescent home. Record forms were those used in similar studies and were supplied by the Texas Woman's University. The diets of the patients were calculated for all of the specific nutrients specified by the Food and Nutrition Board, National Research Council¹². The values published by Bowes and Church¹ were used in the calculation of diets.

MEDICAL NUTRITION

OBSERVATIONS AND TESTS

EVALUATION OF SKELETAL DENSITY

To determine the bone density, lateral x-rays were made of the left os calcis. A tracing was made from an anterior

to a posterior point on the lateral x-ray of the os calcis, as the film moved at a standard rate of speed through a light beam. A tracing through this standard bone position as well as a tracing from the same film of an alloy standard wedge which was placed routinely on all films, enabled a numerical value for mineralization of the bone section traced to be established.

The Mack⁽⁶⁾ technique for measuring the mineral density of the bone was employed. A microdensitometer operating on the photoelectric principle was used for this purpose, as described by Nelson, Mack, and Vose⁽¹³⁾.

B O D Y C H E M I S T R Y

HEMATOLOGY-HEMOGLOBIN

The hemoglobin content of the blood stream was determined by a method described by Hawks, Oser, and Summerson⁽⁴⁾. A known volume of blood was diluted with 10 milliliters of 0.1 N hydrochloric acid. The intensity of the brown color of the acid hematin thus formed is proportional to the amount of the hemoglobin present. Readings were made on the Klett-Summerson colorimeter within 30 minutes. A calibration curve for using this instrument was prepared by use of the iron method of Wong⁽¹⁶⁾. The classification groups used to report hemoglobin ranges found in this study were:

<u>Classes</u>	<u>Ranges of Hemoglobin Values</u> <u>gms per 100 cc of blood</u>
Class 1	13.00 gm and above
Class 2	12.99 gm to 11.50 gm
Class 3	11.49 gm to 10.00 gm
Class 4	9.99 gm to 8.50 gm
Class 5	8.49 gm and under

HEMATOLOGY-ERYTHROCYTE COUNTS

The method of determining the number of red cells per cubic millimeter described by Hawk⁽³⁾ was used with the addition of the improved Neubauer ruling. The arbitrary classifications were:

<u>Classes</u>	<u>Ranges of Red Cell Count Values</u> <u>(millions per cubic mm)</u>
Class 1	4.76 and over
Class 2	4.75 - 4.51
Class 3	4.50 - 4.26
Class 4	4.25 - 4.01
Class 5	4.00 and under

MEAN CORPUSCULAR HEMOGLOBIN

From the above values of hemoglobin and erythrocyte count the mean corpuscular hemoglobin was determined using the formula of Wintrobe⁽¹⁵⁾

$$\begin{array}{l} \text{Mean Corpuscular} \\ \text{Hemoglobin (MCH)} = \frac{\text{Hemoglobin (gm per 1000 cc)}}{\text{Red cell count (million per cu mm)}} \\ \text{micromicrograms} \end{array}$$

The MCH Constant shows whether or not hemoglobin is low or high for the number of red cells.

CHAPTER III

PRESENTATION OF DATA

The data obtained during the study are presented in a series of tables as follows.

Tables I through XIII give the calculations of the dietaries in terms of the energy and major nutrients which were consumed by the patients.

Table XIV summarizes the blood tests including hemoglobin, erythrocyte count, and mean corpuscular hemoglobin.

Table XV shows the initial and final skeletal density in terms of grams of bone material, $3 \text{ Ca}_3(\text{PO}_4)_2 \cdot \text{CaCO}_3$.

TABLE I

SUMMARY OF DATA ON
ENERGY CONTENT OF
INITIAL AND FINAL DIETS

PART A. CLASSES OF CONFORMITY

Class of Conformity of Calories	Summary of Per Centage of Subjects In Respective Classes					
	Men Recommended 2600 Calories		Women Recommended 1800 Calories		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Above Recommendation 25 per cent or more						
Class 1			10.0	20.0	3.5	7.2
Class 2	55.6	50.0	80.0	30.0	14.4	42.8
Class 3	44.4	39.9	10.0	40.0	32.1	39.3
Class 4		11.1		10.0		10.7
Class 5						

PART B. AVERAGE DAILY ENERGY INTAKE (Calories)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
2058	1863	1593	1411	1825	1637

TABLE II

SUMMARY OF DATA ON
PROTEIN CONTENT OF
INITIAL AND FINAL DIETS

PART A. CLASSES OF CONFORMITY

Class of Conformity of Protein	Summary of per Centage of Subjects in Respective Classes					
	Men Recommended 65 grams		Women Recommended 55 grams		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Above Recommendation 25 per cent or more	5.5	22.2		20.0	3.6	21.4
Class 1	66.7	55.6	40.0	40.0	57.2	50.0
Class 2	27.8	16.6	40.0	30.0	32.1	21.5
Class 3		5.6	10.0	10.0	3.6	7.1
Class 4			10.0		3.5	
Class 5						

PART B. AVERAGE DAILY ANIMAL PROTEIN INTAKE (Grams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
49.7	61.3	34.1	43.7	41.6	52.0

TABLE II
(CONTINUED)

PART C. AVERAGE DAILY VEGETABLE PROTEIN INTAKE (Grams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
19.5	14.9	15.5	12.6	17.5	13.7

PART D. AVERAGE DAILY TOTAL PROTEIN INTAKE (Grams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
69.2	76.2	49.6	56.3	59.4	66.2

TABLE III

SUMMARY OF DATA ON AVERAGE
INITIAL AND FINAL INTAKE OF
CARBOHYDRATE AND FAT

PART A. CARBOHYDRATE (Grams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
229.9	187.0	187.2	153.0	208.5	170.0

PART B. FAT (Grams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
90.1	90.3	70.0	66.4	80.0	78.3

TABLE IV

SUMMARY OF DATA ON
CALCIUM CONTENT OF
INITIAL AND FINAL DIETS

PART A. CLASSES OF CONFORMITY

Class of Conformity of Calcium	Summary of Per Centage of Subjects in Respective Classes					
	Men Recommended 0.8 grams		Women Recommended 0.8 grams		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Above Recommendation 25 per cent or more						
Class 1			10.0	20.0	3.5	7.2
Class 2	55.6	50.0	80.0	30.0	14.4	42.8
Class 3	44.4	39.9	10.0	40.0	32.1	39.3
Class 4		11.1		10.0		10.7
Class 5						

PART B. AVERAGE DAILY CALCIUM INTAKE (Grams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
1.13	1.12	0.74	0.91	0.93	1.03

TABLE V

SUMMARY OF DATA ON AVERAGE
INITIAL AND FINAL INTAKE
OF PHOSPHORUS

All Men (Grams)		All Women (Grams)		All Subjects (Grams)	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
13.2	13.0	9.5	9.6	11.3	11.3

TABLE VI

SUMMARY OF DATA ON

IRON CONTENT OF

INITIAL AND FINAL DIETS

PART A. CLASSES OF CONFORMITY

Class of Conformity of Iron	Summary of Per Centage of Subjects in Respective Classes					
	Men Recommended 12 grams		Women Recommended 12 grams		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Above Recommendation 25 per cent or more		5.5				3.5
Class 1	27.7	16.7			17.8	10.7
Class 2	50.0	50.0	10.0	30.0	35.7	42.9
Class 3	22.3	27.8	70.0	70.0	39.3	42.9
Class 4			20.0		7.2	
Class 5						

PART B. AVERAGE DAILY IRON INTAKE (Grams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
11.0	10.4	7.4	8.0	8.6	9.2

TABLE VII
SUMMARY OF DATA ON
VITAMIN A CONTENT OF
INITIAL AND FINAL DIETS

PART A. CLASSES OF CONFORMITY

Class of Conformity of Vitamin A	Summary of per centage of Subjects in Respective Classes					
	Men Recommended 5000 I.U.		Women Recommended 5000 I.U.		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Above Recommendation 25 per cent or more	66.7	94.5	10.0	90.0	46.4	92.9
Class 1	5.5	5.5		10.0	3.6	7.1
Class 2			60.0		3.6	
Class 3	27.8		70.0		42.8	
Class 4			10.0		3.6	
Class 5						

PART B. AVERAGE ANIMAL VITAMIN A INTAKE (International Units)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
2278	9986	1608	8707	1943	9346

TABLE VII
(CONTINUED)

PART C. AVERAGE VEGETABLE VITAMIN A INTAKE (International Units)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
3792	2742	3347	2899	3569	2828

PART D. AVERAGE TOTAL VITAMIN A INTAKE (International Units)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
6421	12728	4955	11106	5512	11917

TABLE VIII

SUMMARY OF DATA ON
THIAMIN CONTENT OF
INITIAL AND FINAL DIETS

PART A. CLASSES OF CONFORMITY

Class of Conformity of Thiamin	Summary of Per Centage of Subjects in Respective Classes					
	Men Recommended 1.8 mg		Women Recommended 1.0 mg		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Above Recommendation 25 per cent or more						
Class 1			30.0	20.0	10.7	7.2
Class 2		5.5	60.0	40.0	21.4	17.8
Class 3	88.8	72.3	10.0	30.0	60.6	57.1
Class 4	11.2	22.2		10.0	7.3	17.8
Class 5						

PART B. AVERAGE DAILY INTAKE OF THIAMIN (Milligrams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
1.10	1.14	0.88	0.75	0.99	0.92

TABLE IX

SUMMARY OF DATA ON
RIBOFLAVIN CONTENT OF
INITIAL AND FINAL DIETS

PART A. CLASSES OF CONFORMITY

Class of Conformity of Riboflavin	Summary of Per Centage of Subjects in Respective Classes					
	Men Recommended 1.6 mg		Women Recommended 1.4 mg		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Above Recommendation 25 per cent or more	55.6	88.8	30.0	70.0	46.4	82.2
Class 1	38.8		40.0	20.0	39.5	7.1
Class 2		11.2	10.0		3.6	7.1
Class 3	5.6		20.0	10.0	10.7	3.6
Class 4						
Class 5						

PART B. AVERAGE DAILY RIBOFLAVIN INTAKE (Milligrams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
2.0	2.0	1.4	1.5	1.7	1.7

TABLE X

SUMMARY OF DATA ON
NIACIN CONTENT OF
INITIAL AND FINAL DIETS

PART A. CLASSES OF CONFORMITY

Class of Conformity of Niacin	Summary of Per Centage of Subjects in Respective Classes					
	Men Recommended 13 mg		Women Recommended 10 mg		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Above Recommendation 25 per cent or more	5.5	5.6	10.0		7.2	3.6
Class 1	11.1	11.1	10.0	40.0	10.7	21.4
Class 2	44.4	72.2	20.0	40.0	35.7	60.7
Class 3	27.8	5.6	50.0	20.0	35.7	10.7
Class 4	11.2	5.6	10.0		10.7	3.6
Class 5						

PART B. AVERAGE DAILY NIACIN INTAKE (Milligrams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
11.2	11.3	8.3	8.9	9.7	10.1

TABLE XI

SUMMARY OF DATA ON
ASCORBIC ACID CONTENT OF
INITIAL AND FINAL DIETS

PART A. CLASSES OF CONFORMITY

Class of Conformity of Ascorbic Acid	Summary of Per Centage of Subjects in Respective Classes					
	Men Recommended 75 mg		Women Recommended 70 mg		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Above Recommendation 25 per cent or more		22.2				14.3
Class 1	50.0	50.0	20.0	10.0	39.3	35.7
Class 2	35.3	5.6	30.0	40.0	32.1	17.8
Class 3		5.6	40.0	50.0	14.3	21.4
Class 4	11.1	11.1	10.0		10.7	7.2
Class 5	5.6	5.6			3.6	3.6

PART B. AVERAGE DAILY RAW ASCORBIC ACID INTAKE (Milligrams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
38	15	30	7	34	11

TABLE XI(CONTINUED)PART C. AVERAGE DAILY COOKED ASCORBIC ACID INTAKE (Milligrams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
28	64	20	46	24	55

PART D. AVERAGE DAILY TOTAL ASCORBIC ACID INTAKE (Milligrams)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
66	79	50	53	58	66

TABLE XII

SUMMARY OF DATA ON
VITAMIN D CONTENT OF
INITIAL AND FINAL DIETS

AVERAGE DAILY VITAMIN D INTAKE (International Units)

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
64	73	40	41	52	57

TABLE XIIISUMMARY OF DATA ON EXCESS
ACID AND BASE CONTENT OF
INITIAL AND FINAL DIETSPART A. AVERAGE DAILY EXCESS ACID

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
33.7	26.9	21.4	21.6	27.5	24.2

PART B. AVERAGE DAILY EXCESS BASE

All Men		All Women		All Subjects	
Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
38.0	34.7	28.6	24.8	33.3	29.7

TABLE XIV

SUMMARY OF DATA

ON HEMOGLOBIN

PART A. HEMOGLOBIN CONCENTRATION

Class of Conformity	Summary of Percentage of Subjects in Respective Classes					
	Men Recommended 12 grams		Women Recommended 12 grams		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Above Recommendation 25 per cent or more	5.5	22.2		20.0	3.6	21.4
Class 1	66.7	55.6	40.0	40.0	57.2	50.0
Class 2	27.8	16.6	40.0	30.0	32.1	21.5
Class 3		5.6	10.0	10.0	3.6	7.1
Class 4			10.0		3.5	
Class 5						

T A B L E X I V
(C O N T I N U E D)

PART B. HEMATOLOGICAL CORPUSCULAR HEMOGLOBIN

Class of Conformity	Summary of Percentage of Subjects in Respective Classes					
	Men Recommended 27-31 micro- micrograms		Women Recommended 27-31 micro- micrograms		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Above Recommendation 25 per cent or more						
Class 1	100	100	88.9	88.9	96.1	96.1
Class 2			11.1	11.1	3.9	3.9
Class 3						
Class 4						
Class 5						

TABLE XV

SUMMARY OF DATA ON
SKELETAL DENSITY

Class of Conformity	Summary of Percentage of Subjects in Respective Classes					
	Men		Women		All Subjects	
	Initial Test	Final Test	Initial Test	Final Test	Initial Test	Final Test
Class 1	6.3				4.2	
Class 2			12.5	12.5	4.2	4.2
Class 3	62.5	50.0	37.5	50.0	54.1	50.0
Class 4	31.2	43.7	50.0	37.5	37.5	41.6
Class 5		6.3				4.2
Average grams of $3\text{Ca}_3(\text{PO}_4)_2 \cdot$ CaCO_3 per cc of bone	0.69	0.64	0.65	0.58	0.67	0.61

CHAPTER IV

DISCUSSION OF FINDINGS

DIETARY INTAKE OF ENERGY AND OF MAJOR NUTRIENTS

The recommendations of the Food and Nutrition Board of the National Research Council⁽¹²⁾ served as the basis for formulating the results in terms of their conformity to the recommendations. The classes are:

A - those above recommended allowances by at least 25 per cent;

Class 1 - those nutrients meeting the recommended allowances;

Class 2 - the nutrients coming from 99 to 75 per cent of the recommended allowances;

Class 3 - the nutrients coming from 74 to 50 per cent of the recommended allowances;

Class 4 - the nutrients coming from 49 to 25 per cent of the recommended allowances;

Class 5 - the nutrients are below 25 per cent of the recommended allowances.

ENERGY INTAKE

The initial intake of calories by the men showed that 55.6 per cent were in Class 2, and 44.4 per cent were in

Class 3, based on the recommendation for those who are not ill. Since these men were not ambulatory except for a short time daily on the part of a very few, as much as 2600 calories were not necessarily required. In the final calorie intake 50 per cent were in Class 2, 38.9 per cent were in Class 3, and 11.1 per cent were in Class 4. None of the men were grossly underweight.

The initial caloric intake of the women showed that 10 per cent were in Class 1, 80 per cent in Class 2, and 10 per cent in Class 3. Again, several of the women were overweight even with a caloric intake of 1800 calories. It was recommended that the calories be reduced. Therefore, in the final test 20 per cent were in Class 1, 30 per cent in Class 2, 40 per cent in Class 3, and 10 per cent in Class 4. Table I, Part A, indicates also that 3.5 per cent of all subjects initially fell in Class 1, 14.4 per cent in Class 2, and 32.1 in Class 3. In the final tests 7.2 per cent were in Class 1, 42.8 per cent in Class 2, 39.3 per cent in Class 3, and 10.7 per cent were in Class 4.

Part B of Table I shows that initially the average intake of all the men was 2058 calories and the final average intake was 1863 calories. Initially, the average intake was 1593 calories for all women and the final average intake was 1411 calories. All subjects showed an average initial intake of 1825 calories and the average final intake was 1637 calories. This table indicates that the medical requirements of a lower calorie diet generally was followed.

P R O T E I N I N T A K E

Table II, Part A, shows that 5.5 per cent of the men initially were 25 per cent above the recommended protein allowances of the Food and Nutrition Board, National Research Council, that 66.7 per cent fell in Class 1, and 27.8 per cent in Class 2. Even with the high percentage meeting or exceeding the protein recommended allowances, it seemed advisable to increase the animal protein, thus increasing the total protein. This was based on the generally accepted belief that older persons should have an increase in protein intake.

In the final records, 22.2 per cent of the men fell in the range which was 25 per cent above the recommended allowances, 55.6 per cent were in Class 1, 16.6 per cent in Class 2, and 5.6 per cent in Class 3.

As has been shown in the Pennsylvania Mass Human Nutrition Studies, the women did not tend to reach their own recommended allowances as did the men. Initially, 40 per cent fell in Class 1, 40 per cent in Class 2, 10 per cent in Class 3, and 10 per cent in Class 4 with respect to protein intake. After the recommendation was made that liver be included in the diet once weekly, and that powdered skim milk be incorporated in recipes whenever possible, the final tests showed 20 per cent of the women to fall in the range of protein intake above the recommendation by 25 per cent, with 40 per cent in Class 1, 30 per cent in Class 2, and 10 per cent in

Class 3. Of All subjects initially, 32.1 per cent fell in Class 2, 3.6 per cent were in Class 3, and 3.6 per cent were in Class 4. After the menu and recipe changes, the final tests showed 21.4 per cent to be 25 per cent above the recommended allowances, 50 per cent in Class 1, 21.5 per cent in Class 2, and 7.1 per cent in Class 3.

Part B of Table II indicates that the average intake of animal protein by all men initially was 49.7 grams and finally 61.3 grams. The average vegetable intake initially was 19.5 grams and finally 14.9 grams. This shows that the total protein intake was increased primarily in animal protein.

This table shows also that the average animal protein intake of all women initially was 34.1 grams and finally 43.7 grams. The average vegetable protein intake decreased from an initial average of 15.5 grams to 12.6 grams. The average animal protein intake of all subjects initially was 41.6 grams; and this was increased to 52.0 grams. The average vegetable protein initially was 17.5; and this was decreased to 13.7 grams.

Part C of Table II shows the total average protein intake of all men increased from the initial 69.2 to the final 76.2 grams. For the women the increase was from the initial 49.6 to the final 56.3 grams. The entire group increased in protein from the initial 54.4 grams to the final 66.2 grams.

C A R B O H Y D R A T E I N T A K E

The carbohydrate intake of the subjects decreased as did the calories from the initial tests to the final tests. The average intake of the men initially was 229.9 grams and finally 187 grams. The average intake of all women decreased from the initial 187.2 grams to the final 153.0 grams. Thus the total initial test for all subjects decreased from 208.5 grams of protein to the final of 170.0 grams as shown in Table III, Part A.

F A T I N T A K E

The fat intake changed very little in the entire study. The average initial intake by all men of 90.1 grams and the final intake was 90.3 grams. This somewhat exceeded the recommendation that fat should not exceed 20 to 25 per cent of the total calories in adults. The initial intake by all women of 70.0 grams and the final intake of 66.4 grams also somewhat exceeded the recommendation since their caloric intake was relatively less. The decrease from the initial test for all subjects of 80.0 grams to the final test of 78.3 grams shows only a very slight decrease. This decrease is an advisable recommendation in considering the total decrease in calories. A recommendation which should be followed in the light of recent scientific findings is that vegetable oils should be substituted for animal fat to a marked extent. See Table III, Part B.

C A L C I U M I N T A K E

The intakes of calcium in Table IV indicate that 50 per cent of the men had 25 per cent more than the recommended allowances, with 39 per cent in Class 1, 5.5 per cent in Class 2, and 5.5 per cent in Class 3, initially. With the addition of powdered milk, the calcium increased to the extent that, in the final tests, 66.7 per cent of the men fell 25 per cent above the recommended allowances, 22.2 per cent fell in Class 1, and 11.1 per cent in Class 2. See Part A of the table.

The women, on the whole, improved their calcium intake from the initial tests of 40 per cent above the recommended allowances 25 per cent, 10 per cent in Class 2, 40 per cent in Class 3, and 10 per cent in Class 4 to the final levels of 40 per cent above the recommended allowances, 20 per cent in Class 1, 20 per cent in Class 2, 10 per cent in Class 3, and 10 per cent in Class 4.

The initial tests showed that, of all subjects, 46.6 per cent fell 25 per cent above the recommendations, 25.1 per cent in Class 1, 7.1 per cent in Class 2, 17.8 per cent in Class 3, and 3.6 per cent in Class 4. The final tests showed a vast improvement, with 57.1 per cent of all subjects 25 per cent above the recommendations, 21.4 per cent in Class 1, 15.3 per cent in Class 2, 3.6 per cent in Class 3, and 3.6 per cent in Class 4.

Part B of the table shows that the average intake of all men initially was 1.13 grams and finally 1.12 grams. For all women, initially the intake was 0.74 grams and finally 0.91 grams. Of all subjects the average calcium intake increased from the initial 0.93 grams to the final test of 1.03 grams. On the average, therefore, calcium intake increased.

PHOSPHORUS INTAKE

The phosphorus weekly intake varied little from the initial to the final intake, in spite of the increase of protein and milk. Table V shows that the average for all men initially was 13.2 grams and finally 13.0 grams. For the women the intake initially was 9.5 grams and finally 9.6 grams. For all subjects the average intake remained the same 11.3 grams both initially and finally.

IRON INTAKE

The iron intake of the men initially showed that 27.7 per cent appeared in Class 1, 50 per cent in Class 2, and 22.3 per cent in Class 3. After the addition of more liver to the menus, the iron intake finally showed that 5.5 per cent fell 25 per cent above the recommendations, 16.7 per cent fell in Class 1, meeting the recommendations, 50 per cent fell in Class 2, and 27.8 per cent in Class 3.

The iron intake of the women initially showed that 10 per cent fell in Class 2, 50 per cent in Class 3, and 20 per cent in Class 4. In the final tests 30 per cent fell in Class 2, and 30 per cent in Class 3.

The iron intake of all subjects, as shown in Table VI, Part A, initially found 17.8 per cent in Class 1, and 35.7 per cent in Class 4. The final tests showed an increase of 3.5 per cent falling above 25 per cent of the total, 10.7 per cent fell in Class 1, 42.9 per cent in Class 2, and 42.9 per cent in Class 3.

Part B showed that the average iron intake for men decreased from an average of 11.0 milligrams initially to 10.4 milligrams in the final test, but that the iron intake for women increased from the initial average of 7.4 milligrams to 8.0 milligrams. The total for all subjects increased from the initial 8.6 milligrams to the final test of 9.2 milligrams.

V I T A M I N A

The amount of vitamin A intake was changed markedly from the initial tests. The initial test for the men showed 66.1 per cent in the class representing 25 per cent above the Vitamin A recommendations, 5.5 per cent fell in Class 1, and the remaining 27.8 per cent fell in Class 3. By adding more liver to the diet, the final tests showed 94.5 per cent of

the men in the classification of those 25 per cent above recommendations; and 5.5 per cent fell in Class 1.

The women also showed a similar change in their intakes of vitamin A during the study. The initial tests showed 10 per cent of the female subjects in the class which represented a level of intake 25 per cent above the recommendations, with 10 per cent in Class 2, 70 per cent in Class 3, and 10 per cent in Class 4. In the final tests was revealed the fact that 90 per cent were in the class 25 per cent above the recommendations; and the other 10 per cent fell in Class 1.

The percentages of all subjects in the initial tests included 46.4 per cent in the class of those 25 per cent above the recommendations, with 3.6 per cent in Class 1, 3.6 per cent in Class 2, 42.8 per cent in Class 3, and 3.6 per cent in Class 4. In the final tests, 92.9 per cent of all subjects appeared in the class of those 25 per cent above recommendations; and 7.1 per cent were in Class 1. See Table VII, Part A.

Part B of Table VII shows an interesting contrast in the intake of animal and vegetable forms of Vitamin A. In the initial test, an average of 2278 International Units of Vitamin A came from animal and 3792 from vegetable sources for the men. In the final tests, 9986 International Units were derived from animal and only 2742 from vegetable sources.

The women also increased their vitamin A intake markedly. In the initial tests, 1608 International Units came from

animal and 3347 from vegetable sources. In the final tests, 8707 International Units came from animal and 2899 from vegetable sources.

The average for all subjects was changed from the initial diet records of 1943 International Units of animal vitamin A and 33569 of vegetable vitamin A. This changed to 9346 International Units of vitamin A from animal and 2828 from vegetable sources in the final tests.

In Part C of Table VII, the average total vitamin A intake for the men was doubled from the initial tests of 6421 to the final tests of 12,728 International Units. The women's intake was more than doubled, from an initial test of 4955 to the final test of 11,106 International Units. Thus the average total intake for all subjects was changed from the initial intake of 3512 to the final intake of 11,917 International Units.

THIAMINE INTAKE

The thiamine intake of all subjects was in need of improvement as indicated from the initial test. Of the men, 88.8 per cent fell in Class 3 and 11.2 per cent in Class 4. In Class 1 there were 30 per cent of the women, with 60 per cent in Class 2, and 10 per cent in Class 3. Table VIII, Part A, shows also that 10.7 per cent of all subjects appeared in Class 1, 21.4 per cent in Class 2, 60.6 per cent in Class 3,

and 7.3 per cent in Class 4, initially. While a small amount of improvement was indicated in the final tests, the reduction of calories seemed to reduce the total food intake, such as breads and cereals, containing the B-complex vitamins. The final tests for the men showed 5.5 per cent of them to be in Class 2, 72.3 per cent in Class 3, and 22.2 per cent in Class 4. The final tests for the women showed 20 per cent to be in Class 1, 40 per cent in Class 2, 30 per cent in Class 3, and 10 per cent in Class 4. The final tests for all subjects showed 7.2 per cent to be in Class 1, 17.8 per cent in Class 2, 57.2 per cent in Class 3, and 17.8 per cent in Class 4.

Part B of Table VIII showed that the average intake for the men remained at 1.1 milligram initially and finally. The thiamine intake of the women decreased from the initial test of 0.88 to 0.75 milligrams in the final tests. The average intake for all subjects therefore decreased. The initial test included an average of 0.99 milligrams and the final test was 0.92 milligrams.

RIBOFLAVIN INTAKE

The intake of riboflavin showed some improvement during the study. The initial test of the men showed that 55.6 per cent fell in the class in which 25 per cent fell above the recommendations; 38.8 per cent fell in Class 1, and 5.6 per

cent in Class 3. Since the breads and cereals were decreased in the diet, the addition of powdered skim milk aided in the maintenance and improvement of the riboflavin intake. In the final tests, 88.8 per cent of the men were consuming 25 per cent above the recommendations for riboflavin.

The women also improved in riboflavin intake for the same reasons. In the initial tests, 30 per cent fell in the highest class, that which was 25 per cent above the recommendations, with 40 per cent in Class 1, 10 per cent in Class 2, and 20 per cent in Class 3. In the final tests, 70 per cent fell in the class which was 25 per cent above the recommendations, with 20 per cent in Class 1, and 10 per cent in Class 3 for riboflavin.

The initial tests showed that 46.4 per cent of all subjects were 25 per cent above the recommended allowances in riboflavin ingestion; 39.3 per cent were in Class 1, 3.6 per cent were in Class 2 and 10.7 per cent were in Class 3. In the final tests, 82.2 per cent fell 25 per cent above the recommendations, 7.1 per cent were in Class 1, 7.1 per cent in Class 2, and 3.6 per cent were in Class 3. See Table IX, Part A.

Part B of Table IX shows that the average intake of riboflavin changed very little. The initial and final intake of the men was 2.0 milligrams. The initial test of the women showed 1.4 milligrams on the average and the final test showed

an average intake of 1.5 milligrams. Therefore, the initial and final average of all subjects was 1.7 milligrams of riboflavin.

NIACIN INTAKE

The intake of niacin improved only slightly during the course of this study, according to Table X. In the initial intakes, 5.5 per cent of the men were 25 per cent above the recommendations for niacin; 11.1 per cent were in Class 1, 44.4 per cent were in Class 2, 27.8 per cent were in Class 3, and 11.2 per cent were in Class 4. In the final tests, 5.6 per cent were 25 per cent above the recommendations, 11.1 per cent were in Class 1, 72.2 per cent were in Class 2, 5.6 per cent were in Class 3, and 5.6 per cent were in Class 4.

The intake of niacin for the women was as follows; In the initial tests 10 per cent were 25 per cent above the recommendations, 10 per cent were in Class 1, 20 per cent were in Class 2, 50 per cent were in Class 3, and 10 per cent were in Class 4. In the final tests, 40 per cent were in Class 1, 40 per cent were in Class 2, and 20 per cent in Class 3.

In the initial tests, 7.2 per cent of all subjects were 25 per cent above the niacin recommendations, 10.7 per cent were in Class 1, 35.7 per cent were in Class 2, 35.7 per

cent were in Class 3, and 10.8 per cent were in Class 4. In the final tests, 3.6 per cent were 25 per cent above recommendations, which also had 21.4 per cent in Class 1, 60.7 per cent in Class 2, 10.7 per cent in Class 3, and 3.6 per cent in Class 4.

The average daily intake, as shown in Part B of Table X, showed a slight increase. The men in the initial test consumed 11.2 milligrams and in the final test 11.3 milligrams. The women increased from 8.3 in the initial test to 8.9 milligrams in the final test. Thus the average for all subjects increased from the initial test of 9.7 milligrams to 10.1 milligrams in the final tests.

ASCORBIC ACID INTAKE

The deficiency of ascorbic acid intake in this study was similar to that of ascorbic acid in studies of other institutions. It was very low initially; and there still was room for improvement when the study closed. The initial study showed that 50 per cent of the men were in Class 1, 33.3 per cent in Class 2, 11.1 per cent in Class 4, and 5.6 per cent in Class 5. In the final test 22.3 per cent were 25 per cent above the recommendations, while 50 per cent fell in Class 1, 5.6 per cent in Class 2, and 5.6 per cent in Class 5.

The initial test of the women showed 20 per cent to be in Class 1, 30 per cent in Class 2, 40 per cent in Class 3, and 10 per cent in Class 4. In the final tests, 10 per cent were in Class 1, 40 per cent in Class 2, and 50 per cent in Class 3.

The initial intakes of ascorbic acid by all subjects showed 39.3 per cent to be in Class 1, 32.1 per cent in Class 2, 14.3 per cent in Class 3, 10.7 per cent in Class 4, and 3.6 per cent in Class 5. A slight improvement was shown in the final tests. There were 14.3 per cent 25 per cent above the recommendations, 35.7 per cent in Class 1, 17.8 per cent in Class 2, 21.4 per cent in Class 3, 7.2 per cent in Class 4, and 3.7 per cent in Class 5. See Table XI, Part A.

Part B of Table XI shows that while the ascorbic acid intake increased on a calculation basis, most of the foods were cooked rather than served raw. This was due in part to the poor dental situation of many patients. In the initial tests, of all the men 38 milligrams of ascorbic acid came from raw and 28 milligrams from cooked foods. In the final tests, 15 milligrams came from raw and 64 milligrams from cooked foods. In the initial tests, all the women consumed 30 milligrams of raw ascorbic acid and 20 milligrams cooked. In the final tests, 7.0 milligrams of ascorbic acid came from raw and 47 from cooked sources. The initial tests of all subjects showed 34 milligrams raw and 24 from cooked sources. The final tests showed a ratio of 11 to 55 milligrams from the two sources.

Part C of Table XI shows a definite increase in the intake of total ascorbic acid. The initial tests for men showed 66 milligrams and the final test showed 79 milligrams. The initial tests of the women showed 50 and 53 milligrams for the two respective tests. The initial intakes of all subjects was 58 milligrams and the final tests showed 66 milligrams. This is a nutrient which still needs more consideration.

V I T A M I N D I N T A K E

A few of the patients were ambulatory a part of the time and could obtain vitamin D from the sun; but since many of them can not get in the sun, it was of interest to see how much vitamin D was obtained from the food. Table XII shows that the average intake of all men initially was 64 and finally 73 International Units. The average intake of all women was 40 initially and 41 International Units in the final tests. The average intake of all subjects in the initial test was 52 and in the final test 57 International Units.

A C I D B A S E B A L A N C E

The excess acid and base balances are important in some diseases, and for this reason the average excess of each are shown in Table XIII, Parts A and B. In Part A the initial test of men was 33.7 cc and final test 26.9 cc. The initial test of women showed 21.4 cubic centimeters initially and

21.6 cubic centimeters in the final tests. The initial tests of all subjects showed 27.5 cubic centimeters and the final tests 24.2 cubic centimeters. In Part B the initial tests showed 38 cubic centimeters of excess base, and the final tests showed 34.7 cubic centimeters for all men. The initial test of all women show 28.6 cubic centimeters and the final 24.8 cubic centimeters. The initial test of all subjects showed 33.3 cubic centimeters and the final test 29.7 cubic centimeters.

M E D I C A L O B S E R V A T I O N S

HEMOGLOBIN CONCENTRATION

Hemoglobin levels of the subjects in this study were high, both initially and finally, as is shown in Table XIV. The average hemoglobin values for men were 14.8 grams per 100 milliliters of blood initially, and 14.2 grams of hemoglobin per 100 milliliters of blood finally. The values for women were 12.8 grams of hemoglobin per 100 milliliters of blood initially and 12.8 grams at the close of the study.

Initially 23.5 per cent of the men were in the class 25 per cent above the recommendations, 70.5 per cent were in Class 1, and 6.0 per cent were in Class 2. In the final study 41.1 per cent were in the class 25 per cent above the recommendation, 52.9 per cent were in Class 1, and 6.0 per cent

in Class 2. The women showed a similar increase. Initially 88.9 per cent of the women were in Class 1 and 11.1 per cent were in Class 2. In the final study 11.1 per cent were in the class 25 per cent above the recommendations, 77.8 per cent were in Class 1, and 11.1 per cent were in Class 2.

Taking all the subjects together 15.4 per cent initially were in the class 25 per cent above the recommendations, 76.9 per cent were in Class 1, and 7.7 per cent were in Class 2. In the final tests 30.8 per cent were in the class 25 per cent above the recommendations, 61.5 per cent were in Class 1, and 7.7 per cent were in Class 2.

HEMATOLOGICAL CORPUSCULAR HEMOGLOBIN

The mean corpuscular hemoglobin factor was high in most subjects. The initial and final values were normal or above normal in all cases. See Table XIV, Part B.

SKELETAL DENSITY (OS CALCIS)

The average of all subjects for skeletal density initially was 0.67 grams of $\text{Ca}_3(\text{PO}_4)_2 \cdot \text{CaCO}_3$ per cubic centimeter of bone. Finally the average was 0.61 grams. See Table XV. It is questionable whether the decrease in bone density was due entirely to diet. Research has indicated that the calcium

does not stay in equilibrium in the bone if the body is immobile. Since a great majority of these patients are immobile this fact should certainly be considered.

S U M M A R Y

A nutrition study was conducted using medical-nutrition tests and observations concurrently with an evaluation of food consumption as a means of finding the interrelationship of food intake and some aspects of nutritional status of 28 geriatric patients in the Dallas City-County Convalescent Home. The group was composed of 18 men and 10 women.

It was desired also to learn how the menus and recipes could be altered to fulfill better the nutritional needs of this age group.

A detailed record of the total intake of all foods consumed by each person was kept for a one-week period at the beginning of the study. These records included between-meal snacks as well as food eaten at meal time. The total dietary intake was calculated from tables of averages for energy and major nutrients.

Personnel of the field x-ray unit of the Nelda Childers Stark Laboratory for Human Nutrition Research, College of Household Arts and Sciences, at Texas Woman's University took x-rays of the os calcis for a study of bone density. The technicians in the hematology laboratory of Parkland Memorial Hospital collected and analyzed the blood for hemoglobin and red cell count.

The diet records and medical-nutritional observations showed that there were evidences of deficiencies in many aspects of nutrition status related to the major nutrients.

The author made recommendations as to menu planning, and furnished more recipes and recipe material so that the diet furnished the patients would furnish a more concentrated form of the nutrients. The diet study and the medical-nutrition observations and tests were repeated at the close of the study for comparative purposes.

When the diets were calculated, it was found that improvement in intake was found at the conclusion of the study, even though initial values tended not to be extremely low in most cases. Energy intake in general was less than that recommended, however, not undesirable in this group of people. The average protein intake increased. The intake of carbohydrate decreased along with the decrease of calories. Fat remained fairly constant and was only slightly above the recommended level.

The increase of calcium in the final tests was due to the addition of the powdered skim milk in recipes. The phosphorus level was fairly constant.

The subjects' iron intake, while not high, was increased with the use of liver in the diet.

Vitamin A markedly increased in the diet because of the increased use of liver. The animal form of vitamin A showed a high increase.

The men and women decreased somewhat in their average intake of thiamine, which may be due to the decrease in carbohydrates.

The intake of riboflavin remained constant, as did also the intake of niacin.

Ascorbic acid which was lacking in the first study also remains as an area which needs more work in further work with these patients.

All in all, the subjects of the study made distinct improvements in their dietary intakes during the course of this investigation.

The maintenance of high hemoglobin levels indicates that this area was satisfactory. The demineralization of the bones, however, indicates that more work in this area would be of great value. The decrease in bone density undoubtedly was related to the immobility of the patients. These tests indicate that the recommendations and recipe adaptations were worthwhile and that many factors of improvement and suggestions can be made to the dietitian in charge of the patients in the new location.

B I B L I O G R A P H Y

- (1) Bowes, Anna dePlanter, and Church, Charles F. Food Values of Portions Commonly Used, 8th Edition. Anna dePlanter Bowes, 7th and Delaney St., Philadelphia 6, Pennsylvania. (1956)
- (2) Gibbs, June. Nutrition Study Involving 28 Geriatrics Subjects in Declining Families, M.A. Thesis, College of Household Arts and Sciences, T.S.C.W., (1956)
- (3) Hawk, Philip B. Practical Physiological Chemistry, Sixth Edition, P. Blakeston's Son and Company, (1918)
- (4) Hawk, Philip B., Oser, Bernard, and Summerson, William H. Practical Physiological Chemistry, 12th Edition, Blakeston Company, (1947)
- (5) Mack, Pauline Beery, Comparison of Meat and Legumes in A Controlled Feeding Program, Parts IV, V, VI. Journal of American Dietetic Association, 25:848, 943, 1017. (1949)
- (6) Mack, Pauline Beery, Brown, Walter N., and Trapp, Hughes Daniel. The Quantitative Evaluation of Bone Density, American Journal of Roentgenology and Radium Therapy, 611, 808, (1949)
- (7) Mack, Pauline Beery, and Liene, Julia. They Never Suspected. Bulletin of Westinghouse Electric Corporation, (1948)
- (8) Mack, Pauline Beery, and Shevock, Veronica Delores, and Tomasetti, Madelyn Rochina. Comparison of Meat and Legumes in a Controlled feeding Program, Part I, Dietary Plan, Journal of American Dietetic Association, 23:488, (1947)
- (9) Mack, Pauline Beery, Shevock, Veronica Delores, and Tomassetti, Madelyn Rochina, Part III, Discussion of Findings, Journal of American Dietetic Association, 23: 677, (1947)

- (10) Mack, Pauline Beery, Shevock, Veronica Delores, and Tomasseti, Madelyn Rochina, Part II, Medical, Dental, and Laboratory Studies, Journal of American Dietetic Association 23:588, (1947)
- (11) Mack, Pauline Beery, Urbach, Charles C., Eliel, Doris Russell, Stewart, H.H., and Dodds, Paul A. A Contribution to Study of Nutritional Status in Rural and Urban Populations, The Pennsylvania State College Bulletin, Number 52, (1952)
- (12) National Research Council Food and Nutrition Board, Recommended Dietary Allowances, Revised 1953 National Academy of Sciences. National Research Council Publication No. 302, (1953)
- (13) Nelson, James D., Mack, Pauline Beery, Vose, George. A New Microdensitometric Method for Measurement of Bone Density, (To be published)
- (14) Thieman, Annelise M.B. A Study of Some Aspects of Geriatric Nutrition, Ph.D. Dissertation, College of Household Arts and Sciences, Texas State College for Women, (1954)
- (15) Wintrobe, M.M. Clinical Hematology, Second Edition, Leo and Fibiger, Philadelphia, (1940)
- (16) Wong, San Yin, Colorimetric Determination of Iron and Hemoglobin in Blood, Journal of Biological Chemistry, 77:409, (1928)
- 0550