HEMOGLOBIN CONCENTRATIONS AND PROTEIN, CALORIE, AND IRON INTAKES OF STUDENT NURSES AT ST. JOSEPH'S HOSPITAL IN FLINT, MICHIGAN

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INTRODUCTION

Surveys of eating habits of teenage young women have been made in recent years to appraise nutritional status. There is growing concern for the nutritional status of this group since many girls marry before they are out of their teens and may be subject to the extra nutritional needs of pregnancy while still in their teens.

Intakes of protein and iron are of special interest during late adolescence and pregnancy. Nutrition studies of college women have been reported, and some studies have been made of student nurses. Cursory studies of the diet habits of student nurses have been made over the past three years by the writer involving students enrolled in nutrition classes. It was observed that many of these students had poor nutrition patterns. This study of dietary practices and nutritional status of student nurses was planned with these objectives:

1. To explore dietary habits and actual food consumption as reported in two separate one-day recall records made within a three month interval.
2. To learn whether there were any changes in the students dietary habits as the result of a semester course in foundations of nutrition and other phases of health education.
3. To attempt to discover the general nutritional level as shown by height, weight, and hemoglobin concentration.
4. To determine, if possible, the effect of iron and protein intake on hemoglobin concentration.
5. To compare calculated intake of some food nutrients (protein and iron) with findings in literature, and with recommended allowances of the National Research Council.
6. To add to present information certain data obtained from a study of healthy student nurses.

REVIEW OF LITERATURE

Dietary Survey Methods

The use of several methods simultaneously in the evaluation of a group yields a more complete picture than does the use of a single determination. For a group it is possible to use the 24-hour recall method to determine a representative food intake. In assessing individual food intake, the more detailed three or seven day dietary records or dietary histories reveal a more accurate picture.

Charlotte Young (1) and others using data gathered from 1947 - 1958 from five northeastern states representing seventh, eighth, and ninth grade, high school and college students, pregnant women and male industrial workers, made a comparison between dietary intakes as obtained by dietary histories and by seven-day records for the same subjects. It was found that the dietary history did not give the same estimate of intake for an individual as the seven-day record but differences between methods when applied to college home economic students were much smaller.

The same group (2) made a comparison of the use of the dietary history versus 24-hour recall, and the seven-day record versus 24-hour recall, as methods of estimating the nutrient intake of an individual and a group. Data for these comparisions were obtained from three different population groups: grade school children, high school and college students, and pregnant women.

For an individual in any of the three population groups studied, the 24-hour recall did not give the same estimate of intake as the dietary history, nor the same estimate of dietary intake as the seven-day record. The history and 24-hour recall gave results which were in better agreement for the college group studied. For the mean of a group, the seven-day

record and the 24-hour recall tended to give the same estimate for the dietary intake for most nutrients. Under certain circumstances, it is possible to substitute the 24-hour recall for the seven-day record in estimating group intakes. When an estimate of the mean intake of a group of roughly fifty persons is desired, and when an error of 10% can be tolerated, the shorter simpler 24-hour recall may be used.

Faith Chalmers and others (3), used the same study of the nutritional status in the northeastern part of the United States and attempted to answer the question of how many and which days should be used in a dietary record. For characterizing a group by its mean intake, a one-day record was found to be the most efficient. No "day effect" could be discerned except in the college group which had a lower intake over the weekend.

Three papers in the American Journal of Public Health (4)(5)(6) analyzed the present status of dietary surveys and suggested improvements in presently used methods.

Young and Trulson (4) came to the conclusion that because of the doubtful validity of current methods of dietary surveys it was difficult to evaluate their usefulness. Secondly, it was evident that new methods would serve a useful purpose.

In further discussion of the (5) accuracy of current methods Whiting and Leverton have compared results of collecting and processing dietary data by two methods: Laboratory analysis and calculation from food-value tables. Laboratory analysis is expensive and time consuming but the most accurate. For the food tables, if reliable results are to be obtained, common or usual foods simply prepared must be used, descriptions must be accurate and adequate times of study and adequate numbers of individuals must be used.

As a partial solution to some of these problems, Wiehl and Ried (6) have considered the development of new and improved methods of obtaining dietary information. The suggested a short schedule of simple questions to be developed and field tested in an effort to find a practical means for obtaining information needed to classify individuals according to dietary practices.

The record would not be designed for analysis of quantative estimate but would permit grading of items into four or five categories. The short questionaire for this study would be identified by simple non-technical questions and planned so that broad differences could be recognized.

There was a chance for error in the 24-hour recall method in assuming that the subjects could estimate the size of portions eaten. In the study made by Charlotte Young and others (7), as a report of one of a series growing out of the Northeastern Regional Research Project NE-4, it was determined that on a group basis calculated nutritive values of estimated and measured food intakes showed small and inconsistent differences in most cases.

REVIEW OF LITERATURE

Reported Food Intakes of Young Women

A review of studies of the food intakes of young women, chiefly college students, shows considerable variation in data reported. Odland (8) and others reported in 1955 the results of a study of seven day food records made by 100 Freshmen women at Montana State College. Their records showed a mean daily intake of 2,060 calories, 74 grams of protein, and 10 milligrams of iron. The range of intakes was from 560 to 4,980 calories, 27 to 154 grams of protein, 6 to 25 milligrams of iron. Another study reported by Fry (9) in 1959 showed that 144 dental hygienists, ranging in age between 18 and 25 years (81% 18 - 20 years old), who completed a seven day record of their daily food intake, had a mean caloric intake of 2024 calories, 71 grams of protein and 11.05 milligrams of iron. Scoular and Fosters (10) reported in 1946 the results of a study of 106 college women from Texas whose mean age was 18.2 years. Data was collected by means of fourteen day food records covering two periods. The study showed a mean caloric intake of 2445 calories, 93.9 grams of protein and 18.20 milligrams of iron for the first period, and a mean intake of 2410 calories, 99 grams of protein, and 22 milligrams of iron for the second period. Fourteen college girls were studies in Rhode Island (7) for one day, during which they recorded their food intake at the college cafeteria. The mean of their measured caloric intake was 1,670 calories, the mean protein intake 56.7 grams, the mean iron intake 8.1 milligrams. Marin (11) studied a group of 71 student nurses who compiled seven day food records. Their mean caloric intake was reported as 1699 calories, the mean protein intake 60.1 grams. Forty-five student nurses from Flint (12) who studied at Flint Junior College in 1960, used the twenty-four

hour recall method and recorded their food intake in a nutrition laboratory class session. Their caloric intake ranged from 1600 to 2450 calories with a mean of 2100 calories, the protein intake ranged from 58 to 142 grams, with a mean of 95 grams, the iron intake ranged from 7.5 milligrams to 21.6 milligrams, with a mean of 12 milligrams. Dietary studies of young women of college age, 16 - 20 years, in New York, Maine, Rhode Island, West Virginia, and Montana as reported by the State Agricultural Experiment Stations (12) from 1947 through 1958 revealed a mean intake of 2000 calories, 75 grams of protein and 11 milligram of iron.

Hemoglobin

Estimations of hemoglobin concentration and erythrocyte count are common laboratory procedures used in the assessment of the status of nutrition. Donelson (14) reported in 1945 on the nutritional status of 4550 college women in the Midwestern states, Iowa, Kansas, Minnesota, Nebraska, Oklahoma, and Wisconsin. The mean hemoglobin concentration was 13.4 grams per 100cc with a mean range of 13.0 grams to 13.7 grams. Women college students 16 - 20 years in (13) Maine, Rhode Island, and West Virginia had mean hemoglobins of 13 grams per cent, 12.5 grams per cent and 13 grams per cent respectively per 100cc of blood. Marin's study (11) showed a mean hemoglobin concentration of 13.7 grams with a range of 11.5 grams to 15.8 grams per 100 ml.

Odland and Ostle (15) reported in 1956 the results of clinical and biochemical studies of 112 Montana fifteen year old girls. Mean hemoglobin levels were 13.5 grams and 14.6 grams per 100cc respectively for two regions. Iron intake and hemoglobin laval were correlated at the 1 per cent level of significance ($r = 0.300$) for all students. McAllister and Molsberry (16) reported in 1947 hemoglobin concentrations ranging from 12.01 to 15.52 grams per 100cc of blood,

with a mean of 14.20 ± 0.79 gram for thirty college women studied. These women were students at Virginia Polytechnic Institute. Their ages ranged from 17 to 26 years with a mean of 19 years. Gutowska and Ellms (17) studied 161 girls ranging from 17 to 22 years. Data on hemoglobin concentration, determined by the acid hematin method showed the range of hemoglobin varied from 9.5 to 16.0 grams per 100 ml. of blood, with a mean value of 13.8 grams. Sheets and Barretine (18) studied the hemoglobin concentration of 604 Mississippi college women ranging in age from 16 to 20 years in 1944. Using the acid hematin method of Newcomer for the determination of hemoglobin, concentrations ranged from 8.8 to 15.7 grams per 100cc of blood, with a mean of 12.4 grams.

Summary

A review of the literature of the last fifteen years reveals that information concerning dietary practices and nutritional status of a population group can be obtained by using dietary history, food intake records, and a twenty-four hour recall method. For a group, the last method, which is less time consuming can serve to identify food intakes representing a group pattern. If the record does not include a Saturday or Sunday for college girls studied, any other day may be chosen for the study. Estimating the food intake is as accurate as weighing the food intake in obtaining a group mean for nutrients.

At least fifty subjects and preferably one hundred subjects are needed to study a groups dietary intake. The group in this study is small and so may not be representative. College students have served as subjects for many of the recent nutrition studies of young women. Since nurses in training are within the age range of college students and engage in moderate activity,

results of college studies were used for comparison with findings of the present study along with two (11) (12) other studies of student nurses and one study of dental hygienists. (9)

EXPERIMENTAL PROCEDURE

Subjects

Students enrolled in St. Josephs Hospital School of Nursing, Flint, served as experimental subjects for this survey of nutritional status and dietary patterns. Data were obtained from 38 students who lived in the nurses dormitory and ate most of their meals in the hospital cafeteria.

Diet Records

In February, students were asked to fill out a food intake form, using the 24-hour recall method, during the first nutrition laboratory class period of the semester. In May, a second one-day intake was recorded. From these records the calories, iron, and protein were calculated and entered on a form. For additional information, menus and recipes of foods served on the day studies were made were obtained from the hospital dietitions.

Height & Weight Records

Heights and weights of subjects were obtained during the weeks of the recorded food intakes. Subjects were weighed without shoes and while wearing ordinary clothing. A sliding rule attached to the scale was used in measurement of heights which were taken also without shoes. Records of entrance weights and monthly weights through the first year of training were obtained from the school records.

Hemoglobin

The hemoglobin concentration of the blood was determined twice for each subject. One sample was taken in September when the student entered the school, and a second sample was taken in June at the end of the school year.

The samples for the tests were drawn from a 7cc tube of blood taken for general hematology from the vein in the laboratory. Tests for hemoglobin were determined the same day.

The cyanmethemoglobin method (19) for determining the grams per cent of hemoglobin in 100 ml of blood was used. In using this method, an accurately measured volume of blood (0.02 ml) was diluted in an accurately measured volume of the diluent (4.ml). The diluent, Drabkin's diluent solution, consists of Na HCo_3 3 gm., potassium cyanide (KCN) 150mg., potassium ferricyanide ($K_3Fe(CN)_6$) 600 mg., and distilled water to three liters. The hospital laboratory made up its own solution, it was discarded when it became turbid, stored in a brown bottle and a fresh solution was made up each month.

Ferricyanide converted the hemoglobin iron from the ferrous to the ferric state to form methemoglobin, which then combined with potassium cyanide to produce the stable pigment, cyanmethemoglobin. These two reactions were rapid and staichiometric.

The diluent was used in the amount of 4.0 ml to 0.02 ml of blood, a 1:201 dilution. In this method there was $\pm$ 1% accuracy, .5 gram reproducibility, 98% accuracy to answer the objectivity of the test, and the test is specific since it measured total hemoglobin (19).

The optical density of this unknown solution was then compared with that of the standard using an electrophotometer. The optical density was taken to be directly proportional to the concentration of the pigment. The color

intensity was measured in Bausch and Lomb electrophotometer set at the 540 mu band. Cyanmethemoglobin because of its broad absorbtion band in the region of 540 mu is adaptable to photometry and solutions if the pigment are stable.

The determination of the optical density at various wave lengths of a dilute solution of a hemolysed normal blood (standard) and the repetition of this same procedure in the unknown sample gave the grams % of hemoblobin in the sample.

The standard of reference was crystalline human hemoglobin prepared by the method of Darabkin (20). This was a solution containing 1 milliatom of hemoglobin iron per liter which has a millimolar extinction coefficient of 11.5 in a one centimeter absorbtion cell at a wave length of 540 mu when measured as cyanmethemoglobin. The iron content of hemoglobin is assumed to be 0.335 per cent, which corresponds to an equivalent weight for hemoglobin of 16,700 per atom of iron.

PRESENTATION OF DATA AND DISCUSSION

Food Intake Records

In February at the beginning of the semester course in nutrition, 38 student nurses were asked to record all food eaten in the previous 24 hours; using the recall method. Amounts of food eaten were estimated except for milk which was available in half pint and pint cartons.

The daily intake of calories, proteins, and iron was calculated by use of Composition of Foods, the United States Department of Agriculture, Handbook # 8.

A second 24-hour recall was made in May following four months of nutrition education to see if there had been any changes in intake or dietary patterns.

The subjects were divided into three groups according to height; Short (58-61"), Medium (62-64"), and Tall (64.5 - 68.5").

TABLE 1 - AVERAGE CALORIES, IRON, AND PROTEIN

	PERIOD	CALORIES AVERAGE INTAKE I	CALORIES AVERAGE INTAKE II	IRON AVERAGE INTAKE I	IRON AVERAGE INTAKE II	PROTEIN AVERAGE INTAKE I	PROTEIN AVERAGE INTAKE II
GROUP I SHORT- 61" OR LESS	(8)	1622	1838	8.3	9.6	67.8	75.6
RANGE		1048-2242	1297-2854	5.3-15.9	6.9-13.1	40.7-100.0	62.4-112.0
GROUP II MEDIUM- 62 - 64"	(10)	1957	1811	10.4	9.4	69.0	74.0
RANGE		1265-2972	1402-2417	6.6-15.8	7.0-13.3	50.8-87.0	47.2-90.4
GROUP III TALL- 64.5 - 68.5"	(20)	1925	1819	9.08	9.61	73.5	76.0
RANGE		1038-3122	1101-3923	7.2-13.1	3.4-14.9	48.4-112.2	41.1-125.9

CALORIC INTAKES

Intake of calories ranged from 1100 to 3925, with a mean of 1886 the first period and 1914 the second period for the whole group. Average caloric intakes in the first period ranged from 1622 for the short girls to 1957 for the girls of medium height and 1925 for the girls of tall height. The second period the mean for all groups was much the same, for the short girls 1838, the medium girls 1811, and the tall girls 1819. Students from all three groups were represented by high and low calorie intakes. The nine girls who were overweight in the first period had a mean intake of 1721 calories while the five who were underweight had a mean intake of 1264 calories.

In the second period the nine overweight girls had a mean intake of 1634 calories while the five who were underweight had a mean intake of 1731 calories. These are small numbers for a sampling but the overweight girls lost a total of 26 pounds in the four months, the underweight girls gained only 5 pounds.

The average caloric intake of this group of young women for the period studied was lower than in most studies reported, except for the group of nurses studied by Marin, whose mean intake was 1699 calories. Most other studies of food consumption have reported an average intake of about 2000 calories for college students in this age range.

Recommended dietary allowances for this group are higher than the mean intake found for this moderately active group of girls, the recommended intake is 2400 calories.

A summary of the calculated average dietary intake of this group of student nurses is presented in Table 1.

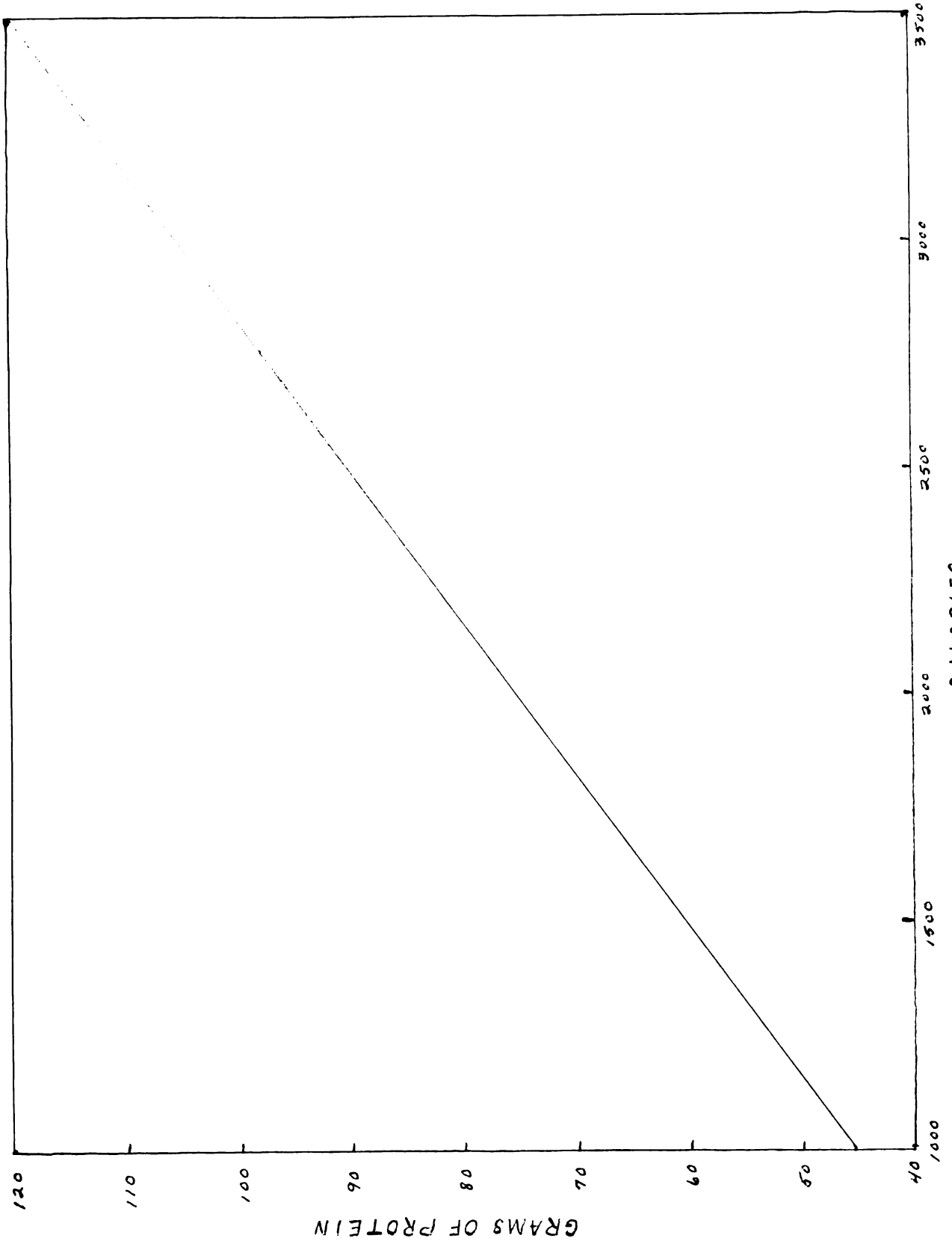
PROTEIN INTAKES

Protein intakes ranged from 40.7 grams reported by one student in the short group to 125 grams reported by a student in the tall group. Average intakes ranged from 67.8 grams for the short group to 76 grams for the tall group. The mean protein intake in the first period for the whole group was 69.5 grams, in the second period the mean was 75.3 grams. In the first period 92% of the 38 students had a protein intake which was two-thirds or more of the recommended allowance. In the second period 89% of the students had a protein intake that represented two-thirds or more of the recommended allowance of 75 grams of protein daily.

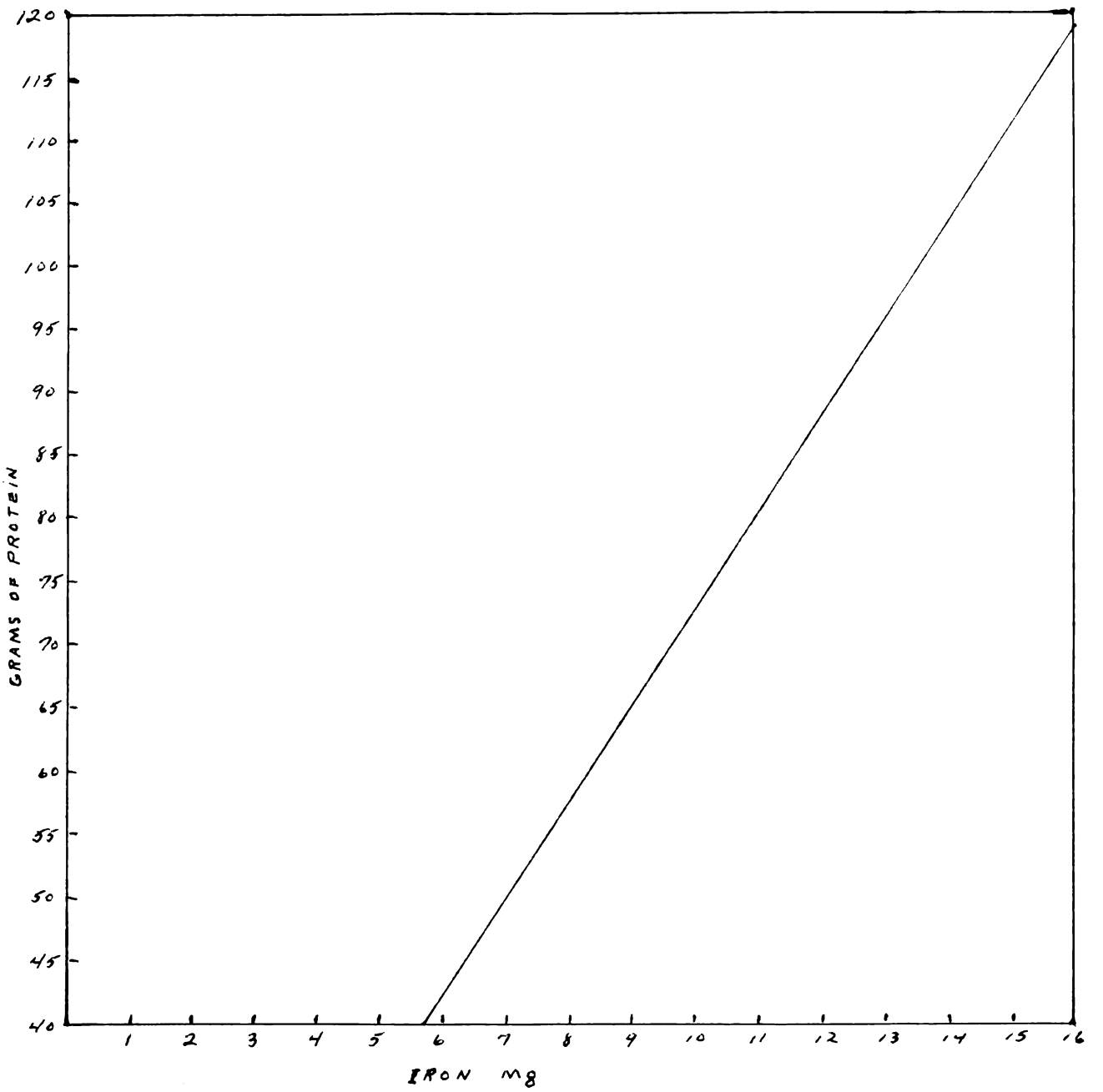
It is particularly unfortunate when protein intakes are low for this group of girls, for they are a group who need an adequate protein reserve in preparation for possible early marriage and pregnancy. Of more importance is the percentage of calories yielded by protein. These 38 students in all cases derived over fifteen per cent of their calories from dietary protein as recommended by some nutritionists.

Protein intake was adequate and sometimes high for this group because expensive protein foods were available to them at the hospital at no extra cost to them. Also milk was available and most of the girls liked milk and drank at least two glasses or more daily, at mealtime and between meals.

In the present study a progressive increase in protein occured with increasing calorie intake. The mean intake of 69.5 grams for these students compares with the findings of 71 grams daily by Fry (12) and 74 grams by Odland (11).



Relationship Between Protein Intake and Caloric Intake



Relationship Between Iron Intake and Protein Intake

IRON INTAKES AND HEMOGLOBIN CONCENTRATIONS

Iron intakes for the student nurses studied were very low. Only 31 % of the whole group reported intakes that were two-thirds of the recommended allowances. Iron intakes ranged from 3.4 milligrams as reported by a student in the tall group in the second period to 15.8 milligrams as reported by a student in the medium group. Mean intake was 8.3 milligrams in the first period for the short group with an increase to a mean of 9.6 milligrams for the same group in the second period. The Medium group did not show a corresponding increase from period I to period II, the mean for period I was 10.4 and it dropped to 9.4 during the second period. The tall group reported a mean intake of 9.08 milligrams the first period and 9.61 milligrams the second period.

The mean intake for the whole group was 9.1 milligrams for the first period and 9.78 milligrams for the second period. These mean intakes agree most closely with the 10.0 milligrams reported by Odland (11), although they are lower than those found by most other investigators, with the exception of the 8.1 milligrams reported by 14 college students in Rhode Island (14).

The group of students studied very seldom chose to eat eggs for breakfast or at other meals. Green leafy vegetables, peas, beans and lentils were not popular foods, nor were cereals a popular item.

The nurses studied were necessarily a selected group since applicants for nursing school would not have been accepted if they showed evidence of very low hemoglobin. These student nurses had hemoglobins that ranged from 11.8 grams per cent to 14.9 grams per cent in period I, and 11.8 - 14.5 grams per cent in the second period. The mean value was 13.1 in the first period with a slight drop to a value of 13.0 in the second period. These mean values are similar to those found by other investigators ranging from the mean value - 12.4 (23) reported by Sheets and Barrentine to a mean value of 14.0 reported by McAllister and Molsberry (21).

TABLE 2 - AVERAGE HEIGHTS, WEIGHTS, AND HEMOGLOBIN CONCENTRATIONS

	PERIOD	HEMOGL GRAMS % AVERAGE I	HEMOGL GRAMS % AVERAGE II	HEIGHT INCHES AVERAGE I	HEIGHT INCHES AVERAGE II	WEIGHT POUNDS AVERAGE I	WEIGHT POUNDS AVERAGE II
GROUP I SHORT 61" or Less	(8)	12.9	12.5	59.9	59.9	109.7	109.0
RANGE		12.0-13.7	11.8-13.3	58"-61"	58"-61"	95-125	93-117
GROUP II MEDIUM 62 - 64"	(10)	13.3	13.4	62.8	63.0	124.0	123.0
RANGE		12.0-14.1	12.2-14.5	61"-64"	61"-64"	105-135	105-138
GROUP III TALL 64.5 - 68.5"	(20)	13.1	12.9	65.7	65.7	134.6	134.6
RANGE		11.8-14.9	11.8-14.5	64.5"-68.5"	64.5"-68.5"	114-166	114-160

TABLE 3 - CHANCES IN HEMOGLOBIN CONCENTRATIONS FROM SEPTEMBER TO MAY

	HEMOGL SEPT.	HEMOGL MAY		IRON INTAKE SEPT.	IRON INTAKE MAY	
Subject 2	12.3	12.9	/ .6 grams %	15.8	8.6	-
Subject 5	14.9	12.4	-2.5	8.4	8.5	0
Subject 12	12.9	13.7	/ .8	10.0	9.9	0
Subject 18	12.5	11.9	- .6	7.7	9.0	/
Subject 21	13.7	12.2	-1.5	9.5	11.4	/
Subject 24	13.3	12.4	- .9	7.6	6.4	-
Subject 25	12.9	12.2	- .7	5.3	9.1	/
Subject 32	11.8	12.5	/ .7	10.0	9.0	-
Subject 34	13.3	12.4	- .9	9.9	9.3	-

HEIGHTS AND WEIGHTS

The students studied were divided into three groups according to height. There were eight girls under 61", ten girls 62" to 64" tall, and twenty girls between 64.5" and 68.5" tall. There was no clear relationship between hemoglobin values and weights of the students. There were fourteen students whose weights deviated 10% or more from the expected weight. Of these, nine students were overweight, and five students were underweight. The overweight students who lost a total of twenty-six pounds in the four month period of the study had a mean caloric intake of 1721 calories the first period, and 1634 the second period. Their protein intake increased the second period along with a decrease in calories. The group of girls who were underweight gained a total of five pounds and reported a mean intake of calories of 1264 in the first period with an increase to 1731 for the second period. The mean protein intake for the underweight group increased from a mean of 61.8 grams daily to 75.3 grams daily. This is a small sampling and so it may not be at all significant as far as individual differences are concerned.

TABLE 4 - AVERAGE CALORIC AND PROTEIN INTAKE OF STUDENT NURSES DEVIATING 10% OR MORE FROM NORMAL EXPECTED WEIGHTS

PERIOD I	NO. OF CASES	CALORIES MEAN	CALORIES RANGE	PROTEIN GRAMS MEAN	PROTEIN GRAMS RANGE
OVERWEIGHT	9	1721	1038 - 2322	60.4	48.4 - 75.7
UNDERWEIGHT	5	1264	1048 - 2216	61.8	40.7 - 79.8
PERIOD II					
OVERWEIGHT	9	1634	1101 - 2417	66.6	47.0 - 90.4
UNDERWEIGHT	5	1731	1384 - 2259	75.3	62.0 -119.0

TABLE 5 - CALORIC INTAKES AND HEMOGLOBIN CONCENTRATIONS OF UNDERWEIGHT AND OVERWEIGHT STUDENTS

PERIOD I

SUBJECT	DEVIATION POUNDS	INTAKE OF CALORIES	HEMOGLOBIN GRAMS %
2	+ 12	1803	12.3
4	+ 15	2046	13.6
9	+ 17	1527	14.1
11	+ 17	1992	13.7
17	+ 21	1356	13.1
18	+ 24	1736	12.5
23	+ 22	1674	13.3
27	+ 12	2322	14.1
29	+ 24	1038	12.5
5	- 13	1711	14.9
13	- 12	1949	13.3
22	- 13	2216	13.3
25	- 16	1399	12.9
33	- 16	1048	13.3

Summary

Calculated dietary intakes of many of the student nurses studied appeared to be low in calories and in iron when compared with recommended dietary allowances. Only 31% of the students had hemoglobin concentrations which were within normal ranges, between 11.0 and 13.0 grams per cent. Donelson (14) found in metabolic balance studies that "in the case of iron the adequacy of the remainder of the diet was of signal importance and that with a good diet an intake of only 7.21 milligrams of iron daily is sufficient". Protein intake compared favorably with the amounts recommended and were adequate because the students drank large amounts of milk. The students reported a mean intake of calories that was more than 500 less than that recommended for girls 16 to 19 years old. In spite of this difference nine of the students were overweight, twenty four students had weights within the normal expected range, and only five students were underweight.

These students had the opportunity to be well fed but individual problems existed and food choices were not always wise. The meals served the students were nutritionally adequate, but the students did not always choose enough servings of green or yellow vegetables, citrus fruits, whole grain cereals and meat to provide the amounts of vitamin A, vitamin C and iron needed to furnish 2/3 of the recommended dietary allowances.

There were no distinct changes or improvement in dietary patterns as a result of four months of nutrition education. The weight changes that resulted were probably the result of changes in dietary patterns that took place before nutrition classes began. These students as part of a post adolescent group carry on the same food habits as they did as younger adolescents. Stearns (21) stated that the teen age group is the group least amenable to nutrition education. Motivation to change diet habits for this post adolescent group stem from a desire to improve appearance,

not for reasons of good health.

Margaret Mead (22) indicated that adolescents are more literate and very much more sophisticated than their elders and can learn a great many more generalizations than their elders. She saw the need for the development of a changing pattern that will be fitted to our increased knowledge of nutrition and to the presence or absence of particular foods. In addition through education she saw the need for the development of individuals who have flexibility and variability enough to eat anywhere, any time if it's necessary, in any part of the world, "any food which might be dictated by the exigencies of war or peace or migration or shortage or change."

SUMMARY

1. The 38 student nurses studied showed no changes in dietary habits as a result of nutrition education over a four month period.
2. As the students increased their calorie intakes their protein intakes also increased.
3. As protein intakes increased the students iron intakes increased.
4. There was no apparent relationship between hemoglobin concentrations and iron intakes. Hemoglobin concentrations fell within the normal range 11.0 to 13.0 grams per cent, with means of 13.1 and 13.0.
5. Protein intakes for the students were adequate, the mean intakes were 69.5 and 75.3 grams. Iron intakes were lower than recommended, mean intakes were 9.1 milligrams and 9.78 milligrams. Calorie intakes were lower than recommended, but the students maintained or lost weight on mean intakes of 1866 and 1914 calories.

CONCLUSIONS

The student nurses studied showed variations in their knowledge of recommended dietary patterns. They can apparently maintain normal weight with less than 2000 calories. They can get along with a smaller amount of iron than 2/3 of the recommended dietary allowances because the remainder of the diet is good.

The present form of nutrition education did not motivate the student to change her eating habits to include eating more servings of meat, citrus fruits or yellow and green leafy vegetables.

LITERATURE CITED

1. Young, C. M., F. Chalmers, H. Church, M. Clayton, R. Tucker, A. Wertz, W. Foster 1952 A comparison of dietary study methods. I dietary history versus seven day records. J. Am. Diet. Assoc., 28:124

2. Young, C., G. Huzan, A. Tucker, W. Foster 1952 A comparison of dietary study methods II Dietary history versus seven day record versus twenty-four hour recall. J. Am. Diet. Assoc., 28:218

3. Chalmers, F., M. Clayton, L. Gates, R. Tucker, A. Wertz, C. Young, W. Foster 1952 The dietary records how many and which days. J. Am. Diet. Assoc. 28:717

4. Young, C., M. Trulson 1960 Methodology for dietary studies. Am. J. Pub. Health 50:803

5. Whiting, M. G., R. Leverton 1960 Reliability of Dietary appraisal. Am. J. Pub. Health 50:815

6. Wiehl, D., A. Ried 1960 Development of new and improved dietary methods. Am. J. Pub. Health 50:824

7. Young, C., F. Chalmers, H. Church, M. Clayton 1953 Subjects estimate of food intake and calculated nutritive value of the diet. J. Am. Diet. Assoc. 29:1216

8. Odland, L. M., L. Page, L. Guild 1955 Nutrient intakes and food habits of Montana students. J. Am. Diet Assoc. 31:1134

9. Fry, Peggy, 1959 Diets of post adolescent young women. J. Am. Diet. Assoc. 35:687

10. Scoular, F., L. B. Foster 1946 Food intake of college women. J. Am. Diet. Assoc. 22:401

11. Marin, Ruth, 1949 Dietary Practices and Nutritional status of student nurses at Sparrow Hospital 1949 unpublished thesis Michigan State University for M. S.

12. Writer's own studies made in 1960 at Flint Junior College

13. Morgan, Agnes, 1959 Nutritional status USA California Agricultural Experimental Station Bulletin 709

14. Donelson, Eva G., P. Nelson, M. Ohlson, M. Pittman, R. Leverton 1945 Nutritional status of Midwestern college women. J. Am. Diet Assoc. 21:145

15. Odland, L., Ruth Ostle 1956 Nutritional status of Montana adolescents. J. Am. Diet. Assoc. 32:823

16. McAllister, C., D. Molsberry 1946 Hemoglobin values of college women. J. Am. Diet. Assoc. 22:497

17. Gutowska, M., E. Ellms, 1946 Nutritional status of women students. J. Am. Diet. Assoc. 22:763

18. Sheets, O., M. Barrentine 1944 Hemoglobin concentration of the college men and women. J. Am. Diet. Assoc. 20:521

19. Connor, C. 1955 Hemoglobinometry. Clinical Chemistry 3:402

20. Wintrobe, Maxwell Clinical Hematology Lea and Fibinger 1956 Phila. Pa.

21. Stearns, G., 1958 Nutritional state of the mother prior to conception J. Am. Med. Assoc. 68:655

22. Mead, Margaret, 1949 Cultural patterning of nutritionally revelant behavior J. Am. Diet. Assoc. 25:677

APPENDIX

NAME: _____ DAY: _____ DATE: _____

DIRECTIONS: List all the foods that you ate in 24 hours, including butter, sugar, cream and beverages. Tell whether the foods were raw or cooked; and if cooked, how (example - raw apple or baked apple or applesauce). Describe mixed dishes such as salads, stews sandwitches, etc. Tell whether bread was made of corn, rye, whole wheat or white flour. Give approximate amounts of each food (example - 1 slice bread, 1 cup of milk, etc).

MEAL	FOOD	HOUSEHOLD MEASURE	FOOD	HOUSEHOLD MEASURE
BREAKFAST				
SNACK				
LUNCH				
SNACK				
DINNER				
SNACK				

FORM FOR CALCULATING DIETS

FOODS	APPROX. MEASURE	CALORIES	PROTEIN (GRAMS)	IRON (MGM.)

INDIVIDUAL BLOOD FINDINGS HEIGHT AND WEIGHT

SUBJECT	AGE*	PERIOD-	HEMOGL I GMS %	HEMOGL II GMS %	HEIGHT I	HEIGHT II	WEIGHT I	WEIGHT II
1	18		12.0	12.5	60.0 In	60.0 In	112 Lb	112 Lb
2	18		12.3	12.9	62.5	63.0	132	135
3	18		12.9	12.7	66.0	66.0	135	135
4	18		13.6	13.5	65.5	65.5	145	143
5	18		14.9	12.4	65.5	65.5	117	118
6	18		14.1	14.1	68.0	68.0	138	140
7	21		13.3	13.3	62.0	62.0	112	114
8	18		12.0	12.2	62.0	62.0	120	118
9	18		14.1	14.1	64.0	64.0	140	138
10	18		12.0	11.8	65.0	65.0	115	118
11	20		13.7	14.1	64.0	64.0	140	140
12	18		12.9	13.7	65.5	65.5	124	124
13	18		13.3	13.3	64.5	64.5	114	114
14	18		12.2	12.2	61.0	61.0	110	108
15	18		12.2	12.4	65.0	65.0	134	133
16	18		13.7	13.6	64.0	64.0	115	119
17	18		13.1	12.9	59.0	59.0	125	121
18	21		12.5	11.9	68.5	68.5	166	160
19	17		13.6	14.0	64.5	65.0	116	120
20	18		14.0	14.5	62.0	62.0	115	115
21	28		13.7	12.2	59.5	59.5	95	93
22	18		13.3	13.7	62.0	62.0	105	105
23	18		13.3	12.9	64.5	64.5	145	144
24	18		13.3	12.4	66.75	66.75	136	138
25	18		12.9	12.2	61.0	61.0	100	104
26	19		12.4	12.7	67.0	67.0	143	146
27	18		14.1	13.7	64.0	64.0	135	132
28	19		14.1	14.5	68.5	68.5	152	150
29	18		12.5	12.2	65.5	65.5	154	146
30	18		13.3	13.3	61.0	61.0	118	117
31	18		12.7	12.9	58.0	58.0	108	108
32	18		11.8	12.5	65.0	65.0	130	130
33	18		13.3	11.8	61.0	61.0	110	107
34	18		13.3	12.4	68.0	68.0	141	140
35	18		12.9	13.3	67.0	67.0	129	127
36	18		11.9	12.2	65.0	65.0	133	132
37	18		12.5	12.2	62.0	62.0	126	119
38	18		14.1	14.0	67.75	67.75	126	134

* Age of nearest birthday

CALCULATED INTAKE OF SOME FOOD NUTRIENTS BY 38 STUDENT NURSES

SUBJECT PERIOD-	CALORIES I	CALORIES II	PROTEIN I Gms	PROTEIN II Gms	IRON I mgs	IRON II mgs
1	2099	1914	69.50	73.9	7.40	10.0
2	1803	1402	59.40	47.2	15.75	8.6
3	1985	1109	77.20	41.1	8.10	3.4
4	2046	1491	72.60	59.9	7.80	9.3
5	1711	1426	64.50	67.4	8.40	8.5
6	2828	2483	112.20	113.3	9.40	9.7
7	1964	1771	87.00	76.1	12.30	7.0
8	1798	1648	71.40	78.4	6.60	9.9
9	1527	1734	53.70	68.2	9.25	10.3
10	1893	2848	73.80	125.9	10.13	14.9
11	1992	2307	66.20	88.5	10.40	13.3
12	2289	2109	94.90	75.7	10.00	9.9
13	1949	2259	79.80	119.7	7.20	12.4
14	1702	2864	60.00	112.0	5.76	13.1
15	1750	1712	68.80	82.4	8.90	8.8
16	2972	1877	81.90	71.7	13.10	7.7
17	1356	1297	68.60	62.5	7.30	6.9
18	1736	1638	55.60	62.2	7.70	9.0
19	3132	1672	91.20	70.6	8.30	6.4
20	1715	1547	71.00	68.9	6.90	9.0
21	1643	1855	57.70	80.2	9.50	11.4
22	2216	1904	72.70	65.4	8.30	7.3
23	1674	1334	48.40	49.3	8.16	7.6
24	1714	1055	50.00	50.3	7.60	6.4
25	1399	1685	51.30	62.5	5.30	9.1
26	1445	3923	69.60	83.0	8.90	14.0
27	2322	2417	75.70	90.4	13.00	11.5
28	1334	1357	74.70	49.6	10.20	10.0
29	1038	1101	49.50	61.5	7.60	7.8
30	2089	2372	94.60	88.3	9.03	9.0
31	2242	1337	100.00	63.3	15.90	9.1
32	2191	1865	96.70	71.5	10.00	9.0
33	1048	1384	40.70	62.4	6.50	8.4
34	2287	2572	71.40	83.3	9.90	9.3
35	2026	2342	87.70	110.0	8.75	16.0
36	1362	2251	49.40	68.3	11.45	10.1
37	1265	1504	50.80	87.0	8.65	9.4
38	2123	2498	87.10	75.2	13.10	9.7

WEIGHT IN RELATION TO HEIGHT AND CALORIC INTAKE

OF 38 STUDENT NURSES, AGES 17 to 28 YEARS

PERIOD I

SUBJECT	HEIGHT Inches	WEIGHT Pounds	EXPECTED WEIGHT	DEVIATION Pounds	INTAKE OF CALORIES
1	60	112	111	+ 1	2099
2	62	132	120	+ 12	1803
3	66	135	130	+ 5	1985
4	65	145	130	+ 15	2046
5	65	117	130	- 13	1711
6	68	138	142	- 4	2828
7	62	112	118	- 6	1964
8	62	120	118	+ 2	1798
9	64	140	123	+ 17	1527
10	65	115	126	- 11	1893
11	64	140	123	+ 17	1992
12	65	124	130	- 6	2289
13	64	114	126	- 12	1949
14	61	110	116	- 6	1702
15	65	134	126	+ 8	1750
16	64	115	123	- 8	2972
17	59	125	104	+ 21	1356
18	68	166	142	+ 24	1736
19	64	116	126	- 10	3132
20	62	115	118	- 3	1715
21	58	95	104	- 9	1643
22	62	105	118	- 13	2216
23	64	145	123	+ 22	1674
24	67	136	135	+ 1	1714
25	61	100	116	- 16	1399
26	67	143	135	+ 8	1445
27	64	135	123	+ 12	2322
28	68	152	142	+ 10	1334
29	65	154	130	+ 24	1038
30	61	118	116	+ 2	2089
31	58	108	101	+ 7	2242
32	65	130	126	+ 4	2191
33	65	110	126	- 16	1048
34	68	141	138	+ 3	2287
35	67	129	135	- 6	2026
36	65	133	126	+ 7	1362
37	62	126	118	+ 8	1265
38	68	126	138	+ 12	2123

NUMBER OF STUDENTS WHOSE INTAKES WERE TWO-THIRDS

OR MORE OF THE RECOMMENDED DIETARY ALLOWANCES

	PERIOD-	CALORIES I	CALORIES II	IRON MGS. I	IRON MGS. II	PROTEIN GMS. I	PROTEIN GMS. II
ALL STUDENTS	(38)	29	25	12	12	35	34
		76%	66%	31%	31%	92%	89%
GROUP I SHORT	(8)	5	5	1	3	7	8
		62.5%	62.5%	12.5%	37.5%	87%	100%
GROUP II MEDIUM	(10)	8	7	5	3	10	9
		80%	70%	50%	30%	100%	90%
GROUP III TALL	(20)	16	13	5	6	18	17
		80%	65%	25%	30%	90%	85%

Menu for Table 7

Breakfast

Tomato Juice

Fried Egg

Whole Wheat Toast - Butter

Skim Milk

Coffee

Dinner

Roast Beef

Mashed Potatoes and Gravy

Asparagus

Tossed Green Salad

Butterscotch Pie

Skim Milk

Supper

Chili Con Carne

Crackers

Cole Slaw

Fruit Jello

Skim Milk

Snack

Nut Cookies

Skim Milk

AT/jw
11/10/61

Table 7

Menu based on foods at St. Joseph's Hospital cafeteria on May 5, 1961.

	Approx. Measure	Calories	Protein gms.	Calcium gms.	Iron mgs.	Vitamin A I.U.	Thiamine mgs.	Riboffavin mgs.	Vitamin C mgs.
Breakfast									
Tomato juice	½ Cup	20	1.2	.017	.5	1,035	.05	.13	18
Egg	1	93	6.5	.030	1.4	540	.04	.13	--
Whole wheat toast	1 slice	80	2.5	.010	.6	---	.08	.03	--
Butter	1 t	35	---	---	--	165	--	--	--
Skim milk	1 Cup	85	8.5	.280	.2	385	.10	.41	2
Dinner									
Roast beef	3 3/4 x 3½ x ¼"	210	17.7	.010	2.3	---	.07	.17	--
Mashed potatoes	½ Cup	80	2.2	.027	.6	40	.08	.05	7
Gravy	2 T	72	1.1	.002	.4	---	.02	.03	--
Asparagus	½ Cup	20	2.0	.020	1.0	1,040	.13	.17	20
Tossed salad	3/4 Cup	43	1.2	.023	.7	833	.06	.05	18
Lettuce with carrots	¼ carrot	5	.1	.005	.01	1,430	.04	.01	1
Butterscotch pie	1/8 pie	353	4.5	.011	1.4	699	.06	.17	1
Skim milk	1 Cup	85	8.5	.280	.2	385	.10	.41	2

continued on next page

Table 7
Menu (cont'd)

	Approx. Measure	Calories	Protein gms.	Calcium gms.	Iron mgs.	Vitamin A I.U.	Thiamine mgs.	Riboffavin mgs.	Vitamin C mgs.
Supper									
Chili	1 Cup	323	21.0	.005	4.8	160	.14	.17	18
Crackers	4	68	1.6	.004	--	---	--	--	--
Cole slaw	½ Cup	71	.7	.023	.3	40	.03	.03	25
Fruit jello	½ Cup	84	2.1	.008	.2	---	--	--	--
Skim milk	1 Cup	85	8.5	.280	.2	385	.10	.41	2
Snack									
Skim milk	1 Cup	85	8.5	.280	.2	385	.10	.41	2
Nut cookies	2	106	1.2	.005	.4	160	.04	.02	--
TOTAL		2,090	99.5	1.420	15.2	8,122	1.24	2.72	114
Recommended allowances		2,400	75.0	1.300	15.0	5,000	1.20	1.90	80

AT/jw
11/10/61