DIETARY PRACTICES AND NUTRITIONAL STATUS OF STUDENT NURSES AT SPARROW HOSPITAL, LANSING, MICHIGAN

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DIETARY PRACTICES AND NUTRITIONAL STATUS OF STUDENT NURSES AT SPARROW HOSPITAL, LANSING, MICHIGAN

By

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INTRODUCTION

Surveys of various population groups have been conducted in recent years in an effort to appraise nutritional status. Methods used have been varied. Dietary histories, records of food intake, physical examinations, anthropometric measurements, and biochemical analyses have been employed in various combinations. Although the information obtained from nutrition surveys is largely presumptive, such surveys do provide a means for estimating relative nutritional status of a group.

Nutrition studies of young women have been reported recently. In 1937, in a discussion of present-day problems in nutrition, Todhunter (1) expressed concern over the "tendency of many young women to be more interested in a slender figure than in a well-nourished body" in the light of knowledge that lowered caloric intakes have usually been accompanied by reduced intakes of specific nutrients. College students have served as subjects in most of the studies of young women. Such research has been stimulated by establishment of cooperative projects among colleges (2, 3).

A review of recent literature reveals a paucity of nutrition studies of student nurses as a group. That such information might be of value was noted during the time that the writer served as health nurse in the school of nursing selected for study. It was observed that many of the students had at some time during training received multi-vitamin or iron medication, that some students were apparently selecting inadequate diets, and that missing of meals occurred with some frequency.

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 patterns, as reported in dietary histories and food intake records;

2. To attempt to discover the general nutritional level, as shown by health histories, biochemical tests and maintenance of weight;

3. To compare calculated intake of food nutrients with findings in the literature, and with recommended allowances of the National Research Council (4);

4. To learn whether or not a group which had received instruction in health practices and in the principles of nutrition appeared to be applying such knowledge to actual practice;

5. To determine, if possible, the influence on dietary practices of adaptation to certain factors in the nursing situation such as changing hours of duty; and

6. To add to present information certain data obtained from a study of a group of apparently healthy young women.

REVIEW OF LITERATURE

Dietary Survey Methods

The use of several methods simultaneously in the evaluation of the food intake of a group yields a more complete picture than does the use of any single determination yet developed. Each method of appraisal has certain values and limitations, and data obtained through its use must be viewed in the light of such limiting factors.

Burke (5) expresses the belief that a detailed dietary history is of value as a tool in nutrition research, since nutritional status reflects the average dietary intake for the period of observation or for the period preceding a study. Such a dietary history should attempt to discover the average or representative food intake as carefully as possible. The amount of food nutrients in the average dietary can then be calculated and a rating scale of relative nutritional status developed. This evaluation should not, however, go beyond its limits of dependability. Since a one-day or even a seven-day period may not be representative of the usual intake, Burke feels that diet records are the least valuable part of the information obtained.

An opposite view is taken by Huenemann and Turner (6), who compared dietary histories with food intake records of 25 children, ages six to 16 years. In their study no history was found to agree with a 10- to 14-day weighed diet record within 20 per cent for all constituents. Approximately one-half differed significantly in five or six nutrients. These investigators conclude that the dietary history has little quantitative value and its use is questionable in research on a small number of cases.

In repeated records of food intake, variations were found in all nutrients, indicating that diets may differ from time to time, making several investigations necessary in a longer study.

In reviewing nutrition surveys conducted in Tennessee and North Carolina, Darby (7) states that seven- or three-day food records gave mean results that were "reasonable if not viewed with a background conditioned by the expectation of deficiencies". Agreement was found between calculated and chemically determined food values in sample meals, especially when mean values were considered. The best agreement occurred in the low-intake group. Darby concludes that "this method yields useful information regarding the mean level of intakes of a population group. It has less value for assessing the intake of an individual".

Leverton and Marsh (8) found a significant variation in food intakes for week days and for Saturday and Sunday of 24 college girls on self-selected diets. They conclude that studies should be conducted for at least one week, or preferably for 10 days. Although student nurses do not regularly have free week-ends, a seven-day period usually covers the days off duty, when dietary patterns may be changed.

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. Coons and Schiefelbusch (9) report results of a study in which self-selected diets of 17 subjects provided a mean daily intake of 1990 Calories, 56 grams of protein, and 0.93 grams of calcium. The range of intakes was from 1747 to 2214 Calories, 41 to 71 grams protein, and 0.49 to 1.55 grams calcium. Another study, reported in 1934 by Latzke (10), shows that 31 students selected diets from a college cafeteria, which furnished an average of 1674 Calories, 50.9 grams of protein, and 0.613 grams of calcium

per day. Individual intakes varied from 1010 to 2529 Calories, 32.88 to 78.84 grams protein, and 0.266 to 1.213 grams of calcium. Pittman et al. (11) report that 27 college women from Ohio and Kansas ingested a daily average of 2038 Calories, individual intakes varying from 1119 to 3267 Calories. Students from Ohio showed a mean intake of calories which was significantly lower than that for Kansas.

The work of Morris and Bowers (12) in Utah reveals that 100 college women were eating an average of 0.717 grams calcium, 60.71 grams protein, and 1805 Calories each day. Greenwood and Lonsinger (13, 14), who calculated dietary components from seven-day food records of 203 students, report average daily intakes as follows: 2016 Calories (range 1089-3082), 64.6 grams protein (range 39.6-91.0), and 0.8288 grams calcium (range 0.350-1.551). Studies of 124 college women from four north central states, reported by McKay et al. (15) in 1942, show that students on self-selected diets consumed 34.69 to 109.56 grams of protein and 0.322 to 2.323 grams of calcium daily. Mean intakes of protein and calcium were 63.18 and 0.941 grams, respectively.

Thirty-eight college women were studied as freshmen and as seniors by Ohlson and others (16). These students had an average daily intake of 2178 Calories, 69.5 grams protein, and 0.94 grams calcium for the two periods of study. Morris and Bowers (12) report daily average intakes of 7793 International Units of vitamin A and 44.7 milligrams of vitamin C. Intake of ascorbic acid by 345 women averaged 84.6 milligrams daily during the period of a study by Dodds and MacLeod (17).

In summary, results of several studies of food intakes of young women show that mean intakes of Calories ranged from 1674 to 2178, average intakes of protein ranged from 50.9 to 69.5 grams, and daily intakes of calcium averaged from 0.613 to 0.941 grams. Two studies record ascorbic

acid intakes of 44.7 and 84.6 milligrams daily, and in one study an average intake of 7793 International Units of vitamin A was found.

Dietary practices are related to food intake, and a study of food habits provides information substantiating or explaining certain of the findings of food consumption studies. Shaw (18) reports food habits of 80 college students, as such practices were revealed by two-day diet records. One pint of milk was consumed daily by nearly one-half of the students, but about one-fourth drank no milk. Forty-two per cent chose no green leafy vegetables, 10 per cent ate no fruit, and approximately one-half had no citrus fruit during the two-day period. Nearly all students ate between meals. One-third of all breakfasts were omitted or inadequate. For six per cent of the group, all meals were inadequate.

Reynolds et al. (19) studied seven-day food records of 3432 subjects. They found high protein foods, such as meat and meat substitutes, to be most often selected, followed by milk, green and yellow vegetables and citrus fruits, with whole-grain cereals chosen least often. Two periods of seven-day food records furnished the information which is reported by Young (20). It was found that weekly average intakes of all nutrients for a group of Cornell University women were within the minimum requirement of two-thirds of the National Research Council allowances. Milk intake was higher than that reported in the Shaw study, 93 per cent drinking at least one glass daily, over one-half drinking two glasses, and more than one-fourth consuming three or more glasses of milk each day. Lower intakes were reported for eggs and whole-grain cereals. All students ate between meals. One-half of the women never missed breakfast, and no student missed breakfast consistently.

Using inventories of food purchased as a basis for the survey of dietary practices of 213 college women, Lamb and McPherson (21) arrive at

the conclusion that no generalized deficiencies of food groups or nutrients were present. The recommended milk allowance was met. Consumption of citrus fruits and green and yellow vegetables was higher than expected. One-half of cereal products eaten were whole-grain. The number of eggs consumed was low in most cases. A high consumption of fat and sugar was found.

Anthropometric Data

Jackson (22) found the mean height of a group of 1022 women students at the University of Minnesota to be 63.657 inches. Average body weight for the group was 119.87 pounds. Records of 1000 Smith College students were examined by Gordon (23), who reports median heights of 63.5 to 65.4 inches for students grouped by age and body build. Heights ranged from 58 to 70.9 inches. The median weight at 19 years was 126 pounds, and at 20 years, 124 pounds. Measurements made on 17,127 college women between the ages of 16 and 21 years were analyzed by Diehl (24). The means of height and weight for the total group were 63.75 inches and 120.69 pounds, respectively. Heights varied from 48 to 73 inches, and weights ranged from 64 to 245 pounds. Findings in this study showed the weights of college women to be uniformly lower than weights given in life-insurance tables, except for the 16-year age group. These findings raise a question concerning the use of such tables as a basis for determining "normal" weights of college women. Diehl concludes, after this report, that no significant increase in height or weight occurs after the age of 16 in a group of college women.

Several studies, in which measurements of the same subjects were repeated over a period of several years, show that there is a small increase in height during college. Such an increase was not observed in

Diehl's study, where single measurements of a large number of subjects furnished the data. In such a study individual differences in total height would tend to mask any increases which had occurred. Barker and Stone (25) of Stanford University analyzed records of heights and weights of 1290 women in that school. The mean height at 20 years was found to be 64.63 inches, with an average weight of 120.90 pounds. A small but significant increment in height and weight was found to have occurred during the years spent in college. Increase in stature during this period has also been noted by Gould (26) and Donelson et al. (27).

A study by Gutowska and Ellms (28) shows an average height of 64.45 inches and a mean weight of 130.69 pounds for a group of Massachusetts students. Greenwood and Lonsinger (13) found an average in height of 164.07 centimeters and an average in weight of 58.40 kilograms for 203 Oklahoma women. In a study of 1013 college freshmen from four of the North Central States reported by Donelson and others (29), when subjects were grouped by states, mean heights ranged from 161.4 to 164.8 centimeters, and mean weights ranged from 55.8 to 58.4 kilograms. Students from Ohio were found to be significantly shorter than were students from the other states studied. College women in this study exceeded in height and weight previous measurements of women from the North Central States.

Hemoglobin

Osgood (30) reports an average value for the hemoglobin concentration of the blood of 369 young women as 13.9 grams per 100 milliliters. For 100 women, Sachs et al. (31) found an average hemoglobin value of 12.96 grams and for 10 women, a mean value of 13.5 grams, with a range of 12.4 to 14.3 grams per cent. Ohlson and others (32) report a mean hemoglobin of 13.4 grams in a study of 4550 students from the North Central

States. Although a range in values from 8.5 to 17.5 grams was recorded, 72 per cent of all tests were within one standard deviation of the mean, or between 12.2 and 14.6 grams per 100 milliliters. These investigators conclude that the normal standard for hemoglobin concentrations must be interpreted as a range of values, this range being wider than those reported in previous studies.

Of 604 women studied by Sheets and Barrentine (33) at Mississippi State College, 76.4 per cent had hemoglobin values between 11.5 and 14.0 grams. The complete range was 8.8 to 15.7 grams, with a mean of 12.4 grams per 100 milliliters. This average value is lower than the mean values reported by most investigators. Gutowska and Ellms (28) found a hemoglobin range of 9.5 to 16.0 grams per cent, with a mean value of 13.8 grams in a study of 161 Massachusetts students. MacMillan and Todhunter (34) report hemoglobin values for young women which range from 9.2 to 15.8 grams, with a mean of 13.9 grams. A mean hemoglobin concentration of 14.20 grams was found for 30 college women studied by McAllister and Molsberry (35). The concentrations ranged from 12.01 to 15.52 grams per 100 milliliters.

Plasma Ascorbic Acid

The blood plasma is a carrier of ascorbic acid to the various body tissues and is influenced by diet. Laboratory tests of reduced ascorbic acid content of the plasma have been used in nutrition surveys to add objective information in attempts to appraise nutritional status.

Seven young women were studied by Todhunter and Fatzer (36), and were found to have ascorbic acid concentrations of 0.86 to 1.66 milligrams per 100 milliliters plasma during a period when they were eating their usual diets. Dodds and MacLeod (17) report a mean plasma ascorbic acid concentration of 0.67 milligrams per cent for 345 college women in

Tennessee. An average fasting plasma ascorbic acid value of 0.66 milligrams per cent is reported for 582 women by Donelson et al. (37). MacMillan and Todhunter (34) report plasma ascorbic acid values for 174 young women which range from 0.11 to 1.65 with a mean value of 0.65 milligrams per 100 milliliters.

Summary

A review of the recent literature reveals that certain information concerning dietary practices and nutritional status of a population group can be secured through dietary histories, food intake records, height and weight measurements, and biochemical tests for determination of blood hemoglobin and plasma ascorbic acid concentrations. These various methods tend to supplement rather than replace one another in the determination of nutritional status, and therefore all have been employed in this study.

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 live under some of the same conditions, it was felt that results of college studies could be used for comparison with the findings of the present study.

EXPERIMENTAL PROCEDURE

Subjects

Students enrolled in the Edward W. Sparrow Hospital School of Nursing served as experimental subjects for this survey of nutritional status and dietary practices. Data were obtained from 71 of the 99 students in that school. Those not included in the study were omitted because of vacations, affiliations, or working hours which made scheduling difficult. The 71 young women ranged in age from 19 to 32 years and were all in apparent good health. They lived in the nurses' dormitory and ate most of their meals in the hospital cafeteria.

Before the survey was begun, an explanatory notice was posted on the students' bulletin board. This letter stated the purpose of the project, told what would be expected of persons serving as subjects, and expressed a desire for the cooperation of the students. A sample diet record form was also posted, with instructions for completing it. Subjects were individually informed of the time of their blood tests.

The study was begun on February 17, 1949 and information was obtained at intervals throughout the four-month period ending June 14, 1949.

Questionnaires

Because of varying time schedules, personal interviews were not arranged. It was felt that, since this was a group of students, satisfactory information could be obtained through questionnaires. Two sets of questions were developed, one to obtain general information on family background and history of dietary practices, and the other form to secure data

on general health conditions, past and present. A copy of each questionnaire may be found in the Appendix. Additional or verifying information about the health of the subjects was available from medical records kept by the school health nurse.

Subjects received copies of the two questionnaires at the time of blood testing, and were asked to return the completed forms with their food intake records. Seventy subjects returned completed questionnaires.

Diet Records

On the day of blood testing, subjects were given seven copies of a form for reporting daily food intake. They were asked to record all food eaten on the day preceding the examination, and to keep such daily diet records for a total of seven consecutive days. Subjects were on unrestricted self-selected diets with the exception of two who were following prescribed low-caloric reducing diets.

Records of food intake were obtained from 68 of the subjects. From these records the number of servings per period of each type of food was determined and entered on a calculation form. Copies of the forms used for recording food intake and for calculating diets may be found in the Appendix. Intakes of calories, protein, calcium, vitamin A and vitamin C for the period were calculated by use of the short method of Donelson and Leichsenring (38). Average daily intake of each was then found by dividing total intake by the number of days for which food records were kept.

The Donelson and Leichsenring table is a useful tool for rapid calculation of the components of a mixed dietary. The authors report close agreement between the values secured with short and long methods of computation of food values of 30 three-day records. They found no deviation

greater than 2.5 per cent in the results obtained by use of the two methods. Studies of usual dietaries in the North Central States served as the basis for food values included in the table. The figures, therefore, are representative of foods eaten in this section of the country. One period of study of the food consumption of an individual can serve only as an indication of the average or usual intake. Variations in the composition of various foods would also tend to decrease the assumed greater accuracy of a long method of computation. The use of the short method of calculation in this study was felt to be justified on the basis of these observations.

For purposes of information and validation, menus of foods served in the hospital cafeteria during the period of study were obtained from the hospital dietitians.

Height and Weight Records

Heights and weights of subjects were obtained during the week of recorded food intake. Subjects were weighed without shoes and while wearing ordinary clothing. Heavy coats or jackets were removed. The scales used were those in the office of the school health nurse. A sliding rule attached to the scales was employed in measurement of heights, which were taken without shoes while the subject stood on the platform of the scales.

Records of entrance weights and monthly weights throughout training were obtained from the health nurse. These weights were taken on the same scales and under conditions similar to those described above. Since individuals had spent varying amounts of time in the school, the same information was not obtained for all subjects. Twenty-five students included in this study had been enrolled for about six months, while 11 had been in training for over 30 months. Eight subjects had been enrolled for 24 months, 16 for 18 months, and 11 of the students for 12 months.

Findings were compared with Wood's Table of Height and Weight for Women of Different Ages (39), and with figures reported in the literature.

Hemoglobin

The hemoglobin concentration of the blood was determined once for each subject. The sample for this test was taken at the same time and under the same conditions as was the specimen for determining plasma ascorbic acid, described later.

After the finger and knife-blade were sponged with alcohol, a small cut was made near the tip of the finger. The first drop of blood was wiped away, then several drops were collected in a paraffin cup containing a small amount of heparin, which was used to prevent coagulation. The Sheard-Sanford method (40) of hemoglobin determination was then followed. A 0.02 cubic centimeter sample of the whole capillary blood was laked in 10 cubic centimeters of 0.1 per cent sodium carbonate. Sodium carbonate, rather than distilled water, was used in the conversion of hemoglobin to oxyhemoglobin to prevent possible clouding caused by precipitation of globulin, and to prevent the formation of acid hematin. Since little change in the reading occurs for several hours, the sample was transported from the nurses' residence to the laboratory in this form. Duplicate readings were made in a Cenco-Sheard-Sanford Photelometer (41) using Cenco Filter Number 525P. Distilled water set at 100 was used as a standard.

The hemoglobin concentration of the blood was calculated from a calibration chart supplied with the instrument and filter. Swanson[1] has

1. Personal Communication, Dr. Pearl Swanson, Iowa State College, June 1949.

recently reported results of a study of the concentrations of hemoglobin found in samples of heparinized and non-heparinized blood. Higher values were obtained when heparin was added, with a mean increase of 0.59 grams. On the basis of these findings, all hemoglobin values reported in this paper have been corrected by subtracting 0.5 grams from the values obtained on heparinized blood.

Hemoglobin values found in this study were analyzed for mean, standard deviation and probable error of the mean, and were compared with reports of other studies of young women.

Plasma Ascorbic Acid

Blood plasma concentration of reduced ascorbic acid was determined once for each experimental subject. The sample was obtained at the nurses' residence before the subject had eaten breakfast, which, in most cases, was at 6:30 o'clock. All of the subjects appeared to be in good health at the time of examination.

Analysis for ascorbic acid followed the micromethod of Farmer and Abt (42,43). Two 1.0 milliliter samples of capillary blood from a finger cut were collected into vials containing dried two per cent lithium oxalate. In some cases a second cut was necessary to provide sufficient blood. The vials of oxalated blood were then immediately centrifuged for five minutes to separate the plasma.

Plasma proteins were precipitated by the addition of 0.2 milliliters glass-distilled water and 0.4 milliliters five per cent metaphosphoric acid to 0.2 milliliter sample of the plasma. Since removal to the laboratory for the titration procedure was desired, this stage was chosen as the most satisfactory time for transportation on the basis of data presented in Table 1. To determine the effects of precipitation and storage time on loss of ascorbic acid from plasma, intravenous blood from one

subject was treated in three ways: Method 1, precipitated plasma was centrifuged and titrated immediately; Method 2, precipitated plasma was centrifuged, refrigerated for four hours, then titrated; and Method 3, precipitated plasma was refrigerated for four hours, then centrifuged and titrated immediately. Results showed no appreciable loss of ascorbic acid from the precipitrated plasma samples which were stored for four hours before centrifuging. There was a possible small loss from samples stored for four hours after separation of the precipitate by centrifuging.

Table 1. Effect of Precipitation and Storage Time on Recovery of Reduced Ascorbic Acid from Blood Plasma

Sample Number	Ml. Dye Used to Titrate Plasma		
	Method 1	Method 2	Method 3
1	.120	.117	.120
2	.117	.113	.121
3		.110	.113
4		.113	.118
Average	.1185	.113	.118

After samples were taken to the laboratory, they were centrifuged for five minutes to separate the plasma protein precipitate. Two 0.2 milliliter samples of the deproteinized plasma were then titrated immediately with a standardized solution of 2,6-sodium dichlorobenzeneneindophenol to an end-point of the first faint pink which persisted for 20 seconds. Two reagent blanks were titrated to the same end-point. A special 0.1 milliliter microburette operated by mercury pressure was used for titrating.

Calculations were based on the formula:

(ml. dye to titrate sample - ml. dye to titrate blank) x micrograms a. a. to reduce 1 ml. dye x 2 = mg. a. a./ 100 ml. plasma

All solutions were prepared with glass-distilled water and were stored in a refrigerator. Five and six per cent solutions of metaphosphoric acid were prepared weekly (49), and a three per cent solution was made daily as needed. A stock solution of indophenol dye was prepared weekly with Sorenson's phosphate buffer solution of pH 7. A dilute dye solution was made each day from this stock solution. The dilute dye was standardized with a solution of pure crystalline ascorbic acid (l-Ascorbic Acid, C.P., Fisher and Eimer & Amend) in three per cent metaphosphoric acid.

Results for one subject were rejected because of hemolysis of the sample. Mean, standard deviation and probable error of the mean were calculated for the values obtained. Comparisons were made with results reported from other studies.

PRESENTATION OF DATA AND DISCUSSION

Dietary Histories and Food Intake Records

Sixty-eight student nurses kept records of their daily food intakes for a period of one week each. Amounts of foods eaten were estimated, except in certain cases, such as the half-pint bottle of milk, which could be measured. The amounts reported, therefore, should be somewhat more accurate than if the quantities reported were all estimated. Average daily intakes of calories, protein, calcium, vitamin A and vitamin C were calculated from these diet records by use of The Food Composition Table for Short Method of Dietary Analysis (Revised), prepared by Donelson and Leichsenring (38). A table of average daily dietary intakes of the 68 subjects may be found in the Appendix.

A summary of the calculated average daily dietary intakes of this group of student nurses is presented in Table 2. Intakes of Calories ranged from 858 to 2481, with an average of 1699 Calories per day. Only two values below 1000 Calories were found. One of these girls was following a prescribed low-calorie reducing diet, and the other missed six meals during the week of study. One-fourth of the subjects ingested 1000 to 1500 Calories, over one-half ate food furnishing 1500 to 2000 Calories, and about one-fifth consumed more than 2000 Calories.

Table 2. Daily Dietary Intakes of Calories, Protein, Calcium, Vitamin A, and Vitamin C of 68 Student Nurses

Calories Ingested	No. of Cases	Calories		Proteins		Calcium		Vitamin A		Vitamin C	
		Mean	Range	Mean Gm.	Range Gm.	Mean Gm.	Range Gm.	Mean I.U.	Range I.U.	Mean mg.	Range mg.
Below 1000	2	868	858-877	36.9	32.6-41.2	0.22	0.18-0.25	5652	3697-7607	81	47-115
1000-1499	17	1336	1120-1493	48.8	35.1-65.8	0.54	0.20-0.97	4573	1171-11078	49	24-108
1500-1999	37	1762	1503-1984	61.6	45.2-75.9	0.81	0.21-1.21	5564	1857-13280	56	19-93
Over 2000	12	2159	2038-2481	75.3	64.7-89.1	1.14	0.76-1.85	6455	2818-11015	81	33-130
Total	68	1699	858-2481	60.1	32.6-89.1	0.78	0.18-1.85	5476	1171-13280	59	19-130

The average caloric intake of this group of young women for the period studied was lower than in most studies reported. It agrees most closely with the reports of Latzke (10), who found students selecting foods supplying an average of 1674 Calories, and Morris and Bowers (12), who found an average intake of 1305 Calories for a group of Utah students. Most other studies of food consumption have reported an average intake of about 2000 Calories for women of this age range.

In the present study a progressive increase in mean intakes of specific nutrients occurred with increasing caloric intakes. The average daily protein intake of this group of student nurses was 60.1 grams, with a range of 32.6 to 89.1 grams. The mean intake of protein was higher than the 50.9 and 56 grams reported by Latzke (10) and Coons and Schiefelbusch (9) respectively. It most closely agrees with the 60.71 grams reported by Morris and Bowers (12). Values found by other investigators have been somewhat higher, ranging from 63 to 70 grams of protein per day (14,15,16).

Calcium intake for the group averaged 0.78 grams per day, and ranged from 0.18 to 1.85 grams. This mean intake compares with findings of 0.717 grams daily by Morris and Bowers (12) and 0.8288 grams per day by Greenwood and Lonsinger (14). Except for the intake of 0.613 grams found by Latzke, calcium consumptions observed by other investigators have been higher, averaging 0.93 to 0.94 grams per person daily (9,15,16).

The mean intake of vitamin A was computed to be 5476 International Units per day, but individuals within the group varied from 1171 to 13,280 International Units per day. Since intake of vitamin A is dependent upon choice of specific foods, there was found to be less consistent increase with calories eaten than was shown by certain other nutrients. The average vitamin C content of diets tended to rise with

increasing calories, although much individual variation occurred. The calculated amount of ascorbic acid ingested ranged from 19 to 130 milligrams per day, and averaged 59 milligrams. These figures do not include ascorbic acid intakes from dietary supplements, which will be discussed later. Such additional vitamin C would have raised the figures reported in Table 2. It is of interest to note that dietary sources of ascorbic acid provided an average of about 60 milligrams per day, an amount which probably meets the needs of many of the subjects.

On the basis of data obtained, only a few observations on dietary adequacy appear justified. In the comparison of survey findings with dietary standards or allowances, it must be remembered that "inasmuch as variability is a fundamental attribute in biology, it becomes impossible to fix a single figure as the requirement for a substance" (7). Standardization of requirements is difficult, also, because of changing knowledge and inadequacies of present measures and means of detecting mild deficiencies (12). As emphasized by Sherman and Atwater (45), "a dietary standard is only an indication, not a rule". The recommended allowances of the National Research Council were planned to serve as a guide in the planning of adequate diets for a normal population. Balance studies and other chemical measures of nutritional status (46) have shown that these allowances are greater than the needs of many individuals. It appears, therefore, that persons whose intakes equal or exceed these allowances are presumable adequately nourished, but it does not necessarily follow that all people failing to reach these goals are malnourished. (4)

It would seem that student nurses, in general, should be classified as moderately active individuals. National Research Council recommended allowances for a moderately active, 123-pound woman are:

2400 Calories, 60 grams protein, 1.0 grams calcium, 5000 International Units vitamin A and 70 milligrams ascorbic acid daily. Since many of the subjects were in the 19-20 year age groups, the above allowances were compared with recommendations for girls 16 to 20 years of age. The protein allowance for post adolescent girls is 75 grams, and an ascorbic acid intake of 80 milligrams is recommended. Other recommendations are the same as those for a moderately active woman.

In comparison with the above allowances, the average intake of calories appears to be low. Calcium and vitamin C intakes also are somewhat below allowances. The average protein intake is within that recommended for women, but is low for girls 16 to 20 years. Whether or not the actual requirements of these students for maintenance of normal nutrition are being met cannot be determined from the present study. It would appear, however, that if satisfactory nutritional states are being maintained by present calculated dietary intakes, requirements of certain specific nutrients by some individuals are lower than those generally found.

As mentioned earlier, low-caloric diets tended to be low in other nutrients. Of the 19 subjects ingesting less than 1500 Calories only two had 60 or more grams of protein, and only one averaged one gram of calcium daily. Intake of the specific nutrients studied reached or exceeded allowances in nearly all cases where the energy intake was over 2000 Calories. It was observed that calcium intake did not reach one gram per day until more than two glasses of milk were included in the daily dietary. Thirty-five per cent of the group ingested the recommended daily amount of calcium.

Of especial interest for the partial explanation of low dietary intakes is the record of meals missed during the week of study. Table 3 summarizes these data. A meal was defined more in terms of time of eating

than in terms of quality. For instance, black coffee and fruit juice at breakfast-time served as a meal for some of the subjects. If judged in terms of nutrients supplied, the number of meals which were missed or grossly inadequate would have been increased. Meals for students working evenings were interpreted as the corresponding day-time meals. Jackson and Schuck (47), in a study of Purdue University women, found that omissions or inadequacies of breakfasts were not compensated by the rest of the meals for the day and caused a low intake of whole and enriched grain products, milk and fruits for the week. Because of our usual menu patterns, the missing of any meal is likely to result in the omission of certain foods from the day's dietary. For example, cereals and citrus fruits are usually eaten at breakfast, while meats or other high protein foods are most frequently served at dinner. A consistent omission of breakfast would lead to a low consumption of citrus fruits for the week, and the missing of dinner would lower the protein food intake.

In this study breakfast was omitted by one-half of the students one to three times, supper by one-third of the girls one to five times, and the noon meal by eight individuals one to two times during the week. Meals missed on days off duty accounted for about one-third of the meals omitted. The large number of suppers missed can be explained in part by the fact that many students who worked evenings did not eat at 11:00 o'clock when reporting off duty. In other words, there was a tendency for students working the evening shift to eat only two meals a day.

Table 3. Number of Meals Missed Per Week by 68 Student Nurses

Group	Number
Total meals missed	82
Breakfast	41
Noon	11
Evening	30
Students missing meals	
0 meals missed	19
1 meal missed	22
2 meals missed	8
3-4 meals missed	8
6 meals missed	1

Six students reported regular intake of vitamin preparations, and two reported occasional use of these dietary adjuncts. These supplementary intakes of vitamins are not included in Table 2, which considers only the nutrients derived from foods eaten. One student was receiving iron supplementation daily. Only three girls reported occasional or weekly use of laxatives. A list of the subjects who were receiving dietary supplements and the composition of such preparations may be found in the Appendix.

As stated earlier, milk consumption equaled or exceeded the recommended intake in only about one-third of the cases. In an effort to learn what beverages were replacing milk in the menu, intakes of coffee, tea and cola were determined. Cola type beverages were reported consumed one to three times a week by 27 girls, four to five times weekly by two girls, and 11 to 14 times during the week by two girls. Tea was not generally used, although four individuals drank five to 13 cups during the week. Coffee was the non-milk beverage most often chosen. Only 16 students drank no coffee during the week, 32 had one cup or less daily,

17 drank two to four cups per day, and three averaged five or six cups each day. Table 4 shows that there was a tendency for coffee intake to decrease with increased milk intake.

Table 4. Comparison of Coffee Intake with Amount of Milk Consumed

Glasses Milk Per Day	No. of Cases	Cups Coffee Per Day	
		Average	Range
0-1	13	2.1	0-6
1-2	31	1.4	0-5
Over 2	24	0.5	0-3

Between-meal and bedtime snacks were fairly frequent. Over one-half of the group reported occasional snacks, and more than one-third ate between meals often or regularly. Only five students indicated that they ate only at mealtime. Twenty-nine of the 70 girls reported eating meals away from the hospital or nurses' residence once a week or more. Nearly one-half stated that they ate out only about once a month. Since many leave the hospital on days off duty, the latter figure seems high. Perhaps meals eaten at home were not considered "eating out".

A check-list was included in the general questionnaire in an attempt to discover changes in food habits which had occurred during the period since the student enrolled in the school. Responses to such a list are necessarily subjective, and are influenced by forgetting and various factors of personal bias, so must be viewed within the limitations of such information. Opinions of usual food consumption often vary from actual amounts of food consumed. Ohlson and others (48) found that subjects consistently thought their milk consumption to be higher than was found when actual dietary records were checked. Such a comparison

was made in the present study, with somewhat similar findings. Results of this analysis are shown in Table 5.

Table 5. Comparison of Student's Opinion of Average Milk Intake with Actual Amount of Milk Consumed

Students Reporting	Number
Actual intake	18
More than actually consumed	42
Less than actually consumed	7

Table 6 presents a summary of changes in food habits, as reported by 70 student nurses. Of especial interest are the reports of lowered intakes of eggs, citrus fruits, cheese and fresh meats. Custards and butter or margarine were also eaten less frequently by several persons. With the exception of butter and perhaps fresh meats, reductions in intake of these various foods was probably influenced by lesser availability in the hospital cafeteria. During the period of study, eggs and custards were seldom served. Sufficient high vitamin C foods were eaten by some of the students, so these needs could have been met by careful choice of foods. The possibility of serving more cheese on the hospital menu is indicated.

Since students did not pay for their meals, cost should not have influenced the choice of foods. Several students commented on the fact that they received more starchy foods in the hospital cafeteria than in their usual home dietaries. This probably was true. In view of the apparently low caloric intakes of many of the subjects, perhaps the use of some of the combination dishes was indicated. The use of eggs at other meals, in addition to breakfast, is suggested, especially since

individuals working evenings usually omit breakfast. Devilled eggs, served as a salad or a garnish, are often accepted more easily than a breakfast egg not done to taste. Leafy green vegetables which are not well-accepted when cooked might be offered in a fresh crisp salad with a tart dressing. Such small changes in methods of food preparation might increase consumption of certain foods.

Changes in milk intake varied, with about the same number reporting increased and decreased intakes. Milk was available at all meals, and also between meals in the nurses' residence. Potatoes and whole-grain breads were other foods for which a fairly large number of students reported lowered intakes. An increase in the amount of macaroni products and rice eaten could partially replace calories lost by lessened potato and bread intakes. The total findings may indicate that certain individuals were eating smaller quantities of food than they had been consuming before they enrolled in the school. Comments were made by several of the students that they ate less now than they did at home. Thirty students reported increased coffee intakes. This was the largest single change in food habits reported. More favorable changes included increased consumption of liver by 10 individuals, and a decrease in the amount of candy eaten by 14.

Table 6. Changes in Food Habits During Training as Reported by 70 Student Nurses

Food	Number of Students Reporting			
	More now	Learned to eat	Less now	Does not eat
Milk	10	1	12	5
Eggs	4		20	5
Custards	2	1	7	17
American cheese		2	11	8
Liver	6	4	5	16
Fresh meats	4	1	14	
Oranges and grapefruit	6	1	18	1
Tomatoes	7	1	7	5
Fresh vegetable salads	9	5	9	
Spinach	8	3	5	8
Carrots	2	2	5	7
Potatoes	2		19	4
Breakfast cereals	6	5	9	15
Whole-grain bread	7	1	12	7
Macaroni, rice, etc.	14	1	5	
Navy and lima beans	4	5	3	16
Butter and margarine	3		8	
Cake	3		14	
Candy	7		14	4
Coffee	16	14	5	10

Hemoglobin

Results of a single determination of hemoglobin concentration of the blood in tests of 71 student nurses showed a mean of 13.7 grams per 100 milliliters, with a range of 11.5 to 15.8 grams per hundred milliliters. Figure 1 presents a frequency distribution of the values obtained. Seventy per cent of all cases fell within one standard deviation of the mean, or between 12.9 and 14.5 grams, and all were within three standard deviations above or below the mean. Hemoglobin concentrations of the individual subjects may be found in a table in the Appendix.

The average concentration of 13.7 grams found in this study is near the mean value of 13.4 grams reported for 4550 women from the North Central States (32). The mean of this study also approaches the average values of 13.8 and 13.9 grams per cent which have been reported by several other investigators (28,30,34). The range of values in this study was not as great as have been the variations reported in several other studies. This can probably be explained by the fact that the subjects were examined routinely throughout their training, and any very low hemoglobin concentrations would have been found and treated.

Hemoglobin values have been found to vary within, as well as among, individuals. Therefore, results of single determinations should not be accepted as absolute values. Such results can be used as indications of probably hemoglobin concentrations of individuals studied. Findings for this group of student nurses show that hemoglobin concentrations of these subjects appear to be within the normal range.

No consistent relationships were found between the observed hemoglobin values and intake of specific dietary nutrients. Low concentrations of plasma ascorbic acid occurred at random throughout the range of hemoglobin values.

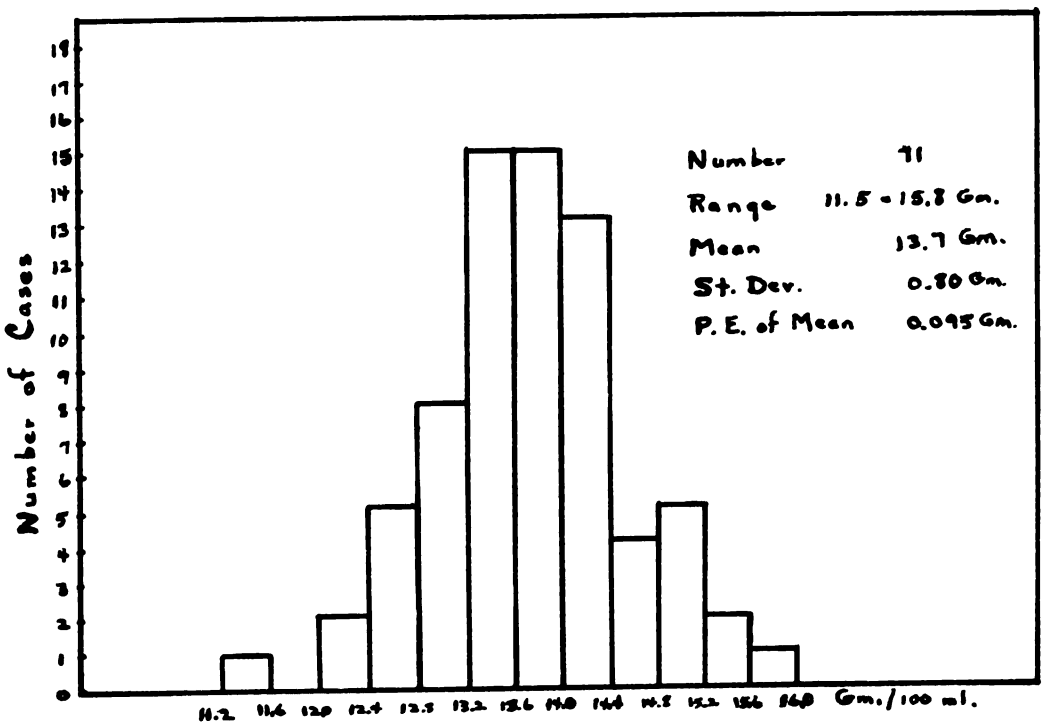

Figure 1. Hemoglobin Concentrations of 71 Student Nurses

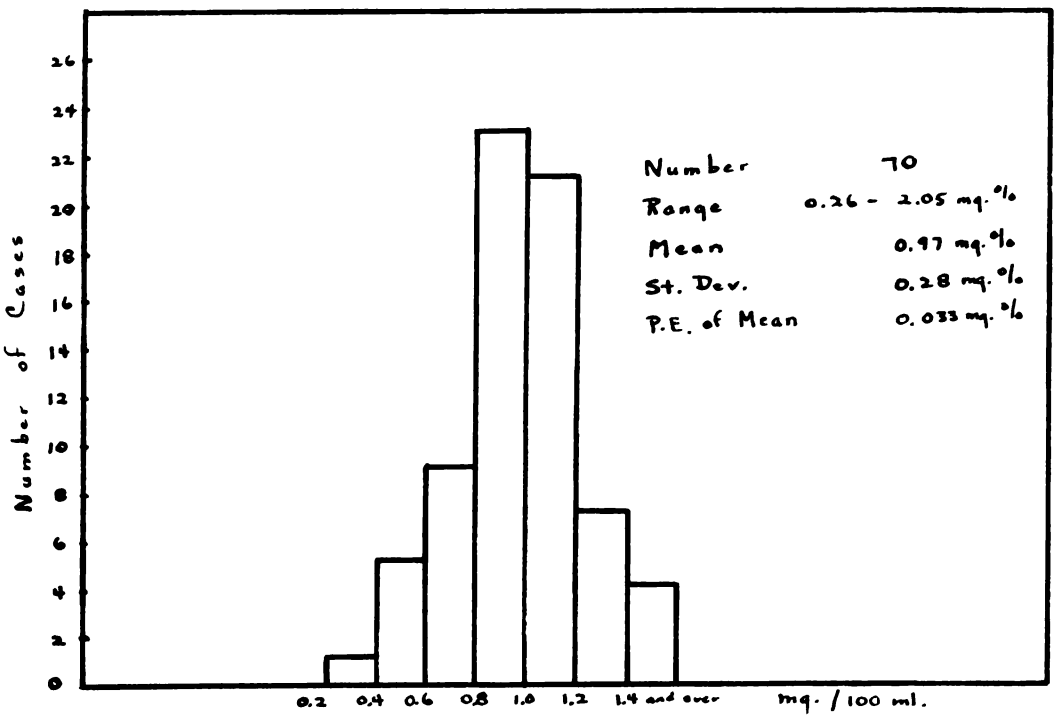

Figure 2. Concentrations of Plasma Ascorbic Acid of 70 Student Nurses

Plasma Ascorbic Acid

Concentration of reduced ascorbic acid in blood plasma of 70 student nurses averaged 0.97 milligrams per hundred milliliters plasma. The range of values was found to be from 0.26 to 2.05 milligrams per cent. Fifty-three values, or 75.7 per cent of all cases were within one standard deviation of the mean or between 0.69 and 1.25 milligrams per cent. Only one value was more than three standard deviations from the mean. This was the high concentration of 2.05 milligrams per 100 milliliters for a student taking 500 milligrams of crystalline ascorbic acid daily in addition to that received in food. Figure 2 shows the distribution of plasma ascorbic acid values for this group. A table in the Appendix lists plasma ascorbic acid concentrations for the individual subjects.

The mean plasma ascorbic acid value found in this study is higher than the 0.66 milligrams per cent reported for women from the North Central States (37). It is also higher than the average 0.797 milligrams per cent recorded by Dodds and MacLeod (17) and the mean of 0.65 milligrams per 100 milliliters found by MacMillan and Todhunter (34).

There was an apparent limited correlation found between intake of vitamin C and plasma ascorbic acid concentration. Table 7 shows an increasing mean intake of vitamin C with increasing ascorbic acid concentrations of blood plasma. This table includes six individuals who received 75 to 500 milligrams of supplementary vitamin C each day. These additional amounts have been included in the intake ranges recorded in the table. A wide range of intakes was observed for each plasma level. The low intakes of vitamin C recorded for certain subjects, whose plasma ascorbic acid concentrations appeared satisfactory, suggest that the

vitamin C requirements of some individuals may be much lower than the amounts usually considered to be necessary.

Table 7. Intakes of Vitamin C at Increasing Levels of Plasma Ascorbic Acid Concentration

Plasma Ascorbic Acid Concentration	No. of Cases	Intake of Vitamin C	
		Mean Intake	Range of Intake
mg./100 ml.		mg.	mg.
0.20-0.39	1	27	-
0.40-0.59	5	57.6*	31-94*
0.60-0.79	9	44.3	31-84
0.80-0.99	23	61.0*	24-107*
1.00-1.19	19	70.5*	31-190*
1.20-1.39	7	102.1*	51-212*
1.40 and over	3	244.3*	63-562*

*Figures include intake of vitamin supplements.

Health Histories

Good health is a requirement for entrance into, and is necessary for remaining in, nurses' training. This process of selection rules out individuals with poor health records. An examination of medical records for this group gave a general picture of apparently good present health. The chief illnesses of these students during training were upper respiratory infections, gastrointestinal upsets, and surgical operations, such as appendectomies and tonsillectomies, which were of short duration and probably had little effect on the nutritional states of the individuals concerned.

Food allergies result in the restriction of those foods which have been found to produce allergic responses. Since such allergies were reported by nine of the students, dietary records of these individuals were examined for the possible effects on food intake. The average dietary intake of this group was found to be close to the mean for all the subjects studied. The allergy-group ate foods providing an average of 1697 Calories, 59.3 grams protein, 1.79 grams calcium, 5183 I.U. vitamin A and 55 milligrams ascorbic acid daily. However, about one-half of these subjects had low intakes of several or all of the nutrients calculated. Allergy lists of these students showed that adequate diets could be selected from the food served, if the individuals so desired.

Since menstrual difficulty may be a health problem for some young women and may influence dietary intake during periods of catamenia, certain data revealed by this study are included in this report. The average age of onset of menstruation was found to be 12.6 years, with a range of 10 to 16 years. This is the menarcheal age reported by Simmons and Greulich (49) from the analysis of records of 200 girls. Other investigators (23,50) report that menstruation begins most often during the thirteenth year.

Table 8 presents a distribution of the degree of menstrual difficulty reported by these subjects. About one-half reported no difficulty, about one-third had some discomfort, while about one-sixth had moderately severe difficulty or incapacity with periods. A higher number of cases of menstrual discomfort were found to occur in the girls who started to menstruate between 11 and 13 years of age. Whether or not this finding is associated with age of onset, with stature, or both, is questioned, since it was also discovered that students of shorter present height had tended to reach the menarche earlier than had girls of greater

present stature. A classification of degree of menstrual difficulty by height showed a mean present height of 62.3 inches for students reporting severe difficulty and an average height of 64.4 inches for those reporting no difficulty.

Table 8. Degree of Menstrual Difficulty Reported by 71 Student Nurses

Age of Onset	No. of Cases	Present Height Mean	Present Height Range	Degree of Menstrual Difficulty Severe	Mod.Sev.	Mod.	None
yr.		in.	in.	no.	no.	no.	no.
10	1	64.5					1
11	16	63.3	62.0-65.0	1	4	3	8
12	15	64.0	59.0-70.5	2	1	6	6
13	24	64.4	61.0-71.5	2	1	9	12
14	11	64.9	61.0-69.0			5	6
15	3	65.5	64.0-67.0			1	2
16	1	63.0					1
Total	71			5	6	24	36

Heights and Weights

For this group of 71 young women an average height of 64.0 inches, or 162.6 centimeters, was found, with a range of 59 to 71.5 inches, or 149.9 to 181.6 centimeters. Weights ranged from 103 to 162 pounds (46.8 to 73.6 kilograms), with an average weight of 128.4 pounds (58.4 kilograms). Table 9 presents the average weight and the range of weights for girls of different heights, as found in this study and as compared with a standard table. The range of expected weights is recorded as 10

per cent below the mean expected weight to 15 per cent above that weight. The average actual weights were somewhat higher than the mean expected weights for students between 64.0 and 66.5 inches. Heights and weights of the individual subjects are recorded in a table which may be found in the Appendix.

Table 9. Weight in Relation to Height of 71 Student Nurses Ages 19 to 32 Years

Height	No. of Cases	Actual Weight		Expected Weight*	
		Mean	Range	Mean	Range
in.		lb.	lb.	lb.	lb.
59.0	1	110		109	98-125
....					
61.0	5	113	106-118	116	104-133
61.5	1	103		117	105-134
62.0	6	115	103-126	118	106-136
62.5	3	134	126-147	119	107-137
63.0	5	113	104-130	120	108-138
63.5	6	117	103-128	122	110-140
64.0	16	134	113-156	125	112-144
64.5	6	133	120-148	126	113-145
65.0	5	135	112-146	127	114-146
65.5	4	135	131-140	130	117-149
66.0	4	134	124-151	132	119-152
66.5	2	155	148-162	134	121-154
67.0	2	129	128-130	135	122-155
67.5	1	145		137	123-157
68.0	1	155		138	124-158
....					
69.0	1	138		150	135-172
....					
70.5	1	145		146	131-168
....					
71.5	1	145		148	133-170

*Based on the Table of Height and Weight for Women of Different Ages by Thomas D. Wood, M. D. (39)

Comparison with findings in the literature shows this group of students to be somewhat shorter on the average than were college women studied by Greenwood and Lonsinger (19), Ostrovska and Ellms (29), and Donelson et al. (20). These investigators reported mean statures of 164.1, 164, and 163.7 centimeters respectively. Smith College students (23) and Stanford University students (15) were also found to be taller than this group of student nurses. The mean height reported from the present study was near the average of 63.75 inches for the large group of college women studied by Diehl (24). When heights were averaged by states in the Donelson study mentioned above, average statures varied from 161.4 to 164.8 centimeters. Of the states included in the study, Ohio was probably the most comparable to Michigan. Students from Ohio were found to have a mean height significantly lower than any of the other states studied. The subjects of the present study exceeded the Ohio girls in height by approximately one centimeter, but were nearer the heights of the Ohio subjects than the statures reported for young women from the other states.

The average weight recorded in this study compared most closely with that reported by Greenwood and Lonsinger (19). A higher average weight was reported in one study (29), but several other studies (22,24,29) recorded mean weights which were lower than those found in this study.

There were 16 deviants from "normal" or expected weights for height and age, eight overweight and eight underweight. Five of the eight obese subjects were six to 15 pounds overweight, while seven of the eight underweight subjects were one to five pounds below their lowest normal expected weights. Several students at the borderline were not included in the deviant groups.

Table 10 shows the average dietary intake for the group of overweight girls to be considerably lower than is the mean intake of the underweight girls. This finding is in line with the report by Brown and Ohlson (51) that obese young women were found to be maintaining their body weights on less calories than those consumed by average young women of normal weight. Several of the obese students in a present study were restricting their intakes in an effort to lose weight. Two were taking thyroid extract and benzedrine preparations under medical supervision. They still remained in the overweight group, however.

Studies of the weight changes of subjects in this survey produced several interesting findings. Table 11 presents the pattern of weight change during the period of training. Weight figures were obtained for total time in training, and changes were determined for six-month and yearly intervals. The figures for the first year in training include all students in the study, while second year figures include only those who were in, or had completed, their second year in the school. Figures given for the third year represent the 11 senior students studied. Over one-half of the students gained weight during their first six months in training, while only about 10 per cent lost weight during the same period. During the next year and one-half, weights tended to remain fairly constant, or to decrease. In the small sample of senior students studied, a pattern of increased weight loss was noted during the last year of training, especially in the last six months.

Table 10. Average Daily Dietary Intakes of Student Nurses Deviating from Normal Expected Weights

Group	No. of Cases	Calories		Protein		Calcium		Vitamin A		Vitamin C	
		Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
				Gm.	Gm.	Gm.	Gm.	I.U.	I.U.	mg.	mg.
Overweight	8	1406	858-2045	56.5	32.6-65.8	0.71	0.18-1.16	5744	2055-11078	67	27-115
Underweight	7	2015	1493-2481	71.4	44.9-89.1	1.11	0.89-1.85	5579	3049-9160	70	47-130

Table 11. Weight Change of Student Nurses by Six-Month and Yearly Intervals

Period of Training	Number of Cases	No Weight Change		Weight Gains			Weight Losses		
		Number	Per cent	Number	Per cent	Average Amount Gained	Number	Per cent	Average Amount Lost
						lb.			lb.
First Year	71	33	46.5	27	38.0	8.1	11	15.5	6.1
First 6 months	71	24	33.8	40	56.3	6.5	7	9.9	4.7
Second 6 months	71	36	50.7	13	18.3	4.5	22	31.0	6.2
Second Year	46	23	50.0	8	17.4	5.5	15	32.6	7.7
First 6 months	46	29	63.0	5	10.9	5.6	12	26.1	7.5
Second 6 months	35	22	62.9	5	14.3	5.2	8	22.8	5.0
Third Year	11	4	36.4	3	27.3	3.7	4	36.3	16.8
First 6 months	11	5	45.4	3	27.3	4.0	3	27.3	10.0
Second 6 months	11	3	27.3	2	18.2	7.0	6	54.5	8.8

A summary of total weight change during training of 19 subjects is presented in Table 12, which is based on the difference between entrance weight and graduation weight. It should be mentioned that weight changes observed appeared desirable in relation to the entrance weight, except in the case of one weight loss.

Table 12. Comparison of Entrance Weight With Graduation Weight of 19 Student Nurses

Weight Change	No. of Cases	Amount of Change 1-9 lb.	Amount of Change 10-19 lb.
		no.	no.
None	8		
Gain	5	3	2
Loss	6	2	4

Average intakes of food nutrients by groups of students apparently gaining, maintaining, or losing weight during the period of study are reported in Table 13. The lowest mean dietary intake was found for the group losing weight, and the highest average intake for the gaining group. The reputed value of 858 Calories daily is low for a student apparently maintaining body weight. The next lowest caloric intake by an individual maintaining weight was 1253. Since the effects of increased or decreased caloric intake are not immediate, figures reported here may reflect dietaries of several weeks past, or in the case of the very low caloric diet, weight changes may have been measured later if the diet had been followed for a limited number of days at the time of study.

Table 13. Average Daily Dietary Intakes of Students Changing or Maintaining Their Weights During the Week of Study

Group	No. of Cases	Calories		Protein		Calcium		Vitamin A		Vitamin C	
		Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
				Gm.	Gm.	Gm.	Gm.	I.U.	I.U.	mg.	mg.
Gaining weight	6	1843	1428-2274	63.2	49.7-76.5	0.65	0.28-0.89	6798	1857-10950	59	21-108
Maintaining weight	48	1748	858-2481	60.9	32.6-89.1	0.83	0.20-1.85	5264	1463-13080	59	24-130
Losing weight	14	1468	977-2188	56.1	36.0-80.3	0.69	0.18-1.19	5637	1171-11078	62	19-115

Summary

Calculated daily dietary intakes of many of the student nurses studied appeared somewhat low when compared with recommended allowances. In spite of their apparently low intakes, these students seemed to be in good health at the time of study. Their average hemoglobin and plasma ascorbic acid values were within normal ranges. Weight changes tended to follow caloric intakes. The average intake of calories by the group of subjects gaining weight was higher than that of the group losing weight. Most of the students were maintaining their weights on present intakes. Those weight changes which occurred were, in most cases, desirable. These common indices would suggest that the general nutritional status of the group was good at the time of study. It should be noted that intakes of all the subjects were not low. Some students were eating at high levels, and, even at lower levels, few extremely low intakes were recorded.

Several questions arise as the result of findings of this study. Are the intakes of these subjects meeting their needs, and if so, are the actual energy and nutrient requirements of this group lower than those usually expected for individuals of this age range and type of activity? If present intakes of these students are not meeting their individual needs, what will be the long time effect of such deficits?

These student nurses had received instruction in the principles of nutrition and diet therapy in addition to courses concerned with general health. From the data presented it can be concluded that many of the students were not making application of theoretical knowledge to actual practice. The findings of this study imply a need for more effective education in the field of personal food requirements and good dietary habits. Since food consumption was found to be influenced by changing

hours of duty, emphasis should be placed on the fulfilling of daily requirements regardless of the time of meals.

Findings of this study indicate that meals served to the student nurses were nutritionally adequate. The adequacy of individual dietaries was dependent upon the food choices made by the subjects. In addition to the increased emphasis on education suggested above, students might be encouraged to eat more of certain nutritionally important foods if some small modifications were to be made in methods of preparing and serving them.

SUMMARY

1. Seventy-one student nurses, who ranged in age from 19 to 32 years, were studied. Information obtained included dietary histories, health histories, hemoglobin and plasma ascorbic acid analyses, diet records, and height and weight measurements.

2. Mean daily calculated intakes were estimated as 1699 Calories, 60.1 grams protein, 0.78 grams calcium, 5467 International Units vitamin A, and 59 milligrams ascorbic acid. There was found to be a wide variation in individual intakes, ranging from 858 to 2491 Calories, 32.6 to 89.1 grams protein, 0.18 to 1.85 grams calcium, 1171 to 13,280 International Units vitamin A and 19 to 130 milligrams ascorbic acid. Higher intakes of specific nutrients tended to parallel increased caloric intakes.

3. A number of students reported eating less eggs, custards, citrus fruits, cheese, fresh meats, potatoes and whole-grain breads since entering training. Meals were missed fairly frequently. Most students ate between meals. One-third drank more than two glasses of milk daily. Coffee intake tended to be high, especially in cases of lower milk consumption. Irregular hours of work appeared to result in lowered food intakes.

4. Average hemoglobin concentration of the blood was found to be 13.7 grams, with a range of 11.5 to 15.8 grams per 100 milliliters blood. No apparent relationship was found between hemoglobin concentration and dietary intake of nutrients studied.

5. Results of one determination of reduced ascorbic acid concentration of the blood plasma showed a range of 0.26 to 2.05 milligrams per 100 milliliters, with an average value of 0.97 milligrams per cent. There was a positive relationship demonstrated between plasma ascorbic acid values and mean intakes of vitamin C, although individual variations were great.

6. Heights of these young women ranged from 59 to 71.5 inches (149.9 to 181.6 centimeters) and weights varied from 103 to 162 pounds (46.8 to 73.6 kilograms). Average stature was found to be 64.0 inches (162.6 centimeters), with a mean weight of 128.4 pounds (58.4 kilograms). Eight subjects were found to be over 10 per cent below their expected weights for height and age, and eight were more than 15 per cent above their expected weights. There appeared to be a pattern of weight gain during the first six months in training, followed by a gradual return to entrance weight for many students.

7. Average food intake of the overweight students was found to be lower than that of underweight subjects. Those students losing weight were eating fewer calories, and those gaining weight were eating more calories than were the students whose weights remained constant during the period of study.

CONCLUSIONS

The student nurses studied showed variations in their application of knowledge of recommended dietary practices to individual intakes. Many seemed to be eating at lower levels than might be expected in view of health education obtained in nurses' training.

Although food intakes of many of these subjects appeared to be somewhat low, their average hemoglobin and ascorbic acid concentrations were within normal ranges, and nearly four-fifths were maintaining or increasing their weights. The present general health of the group apparently was good.

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APPENDIX

NUTRITIONAL SURVEY - SPARROW HOSPITAL
Spring 1949

Name_____ Class_____ Date_____

Home address_____If you live in a town give its size___

Do you, or have you ever lived on a farm?_____

Birth date_____ Age_____ Sex_____

Place of birth_____

Nationality_____ Are you a citizen of the U.S.?_____

Father's birthplace_____

Mother's birthplace_____

How many generations has your family lived in the U.S.?_____

How many members are there in your family?_____ At home?_____

Father_____

Mother_____

Brothers_____ Younger?_____ Older?_____

Sisters_____ Younger?_____ Older?_____

Are all members of your family living?_____

If not, give cause of death_____ age at death_____ relation_____

_____ _____ _____

Who is wage earner in your family?_____ Occupation?_____

Has he worked steadily during the past 5 years?_____

If not, give reasons_____

Do any other members of your family contribute to your support?_____

Father's education: Grade completed_____ College_____ Degree_____

Mother's education: Grade completed_____ College_____ Degree_____

How many rooms are there in your home?_____

Does your family own your home?_____ Rent it?_____

Approximate rent_____
(below $30, $30-$60, over $60)

Page two

Have your eating habits changed since entering training?_____

Check ( ) the foods that you eat now but did not eat at home. Mark (x) the foods you do not eat. Also indicate by "more" or "less" any changes in amounts of foods eaten since entering training.

Milk_____ Macaroni, rice, etc._____

Coffee_____ Carrots_____

Liver_____ Navy or lima beans_____

Eggs_____ Butter or margarine_____

Cake_____ Meat (fresh)_____

Breakfast cereals_____ Potatoes_____

Oranges and grapefruit_____ Whole grain bread_____

Spinach_____ Candy_____

American cheese_____ Tomatoes_____

Custards_____ Fresh vegetable salad_____

Others, or comments:

How often do you eat out?_____

Do you eat between-meal snacks?_____ Often?_____ Seldom?____Regularly?__

Do you eat at bedtime?_____ Often?_____ Seldom?____Regularly?__

Does your home have electricity?_____

running water?_____

bathroom?_____

Does your family have an automobile?_____

radio?_____

refrigerator?_____ mechanical___ ice_____

How many hours of sleep do you get when on day duty? _____ 3-11?_____

Nights?_____

How much sleep have you had in the past 24 hours?_____

Page three

Did you work before entering training?_____ Occupation?_____

Method of financing education_____

Do you participate in sports: actively?_____ occasionally?_____

never?_____

What sports do you particularly like?_____

When did you last have ice cream_____

candy_____

gum_____

soft drinks_____

tea, coffee_____

Do you take vitamin preparations?_____ What kind?_____

Do you take iron medication?_____ What kind?_____

Do you take laxatives?_____ How often?_____ What kind?_____

How many glasses of milk do you drink daily?_____

How many glasses of water do you drink daily?_____

What foods do you usually eat for breakfast?

Dinner?

Supper?

MEDICAL HISTORY

Name_____ Date_____

Check once the conditions which you have had and give approximate dates. Check twice those you now have.

Acne	Jaundice
Bronchitis	Allergies (specify)
Chickenpox	Tonsillitis
Measles	Colds, frequent
Whooping Cough	Pneumonia
Diarrhea	Migraine headaches
Diphtheria	Infantile Paralysis
Scarlet Fever	Smallpox
Tuberculosis	Appendicitis
Typhoid Fever	Mumps
Rheumatic Fever	Other (specify)
Joint pains	

Have you ever had any surgical operations? Explain_____

Have you ever had any broken bones? Explain_____

Have you ever been confined to bed for longer than 2 weeks?_____

If so, why and how long?_____

Do you have a family doctor?_____ Dentist?_____

When did you last see a dentist?_____

When were you last under the care of a doctor?_____

Are you taking any medications now?_____

Is any member of your family now under doctor's care?_____

Why?_____

Do you ever have:	Shortness of breath		Sore mouth
Loss of appetite	Chest pain	Swellings	Nausea or vomiting
Fainting spells	Cramps	Boils	

Page two

Menstrual history:

Age of menarche_____

Length of cycle_____

Duration of period_____

How many napkins do you use?_____

Pain (describe)_____

Is medication necessary?_____

Has either of your parents or any brother or sister had:

Tuberculosis_____ Diabetes_____

Insanity_____ Cancer_____

Epilepsy_____ Heart Disease_____

Gout_____

Any significant loss or gain in weight before entering training?_____

Since enrolled in the school?_____

Weight upon entrance_____

Date	Height	Weight	Hemoglobin	Plasma ascorbic acid

Record of illness during study.

RECORD OF MEALS FOR ONE DAY

Name_____ Day_____ Date_____

DIRECTIONS:
List all the foods that you have eaten in the last 24 hours, including butter, sugar and cream, and beverages.
Tell whether food was raw or cooked, and if cooked tell how, as raw apple or baked apple. Describe mixed dishes such as salads, stews, sandwiches, etc.
Tell whether bread was made of corn, rye, whole wheat or white flour, as corn muffins.
Give approximate measure (e.g. 1 slice, 1 cup, etc.) for each food.

FOODS EATEN FOR BREAKFAST

1._____ 4._____ 7._____

2._____ 5._____ 8._____

3._____ 6._____ 9._____

What foods did you eat or drink between breakfast and noon?_____

FOODS EATEN AT NOON

1._____ 4._____ 7._____

2._____ 5._____ 8._____

3._____ 6._____ 9._____

What foods did you eat or drink between the noon and evening meal?_____

FOODS EATEN AT EVENING MEAL

1._____ 5._____ 9._____

2._____ 6._____ 10._____

3._____ 7._____ 11._____

4._____ 8._____ 12._____

What foods did you eat or drink before you went to bed?_____

Vitamin preparations_____ Amount_____

Iron medications_____ Amount_____

Other medications_____ Amount_____

Time of duty (e.g. 7-3 P.M.)_____ Ward_____

Name

Date

Vitamin preparations _____
Iron medications _____
Other medications _____

Duty hours

FORM FOR CALCULATING DIETS

FOODS	Approx. Measure	Calo-ries	Protein Grams	Calcium Grams	Iron Grams	Vitamin A. I.U.	Thiamin Bl Mgm	Ribo-flavin Mgm	Nicoti-nic Acid Mgm	Ascor-bic Acid Mgm
TOTALS										

CALCULATED AVERAGE DAILY INTAKE OF FOOD NUTRIENTS BY 68 STUDENT NURSES

Subj. No.	Calories	Protein Gm.	Calcium Gm.	Vitamin A I.U.	Vitamin C mg.
1	1964	66.7	0.89	5127	62
2	1493	44.9	0.54	3049	53
3	2274	76.5	0.86	7660	63
4*					
5	1984	75.9	1.14	4681	62
6	1863	65.1	1.16	4706	27
7*					
8	1448	52.1	0.84	1463	31
9	1897	49.7	0.30	1857	21
10	2481	89.1	1.85	9160	130
11	1612	60.8	0.89	2737	65
12	1951	73.2	1.11	4330	62
13	877	41.2	0.18	7607	115
14	1958	73.3	1.08	7025	46
15	2085	66.7	0.76	2818	33
16	1831	68.2	0.97	3743	47
17	1936	66.5	1.08	7288	60
18	1593	51.2	0.64	6849	89
19	1976	72.2	1.21	8142	49
20	2038	70.2	1.06	11015	67
21	1644	61.9	0.80	4421	70
22	1380	54.0	0.68	5017	51
23	2305	83.0	1.29	7451	97
24	1981	74.0	1.16	9002	84
25	2188	80.3	1.19	3260	75
26	1604	53.9	0.68	4960	31
27	1673	57.0	0.61	6901	39
28	2108	76.5	1.29	3091	63
29	1309	36.8	0.38	3667	53
30	1353	46.9	0.20	3557	51
31	1564	68.1	0.93	5335	31
32	2103	74.2	1.17	7997	84
33*					
34	1580	49.5	0.55	5436	68
35	1743	65.0	0.72	6740	52
36	1941	69.6	0.68	3674	83
37	1304	38.0	0.30	2725	58
38	1884	65.0	0.76	6147	63
39	1461	47.2	0.43	3082	38
40	2067	78.4	1.27	5448	83
41	1253	35.1	0.37	1687	24
42	2045	64.7	0.77	3350	107
43	1850	58.6	0.85	6247	60
44**	1522	45.2	0.42	10934	74
45	1636	57.7	0.74	3721	34
46**	1714	65.2	1.10	2496	48
47	1783	57.0	1.03	6164	72
48	1268	49.9	0.61	4088	39
49	2173	78.1	1.09	6575	75

Calculated Average Daily Intake of Food Nutrients by 68 Student Nurses (Continued)

Subj. No.	Calories	Protein Gm.	Calcium Gm.	Vitamin A I.U.	Vitamin C mg.
50	1374	45.6	0.39	3211	27
51	858	32.6	0.25	3697	47
52	1580	61.1	0.81	5792	79
53	1719	62.9	0.87	7199	49
54	1687	67.2	0.98	7484	19
55	1763	63.2	0.58	2133	34
56	1827	61.6	0.86	13280	56
57	1339	36.0	0.20	1171	36
58	1302	56.8	0.67	9842	48
59	1612	50.4	0.67	3044	46
60	1428	51.2	0.28	10850	108
61***	1473	60.1	0.77	2055	37
62	1270	51.8	0.77	3892	34
63	1131	65.8	0.97	11078	39
64	1753	69.9	0.83	8556	46
65	1709	54.3	0.21	4573	40
66	1656	65.5	0.97	5224	93
67	1503	53.6	0.74	4247	62
68	2043	65.8	1.07	9632	94
69	1120	57.5	0.79	7313	99
70	1913	52.9	0.43	2235	80
71	1769	47.8	0.61	3448	70

* Food records not returned
** Six-day period
*** Five-day period

INTAKE OF DIETARY SUPPLEMENTS BY STUDENT NURSES DURING PERIOD OF RECORDED FOOD INTAKE

Subject Number	Name of Supplement	Amount Taken
5	Ascorbic Acid	500 mg. daily
6	Ferrous Sulfate	15 grains for 3 days
9	Ascorbic Acid	250 mg. one day
	Multicebrin	2 gelseals for 2 days
12	Multicebrin	2 gelseals daily
13	Multicebrin	1 gelseal daily
27	Mol-Iron	3 capsules one day
54	Multicebrin	1 daily
56	Ferrous Sulfate	5 grains one day
69	Multicebrin	1 daily

COMPOSITION OF DIETARY SUPPLEMENTS

Name	Manufacturer	Composition	
Gelseals No. 100 Multicebrin	Eli Lilly & Company	Thiamin Chloride	3 mg.
		Riboflavin	3 mg.
		Pyridoxine Hydrochloride	1.5 mg.
		Pantothenic Acid (as Calcium Pantothenate)	5 mg.
		Nicotinamide	25 mg.
		Ascorbic Acid	75 mg.
		Vitamin A	10,000 I.U.
		Vitamin D	1,000 I.U.
White's Mol-Iron	White Laboratories, Inc.	Ferrous Sulfate (3 gr.)	195 mg.
		Molybdenum Oxide (1/20 gr.)	3 mg.

INDIVIDUAL BLOOD FINDINGS, HEIGHTS AND WEIGHTS

Subject Number	Age*	Hemoglobin Gm./100ml.	Ascorbic Acid mg./100 ml.	Height in.	Weight lb.
1	20	13.2	1.27	63.0	104
2	21	13.0	1.17	63.5	109
3	20	13.2	1.52	65.0	134
4	20	15.8**	1.13***	61.0	118
5	21	12.6	2.05	62.0	120
6	21	14.0	0.26	64.0	151
7	21	13.8	1.47	65.0	138
8	20	13.9	1.12	67.0	130
9	21	12.9	0.92	64.0	129
10	20	14.4**	1.03	61.5	103
11	20	12.2	1.28	66.0	127
12	21	12.6	1.33	61.0	108
13	22	13.9	1.10	66.5	162
14	23	12.8	0.78	66.0	124
15	19	14.6	0.73	62.5	126
16	19	13.5	1.00	63.5	103
17	19	14.8	0.97	65.0	145
18	20	14.6	1.00	62.0	126
19	20	14.0	0.57	63.0	108
20	26	14.0	0.92	65.5	133
21	19	12.8	1.05***	61.0	118
22	19	15.3	1.22	63.0	130
23	19	13.0	0.89	71.5	145
24	19	14.0	0.78	63.5	128
25	19	13.2	0.47	62.0	105
26	19	14.0	0.65	62.0	112
27	19	12.6	0.44	64.0	123
28	19	13.9	0.84***	63.0	113
29	24	14.8	1.07	65.5	140
30	19	13.6	0.92	64.0	139
31	21	13.2	0.48	59.0	110
32	25	15.1	1.01***	64.0	125
33	21	13.1	1.03	65.0	112
34	21	12.5	1.24	64.0	113
35	32	13.0	0.70	69.0	138
36	21	13.6	1.25	67.5	145
37	19	14.6	1.01	66.5	148
38	20	13.6	0.90	64.0	156
39	20	14.0	1.01	61.0	115
40	23	13.2	1.12	64.0	118
41	20	15.1	0.80	63.5	122
42	19	14.8	0.93	65.0	146
43	22	13.0	0.90	64.5	128
44	22	15.4	0.81	64.0	137
45	19	13.4	0.62	64.5	130
46	19	13.2	1.00	64.0	130
47	19	14.2	0.87***	63.5	125
48	19	13.2	0.62	63.0	110

Individual Blood Findings, Heights and Weights (Continued)

Subject Number	Age*	Hemoglobin Gm./100ml.	Ascorbic Acid mg./100 ml.	Height in.	Weight lb.
49	20	13.8	0.95	62.0	103
50	20	14.0	0.91	64.0	130
51	20	14.0	1.04	62.5	147
52	21	14.0	1.04	64.0	138
53	19	13.5	0.92***	64.0	122
54	19	13.8	0.58	63.5	112
55	19	13.5	0.94	64.5	120
56	28	12.1	0.94	64.0	142
57	20	13.9	0.88	65.5	134
58	21	13.2	0.94	62.0	125
59	20	14.2	1.05***	66.0	151
60	20	13.8	1.52	68.0	155
61	20	14.0	0.99***	64.5	148
62	21	13.9	0.75	64.0	125
63	21	14.2	1.17	64.0	156
64	20	13.5	0.64	66.0	134
65	22	13.9	0.92	67.0	128
66	20	12.6	1.14	64.5	126
67	19	13.9	1.06***	65.5	131
68	19	11.5	0.89	62.5	131
69	19	13.8	1.25***	64.5	148
70	20	13.5	hemolyzed	70.5	145
71	19	13.5	0.91	61.0	106

* Age of nearest birthday
** Based on single value (no duplicate)
*** Based on 2 determinations on single sample (no duplicate)