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The major purposes of this study were to: (1) measure the level of nutrition knowledge acquired by students enrolled in the Bowman Gray School of Medicine; (2) compare the levels of nutrition knowledge acquired by second-year Bowman Gray students with the nutrition knowledge acquired by second-year students enrolled in four New England medical schools determined in a previous study; (3) determine the extent to which measured differences related to selected factors--medical school class, undergraduate science electives completed, sex, food habits, possible future medical specialty, and pre-medical educational geographic area; (4) identify the subject content of test items most frequently answered incorrectly by the medical students.

The Phillips' Nutrition and Diet Therapy Knowledge Test (NDT) was administered to 173 students enrolled in Bowman Gray School of Medicine during the 1972 spring semester. Responses to test items, personal data, and student file data were analyzed by appropriate statistical methods.

Performance on the Phillips' NDT Test indicated that the majority of the Bowman Gray students tested were not familiar with many of the basic nutritional concepts and facts concerning nutrition. Second-year medical students at Bowman Gray did not achieve higher test scores on the NDT than did students enrolled in four New England medical schools who were tested five years previously. Evidence indicated little or no positive relationship between test scores of students and selected demographic factors. Although the number of test items answered correctly by each succeeding class year increased, the length of time

enrolled in medical school did not significantly increase their knowledge of basic nutritional concepts and facts concerning nutrition.

Some implications drawn from this study may provide a frame of reference for the development, implementation, and evaluation of nutrition education programs in medical school curricula.

NUTRITION KNOWLEDGE OF STUDENTS ENROLLED IN ONE NORTH CAROLINA MEDICAL SCHOOL

by

Karen D. J. Richardson

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Approved by

Millred B. Johnson
Thesis Adviser

APPROVAL PAGE

This thesis has been approved by the following committee of the Faculty of the Graduate School at the University of North Carolina at Greensboro.

Thesis Adviser Mildred B. Johnson

Committee Members Joan F. Cassatly

Allen C. Magee

Mildred B. Johnson

Nov. 24, 1975
Date of Acceptance by Committee

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To my husband and children goes my gratitude for continued confidence, patience, and encouragement.

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CHAPTER I

OVERVIEW OF THE STUDY

Nutrition is an essential component of preventative and therapeutic medicine. The recognized presence of malnutrition in all strata of the American society is creating a demand for professionals properly trained in nutrition. The public is exposed to a growing amount of inaccurate and misleading information concerning nutrition and is becoming increasingly more confused in the attempt to differentiate facts from half-truths and fallacies. Because nutrition is such an integral part of both preventative and therapeutic medicine, the nutritional status of a patient is an important factor in his clinical management. It becomes increasingly important that students in medical school gain an adequate knowledge of the principles of nutrition and acquire the ability to translate these principles into specific recommendations when treating and advising patients in clinical practice.

A number of studies have focused on the quantity and quality of nutrition teaching in medical schools during the past twenty years (2, 7, 9, 18, 33, 50, 53). The results of these studies indicate that medical students are exposed to only small amounts of nutrition information. Nutrition concepts and facts were shown to be so well dispersed among other subject matter in the curriculum that the significance of nutrition in medicine was lost; the result being that nutritional problems in clinical practice cannot be dealt with adequately.

Several conferences have focused on the status of nutrition in medical schools and have made urgent and specific recommendations for incorporating nutrition into the medical curriculum (5, 6, 20, 24, 32, 34, 41, 49, 51, 52, 53, 55). Yet, only a small percentage of the medical schools have attempted to implement these recommendations (3, 4, 14, 31, 38, 39, 59).

Since the need for greater efforts to make nutrition an integral and essential part of medical education has been recognized, an initial step toward the development of a strong nutrition program would be to determine the extent of nutrition knowledge presently acquired by students enrolled in medical schools. Little research has been conducted to determine just how well medical students are prepared in the basic knowledge of nutrition and diet therapy (21, 36).

Purpose of the Study

The purposes of this study were to: (1) measure the level of nutrition knowledge acquired by students enrolled in the Bowman Gray School of Medicine[1]; (2) compare the levels of nutrition knowledge acquired by second-year Bowman Gray students with the nutrition knowledge acquired by second-year students enrolled in four New England medical schools (36); (3) determine the extent to which measured differences in grouped Bowman Gray students are related to selected factors--medical school class, undergraduate science electives completed, sex, food habits, possible future medical specialty, and pre-medical educational geographical area; and (4) identify the nutritional subject matter of

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[1]The Medical School of Wake Forest University, Winston-Salem, North Carolina, hereinafter to be referred to as Bowman Gray.

test items answered incorrectly by the medical students. An analysis of the findings of the study could be of value to medical school faculties involved in curriculum planning and evaluation of current nutrition education programs.

It was hypothesized that:

1. There is no statistically significant difference at the .01 level of confidence between the mean value attained by the second-year class at Bowman Gray on the Phillips' Nutrition and Diet Therapy Knowledge Test and the means attained by the second-year classes included in the Phillips' study (36).
2. There are no significant relationships in Bowman Gray student Phillips' Nutrition and Diet Therapy Knowledge Test scores when compared by medical school class, selected undergraduate science elective courses completed, and sex.

Study Design

A Medical Student Nutrition and Diet Therapy Test (NDT)[1] developed by Phillips (36), was selected as the instrument to determine the level of nutrition knowledge of students enrolled in Bowman Gray School of Medicine (Appendix A). A data sheet was developed to secure the following information: class membership, possible future medical specialty, sex, food habits, and pre-medical educational geographical area (Appendix B).

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[1]Hereinafter to be referred to as the NDT Test.

The administrative staff and students at Bowman Gray were contacted and the purpose of the study was explained. Permission was granted for the 288 students enrolled to participate during the 1972 spring semester. This included 77 first-year students, 74 second-year students, 76 third-year students, and 61 fourth-year students. Times and places of each class testing period were announced.

The data were coded for appropriate statistical computations. Bowman Gray faculty members and the technical staff of the Bowman Gray Computer Center assisted in the programming and tabulation.

Limitations

The study was limited to those medical students enrolled in Bowman Gray who participated in the scheduled class testing. No attempt was made to test the total enrollment.

Although proper nutrition and the eating of food is an important part of our well-being, most of the public has limited access to accurate and useful nutrition information. An increasing number of people are looking to the medical practitioner for sound nutrition advice with focus on disease prevention, and medical schools have been designated as the primary source of nutrition education for clinicians. This study seeks to examine the nutrition knowledge now being acquired by medical students in the current medical school curriculum.

CHAPTER II

REVIEW OF RELATED LITERATURE

During the past two decades a number of surveys, conferences, committee reports, symposia, and individual investigators have attempted to outline the importance and assess the status of nutrition in the education of physicians. Although recommendations for the improvement of nutrition teaching in existing programs have been made in the last ten years, few medical schools have reported attempts to implement those recommendations. Evaluation of the nutrition knowledge acquired by students enrolled in medical schools using tested instruments had not been reported prior to 1967 (36). The results of this evaluation provided further evidence of the need for greater efforts to incorporate nutrition into the medical curriculum.

Importance of Nutrition in the Teaching of Medicine

In the past fifty years a great number of important nutrition research discoveries have emphasized the relationship between nutrition and health and disease. Current research has pointed out the increasing importance of the effect of many diseases on the nutritional status of the patient, and conversely, the important influence of the patient's nutritional status on disease management and prevention.

The function of "nutrition" in medicine can no longer be regarded as only the diagnosis and treatment of nutritional deficiency disease and the prescription of a standard dietary regimen for the management of only a few specific metabolic diseases. The coordinator of a session of the Conference on Nutrition Teaching in Medical Schools (24), pointed out, "Nutritional considerations permeate almost every clinical problem that the physician encounters (p. 34)." These clinical problems are met in the nutritional management at all stages of growth: infancy, adolescence, pregnancy, and aging; and also during all kinds of stress.

The Council on Foods and Nutrition of the American Medical Association reported in 1961 (54) that a panel of medical specialists stated, "Medical students should be able to adapt current nutrition research to practical applications in the management of disease (p. 506)." The 1963 Conference on Nutrition Teaching in Medical Schools (24) also stressed the fact that the physician has a responsibility to apply sound nutritional principles in not only nutritional deficiency states, but must also use these same principles to help his patients maintain good health.

In 1970 the Nutritional Sciences Training Committee stated that the increasing awareness of the role of nutrition was a result of intensive research in many metabolic areas: including work in coronary heart disease, anemias, osteoporesis, and obesity. Conversely, because precise and informed dietary control is necessary in the conduct of clinical research programs, it was generally agreed that research investigators should have adequate training in nutrition. A 1969 review of nutrition research by the National Dairy Council (33) indicated that studies showed the importance of nutrition during illness, the high

incidence of vitamin deficiency in hospital patients, the negative nitrogen balance following trauma, the increasing significance of trace minerals, post-surgical losses of intracellular elements, and the possible dietary treatment of some kinds of cancer.

Krehl, (26) stated that physicians must have a good nutritional background to be able to convincingly refute the misrepresentations of unscrupulous, profiteering people who prey on the desperate arthritic and obese patients. It was further stated that practicing physicians must also be able to counsel patients and inform the general public about confusing claims made by the food industry, pharmaceutical manufacturers, "health" food proponents, and well-meaning (but misinformed) self-styled "nutrition experts."

Status of Nutrition Education in Medical Curricula

How well prepared is the physician to provide information and counseling in nutrition? In 1969 Mayer (31) conducted a survey of interns and residents in Harvard-affiliated hospitals which showed that only 26% of those interviewed considered their medical school training in nutrition to be adequate.

Blecha (2) reported in 1953 that twenty-three of the thirty medical schools responding to a questionnaire were teaching nutrition an average of only eight total class hours. In 1958 High (18) found that only twelve out of sixty responding medical schools surveyed offered a specific course in nutrition, and only about half (twenty-eight) of the schools recognized an inadequacy in nutrition teaching or indicated a need for improvement. A 1963 report on the keynote address to

the American Medical Association Conference on the Teaching of Nutrition in Medical Schools (53) stressed the fact that the teaching of nutrition seemed to be scattered throughout most medical school departments with little or no coordination.

In a report of surveys and conferences conducted by the Council of Food and Nutrition of the American Medical Association (54), findings of a 1960 survey indicated that inadequate attention was given to nutrition teaching. The Council stated that the surveys "have shown that the graduating medical student is seldom equipped to cope with the nutritional problems encountered in practice (p. 503)." This survey also pointed out the many ways nutrition was incorporated into medical curricula. Since only seven schools had a separate department or section of nutrition, nutrition information was usually included in courses in biochemistry and physiology, in the clinical departments of pediatrics, obstetrics, medicine, surgery, and in preventative medicine. In some of the schools, nutrition was taught mainly in the clinical years with emphasis on the use of diet therapy. In a presentation of a brief evaluation of nutrition teaching in New York City area medical schools (55), it was reported that five out of the seven schools surveyed had little or no active or ongoing implementation or application of nutrition concepts in medical education curricula.

In 1970 the Nutrition Sciences Training Committee (35) stated:

> Surveys of medical schools indicate that every department "teaches" nutrition, yet it is agreed that the usual graduate has little factual knowledge in nutrition and nutrition is poorly utilized in medical practice (p. 204).

These reports pointed out that the diffusion of nutrition facts into a variety of subjects is the unavoidable result of the diverse bases for the principles of nutrition. The selection and incorporation of isolated detailed aspects of nutrition relevant to each clincial subject leads to wide gaps in the student's comprehension of the basic concepts of the science of nutrition.

Recommendations and New Directions for Nutrition Teaching in Medical Schools

A list of recommendations for the improvement of existing programs was a part of each previously cited survey or conference report on medical school nutrition teaching. Similar points were emphasized and reemphasized as crucial to curriculum improvement. The report of the International Union of Nutritional Sciences Committee V-I Meeting (20) summarized these points:

1. A medical school should place authority in an individual or committee, with responsibility to propose an integrated and full teaching program in nutrition, which would cover the efforts of various departments.

2. The physiological and biochemical basis of nutrition be taught in the preclinical years.

3. The pathology and therapy of nutritionally induced disease be taught in the clinical years.

4. Clinical nutrition and preventative or therapeutic dietetics be presented to the medical student in such a manner that he could make use of this knowledge in medical practice.

5. The public health and community medicine aspects of nutrition should be an integral component of the medical curriculum (p. 1400).

Medical education, in general, is undergoing radical change at this time. The overall objectives of medical education are under scrutiny for the first time

since the Flexner report to the Carnegie Foundation in 1910 (11) provided the basis for medical education objectives. At this time, most of the approximately 100 medical schools in this country are planning, or have already introduced, major changes and innovations into curricula. New schools of medicine are rapidly being developed which offer a chance to innovate programs without previous bias. It is generally agreed that perhaps the time has come for the implementation of recommendations for nutrition education made in the past.

Efforts to incorporate new programs in nutrition by a few medical schools have been reported in the past few years (3, 14, 17, 19, 39, 45, 59). The faculty of the Medical College of Virginia (17) has instituted a "meal-conference" approach to demonstrate to medical students the application of nutrition to health and disease. Medical centers such as the University of Texas (59) and the Columbia-American University of Beirut (30) have organized a curriculum and produced a syllabus for nutrition teaching. Christakis (3, 4) described and outlined the new Mount Sinai School of Medicine comprehensive program of nutrition teaching.

In a survey of the current status of nutrition in American medical schools (50), medical school catalogs and medical licensure examination questions revealed an expected quantitative inadequacy in that only 20% of the schools surveyed provided some nutrition education in the core curriculum and only one-fifth of them offered an independent nutrition course. The percentages of questions in seven review books for licensing examinations classified as "nutritional" ranged from 35.4% in one book's biochemistry section to a range between 4.7% to 0 in

other specialty areas. Qualitatively, only three general categories of nutrition were covered in review book questions: classical deficiency diseases; vitamin toxicity; and protein, fat, and carbohydrate metabolism. The investigators postulated that questions about other important aspects of nutrition were omitted from the review books because the licensure examinations might contain no questions on any other areas of nutrition.

Evaluation of Nutrition Education in Medicine

The need to assess the nutrition knowledge of medical students is necessary in the light of the numerous indictments made of the present methods of teaching nutrition in medical schools. Evaluation is imperative in any reorganization of the curriculum and during the formation of new nutrition programs.

Prior to 1967 no study had reported the measurement of the level of nutrition knowledge acquired by students while attending medical school. The only standardized instruments available which measured the nutrition knowledge of any specific professional groups were the National League for Nursing Achievement Test of Nutrition (15) and the American Dietetic Association registry tests.

Consequently, Phillips (36, 37) developed a test of selected concepts of normal nutrition and diet therapy. This test was administered to a total of 254 second-year medical students in four New England medical schools. Out of a total possible score of 100, the means attained by the classes in those medical schools ranged from 40.4 to 48.5. The mean for the control group of thirteen persons in the field of nutrition and dietetics was 82.62. Analyses of variance

calculated to determine the significant differences between the mean of the scores attained by the control group and the mean of each group of medical students was twenty-five times greater than the figure accepted as significant at the .01 level of confidence. In an analysis of the subject content of items, at least 60% of the students answered incorrectly those test items that dealt mainly with normal nutrition, the treatment of diabetes mellitus, and the dietary aspects of treating hypertension, cholecystitis, and overweight problems.

Performance on the test showed that 60% of the students from all four medical schools responded incorrectly to approximately one-third, 32, of the test items. It was also shown that at least 60% of those medical students tested were not familiar with many of the basic concepts and information related to nutrition that a panel of experts considered to be important for them to know.

The results of an evaluation of nutrition knowledge of second-year medical students enrolled in the St. Louis University School of Medicine (21) on a 40-question, multiple-choice questionnaire confirmed the impression that those students were not well acquainted with practical nutrition. The 135 students tested achieved a mean score of 49.9%.

The existing literature emphasizes the need to evaluate the teaching of nutrition during the education of physicians. Experts in medicine and nutrition point out that the physician has a key role in the nutrition education of his patients and the general public, and members of Congress have also recognized the need for efforts to incorporate nutrition into the medical curriculum (23, 41). The areas of concentration for nutrition education should include: the recognition of

the normal nutritional needs throughout the life cycle, background information to check the flood of false and misleading public statements made regarding food and diet, and the application of proper nutritional therapy in disease conditions. Only one study reports the development and use of a valid and reliable educational tool to measure the level of the medical student's nutrition knowledge.

CHAPTER III

PROCEDURE

This study was designed to measure the level of nutrition knowledge attained by students enrolled at Bowman Gray School of Medicine (Bowman Gray). The performance of the Bowman Gray students was compared with the students tested in four New England medical schools.

Population and Sample

The population for this study included the 288 students enrolled in Bowman Gray during the 1972 Spring semester. Of the total enrollment, there were 77 students enrolled in the first-year class, 74 in the second-year class, 76 in the third-year class, and 61 in the fourth-year class. The study was limited to those enrolled students who participated in the scheduled class testing. The student contacting and test scheduling was facilitated by the office of the Dean of Student Affairs.

Although the basic scientific pre-medical preparation required of entering medical students varies for each medical school, the entering student at Bowman Gray ordinarily acquires that preparation in the following undergraduate courses: general biology, general chemistry, organic chemistry, and general physics. The four-year curriculum leading to the M.D. degree at Bowman Gray in 1972 consisted of six teaching units divided among 15 departments. Units I, II, and III involved the major part of the first two years with academic and laboratory

course work comprising 75% of class time and clinical experience the remainder. Included in these units were basic courses in physiology and biochemistry with 7 one-hour lectures on nutrition-related subjects. Units IV, V, and VI consisted of two-and-one-fourth years of clinical experience in the specific medical specialties in the hospital and clinics and elective extra-mural programs.[1]

The Instrument

The Phillips' Medical Student Nutrition and Diet Therapy Knowledge Test (NDT Test) was selected as the instrument to measure the level of nutrition knowledge attained by medical students enrolled at Bowman Gray. The instrument, developed by Phillips[2], was the only instrument reported in the literature designed especially for medical students. This instrument has been found to be internally consistent. The validity of the concepts and test items was determined by a jury of 24 persons active in teaching medical specialties or consultants in nutrition. The NDT Test consists of 100 multiple-choice items, containing an equal number of normal nutrition and diet therapy items judged to be important and practical for medical students to know. A personal data sheet was developed to secure information relating to sex, possible future medical specialty, marital status, food habits, class membership, and geographical background.

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[1]Bowman Gray School of Medicine of Wake Forest University, Admissions Bulletin, 1972-73.

[2]Permission for use of the instrument was received from the author.

Collection of the Data

Students enrolled in the first two classes were tested in class groups because academic courses are attended in class groupings. Members of the third- and fourth-year classes were contacted individually and tested in small groups due to the small-group clinical and elective rotation schedules that comprise the curriculum during that period.

The NDT Test, answer sheet, and personal data sheet were distributed to each test group. The purpose of the study, appreciation of participation, time limitation, and test instructions were given verbally to each group by the investigator. In addition, some small group testing was operated on an honor system because of scheduling difficulties. A total of 173 students were tested, giving a 60.08 percent participation. Individual class participation was: 77.9% first-year students; 97.6% of the second-year students; 31.6% of the third-year; and 26.7% of the fourth-year.

Analysis of Data

Responses to NDT Test items, personal data, and student file data were coded for statistical analysis. Bowman Gray Computer Center staff and faculty members assisted in statistical programming. Duncan's New Multiple Range Test, Bartlett's Test of Homogeneity of Variance, Analysis of Variance, and Item analyses were used to analyze the data. To assure a statistically valid comparison between the scores reported by Phillips (36) and the scores obtained in this study, items were judged to be correct using the same answer key as that used in the previous study (13).

CHAPTER IV

ANALYSIS OF DATA

The four major objectives of this study were to: measure the level of nutrition knowledge acquired by students enrolled in the Bowman Gray School of Medicine (Bowman Gray); compare the levels of nutrition knowledge attained by second-year Bowman Gray students with the nutrition knowledge level attained by second-year students enrolled in four New England medical schools; determine the extent to which differences in levels of nutrition knowledge of Bowman Gray students are related to selected factors--medical school class, undergraduate science electives completed, student geographic origin, food habits, and sex; and identify the subject content of test items most frequently incorrectly answered by the medical students.

The levels of nutrition knowledge attained by the medical students were measured by using the Phillips' Medical Student Nutrition and Diet Therapy Knowledge Test (NDT Test). A personal data sheet was used to secure information relating to sex, undergraduate science electives completed, food habits, and geographic origin.

The data for this study were obtained from 173 of the 288 students enrolled in Bowman Gray during the 1972 spring semester. The data were analyzed and presented as follows:

1. A description of the medical students who participated in this study in terms of sex, medical school class membership, age, socio-economic-geographic background, undergraduate elective science courses completed, marital status, and food habits.
2. The relationship of Bowman Gray students' nutrition knowledge scores and means when compared by class membership, undergraduate science electives completed, and sex.
3. A comparison of nutrition knowledge scores and means of the second-year Bowman Gray students tested with the nutrition knowledge scores and means of the second-year students of four New England medical schools.
4. The description of subject content of test items most frequently answered incorrectly by Bowman Gray students tested.

Description of Medical Students

The population for this study included the 288 students enrolled in the four classes at Bowman Gray School of Medicine in the 1972 spring semester. One hundred and seventy-three, 60.06 percent, of the enrolled students participated in the scheduled testing. The class with the largest percentage of participation in the testing was the second-year class, with 98.6 percent (Table I).

Demographic data from the 173 students indicated that of the approximately 92 percent male and 8 percent female students tested, slightly over 85 percent were between the ages of 23 and 27, and only a little more than half

TABLE I

NUMBER AND PERCENTAGE OF MEDICAL STUDENTS TESTED FROM EACH CLASS

Class	Total Enrollment	Number Tested	Percentage
I	77	60	77.9
II	74	73	98.6
III	76	24	31.57
IV	61	16	26.66
Total	288	173	60.06

(54 percent) were not married (Table II). It was also found that just over 60 percent of the participants grew up in households earning $20, 000 or less and attended high school and college in incorporated areas of 50, 000 population or less in the southeastern region of the United States.

Students were asked to check whether they considered their eating habits as good, average, or poor. Students also indicated frequency of dieting, quality of breakfast, and frequency of consumption of "organic" or "natural" foods. This information is summarized in Table III. Fifty-four percent of the students described their eating habits as "average" and 32 percent stated they had "good" eating habits. Twenty-eight percent stated they never ate anything more than toast and coffee for breakfast, while almost an equal percentage (28%) stated they had more than toast and coffee every morning. About half of the students responded that they never dieted and never ate "organic" foods. Of the students

TABLE II

NUMBERS AND PERCENTAGES OF VARIABLES REPRESENTING BACKGROUND AND DEMOGRAPHIC CHARACTERISTICS OF MEDICAL STUDENTS TESTED

Variable	Number of Students					
	Class I	Class II	Class III	Class IV	Total	Percentage
Sex						
Male	54	68	24	14	160	92.48
Female	6	5	0	2	13	7.51
Age						
21-22	4	0	0	0	4	2.39
23-24	36	48	1	0	85	50.89
25-26	11	19	19	10	59	35.32
over 26	6	5	3	5	19	11.37
Marital Status						
Single	32	41	11	7	91	53.84
Married	26	30	12	8	76	44.97
Separated	0	2	0	0	2	1.18
Divorced	0	0	0	0	-	-
Widowed	0	0	0	0	-	-
Type of Community Residence during 7 - 12 Grade						
Rural	16	14	3	2	35	20.71
Unincorporated suburban	8	14	1	3	26	15.38
Incorporated area	35	44	19	10	108	63.90
Population						
under 10, 000	26	28	5	5	64	38.32
10, 000-50, 000	17	18	7	5	47	28.14
50, 001-100, 000	4	3	5	3	15	8.98
100, 000-250, 000	8	14	3	1	26	15.56
250, 001-1 million	1	3	2	1	7	4.19
over 1 million	1	6	1	-	8	4.79

TABLE II--Continued

Variable	Number of Students Class I	Class II	Class III	Class IV	Total	Percentage
Parents' Approximate Income Range (High School)						
under $10,000	22	30	4	4	60	35.71
$10,000-19,999	21	24	11	9	65	38.69
20,000-40,000	8	11	6	1	26	15.47
over 40,000	7	7	2	1	17	10.11

Geographic Location	HS	Coll	HS	Coll	HS	Coll	HS	Coll	HS	Coll	HS	Coll
NC	30	37	36	41	10	10	7	7	83	95	49.70	55.55
So. East US	5	6	15	12	5	4	2	2	27	24	16.16	14.03
Remainder US & Outside	22	15	8	21	8	10	6	6	57	52	13.30	30.07

TABLE III

RELATIONSHIP OF STATED KIND OF EATING HABITS AND FREQUENCY OF DIETING, QUALITY OF BREAKFAST EATEN AND CONSUMPTION OF "ORGANIC" OR "NATURAL" FOODS BY NUMBER OF STUDENTS TESTED

Variable	Stated Eating Habits		
	Good	Average	Poor
Frequency of Dieting			
Never	30	40	10
Rarely	14	20	3
Occasionally	8	18	3
Frequently	0	10	4
Always	2	4	2
Number of Times per Week More than Toast and Coffee Eaten for Breakfast			
0	11	27	10
1	4	11	4
2	1	11	3
3	5	8	2
4	1	3	-
5	3	4	-
6	8	6	1
7	20	22	2
Frequency of "Organic" or "Natural" Food Consumption			
Never	15	56	14
Rarely	20	18	2
Occasionally	15	17	2
Frequently	4	1	2
Always	-	-	2

who described their eating habits as "good, " 30 stated they never dieted, but 11 stated they ate no more than toast and coffee for breakfast. Ten of the students who described their eating habits as "poor" also indicated they ate nothing more than toast and coffee for breakfast. An almost equal number of students who described their eating habits as "average" stated they never ate more than toast and coffee for breakfast (27 students) as those who had a more substantial breakfast 6 or 7 times a week (28 students).

Student Test Performance

Out of a total possible score of 100 on the Phillips' NDT Test, the highest student score was 70 and the lowest was 26. The lowest mean value was attained by the first-year class, 41.8, with progressive increased means achieved by each succeeding class. The calculated standard deviations from the means indicated that the greatest variance occurred in Class II. Findings are summarized in Table IV.

TABLE IV

RANGE, MEANS, AND STANDARD DEVIATIONS FROM THE MEANS FOR BOWMAN GRAY MEDICAL SCHOOL CLASSES TESTED

Class	Range of Scores Low	High	Mean	Standard Deviation
I	26	59	41.8	7.449
II	30	70	46.9	8.109
III	36	67	54.6	7.319
IV	48	68	57.9	6.532

An analysis of variance was used to determine whether significant differences existed between the four classes of medical students. Table V shows a calculated F value of greater than 3.78 and therefore significant at the .01 level of confidence.

TABLE V

ANALYSIS OF VARIANCE BETWEEN MEANS OF THE FOUR BOWMAN GRAY CLASSES TESTED

Sources of Variance	Degrees of Freedom	Sums of Squares	Mean Square
Between Groups	3	4871.316	1623.772*
Within Groups	169	9881.358	58.469
TOTAL	172	14752.675	

*highly significant ($p < 0.01$)

Duncan's New Multiple Range Test was applied to determine which difference among pairs of means were significant at the .01 level of confidence. Arranging the mean values attained by each class in rank order showed the ordering to be the same as the ranking would be for the length of time spent in medical school:

First-year Class (BG I): 41.81
Second-year Class (BG II): 46.89
Third-year Class (BG III): 54.59
Fourth-year Class (BG IV): 57.84

The data in Table VI show a significant difference at the .01 level of confidence when comparing the means attained by the first-year class and the

TABLE VI

COMPARISON OF THE DIFFERENCE IN MEAN VALUES ATTAINED BY THE FOUR BOWMAN GRAY CLASSES TESTED

Between Means of Classes	Arithmetical Mean Difference	Duncan's Value for Least Significant Range	Level of Confidence
I and II	5.08	3.42	.01
		2.60	.05
I and III	12.78	4.96	.01
		3.81	.05
I and IV	16.03	5.93	.01
		4.59	.05
II and III	7.70	4.63	.01
		3.52	.05
II and IV	10.95	5.67	.01
		4.35	.05
III and IV	3.25	6.35	.01
		4.83	.05

second-year class; between the first-year class mean and the mean of the third-year class; between the first-year class and the fourth-year class; between the second-year class and the third-year class; between the second-year class and the fourth-year class, since the arithmetical difference between the means in each comparison exceeded the value for the least significant difference obtained by Duncan's Test. There was no significant difference between the means determined for the third- and fourth-year classes at the .05 level of confidence since the arithmetical difference between the means of the two classes did not exceed

the value obtained by Duncan's Test for the least significant difference at that confidence level.

Certain factors that might have affected the scores attained by the students tested were investigated. The factors included: the amount of nutrition information possibly acquired in certain undergraduate science electives taken by the student before entering medical school; nutrition information acquired by women students possibly because of more exposure to food preparation in the home; and the amount of nutrition information acquired independently because of motivation toward a future medical specialty goal (only a small percentage of students indicated a choice of post-graduate medical specialty so this factor could not be related to test performance).

The subgroup means that were calculated and compared with the class mean and total mean included: students who completed one or more undergraduate courses in Chemistry or Biochemisty, Biology or Genetics, Physiology, Microbiology, and those who took none of those courses; students who had completed an undergraduate nutrition course; and women students tested. As shown in Table VII, with the exception of the mean of the women students tested, there appears to be little or no difference by inspection between the subgroup means and the total and class means.

TABLE VII

COMPARISON OF SELECTED MEDICAL STUDENT SUBGROUP MEANS ON THE PHILLIPS' NDT TEST

	Class I		Class II		Class III		Class IV		Total Tested	
	n	mean	n	mean	n	mean	n	mean	n	mean
Undergraduate Science Courses Completed										
Chemistry/ Biochemistry	29	42.37	27	46.4	6	53.33	2	58.5	64	50.15
Physiology	34	42.82	34	44.88	11	56.81	6	56.66	85	50.29
Microbiology	28	41.92	35	47.71	4	54.75	3	55.66	70	50.01
Biology	44	39.38	68	47.26	16	54.12	8	57.12	136	50.22
None of Above	7	41.0	1	52.0	3	55.0	5	57.8	16	51.45
All of Above	15	41.86	7	44.28	1	53.0	2	61.5	25	50.16
Nutrition	1	40.0	1	70.0	0	-	0	-	2	55.0
Women	6	47.83	5	55.6	0	-	2	65.5	13	56.31
Total	60	41.8	73	46.9	24	54.6	16	57.9	173	47.2

Comparison of Bowman Gray Class II Test Performance with the Test Performance of Class II Students in Four New England Medical Schools

A comparison of scores, means, and standard deviation from the mean attained by the medical students tested in the second-year class enrolled at Bowman Gray and those attained by second-year students tested in four New England medical schools by Phillips (36) is shown in Table VIII.

TABLE VIII

COMPARISON OF RANGE OF SCORES, MEANS, AND STANDARD DEVIATIONS DETERMINED FOR THE BOWMAN GRAY SECOND-YEAR CLASS AND THOSE DETERMINED FOR THE SECOND-YEAR CLASSES TESTED IN PHILLIPS' STUDY

Class II	Range of Scores Low	High	Mean	Standard Deviation
Bowman Gray	30	70	46.9	8.109
Phillips'				
School A	15	61	40.4	9.156
School B	36	64	47.9	6.702
School C	29	68	47.1	8.338
School D	26	65	48.5	7.652

After ranking the class means and comparing the mean differences Duncan's Test was applied to determine which difference among pairs of means were significant at specific levels of confidence. Table IX shows that there was no significant difference at the .05 level between the Bowman Gray Class II mean and the mean attained by Class II of Schools B, C, or D, since the value obtained from comparing these means arithmetically did not exceed the value for the least significant range obtained by Duncan's Test. There was a significant difference found at the .01 and the .05 levels of confidence between the means of Bowman Gray Class II and Class II of School A. Phillips also found a significant difference at the .05 level between the mean attained by School A and the other groups tested in that study, but could find no variation between the schools' course contents that explained the difference.

TABLE IX

COMPARISON OF THE DIFFERENCES IN MEAN VALUES ATTAINED BY SECOND-YEAR MEDICAL SCHOOL CLASSES ON THE PHILLIPS' NDT TEST

Classes	Arithmetical Mean Difference	Duncan's Value for Least Significant Range	Level of Confidence
Bowman Gray and School A	6.545	3.36 2.56	.01 .05
Bowman Gray and School B	1.004	3.88 2.98	.01 .05
Bowman Gray and School C	0.223	3.73 2.84	.01 .05
Bowman Gray and School D	1.561	4.30 3.33	.01 .05

Performance of Bowman Gray Students on NDT Test Items

The percentage of medical students tested from each class and the total group who gave correct responses to each test item is presented in Appendix C. Twenty-three test items were answered incorrectly by 66% or more of the total number of students tested (items numbered 9, 10, 13, 19, 20, 24, 27, 30, 31, 32, 37, 40, 41, 42, 43, 54, 64, 69, 81, 84, 88, 99, and 100). A summary of the items answered incorrectly by at least two-thirds of the students tested in each class follows:

Class I: 9, 10, 11, 12, 13, 19, 20, 24, 27, 31, 32, 37, 40, 41, 42, 43, 54, 58, 64, 67, 69, 72, 73, 75, 80, 81, 84, 87, 88, 99, 100; for a total of 32 missed items.

Class II: 9, 10, 12, 13, 19, 24, 27, 28, 30, 31, 32, 37, 39, 40, 41, 42, 48, 61, 64, 69, 73, 78, 79, 81, 84, 87, 88, 99; for a total of 28 missed items.

Class III: 10, 13, 14, 19, 24, 30, 31, 43, 47, 54, 57, 63, 64, 70, 81, 84, 88, 99, 100; for a total of 19 items missed.

Class IV: 10, 13, 21, 31, 43, 44, 45, 69, 78, 81, 84, 99; for a total of 12 items missed.

Items numbered 9, 10, 11, 12, 13, 14, 19, 20, 21, 24, 27, 28, 30, 31, 32, 37, 39, 40, 41, 42, 43, 44, 45, 47, and 48 dealt mainly with normal nutrition. Items numbered 54, 57, 58, 59, 61, 63, 64, 67, 69, 70, 72, 73, 75, 78, 79, 80, 81, 84, 87, 88, 89, 99, and 100 dealt with the dietary aspects of treating disease conditions and the foods advisable for treatment.

Those test items which were answered incorrectly by 80 percent or more of the class members related to the following subjects are summarized in Table X.

Performance on the Phillips' NDT Test indicated that the majority of the Bowman Gray students tested were not familiar with many of the basic nutritional concepts and facts concerning nutrition that a panel of selected nutritionists and practicing physicians consider to be important for medical students to know It also indicated that second-year medical students in another United States geographic location, and after a five-year interim, did not achieve higher test scores than those students included in Phillips' study. Although the number of

TABLE X

TEST ITEMS ANSWERED INCORRECTLY BY 80% OF BOWMAN GRAY STUDENTS TESTED

Test Item	Content	Class I	II	III	IV
10	Protein need of population groups	x	x	x	
12	Nutrient most easily destroyed in food preparation		x		
13	Loss of calcium in processing cottage cheese				x
19	Egg yolk identified as a source of iron			x	
24	Common adult nutrient deficiency			x	
30	Vitamin D toxicity symptoms		x		
31	Adult recommended daily allowance for Vitamin A	x	x	x	
32	Riboflavin deficiency symptoms	x	x		
37	Ascorbic acid function		x		
40	Dietary substitution for fluid whole milk	x	x		
43	Nutrient recommendations for food intake improvement				x
64	Hepatitis	x	x		
67	Celiac Disease	x			
81	Atherosclerosis	x	x	x	x
84	Hypertension	x	x	x	x
99	Obesity	x			x
100	Acute Cholecystitis	x			

test items answered correctly by each percentile in each succeeding class year increased, the highest scores attained by students to be receiving the M.D. degree within a month (Class IV) were no higher than the highest scores attained by students who had completed only two or three years of medical school.

CHAPTER V

SUMMARY AND IMPLICATIONS

Research studies have documented the role and importance of nutrition education in the medical school curriculum. These studies also indicated that medical students are exposed to only small amounts of nutrition information. Only a few medical schools have reported attempts to implement the many recommendations that have been made that would enable medical students to gain a more adequate knowledge of the principles of nutrition and acquire the ability to translate these principles into more effective patient management. This study attempted to examine the nutrition knowledge now being acquired by medical students in the current medical school curriculum.

The Problem

The major purposes of this study were to: (1) measure the level of nutrition knowledge acquired by students enrolled in the Bowman Gray School of Medicine; (2) compare the levels of nutrition knowledge acquired by second-year Bowman Gray students with the nutrition knowledge acquired by second-year students enrolled in four New England medical schools (36); (3) determine the extent to which measured differences in grouped Bowman Gray students are related to selected factors--medical school class, undergraduate science electives completed, sex, food habits, possible future medical specialty, and pre-medical educational geographical area; (4) identify the subject content of test items most

frequently answered incorrectly by the medical students.

The hypotheses tested in this study were:

1. There is no statistically significant difference at the .01 level between the mean value attained by the second-year class at Bowman Gray on the Phillips' Nutrition and Diet Therapy Knowledge Test and the means attained by the second-year classes included in the Phillips' study (36).
2. There are no significant relationships in Bowman Gray student Nutrition and Diet Therapy Knowledge Test scores when compared by: (1) medical school class, (2) selected undergraduate science elective courses completed, and (3) sex.

Limitations

The study was limited to those medical students enrolled in Bowman Gray who participated in the scheduled class testing. No attempt was made to test the total enrollment.

Study Design

A Medical Student Nutrition and Diet Therapy Test (NDT), developed by Phillips (36), was selected as the instrument to determine the level of nutrition knowledge of students enrolled in Bowman Gray School of Medicine. A data sheet was developed to secure the following information: class membership; undergraduate science electives completed; possible future medical specialty; sex; food habits; and pre-medical educational geographic area.

Permission was obtained for the 288 students enrolled at Bowman Gray to participate in the study during the 1972 spring semester. This included 77 first-year students, 74 second-year students, 76 third-year students, and 61 fourth-year students.

Major Findings

Some major findings of this study in relation to the level of nutrition knowledge acquired by currently enrolled medical students were:

1. Out of a total possible NDT Test score of 100, the highest student score was 70. The lowest score was 26.
2. Seventy-five percent of the total Bowman Gray students tested correctly answered only a few more than half of the NDT Test items. Less than 54 items were answered correctly by 130 students.
3. The level of nutrition knowledge increased progressively for each additional year the students were enrolled in medical school. The class mean values attained were: 41.8--Class I, 46.9--Class II, 54.6--Class III, and 57.9--Class IV.
4. There were significant differences in the mean values determined for each of the four Bowman Gray classes. These differences were at the .01 level of confidence between each class mean.
5. There was no significant difference between the mean values determined for the Bowman Gray second-year class and the means determined for three of the four second-year medical school classes tested by Phillips. There was no difference at the .05 level of

confidence between Bowman Gray Class II and the second-year classes tested from Schools B, C, and D. (Phillips reported a significant difference at the .05 level between School A and the other three schools tested, and this study showed a significant difference at the same level of confidence between Phillips' School A mean and Bowman Gray Class II.)

6. A comparison of the means attained by medical students grouped according to selected factors showed no significant differences. With the exception of the slightly higher means attained by women students, the means attained by groupings of students according to undergraduate science electives completed showed no changes.
7. Twenty-three NDT Test items were answered incorrectly by more than two-thirds of the total students tested. These items included 15 that dealt with normal nutrition and 8 that were concerned with the dietary aspects of treating disease conditions and the foods advisable for treatment.
8. Student responses to personal eating habits indicated an uncertainty of the definition of quality eating habits. This was indicated by the relationship of stated good, average, or poor eating habits and the large number of students who stated they did not eat a substantial breakfast very often.

The findings of this study indicated that the majority of the Bowman Gray students tested were not familiar with many of the basic nutritional concepts and

facts concerning nutrition that a panel of selected nutritionists and practicing physicians consider to be important for medical students to know. It also indicated that second-year medical students in another United States geographic location, and after a five-year interim, did not achieve higher test scores than those students included in Phillips' study. Although the number of test items answered correctly by each succeeding class year increased, the highest scores attained by students receiving the M.D. degree within a month (Class IV) were no higher than the highest scores attained by students who had completed only two or three years of medical school.

Hypotheses Tested

Hypothesis I. There is no statistically significant difference at the .01 level of confidence between the mean value attained by the second-year class at Bowman Gray on the Phillips' Nutrition and Diet Therapy Knowledge Test and the means attained by the second-year classes included in the Phillips' study. Since no significant difference was found at the .01 level of confidence between the mean values attained by four of the five second-year classes tested, there is no basis for rejection of this hypothesis.

Hypothesis II. There are no significant relationships in Bowman Gray student NDT Test scores when compared by: medical school class, selected undergraduate science electives completed, and sex. Since there was a significant difference at the .01 level of confidence between the means of each medical school class tested, this part of the hypothesis cannot be accepted. Though there were indications of slight differences in mean values determined for groups

of students completing certain undergraduate science electives, and a little greater difference between the mean determined for women students tested, there was not enough evidence to reject this part of the hypothesis.

Implications

The findings were interpreted and the implications were stated with an awareness of the limitations that existed in this study. Implications resulting from this study may provide a frame of reference for the development, implementation, and evaluation of nutrition education programs in the medical curriculum. Implications drawn from this study were grouped in two categories: medical nutrition education programs and further research.

Medical Nutrition Education Programs

1. The nutrition resources of an institution could be identified and combined through the means of a coordinating committee--which includes a nutritionist--with the responsibility for evaluating the nutrition content of the curriculum, recommending methods to strengthen existing programs and, providing a monitoring or surveillance system of nutrition teaching.
2. A designated course in basic scientific nutrition principles and their application to human health could be developed.
3. Specific nutrition teaching could be incorporated into biochemistry, physiology, and behavioral science courses. The success of applying nutrition knowledge lies in the outcome of behavioral change by both

physicians and patients.

4. Special elective courses on both the undergraduate and graduate levels could be developed, involving the integration of nutrition principles in community medicine, family health care, metabolic research, and specific medical specialties.
5. The teaching of preventative and applied nutrition could be conducted in small student groups using the interdisciplinary team approach including physicians, dentists, nutritionists, nurses, psychologists, social workers, and other health professionals.

Further Research

Further study is needed as a basis for identifying areas of nutrition emphasis in the medical school curriculum. It is recommended that consideration be given the following:

Determination of the level of nutrition knowledge of newly enrolled students at medical school entry.

A determination made of nutrition knowledge acquired by students at the completion of each year of medical education (including post-graduate internships and residencies).

A comparison of these evaluations with those of other medical schools.

Continuous evaluation of the level of nutrition knowledge acquired by medical students is essential to nutrition program development. Curriculum planning must provide for the presentation of basic nutrition concepts that are applicable to clinical medicine in a relevant manner.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Barnes, R. H. 1968. Doctor's Dietary Antics. Nutrition Today. 3:21.

2. Blecha, E. E. 1953. Instruction of Medical Students in Nutrition. Journal of the American Dietetic Association. 28:910.

3. Christakis, G. J. 1972. The Current Status of Nutrition Teaching at The Mount Sinai School of Medicine of The City University of New York. American Journal of Clinical Nutrition. 25:997.

4. Christakis, G. J. 1972. Teaching Nutrition in the Medical School. Journal of Nutrition Education. 4:141.

5. Council on Foods and Nutrition, American Medical Association. 1962. Report on Conference on Nutrition Teaching in Medical Schools. Chicopee, Massachusetts.

6. Council on Foods and Nutrition, American Medical Association. 1963. Summary of a Report on Conference on Nutrition Teaching in Medical Schools. Journal of the American Medical Association. 183:147.

7. Council on Foods and Nutrition, American Medical Association. 1963. The Nutrition Teaching in Medical Schools. Journal of the American Medical Association. 183:955.

8. Duncan, D. B. 1955. Multiple Range and Multiple F Tests. Biometrics. 11:1.

9. Dutra de Oliveira, J. E. 1974. Teaching Nutrition in Medical Schools: Some Problems and Proposed Solutions. Journal of Nutrition Education. 6:49.

10. Elvehjem, C. A. 1953. The Importance of Food in Preventive Medicine. American Journal of Public Health. 43:523.

11. Flexner, A. 1910. Medical Education in the United States and Canada: A Report to the Carnegie Foundation for the Advancement of Teaching. Bulletin No. 4. New York.

12. Flynn, M., D. Keithly, and J. Colwill. 1974. Nutrition in the Education of the Family Physician. Journal of the American Dietetic Association. 65:269.

13. Food and Nutrition Board. 1964. Recommended Daily Allowances. 6th ed. National Research Council, National Academy of Sciences. Washington, D.C.

14. Frankle, R. T., E. R. Williams, and G. Christakis. 1972. Nutrition Education in the Medical School: Experience with an Elective Course for First-year Medical Students. American Journal of Clinical Nutrition. 25:709.

15. Grant, F. W. and G. McCarthy. 1971. Nutrition Subject Matter in the Nursing Curriculum. Journal of the American Dietetic Association. 58:26.

16. György, P. 1962. Education and Training in Nutrition. American Journal of Clinical Nutrition. 10:1.

17. Harlan, W. R., E. A. Lounds, and E. M. Behrend. 1968. Teaching Applied Nutrition to Medical Students. American Journal of Clinical Nutrition. 21:320.

18. High, E. G. 1958. A Survey of the Teaching of Nutrition in Medical Schools. Journal of Medical Education. 33:787.

19. Hiscock, E. A. 1948. Nutrition Clinic for Medical Students. Journal of the American Dietetic Association. 24:782.

20. International Union of Nutritional Sciences, Committee V-1. E. Kodicek, chairman. 1971. Nutrition Education in Medical Faculties. American Journal of Clinical Nutrition. 24:1399.

21. Ishida, Y., M. C. Ishida, and V. Ewers. 1974. Nutrition Knowledge of Medical Students. Current Medical Dialogue. 4:111.

22. James G. 1967. The Medical School of the Future and Its Role in the Community. Journal of the American Medical Association. 202:415.

23. Javits, Senator J., et al., 1969. Nutrition and Medical School Education Bill. Senate Bill No. 1865.

24. Johnson, O. C. 1963. A Conference on Nutrition Teaching in Medical Schools. Nutrition Review. 21:33.

25. King, C. G. 1962. Teaching and Training in Nutrition. American Journal of Clinical Nutrition. 11:611.

26. Krehl. W. A. 1962. Nutrition Advice--A Problem and a Challenge. American Journal of Clinical Nutrition. 10:365.

27. Lewis, M. N. 1948. Teaching Medical Students. Journal of the American Dietetic Association. 24:38.

28. Lewis, M. N. 1949. The Dietitian's Role in the Education of Medical Students. Journal of the American Dietetic Association. 25:588.

29. Lewis, M. N. 1956. How to Make Nutrition Education Effective for Students, Interns, and Residents. Hospitals. 39:70.

30. McLaren, D. S. 1970. Nutrition in the Medical School. American Journal of Clinical Nutrition. 23:1264.

31. Mayer, J. and J. Dwyer. 1969. On-the-Job Nutrition Teaching in the Hospital. Postgraduate Medicine. 46:219.

32. Mueller, J. F. 1967. Nutrition Teaching in Medical Sciences. Federation of American Societies for Experimental Biology Proceedings. 26:167.

33. National Dairy Council. 1969. Nutrition in Medical Education. Dairy Council Digest. 40:No. 3.

34. National Nutrition Consortium: Position Paper. 1974. Teaching Nutrition in Medical Schools. Excerpted in Journal of the American Dietetic Association. 65:259-261.

35. Nutritional Sciences Training Committee. 1970. Report on the Status of Nutrition. American Journal of Clinical Nutrition. 23:196.

36. Phillips, M. G. 1967. A Determination of the Level of Knowledge of Nutrition Attained by Second-year Medical Students. Unpublished Doctoral Dissertation. Boston University.

37. Phillips, M. G. 1971. The Nutrition Knowledge of Medical Students. Journal of Medical Education. 48:86.

38. Popper, H. A. 1965. The Mount Sinai Concept. Clinical Research. 13:500.

39. Popper. H. A. 1965. A New Curriculum. Annals of the New York Academy of Sciences. 128:552.

40. Power. L. 1974. Physicians Need Sound Advice on Nutrition. American Medical News.

41. Schweiker, R. S. 1973. S. 324. The Nutritional Medical Education Act of 1973. U.S. Senate, Committee on Labor and Public Welfare, Washington, D.C. Congressional Record. 119.

42. Sebrell, W. H. 1964. The Clinical Teaching of Nutrition. Journal of Clinical Nutrition. 15:111.

43. Sebrell, W. H. and T. B. Van Itallie. 1962. Nutrition Teaching in Preventive Medicine. Archives of Environmental Health. 4:630.

44. Shank, R. E. 1966. Nutrition Education in Schools of Medicine. American Journal of Public Health. 56:939.

45. Sherr, S. and E. Munves. 1973. A Medical Course in Human Nutrition: Additional Comments. American Journal of Clinical Nutrition. 26(8):792.

46. Sliepcevich, E. M. and W. H. Creswell. 1968. A Conceptual Approach to Health Education: Implications for Nutrition Education. American Journal of Public Health. 58:684.

47. Stare, F. J. 1961. Nutritional Challenges for the Physician. Journal of the American Medical Association. 178:924.

48. Steel, R., G. D. and J. H. Torrie. 1960. Principles and Procedures of Statistics. New York: McGraw-Hill Book Co., Inc.

49. U. S. Senate Select Committee on Nutrition and Human Needs. 1974. National Nutrition Policy Study, Report and Recommendations. Part 3. Nutrition and Government. 27-36.

50. Wen, Chi-Pang, H. D. Weerasinghe, and J. T. Dwyer. 1973. Nutrition Education in United States Medical Schools. Appraisal from Catalogues and Standard Examinations. Journal of the American Dietetic Association. 63:408.

51. White House Conference on Food, Nutrition, and Health. 1970. Nutrition Teaching in Medical Schools. Appendix C, Panel IV-2. Washington, D.C.

52. White House Conference on Food, Nutrition, and Health. 1970. Recommendations of Panels on Nutrition Teaching and Education. Nutrition Training of Physicians, Dentists, Nurses, and Allied Health Professionals. Section IV, Panel 2, Recommendation 8. Washington, D. C.

53. White, P. L. 1963. The Role of Nutrition in the Teaching of Medicine. Nutrition Reviews. 21:65.

54. White, P. L., O. C. Johnson, and M. J. Kibler. 1961. Council of Foods and Nutrition, American Medical Association, Its Relation to Physicians. Postgraduate Medicine. 30:502.

55. White, P. L., L. K. Mahan, and M. E. Moore, Editors. 1972. Conference Proceedings on Guidelines for Nutrition Education Programs in Medical Schools and Post-doctoral Training. Williamsburg, Virginia.

56. Williams, R. J. 1972. A Flaw in Medical Education. Nutrition Today. 7:30.

57. Wilson, J. R. 1948. The Teaching of Nutrition in Medical Schools. Journal of the American Dietetic Association. 24:779.

58. Youmans, J. B. 1947. Teaching Nutrition in Medical School. Nutrition News. 11:1, No. 1.

59. Young, E. and E. Weser. 1975. Integration of Nutrition in Medical Education. Journal of Nutrition Education. 7:112.

APPENDICES

APPENDIX A

PHILLIPS' MEDICAL STUDENT NUTRITION AND DIET THERAPY KNOWLEDGE TEST

PHILLIPS' MEDICAL STUDENT NUTRITION AND DIET THERAPY KNOWLEDGE TEST

Instructions

This test was developed to measure the nutrition knowledge of medical students attending four New England medical schools in 1967 as a part of a doctoral research project. Your cooperation in taking this test will allow comparison of the test performance of students from this medical school with that of the students in the New England study.

1. For each test item, select the one best answer.
2. Mark your choice on the separate answer sheet provided; do not mark on test pages.
3. Your score will be the total number of items answered correctly, so be sure to answer every item.

Thank you

PHILLIPS' MEDICAL STUDENT NUTRITION AND DIET THERAPY KNOWLEDGE TEST

1. The food richest in carbohydrate on the basis of a one-half cup serving is

   1. turnips
   2. beets
   3. rice
   4. squash

2. The major difference in the nutritive value of whole milk compared with unfortified skim milk is that whole milk contains more

   1. vitamin A
   2. protein
   3. calcium
   4. sodium

3. The richest natural source of vitamin A is

   1. milk
   2. fish liver oil
   3. eggs
   4. butter

4. The Food and Nutrition Board of the National Research Council has recommended that a desirable daily protein allowance for adults is

   1. 0.5 grams per kilogram
   2. 1.0 grams per kilogram
   3. 1.5 grams per kilogram
   4. 2.0 grams per kilogram

5. The Recommended Dietary Allowances for the United States are guide lines which are based on

   1. small margins of safety
   2. minimal amounts to prevent signs of deficiency
   3. amounts adequate to meet requirements for health and illness
   4. amounts adequate to maintain good nutrition in healthy persons

6. Lean meats are a good source of

   1. niacin
   2. vitamin A
   3. vitamin K
   4. fluorine

7. Which of the following is a good source of iron?

   1. Citrus fruits
   2. Dried beans and peas
   3. Cheese
   4. Honey

8. Which one of the following groups would provide the greatest amount of ascorbic acid?

   1. Oranges, apples, tomatoes
   2. Grapefruit, tomatoes, pineapples
   3. Bananas, apples, cantaloupes
   4. Oranges, tomatoes, grapefruit

9. The adult's requirement for thiamine increases in relation to an increase in the intake of

   1. fat
   2. protein
   3. riboflavin
   4. carbohydrate

10. Which of the following groups has the highest total protein need per day?

    1. Boys 15 to 20 years of age
    2. Pregnant women
    3. Lactating women
    4. Girls 15 to 20 years of age

11. Calorie needs are highest per pound of body weight in

    1. infancy
    2. early childhood
    3. adolescence
    4. adults 20 to 40 years of age

12. The nutrient which is most easily destroyed in food preparation is

    1. niacin
    2. riboflavin
    3. thiamine
    4. ascorbic acid

13. In the making of cottage cheese, there is considerable loss of

    1. ascorbic acid
    2. niacin
    3. calcium
    4. vitamin D

14. Which of the following is an essential amino acid?

    1. Tyrosine
    2. Cystine
    3. Phenyl alanine
    4. Serine

15. Of the following which one contains the largest amount of protein on a serving basis?

    1. Cereal
    2. Root vegetables
    3. Leafy vegetables
    4. Legumes

16. What would be the recommended protein allowance for a physically active man weighing 150 pounds?

    1. 65 grams
    2. 75 grams
    3. 85 grams
    4. 95 grams

17. Which one of the following is the best source of carotene the precusor of vitamin A?

    1. Corn
    2. Beets
    3. Squash
    4. Butter

18. Which of the following groups of nutrients were added to bread as a result of the enrichment program?

    1. Thiamine, riboflavin, niacin, iron
    2. Thiamine, niacin
    3. Thiamine, iron, calcium
    4. Thiamine, iron

19. Egg yolk is a rich source of

    1. vitamin D
    2. calcium
    3. vitamin A
    4. iron

20. The precursor or provitamin of niacin is

    1. methionine
    2. tyrosine
    3. valine
    4. tryptophane

21. Which of the following contains all of the essential amino acids?

    1. gelatin
    2. dried beans and peas
    3. fish
    4. whole wheat bread

22. Which of the following has the least effect on basal metabolism?

    1. Growth
    2. Age
    3. Glandular function
    4. Sex

23. Of the following groups which one has the least need for vitamin D?

    1. Infants 0 to 2 years of age
    2. Adolescents
    3. Pregnant women
    4. Women 20 to 25

24. The nutrient least likely to be deficient in adult dietary in the United States is

    1. iodine
    2. phosphorus
    3. fluorine
    4. vitamin A

25. The 1968 Recommended Daily Allowance for vitamin D for children from 2 to 12 years of age is

    1. 200 I.U.
    2. 400 I.U.
    3. 800 I.U.
    4. 1200 I.U.

26. Mineral oil is not recommended as a low-calorie base for salad dressing because it

    1. contains some calories
    2. speeds up intestinal activity
    3. interferes with appetite
    4. decreases absorption of vitamin A

27. The best way to give vitamins to the infant when he is on a whole milk formula is

    1. in the milk formula
    2. by a dropper
    3. add to the orange juice
    4. mix with the cereal

28. The factor which has the least effect on human protein requirement is

    1. growth
    2. pregnancy
    3. activity
    4. quality of the diet

29. The daily recommended amount of ascorbic acid for an infant of 1 year of age would be supplied by approximately

    1. 2 ounces of pineapple juice
    2. 1/4 cup of tomato juice
    3. 1/2 cup of orange juice
    4. 1/2 cup of apple juice

30. If vitamin D intake approaches a toxic level, the infant may experience all but which one of these?

    1. Hypercalcemia
    2. Hyperphosphatemia
    3. Hypercalciuria
    4. Increased serum alkaline phosphatase

31. The amount of vitamin A recommended for the adult daily is

    1. 2000 I.U.
    2. 3000 I.U.
    3. 4000 I.U.
    4. 5000 I.U.

32. Which of the following is produced by a deficiency of riboflavin?

    1. Beri-beri
    2. Cheilosis
    3. Dermatitis
    4. Anemia

33. Which one of the following does not affect the requirement of vitamin A?

    1. Growth
    2. Amount of pro-vitamin
    3. Sunlight
    4. Deficiency of fat

34. Nutritional studies involving children indicate that emotional states of great intensity whether positive or negative

    1. may decrease the absorption of nutrients
    2. cause an increase in caloric intake
    3. have little effect on absorption of nutrients
    4. have little effect on metabolism

35. Proteins from plant sources

    1. lack one or more essential amino acids
    2. are equivalent to meat proteins in quantity
    3. are equivalent to meat proteins in quality
    4. contain all of the essential amino acids but in less quantity

36. Hypervitaminosis may occur with which one of the following nutrients?

    1. Thiamine
    2. Vitamin E
    3. Riboflavin
    4. Vitamin A

37. An important function of ascorbic acid is

    1. formation of intercellular substance
    2. promotion of absorption of phosphorus
    3. maintenance of normal epithelial membrane
    4. as a component of carboxylase

38. The amount of milk or milk substitutes recommended daily during the third trimester of pregnancy is equal to

    1. two eight-ounce glasses
    2. two to three eight-ounce glasses
    3. three to four eight-ounce glasses
    4. four to five eight-ounce glasses

39. The number of servings of citrus fruit recommended during the third trimester of pregnancy is equal to

    1. one daily
    2. three to four per week
    3. two daily
    4. three daily

40. If during pregnancy a person is unable to drink milk due to intolerance, which substitute would approximate one glass of whole milk in nutritional value

    1. one-half cup of cream
    2. one-half cup of ice cream
    3. one tablespoon of powdered whole milk
    4. one ounce of American cheese

Situation Covering Questions 41 and 42

Mrs. Smith, who is having her first child, has been reading about foods needed and foods to be avoided during pregnancy. Perplexed by contradictory information she sought advice from her doctor. She asked him which of the following statements were true.

41. Which of the following would you select as being a true statement?

1. Gelatin is equal to meat in protein value.
2. It is dangerous to refrigerate food in an opened can.
3. Potatoes are fattening and should be omitted.
4. Frozen vegetables are good substitutes for fresh nutritionally.

42. Which of the following would you select as being a true statement?

1. Yogurt is significantly superior to milk in food value.
2. Margarine and butter are equal in caloric value.
3. Orange juice causes an acid stomach.
4. Milk is constipating.

Situation Covering Questions 43 and 44

John, a 17-year old in his third year of high school, is active in sports, particularly football and basketball. His physical examination revealed that he is forty pounds underweight. His height is six feet, two inches.

He is always hungry. His parents tease him about his appetite and tell him they are going to put a padlock on the refrigerator. He likes most foods except squash, and he rarely eats fruit except for pineapple juice. His daily meal pattern is as follows:

Breakfast	Lunch	Supper
2 slices of toast	2 bologna sandwiches	4 ounces of meat
1 teaspoon of butter	1 glass of milk	1 medium-sized baked potato
1 cup of coffee, black	1 teaspoon of mayonnaise	1/2 cup corn or beets
1/2 cup pineapple juice		1 slice of bread
		1 piece of chocolate cake
		1 coke

Mid afternoon	Bedtime
1 coke	1 coke
1 handful of potato chips	1 piece of cake
1 candy bar	

43. Which one of the following recommendations would be most advisable to improve his food intake and nutritional status?

    1. Increase vitamin A intake
    2. Increase carbohydrate intake
    3. Eliminate food between meals
    4. Decrease calories

44. Which one of the following recommendations would be most advisable to improve his food intake?

    1. Omit potato chips and cokes
    2. Add a food high in Vitamin C
    3. Decrease breads and cereals
    4. Increase fluid intake

45. Which of the following when metabolized produces the least amount of available glucose?

    1. Carbohydrates
    2. Carbohydrates and proteins mixed
    3. Proteins
    4. Fats

46. An early symptom of Vitamin A deficiency is

    1. decreased resistance to infection
    2. xeropthalmia
    3. decreased appetite
    4. decreased dark adaptation

47. A moderately active woman weighing 150 pounds, 25 years of age, living in a temperate climate would need which of the following caloric levels to meet her total metabolic needs?

    1. 2000-2300
    2. 2300-2600
    3. 2600-2900
    4. 2900-3200

48. Which of the following foods has the most calories if eaten in average serving portions?

    1. Milk (eight ounces of skim)
    2. Butter (one tablespoon)
    3. Jam (one tablespoon)
    4. Potato (one small)

49. Which is the factor that most influences total energy requirements in a healthy individual between 25 and 35 years of age?

    1. Activity
    2. Food intake
    3. Muscle mass
    4. Body weight

50. Which of the following vegetables is lowest in carbohydrates?

    1. Carrots
    2. Green peas
    3. Celery
    4. Winter squash

51. A person who has diabetes should follow which of the following principles in selecting his food?

    1. Use foods which contain 5 to 10% carbohydrates
    2. Select special dietetic foods
    3. Use foods which contain no sugar
    4. Omit concentrated sweets

52. In the preparation of food for the individual with diabetes which of the following is advisable in order to make it easier to follow the diet prescription?

    1. Cook his food separately
    2. Limit cooking methods to broiling, baking, and boiling
    3. Use family recipes and determine exchanges in the diet
    4. Omit fat and flour in cooking

53. Which of the following desserts would be permissable for the patient with diabetes if substituted in the diet for equivalent exchanges?

    1. Unsweetened custard
    2. Ice cream
    3. Plain cake
    4. All of the above

54. Under the exchange system for meal planning, which of the following would be grouped as B vegetables (containing approximately seven percent carbohydrate)?

    1. Lettuce, celery
    2. Radishes, spinach
    3. Tomatoes, cabbage
    4. Squash, beets

55. Which of the following are negligible or lacking in calories and may be eaten as desired by a person with diabetes?

    1. Pickles
    2. Unsweetened custard
    3. Bouillon
    4. Gelatin desserts

56. The caloric requirements for persons with controlled diabetes are

    1. approximately the same as for non-diabetics
    2. considerably lower than for non-diabetics
    3. slightly lower than for non-diabetics
    4. based on a reduced basal metabolism

57. When protamine zinc insulin is prescribed the patient requires

    1. a mid-afternoon feeding
    2. a mid-morning feeding
    3. a late evening feeding
    4. a mid-morning and a mid-afternoon feeding

58. In meal planning for the diabetic which one of the following can be substituted for one bread and two fat exchanges?

    1. One-half cup of ice cream
    2. One-half cup of lima beans
    3. One-half cup of rice
    4. Ten soda crackers

59. What seasonings and condiments may the person with diabetes use <u>ad libitum</u>?

    1. Those which do not contain starch
    2. Those which do not contain sugar
    3. Those which do not contain sugar and sodium
    4. Those which do not contain calories

60. Pernicious anemia can be treated most effectively by

    1. folic acid
    2. folic acid and vitamin B_{12}
    3. protein and iron
    4. vitamin B_{12}

61. A reducing diet should contain at least fifty grams of carbohydrate in order to prevent

    1. acidosis
    2. low blood sugar
    3. anemia
    4. toxic effect of anorexants on the liver

62. If a diet has the composition of CHO-200, fat-125, protein-75, (grams) what is the approximate calorie value?

    1. 1700
    2. 1900
    3. 2200
    4. 2500

63. Obesity is defined as

    1. five percent above ideal weight
    2. ten percent above ideal weight
    3. twenty percent above ideal weight
    4. thirty percent above ideal weight

64. A more liberal fat intake is now advocated in treating hepatitis than the low fat diet which was formerly recommended because the increase in fat allowance

    1. provides B-complex vitamins
    2. helps to increase the total food intake
    3. helps to rebuild tissue
    4. aids in digestion

65. If mild cases of esophagela varices occur in cirrhosis which one of the following diets would be prescribed?

    1. Clear liquids
    2. Full liquids
    3. Soft diet
    4. Six-meal bland

66. In the dietary treatment of hepatic coma what amount of protein is recommended for a beginning level after the acute phase has passed?

1. 0-10 grams
2. 20-30 grams
3. 40-60 grams
4. 60-70 grams

67. In celiac disease which one of the following may be most poorly tolerated?

1. Glucose
2. Lipids
3. Lactose
4. Gluten

68. Which one of the following meals would correspond to a low-residue diet?

1. White bread, butter, steak, fruit salad, milk, ice cream
2. Rice, roast lamb, tomato juice, white bread, butter, sherbert
3. Cream soup, baked potato, hamburg, peas, rolls and butter, baked apple
4. Bouillon, mashed potatoes, liver, creamed corn, white bread, butter, custard

69. Which of the following foods should be omitted if the patient had a colostomy performed two weeks ago?

1. Corn flakes, oatmeal
2. Beef, lamb
3. Turnip, cauliflower
4. Milk beverages

70. Which of the following would be the most effective in treating functional constipation?

1. Hot water with lemon
2. Decrease roughage
3. Increase strained juices
4. Increase fruit pulp

71. Which of these foods would not be advised for a patient with an ulcer?

1. Applesauce
2. Prunes, cooked
3. Cucumbers
4. Squash

72. Fat is considered to be an important constituent of the bland diet because it

1. neutralizes acidity
2. depresses gastric motillity
3. provides available glucose
4. is ninety-five percent digestable

73. Which meal would be most suitable for a bland diet?

1. Roast beef, mashed potatoes, string beans, rolls, sponge cake, milk
2. Baked ham, baked potatoes, beets, milk, custard
3. Roast lamb, asparagus, wholewheat bread, apple pie, tea
4. Hamburg patties, creamed potatoes, lima beans, fresh pears, tea

74. Which of the following would not be advisable on a bland diet?

1. Lobster
2. Yellow cheese
3. Liverwurst
4. Ice cream

75. Recent research has pointed out that in treatment of the patient who has an ulcer the most important dietary factor may be

1. elimination of all spices
2. increase protein and ascorbic acid
3. regularity of meals
4. frequency of feedings

76. Which of the following is considered to be the most significant in the recurrence of ulcers?

1. Failure to follow a bland diet
2. Excessive intake of irritants
3. Emotional factors
4. Inadequate food intake

77. Which of the following foods is low in sodium?

1. Peanut butter
2. Butter
3. Salad oils
4. Margarine

78. Which of the following foods is lowest in sodium on an average serving basis?

1. One egg
2. One slice of bread
3. One orange
4. Three ounces of lean meat

79. Which of the following could be used to improve the palatability of the low-sodium diet?

1. Garlic salt
2. Celery salt
3. Ketchup
4. Parsley flakes

80. Which of the following is lowest in sodium?

1. Sausage
2. Bologna
3. Lobster
4. Liver

81. Which of the following contains the highest percent of polyunsaturated fat?

1. Corn oil
2. Margarine
3. Olive oil
4. Coconut oil

82. Which of the following fruits would be allowed on a low-sodium diet?

1. Apple juice
2. Orange juice
3. Bananas
4. All of above

83. Mr. Jones is on a 500-milligram sodium diet. He is moving to Arizona. What is the most significant factor in relation to his dietary regimen?

1. Effect of climate on food intake
2. Availability of low-sodium foods
3. Sodium content of the water supply
4. Nutritive value of produce grown in Arizona

84. In order to convert a 500-milligram sodium diet to a 250-milligram sodium diet which of the following changes would be necessary?

1. Omit salt in cooking
2. Use low-sodium milk
3. Eliminate eggs
4. Eliminate milk

85. Studies of fat intake and heart disease have indicated that increasing the percentage of polyunsaturated fats in diets tends to

1. decrease essential fatty acids
2. decrease serum cholesterol
3. decrease deposition of fat in the tissues
4. decrease fat accumulation in the liver

86. Which one of the following would be completely omitted from the diet in treatment of cholescystitis before definitive operative treatment has been accomplished?

1. Meat
2. Eggs
3. Cream
4. Cottage cheese

87. Which of the following diets would be prescribed for treatment of cholecystitis?

1. Low fat, low protein
2. Low cholesterol
3. Low fat
4. Low fat, low carbohydrate

Situation Covering Questions 88 and 89

Mrs. Burnham visited her doctor when she suspected pregnancy at two months. At her next visit one month later, she had gained an additional six pounds. She did not complain of headache, fatigue, or nausea. She had no signs of edema. She had spent one week visiting relatives; and during this time, found it difficult to get the foods she should have.

88. Which one of the following suggestions should be made to help her control her weight on an 1800-calorie diet?

1. Follow a 200-milligram sodium diet
2. Omit pork, ham, and veal
3. Omit bread and cereals
4. Use skim milk in place of whole milk

89. Which one of the following suggestions should be made to help her control her weight?

1. Use no fat on bread or in cooking
2. Omit eggs and cheese
3. Use margarine in place of butter
4. Use fruit for dessert

Situation Covering Questions 90 and 91

Mr. Jones was admitted to the hospital for medical treatment of a chronic duodenal ulcer. He was placed on a six meal bland diet.

90. Select from the following the dietary modification which would be advisable in treating Mr. Jones

1. Increased calories
2. Omit cooked peas and green beans
3. Limit intake of tea
4. Avoid rolls and muffins

91. Which one of the following dietary modifications would be advisable in treating Mr. Jones?

1. Omit all fresh fruits
2. Omit tomato juice
3. Avoid soups
4. Avoid pepper

Situation Covering Questions 92 and 93

Miss Rayburn was admitted to the hospital suffering from malnutrition. She is 80 years old, lives alone, and only occasionally has had a hot meal brought in by a neighbor. The rest of the time, she prepares her own meals and follows the meal pattern listed

Breakfast	Lunch	Supper
8 ounces of orange juice	1/2 cup of consomme	2 slices of toast
1 slice of toast	1 jelly sandwich	1/2 cup canned peaches
2 teaspoons of butter	Tea with lemon	1 cup of tea
1 cup of coffee with	2 vanilla cookies	1 teaspoon of sugar
2 teaspoons of sugar		1 ounce of cheese
1 teaspoon of evaporated milk		2 teaspoons of butter

92. In evaluating her food habits, which one of the following statements would you select?

1. Inadequate in sodium
2. Deficient in ascorbic acid
3. Deficient in riboflavin
4. Adequate in protein

93. In evaluating her food habits, which one of the following statements would you select?

1. Adequate in vitamin A
2. Inadequate in niacin
3. Inadequate in vitamin E
4. Adequate in calcium

Situation Covering Questions 94 and 95

Mr. Jones, who is slightly overweight, was admitted to the hospital in acute congestive heart failure.

94. During the acute phase of his illness which nutritional recommendation would be the most important to employ?

1. Avoid meals high in bulk
2. Maintain normal calories
3. Adequate calcium intake
4. Increase protein intake

95. During the acute phase of his illness which one of the following would be advisable?

1. Small meals
2. High carbohydrate intake
3. Frequent feedings
4. Increase thiamine

Situation Covering Questions 96 and 97

Mr. Brown underwent a subtotal gastrectomy for treatment of a recurrent gastric ulcer. Post operatively he developed abdominal discomfort, weakness, palpitations, sweating, and tremulousness.

96. Which one of the following modifications would be recommended as part of his dietary treatment?

1. Six to eight small meals daily
2. Low-protein diet
3. High-carbohydrate intake
4. Reduced-fat intake

97. Which one of the following modifications would be recommended as part of his dietary treatment?

1. Use of carbonated beverages
2. Fruit juices given as desired
3. Limit liquids at meal time
4. Increase sugars and jellies

Situation Covering Questions 98 and 99

Mr. Brontis, a 50-year old department store clerk, came to the Out-Patient Department for treatment of obesity. He is six feet tall and weighs 240 pounds. His ideal weight is 200 pounds. He has his lunch at a cafeteria but is home for breakfast and supper.

98. Which one of the following modifications from the normal diet would apply to an 1800-calorie reducing diet for Mr. Brontis?

1. Restrict salt
2. Avoid fried foods
3. Avoid foods like corn, beets, and baked beans
4. Restrict fluid

99. Which one of the following modifications from the normal diet would apply to an 1800-calorie reducing diet for Mr. Brontis?

1. Reduce carbohydrate to 50 grams per day
2. Reduce fat content to 20 grams per day
3. Limit meals to three daily
4. Reduce bread and cereal equivalents

100. Mr. Larsen, a 40-year old business executive, sought medical advice due to severe heartburn and pain in the upper right abdominal quadrant. He was admitted to the hospital for treatment of acute cholecystitis. The prescribed diet consisted of the following: Protein, 60 grams; Carbohydrate, 300 grams; Fat, 50 grams. From the following diet select the dietary modification which would apply to the prescribed dietary regimen.

1. Limit whole milk to one pint daily
2. Omit coffee and tea
3. Restrict meat to beef, chicken, and turkey
4. Decrease carbohydrate intake

APPENDIX B

MEDICAL STUDENTS PERSONAL DATA SHEET

MEDICAL STUDENTS PERSONAL DATA SHEET

Please fill out completely by placing a check ( ) or the necessary information in the space provided. Do not skip any items.

1. Name (1)_____ Class (2)_____
   Last First Middle

2. Marital status: single(1)____; married (2)____; divorced (3)____; separated (4)____; widowed (5)____
   If married, occupation of spouse: _____

3. Number of children: (1-5)_____
   Ages of sons: (1-5)_____; ages of daughters: (1-5)_____

4. In what type of community did you live during the period you attended the seventh through the twelfth grades? rural (1)____; unincorporated suburban area (2)____; incorporated area (3)____
   Approximate population of the community:
   (1) under 10, 000____ (4) 100, 001 to 250, 000 ____
   (2) 10, 000 to 50, 000____ (5) 250, 001 to 1 million____
   (3) 50, 001 to 100, 000____ (6) over 1 million____

5. What was your parent's approximate annual income range during the period you attended the seventh through the twelfth grades?
   (1) under $10, 000____ (3) $20, 000 to $40, 000____
   (2) $10, 000 to $19, 999____ (4) over $40, 000____

6. Have you decided on a medical specialization? yes (1)____; no (2)____
   If so, what? (3-9)_____

7. How would you describe your eating habits? good (1)____; average (2)____; poor (3)____

8. How many times a week do you eat something more than toast and coffee for breakfast? (1-7)____

9. How often do you "go on a diet"? never (1)____; rarely (2)____; occasionally (3)____; frequently (4)____; all the time (5)____

10. How often do you eat "organic" or "natural" foods? never (1)____; rarely (2)____; occasionally (3)____; frequently (4)____; always (5)____

APPENDIX C

PERCENTAGE OF MEDICAL STUDENTS TESTED WHO GAVE CORRECT RESPONSES TO NDT TEST ITEMS

PERCENTAGE OF MEDICAL STUDENTS TESTED WHO GAVE CORRECT RESPONSES TO NDT TEST ITEMS

Test Item	Class I Percent Correct	Class II Percent Correct	Class III Percent Correct	Class IV Percent Correct	Total Students Percent Correct
1	70.0	78.1	87.5	68.8	75.7
2	40.0	47.9	62.5	43.8	46.8
3	66.7	72.6	83.3	87.5	73.4
4	41.7	37.0	50.0	75.0	43.9
5	51.7	47.9	62.5	75.0	53.8
6	66.7	75.3	50.0	68.8	68.2
7	70.0	69.9	79.2	87.5	72.8
8	81.7	84.9	87.5	93.8	85.0
9	21.7	31.5	41.7	43.8	30.6
10	8.3	11.0	8.3	25.0	11.0
11	30.0	57.5	66.7	68.8	50.3
12	26.7	13.7	87.5	68.8	33.5
13	31.7	21.9	20.8	12.5	24.3
14	63.3	41.1	33.3	56.3	49.1
15	44.1	47.9	54.2	43.8	47.1
16	55.0	52.1	50.0	75.0	54.9
17	53.3	56.2	66.7	68.8	57.8
18	45.0	64.4	52.2	50.0	54.7
19	31.7	23.3	4.3	43.8	25.6
20	23.2	37.0	41.7	37.5	32.9
21	58.3	41.1	54.2	25.0	47.4
22	70.0	56.2	75.0	81.3	65.9
23	20.0	91.8	87.5	100.0	84.4
24	23.3	23.3	16.7	37.5	23.7
25	48.3	42.5	50.0	43.8	45.7
26	65.0	83.6	79.2	75.0	75.7
27	25.0	20.5	37.5	50.0	27.2
28	43.3	28.8	41.7	43.8	37.0
29	71.2	72.2	75.0	87.5	73.7
30	41.7	13.9	25.0	37.5	27.3
31	13.3	13.7	12.5	31.3	15.0
32	16.7	5.5	39.1	43.8	17.4
33	45.0	49.3	47.8	37.5	46.5
34	45.8	53.4	50.0	56.3	50.6
35	45.0	53.4	69.6	56.3	52.9

Test Item	Class I Percent Correct	Class II Percent Correct	Class III Percent Correct	Class IV Percent Correct	Total Students Percent Correct
36	40.0	50.7	87.5	87.5	55.5
37	21.7	9.6	50.0	68.8	24.9
38	40.0	38.4	33.3	56.3	39.9
39	43.3	30.1	37.5	50.0	37.6
40	18.3	0.0	50.0	37.5	16.8
41	26.7	32.9	37.5	37.5	31.8
42	26.7	28.8	37.5	37.5	30.1
43	26.7	35.6	29.2	12.5	29.5
44	45.0	43.8	41.7	31.3	42.8
45	33.3	38.4	62.5	25.0	38.7
46	81.7	82.2	83.3	81.3	82.1
47	36.7	53.4	33.3	50.0	44.5
48	40.0	32.9	50.0	43.8	38.7
49	83.3	76.7	87.5	93.8	82.1
50	68.3	84.9	75.0	81.3	77.5
51	48.3	58.9	70.8	75.0	58.4
52	43.3	69.9	87.5	75.0	63.6
53	43.3	75.3	75.0	81.3	64.7
54	21.7	37.5	25.0	37.5	30.2
55	35.0	43.8	62.5	43.8	43.4
56	43.3	72.6	83.3	50.0	61.8
57	38.3	34.2	29.2	37.5	35.3
58	28.3	60.3	66.7	81.3	52.0
59	23.7	41.1	54.2	56.3	38.4
60	34.0	68.5	79.2	87.5	63.6
61	36.7	20.5	73.9	75.0	38.4
62	40.0	52.1	45.8	43.8	46.2
63	43.3	55.6	33.3	62.5	48.8
64	11.7	17.8	33.3	50.0	20.8
65	46.7	61.6	66.7	56.3	56.6
66	46.7	47.9	41.7	43.8	46.2
67	3.4	69.9	87.5	81.3	50.6
68	37.3	37.0	45.8	56.3	40.1
69	26.7	32.9	41.7	31.3	31.8
70	51.7	49.3	33.3	50.0	48.0
71	63.3	60.3	75.0	62.5	63.6
72	31.7	58.9	62.5	68.8	50.9

Test Item	Class I Percent Correct	Class II Percent Correct	Class III Percent Correct	Class IV Percent Correct	Total Student Percent Correct
73	31.7	26.0	54.2	50.0	[illegible]
74	36.7	39.7	62.5	62.5	[illegible]
75	30.0	65.3	87.5	93.8	[illegible]
76	63.3	84.9	62.5	68.8	[illegible]
77	56.7	47.9	45.8	50.0	[illegible]
78	41.7	28.8	54.2	25.0	[illegible]
79	33.9	31.5	45.8	56.3	[illegible]
80	33.3	46.6	62.5	75.0	[illegible]
81	16.7	5.5	16.7	0.0	[illegible]
82	51.7	47.9	75.0	56.3	[illegible]
83	66.7	50.7	45.8	50.0	[illegible]
84	11.7	6.8	16.7	18.8	[illegible]
85	58.3	83.3	75.0	81.3	[illegible]
86	40.0	46.6	70.8	68.8	[illegible]
87	30.0	31.9	75.0	75.0	[illegible]
88	23.3	35.6	20.8	50.0	[illegible]
89	35.0	47.9	37.5	62.5	[illegible]
90	48.3	61.6	79.2	93.8	[illegible]
91	53.3	68.5	54.2	68.8	[illegible]
92	45.0	65.3	62.5	93.8	[illegible]
93	39.0	53.4	41.7	68.8	[illegible]
94	46.7	50.7	45.8	56.3	[illegible]
95	65.0	52.1	70.8	75.0	[illegible]
96	53.3	68.5	87.5	87.5	[illegible]
97	46.7	34.2	79.2	75.0	[illegible]
98	53.3	71.2	58.3	75.0	[illegible]
99	18.3	24.7	33.3	18.8	[illegible]
100	13.3	35.6	33.3	37.5	[illegible]