NUTRITION KNOWLEDGE OF COLLEGE STUDENTS ENROLLED IN A BASIC HUMAN NUTRITION COURSE

By

SANDHYA E. REDDY

Bachelor of Science

Andhra Pradesh Agricultural University

Hyderabad, India

1976

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
December, 1984

NUTRITION KNOWLEDGE OF COLLEGE STUDENTS ENROLLED IN A BASIC HUMAN NUTRITION COURSE

Thesis Approved:

Lee L Ebro
Thesis Adviser

Esther Winterfeldt

L D Wade

Bernice Kopel

Norman N. Durham
Dean of the Graduate College

ACKNOWLEDGEMENTS

The author wishes to extend appreciation to her major adviser, Dr. Lea L. Ebro, for her guidance, support and endless encouragement throughout this research. Appreciation is also extended to Dr. Bernice Kopel and Dr. Esther A. Winterfeldt for their participation and assistance on my Research Committee. A special thank you is extended to Dr. William Warde, Professor in Statistics, for his patience and invaluable help in the data analyses and for serving on the Thesis Committee.

Sincere thanks are further extended to Mrs. Andrea Arquitt and Ms. Luann Soliah, instructors of FNIA 1113, who with their students, participated in this research endeavor.

Finally, I would like to express my love and gratitude to my husband, Pradeep Reddy, and my son, Chaitanya Reddy, for their encouragement, assistance and patience throughout my graduate study.

TABLE OF CONTENTS

Chapter		Page
I.	INTRODUCTION	1
	Purpose and Objectives	3
	Hypotheses	4
	Assumptions	5
	Limitations	5
	Definitions	5
II.	REVIEW OF LITERATURE	8
	Introduction	8
	Nutritional Status Studies	8
	USDA Food Consumption Survey	9
	Hanes Survey	10
	Nutritional Guidelines	10
	Nutrition Education	11
	Need for Nutrition Education	12
	Steps Toward Nutrition Education	14
	Effects of Nutrition Education	17
	Techniques for Teaching Nutrition	21
	Puppets are Effective Teachers	22
	Cartoon Approach to Nutrition Education	22
	Nutrition Course by Telephone	23
	A "Fair" Way to Teach Nutrition	24
	Programmed Instruction in Basic Nutrition	25
	Effectiveness of Radio in Nutrition Education	26
	Talk-Back Television	27
	Nutritional Knowledge and Attitude Studies	28
	Elementary Teachers	28
	Mothers and Children	29
	High School Students	30
	Registered Nurses	31
	Physicians	32
	Dental Students	33
	High School Athletic Coaches	34
	Health Sciences	36
	Nutrition Educators	37

Chapter Page

III. METHOD 38

Sample 38
Research Design 39
Instrumentation 40
Procedure 41
Data Analyses 42

IV. RESULTS AND DISCUSSION 44

Description of the Sample 44
Sex, Age and Class Level 44
Major, Purpose, and Course Requirement 47
Past Nutrition and Chemistry Background 47
Evaluation of Nutritional Knowledge . . . 48
Testing of the Hypotheses 54
Hypothesis One 54
Hypothesis Two 58

V. SUMMARY, RECOMMENDATIONS, AND IMPLICATIONS . . 69

Recommendations 72
Implications 73

BIBLIOGRAPHY 75

APPENDIXES 81

APPENDIX A - FNIA 1113 82

APPENDIX B - GRID 87

APPENDIX C - PRETEST 89

APPENDIX C - POSTTEST 97

APPENDIX D - FOOD RECORD SHEET 110

LIST OF TABLES

Table		Page
I.	Frequency and Percentage Distribution of the Sample According to Selected Variables .	45
II.	Number of Correct Responses by Nutrition Topics	50
III.	Comparison of Group Means at Pre- and Posttest Periods of Nutrition Knowledge Assessment Studies	53
IV.	Increase in Mean Scores (Nutrition Knowledge) as Associated with Selected Variables	55
V.	T-Test Procedure for Mean Scores as Associated with Course Requirement	57
VI.	Mean Intake of Nutrients as Associated with the Selected Variables	60
VII.	Results of T-Test Showing Significant Differences Between Application of Nutrition Knowledge and Variables of Sex, Class Level, and Course Requirement	65

LIST OF FIGURES

Figure		Page
1.	Number of Correct Responses at Pretest	49
2.	Number of Correct Responses at Posttest	49
3.	Comparison of Correct Responses on the Pre- and Posttest	51

CHAPTER I

INTRODUCTION

Human nutrition is the study of foods and its interaction in the total life situation of man. During most of the U.S. history, very little emphasis has been given to nutrition. A prerequisite for sound nutrition is a sufficient and comprehensive food supply to cover energy needs. Only in the last 20 years has the nutritional status of humans gained in importance and nutrition and food have been drawn or considered.

When the Social Security Act of 1935 provided funding, public health nutrition was provided by dietitians. As more public health programs were established in the late 1950's and 1960's, the number of nutritionists increased to meet the public's needs. Even so, the demand for nutrition information and counselling to satisfy the public's need for information far surpasses the number of qualified nutritionists available. Despite the high rate of literacy in the U.S., millions of people have poor diets. Nutrition knowledge is a necessary tool for living. With continuing concern for the gap between knowledge and application in the daily eating pattern of children, youth and adults, there is increased concern on the effectiveness of teaching

nutrition. "They do well on their tests, but they don't apply it" (Poolton, 1972, p. 110).

Vast areas for scientific exploration in nutrition remain unknown. The student needs to learn what others in the areas have discovered, while simultaneously doing some original thinking of his/her own. The application of principles, generalizations and facts by the student in daily situations can serve as an index to his/her understanding of the importance of nutrition to his/her well-being.

The U.S. has been called a nation of nutritional illiterates. According to White (1976), this is not because of lack of information about food and nutrition, but due to lack of motivation to avail oneself of the information. The state of knowledge of Americans is out of phase with the advanced state of knowledge in the science of nutrition.

Nutrition education is important because good nutrition is vital to the achievement of one's genetic potential. A good knowledge of nutrition is essential not only for the maintenance of health, but also for the saving of money and avoidance of waste. It is a base for the evaluation of food and nutrition information, both good and bad, and it is essential to reinforce or correct family teaching about food and nutrition (Cooper and Go, 1976).

Nutrition educators and other health professionals need to apply their skills and knowledge to adapt information so that it is applied to a wide array of situations and then

package it for distribution in a variety of ways, either directly to the intended user or indirectly through intermediate agents. For nutrition education to be viewed as satisfying and effective, some returns of discernible value need to be accepted or seen by the recipient.

There is no single approach to use in nutrition education. Each program needs to be tailored and related to the needs, interests, experiences, and goals of the individual or groups being exposed to the subject. Whether the message is general or detailed, it has to reflect that choosing food for health is not an end in itself, but a means to an end, i. e., giving individuals the nutritional well-being that helps them in everything they do. It is not conveyed by "eat this because it is good for you", but rather by "eating well will help you in what you want to do and to become" (Commentary: What is Nutrition Education?, 1974, p. 17).

Educating the public is a vital component of preventive medicine. Preventive medicine has assumed the role of high levels of individual health maintenance and efficiency. Preventive efforts work and stronger efforts are needed as a nutritious, adequate diet is one of the most effective tools for the prevention of diseases (McGinnis, 1980).

Purpose and Objectives

The purpose in this study was to determine if the knowledge gain in basic human nutrition is applied towards better

dietary habits and menu-planning after completing FNIA 1113 (Basic Human Nutrition).

Specific objectives for this study were as follows:

1. To assess the nutritional comprehension of students before and after taking the course FNIA 1113, as associated with selected variables: age, sex, major, previous courses taken in chemistry and nutrition, and whether the course was required or not.
2. To assess if the level of nutritional knowledge of students is associated with the application of the knowledge in food selection and consumption of an adequate diet.
3. Make suggestions for further research in this area.

Hypotheses

The following hypotheses were postulated for the study:

1. Hypothesis One: There will be no significant difference between the posttest mean scores and pretest mean scores of students enrolled in FNIA 1113 during Spring 1984 as associated with selected variables: age, sex, class level, major purpose for taking the course, whether the course was required or not, and previous courses taken in nutrition or chemistry.
2. Hypothesis Two: There will be no significant difference in the application of knowledge of

students in food selection between the second week and the fourteenth week of enrollment in FNIA 1113 based on the 24-hour recall method and computer analysis of records of randomly chosen participants.

Assumptions

The following assumptions were recognized for this study:

1. The media, techniques and materials used by both instructors were similar.
2. The recordings made by students for the 24-hour recall method were accurate and reliable.

Limitation

The sample was limited to only the students who took both the pretest and posttest (N=130) in FNIA 1113 at OSU during the Spring Semester, 1984. Generalizations based on this study will only apply to the sample used.

Definitions

The following definitions specify the meaning of concepts being utilized in this study:

1. Nutritional knowledge: A state of awareness and understanding of nutrition gained through study and learning experience.
2. Nutrition education: The process by which beliefs attitudes, environmental influences, and understanding about food lead to practices that are scientifically sound, practical, and consistent with individual needs and available food sources (ADA, 1978, p. 302).

3. Knowledge gain: "Gain in job knowledge" (Acacio, McKinley, and Scruggs, 1974, p. 41).

4. Menu-planning: The art of planning nutritious meals by incorporating the knowledge of nutrition facts, the regional availability of foods, and cookery skills (Mahan and Krause, 1979, p. 214).

5. 24-hour recall: A data collection technique where an individual completes a questionnaire or is interviewed by a dietitian/nutritionist or nurse experienced in dietary interviewing and is asked to recall every food item that he/she ate within the last 24 hours, or the previous day (Mahan and Krause, 1979).

6. Cognitive domain: Includes those objectives which deal with the recall or recognition of knowledge and the development of intellectual abilities and skills (Bloom, 1956).

Major categories in the cognitive domain:

a. Knowledge: is defined as the remembering of previously learned material.

b. Comprehension: is defined as the ability to grasp the meaning of the material.

c. Application: refers to the ability to use the learned material in new and concrete situations.

d. Analysis: refers to the ability to break down material into its component parts so that its organizational structure may be understood.

e. Synthesis: refers to the ability to put parts together to form a new whole.

f. Evaluation: is concerned with the ability to judge the value of material for a given purpose.

CHAPTER II

REVIEW OF LITERATURE

Introduction

In recent years, Americans have placed emphasis on their health not only through medical care but also by improving their nutrition. This emphasis is seemingly in the area of prevention rather than medical care which is much more expensive.

Sound nutrition is not a panacea; nutritious food provides needed nutrients and should not be regarded as medicine, or a good charm (Food and Nutrition Board, 1980). Food choices are influenced by many factors and the consumer is bombarded by confusing and conflicting information (U.S. Department of Health, Education, and Welfare, 1979). It is a known fact that good nutrition contributes to the development and health of individuals and that good eating patterns should be established by one and all.

Nutritional Status Studies

The U.S. Public Health Service identified nutrition as one of the six major health care concerns, stating that it affects people at all stages in the life cycle, and that nutrition education and care have to be coordinated (U.S.

Department of Health, Education, and Welfare, 1975). The American diet which is high in calories, sugar, salt, and cholestrol has been associated with heart diseases, hypertension, obesity, diabetes, colon cancer and dental caries.

USDA Food Consumption Survey

The USDA Food Consumption Survey results indicated a decrease in caloric intake by ten percent from 1965 to 1977 (Cronin, Pao, and Hama, 1980). Diets decreased in dietary fats by nine percent, carbohydrates by thirteen percent, and protein by four percent. The consumption of foods high in vitamin C and thiamin increased more than any other nutrients. Vitamin C fortification and citrus juice consumption contributed to the increase. Riboflavin intake decreased from 1965 to 1977, yet intakes met or exceeded the 1974 RDA's. Average calcium intake were 25 percent or more lower for females twelve years and over. Boys aged 15 to 18 had the largest average intake of calcium in 1977. In 1977, children had intakes of calcium ten to twenty percent lower in 1965 and thirteen to fifteen percent lower for teens than in 1965.

Iron intakes for infants in 1977 averaged one hundred percent or more for the RDA (Food and Nutrition Board, 1980), as well as for most school-age children and men. Iron intake for females twelve to fifty years of age were significantly below the recommended levels.

Hanes Survey

The first health and nutrition examination survey (Hanes) was conducted from 1971 to 1974 by the National Center for Health Statistics (NCHS) to measure the nutritional status of the United States population age one to seventy-four years (U.S. Department of Health, Education, and Welfare, 1979). Age, sex, and income level were used for comparison but young children, pregnant women, older adults, and low income groups were the target groups. After the interviews, examinations, and assessments, iron was the nutrient which was below standard most often in the population, especially in low income adults aged 49 to 59, and black children aged six to eleven. Low income black adults, sixty years or older, had the highest prevalence of low hemoglobin and hematocrit values. All age groups of whites, regardless of income or clinical findings, had a higher prevalence of low serum protein values. Blacks seemed to show a higher prevalence of secondary malnutrition than whites in the same sex, age, and income groups. Dietary intake of protein was not markedly deficient. Black women were shown to have more cases of diabetes and heart disease.

Nutritional Guidelines

Improvement of health not only includes treatment of disease but also prevention of disease (Jones and Vermer, 1980). One of the preventive measures is to have good

eating habits based on sound nutritional knowledge, along with a number of other factors.

Dietary guidelines for Americans were developed by U.S. Department of Health and Human Services (HHS) and USDA in 1980. This booklet relates good nutrition in simple language that can be understood by most. It consists of the following dietary recommendations:

1. eat a variety of foods,
2. maintain ideal weight,
3. avoid too much fat, saturated fat, and cholesterol,
4. eat foods with adequate starch and fiber,
5. avoid too much sugar,
6. avoid too much sodium, and
7. if you drink alcohol, do so in moderation.

Studies have indicated that the population's eating habits are changing and that some of these changes may influence the health status of the population negatively, hence a need for nutrition education. Nutrition education is needed by man regardless of economic, educational, cultural, social, or geographic location because there is no instinct in man which can guarantee an adequate diet (Todhunter, 1969).

Nutrition Education

Nutrition education is a multidisciplinary process that involves the transfer of information, the development of motivation, and the modification of food habits where needed (Commentary: What is Nutrition Education?, 1974). No one

needs to be a nutrition specialist to choose his food wisely. People vary greatly in how much they want to know about nutrition and food consumption, hence, nutritionists or dietitians need to be selective in the information they communicate and guard against telling a person more than he or she wants to know.

Need for Nutrition Education

There are millions of people in the U.S. with poor diets, hence, there is an urgent need for nutrition education programs aimed at enabling people to select their own food in accordance with their changing physiological needs and economic conditions. Nutrition education also helps to evaluate to some extent health, as it may be effected by the food intake, utilized for economy, health, enjoyment and convenience - the fruits of technological advancement in the food supply. Also, it enables a person to understand the significant role of nutrition in improving the quality of life, understand the meaning of hunger and starvation (Eppright, 1971).

Public opinion must be aroused in every community for the need of a coordinated effective school and community education program. This needs to be a priority on the list of activities of state, county, and local nutrition councils and public spirited citizens interested in nutrition.

Effective nutrition education must be based on properly qualified and continuing research. Since nutrition is a

relatively new science, the amount of factual information on human nutrition is still somewhat sparse. There is dire need to support and intensify basic and applied research in human nutrition and nutrition education to find solutions to the unanswered questions (Briggs, 1969).

Nutrition and health educators are unanimous in declaring the need for more nutrition education. According to Mayer (1970), ignorance of the basic facts of nutrition is not limited to the poor and the near-poor but cuts across all economic sections of the country. Therefore, nutrition education must be directed at all segments of the population even though the approach may vary with various socio-economic groups. Nutrition education is not only the teaching of facts or ideas; it is also changing behavior - and a very basic behavior at that. For nutritionists to serve the public, relevant information need also to be disseminated widely. They must be knowledgeable about the factors that can and do motivate people to change (Fisk, 1970).

Nutrition research and education play dominant roles in conversation through proper utilization of one of nature's most important basic resources - food. While the U.S. population is presently blessed with a plentiful and broad variety of nutritious foods, the general level of human health is not as high as it should be (Briggs, 1969). Nutrition education is universally needed regardless of income, geographic location, cultural, social or economic patterns, or level of education. There is a need to discover

how to get the public conscious of the importance of nutrition, and how to develop the desire to apply such knowledge to practice.

Steps Towards Nutrition Education

Little was done to teach the public about nutrition before the twentieth century, with some exceptions. Nutrition education programs made little headway in the U.S. until the 1920's when concern for the health of children developed. Malnutrition began to receive the attention of clinics and dispensaries with early nutrition work resting largely in the hands of physicians. It was at this time that Mary Rose initiated studies on methods for teaching nutrition to school children. Her teaching methods were based on the fundamentals that since food makes the difference in health, it is vital to know what and how much to eat in a daily diet (Todhunter, 1969). Another equally effective program was developed by Dr. Lydia Roberts. Also, a research group at Harvard University School of Public Health studied the problem of teaching nutrition in schools.

The universities pioneered the nutrition research and education centers, and the development of research programs and advances in food technology inspired the food industry to participate in the overall effort. In 1941 a group of food manufacturers and related industries organized the Nutrition Foundation to develop a comprehensive nutrition research and teaching activity. The Nutrition Foundation

continues to support the many phases of nutrition education.

In 1912, the Children's Bureau was established in the U.S. Department of Labor. The first bulletin for parents, "Prenatal Care" (1913), was followed by "Infant Care" (1914). These are among the most widely read government bulletins. The U.S. Department of Agriculture had long issued public information leaflets and bulletins on foods, their nutritive value, and how to budget family meals (Todhunter, 1969).

Man is a creature of habit, and most of his habits are formed early in life (White, 1976). The nutrition educator enters the scene when many habits and attitudes are already formed. Adults are most likely to pay attention to nutrition information when they are frightened, threatened by hypertension, diabetes or the need to undertake a diet to correct obesity that may underlie these diseases. Adults, then, must first be motivated to learn before they can be taught.

Nutrition is one health subject that is taught consistently in public schools - but the evidence shows that it is taught poorly. According to Steinberg, (1966), part of the problem is that those that teach health education are in many cases unqualified. This situation cannot be corrected over night, but it seems important for schools to develop improved nutrition education programs. Steps towards this goal would be: 1) to make sure teachers understand that the lack of sound nutrition can keep children from achieving their potential; 2) appoint someone with specialized professional preparation in health and nutrition education;

3) develop local curriculum guides on nutrition; 4) take a look at all aspects of health instruction; and 5) investigate the responsibilities that elementary school teachers are given in relation to portions of the curriculum that are designated as health instruction and include nutrition.

The Society of Nutrition Education is concerned with maintaining and improving the nutritional well-being of the people through education. They act on the belief that the better informed people are, the more likely they are to make better choices in the selection and preparation of their food. It is important to begin to present nutrition information in the elementary grades on the theory that this accumulated knowledge will assist a high school graduate to make informed food choices. Information alone is often not enough to cause or enable a person to improve his/her eating habits and thus his/her nutritional state (Guthrie, 1978).

Increasingly, nutrition educators are concerned about the lack of application of nutrition knowledge gained in the classroom (Poolton, 1972). Perhaps nutrition educators have talked too much in terms of what the young person must or should eat rather than encouraging self-discipline and responsible choice-making. At the 1971 National Nutrition Education Conference, several participants suggested that the teaching approach with focus on nutrients might be preferable to one based on food absorbing more detailed scientific information than they are often given credit for.

She saw a need to teach more about nutrients and sources of nutrition information (Poolton, 1972).

Nutrition educators must continue to come up with many alternative approaches, not one of which by itself can be expected to provide the complete answer. Methods must be like the message emphasizing variety with recognition that results come slowly, and what is good in one setting may not be the best in another. One need not promote a food without evidence of its contribution to good nutrition, and nutritionists or dietitians should not cling to any method of education unless they have evidence that it brings about desirable habits of food consumption (Guthrie, 1978).

Effects of Nutrition Education

Although several investigations of the effects of nutrition have been made, only a limited number deal with the effects of nutrition education and with the evaluation of the extent of the changes produced. As the problems of nutrition education are complex, nutritionists or dietitians need to establish good educational techniques and strategies in their survey program. Objective standards need to be formulated both for assessing nutritional status and changes in the diet of the research subjects and for evaluating nutrition education techniques.

A nutrition education program studied a group of male myocardial infraction (MI) patients who were treated and discharged. The patients assigned to a treatment group

participated in the rehabilitation and nutrition education programs. The nutrition education program was directed towards correcting the main faults in each patient's diet. Although the effect of nutrition education was obvious because of the dietary intakes in the treatment group, it is likely that the myocardial infraction studies have been possible to achieve great behavioral changes in patients following MI.

The desired changes in the diet were greater in the early, intensive teaching period. But, during the second follow-up year, there was a need for remotivation and repeated nutrition education. On the whole, the nutrition education was effective. It may be possible with such a program to produce similar favorable changes in the nutrition of other populations of patients with other diseases (Karvetti, 1981).

In 1971, the Dairy Council of California trained more than 11,000 kindergarten through sixth grade teachers in nutrition education. These teachers in one year reached more than 330,000 school children. The National Research Center, under a study funded by the Dairy Council researched the "big ideas in nutrition education" program and reported that teachers trained by the Dairy Council and who used its nutrition materials in the classroom effect a 151 percent behavioral change (eating habits) in their students, whereas teachers without training or materials effect only a 22 percent change in students (Parker, 1971).

Steelman and Lee developed pretests to appraise student readiness for beginning food and nutrition courses. From Fall 1967 through Fall 1969, the Department of Food and Nutrition at Texas Tech University administered an objective pretest to majors in the college of home economics as well as non-majors to determine the initial status of the students prior to instruction in the beginning course. The non-exempt group's pretest mean was 62.29 percent and final exam score was 72 percent. The higher final exam score reflects the students' growth in food and nutrition knowledge as a result of instruction. The exemption group had a pretest mean of 80 percent but the final exam score dropped to 66.23 percent without benefit of instruction in the beginning course content (Carruth, Briley, and Roy, 1971).

Surveys of nutritional knowledge were made before and after a national nutrition education campaign in Czechoslovakia. The first survey in 1970 of 1,000 women was conducted before the campaign. The main slogan of the 1970 campaign was "learning better cooking." The results were analyzed in detail by computer to assess the standard of knowledge and the results were published before the campaign in journals and through the mass media.

The second survey was done after the 1970 campaign but the same respondents were not used. Both samples, however, were representative cross-sections of the entire female population. For all segments improved knowledge was recorded. This increase in knowledge was statistically significant for

those segments for which, during the first survey, a below average standard of knowledge was found. Hence, to the observer there appears to be the genuine picture of achieved changes (Adamec, 1972).

A research study to measure the influence of a nutrition program for third grade students and a parent program concerning nutrition and school lunch was conducted in an urban school system (Smith and Justice, 1979). The purpose of this study was to measure the influence of a student nutrition education program, a parent nutrition education program, and a combination of these two programs on the comprehension and application of nutrition knowledge by third grade students. In the two-week periods before and after the nutrition education program, the written nutrition knowledge pre- and posttest as well as a scale to measure vegetable preference were given to all third grade students. There were some positive responses to particular evaluation items, such as an increase in consumption of vegetables at lunch and increased participation in the school lunch by the parents and students (Smith and Justice, 1979).

The educational process involved all the methods, techniques, procedures and illustrative materials used to inform and to influence individual food practices. The establishment of food habits entails maintaining presently desirable habits and forming new habits necessary to individual nutritional needs. Nutritional programs are more effective when emphasis is placed on the improvement of current food

patterns rather than on change (Todhunter, 1969). The real goal of nutrition education is to make diets better - to have people eat a life-sustaining, life-enhancing diet. An understanding of the role of nutrition and its application to daily living can be regarded as preventive medicine and is essential to the future health of everyone (Smith and Justice, 1979).

Techniques for Teaching Nutrition

Concern over the nutritional well-being of the nation's population reached new heights with the 1969 White House conference on Food, Nutrition and Health (Farrell and Kendirc, 1972). Conference participants expressed alarm over the increasing deterioration of dietary habits and issued an extensive list of recommendations to combat the situation. Conference delegates acknowledged that past efforts in nutrition education had been relatively ineffective due, they claimed, to a disorganized approach to the subject (Farrell and Kendirc, 1972).

One of the goals of nutrition education is to develop an informed public. In recent years, technology has made an effort to expand the instructional materials and machines available to teachers. Since students learn in a variety of ways, teachers need a varied approach to any area of study (Carruth and Foree, 1971). Some of the techniques used for teaching nutrition will be reviewed by the researcher.

Puppets are Effective Teachers

Puppets proved to be an effective teaching device at the kindergarten level (Wilson, Lawroski and Wallace, 1972). In fact, they were so effective that the kindergarteners passed on what they learned from food puppets and created interests in nutrition at home.

The puppet shows were initiated during the Fall, 1970, by Mary A. Lawroski, Bonneville County extension home economist, as a way to present nutrition information to five-year olds. Each show, timed to last five or six minutes, included a dialogue between Perky (representing good nutrition) and Pattie (representing poor nutrition), plus a visit from a food puppet. What the puppets taught was emphasized after each show. By the end of the year the children had a basic understanding of nutrition, an idea of what foods they should eat everyday, and could categorize various foods in to the four food groups (Wilson, Lawroski, and Wallace, 1972).

Cartoon Approach to Nutrition Education

Teenagers value socializing with peers, and their food selection is influenced by what is available to the group. Two urban high schools were chose as test centers in a study by Carruth and Foree (1971) at Texas Tech University. Two classes received the programmed instruction materials, two used learning packets, and one served as a control group.

An objective pretest was developed and administered to the groups prior to the use of the media.

An inter-group comparison of pretest scores indicated that the groups were homogenous in regard to their knowledge prior to initiation of the study. When posttest scores were analyzed, the groups who received the programmed instruction were significantly higher than those who did not receive them. These findings support the teaching effectiveness of the media and indicate that the students acquired concepts via the media. The programmed instruction groups showed a greater gain initially in concepts and retained them better than the groups using different media. Use of cartoons as a teaching medium resulted in a variety of student responses. Overall, the students felt less pressured to learn "facts" (Carruth and Foree, 1971).

Nutrition Course by Telephone

The knowledge explosion has caught teachers and professionals in a dilemna. To update their knowledge requires access to universities or teaching centers. Many live too distant to commute and cannot return full time to graduate centers for updating. The telephone teaching medium, Telenet, is an alternative to the more traditional methods of on-campus classes (Wakefield and Allene, 1973). Telenet takes the instructor to the students via a selected medium. A graduate-undergraduate course was taught using the Kansas

State University Continuing Education system to 111 students in 18 stations in Kansas.

Student evaluation was based on pre/post tests, periodic examinations, and individual projects. Data from the pre/post tests indicated a significant gain in nutrition knowledge during the course. The course was also evaluated by measuring the degree to which the individual students perceived their purposes in enrolling for the course were met. The overall mean of 3.86 on a one to five scale indicated that the purposes of the class were partially to well satisfied. Two months after completion of the course, a follow-up survey was conducted of teacher enrollees. Teachers indicated that they had written for new materials since completing the course, they had used multi-media in teaching nutrition to their classes, they would recommend the course to a fellow teacher, and they would enroll in another Telenet course. Telenet offers an effective medium for providing educational opportunities to groups with special needs in geographically far-flung sparsely populated areas (Wakefield and Allene, 1973).

A "Fair" Way to Teach Nutrition

A Nutrition Fair held at Children's Hospital and Adult Medical Center of San Francisco successfully communicated new trends in hospital dietetics and showed the relationship of dietary to other hospital departments (Marvosh, 1970). The first category of displays covered new trends in hospital

dietetics. The second category of displays included general nutrition and therapeutic modifications of a normal diet. The third category involved the relation of the dietary department to other hospital departments.

The displays communicated new trends in hospital dietetics, showed good nutrition and therapeutic modifications of a normal diet, related food and nutrition to hospitals, departments, and included the community. The Nutrition Fair was a fun and interesting method of nutrition education (Marvosh, 1970).

Programmed Instruction in Basic Nutrition

One of the more recent innovations in education has been programmed instruction. Programmed instruction is one method of coping with the increasing number of students, the lack of qualified teachers, and the increasing demand for opportunities for independent study (Studdiford and Guthrie, 1972). Programmed instruction allows the student to master basic concepts at his own pace. A linear program presenting basic nutrition information concepts, such as functions, sources, and stability of nutrients, was developed. It was tested with a group of college students in an elementary nutrition class at Pennsylvania State University. Some of the students were assigned to an experimental group and the other members to a control group.

A posttest of nutrition knowledge was given to both groups five weeks after the course was completed. A paired

t-test indicated no difference between groups on the basis of scores on the pretest. The experimental group scored significantly higher on the posttest. Results seemed to indicate that students using the programmed material had a better understanding of the basic concepts and they also retained it longer after the end of the course. Although total study time was not reduced, learning, as assessed by test scores, and retention, as assessed by a score on a posttest, were higher by the group using programmed materials (Studdiford and Guthrie, 1972).

Effectiveness of Radio in Nutrition Education

Recent trends indicate that advertisers recognize radio as a means of communicating with large audiences, especially by way of short messages inserted into scheduled programs. Chicci and Guthrie (1982) conducted a study in developing short messages on carbohydrates for radio broadcast and conducted telephone interviews that included a brief knowledge test. Samples were randomly selected from three population segments - residents of a university town, university students, and residents of a nearby rural community, in Pennsylvania.

They assessed the impact of the radio campaign on nutrition knowledge scores for each population segment. In the rural community, knowledge scores did not improve over the course of the radio campaign. University town residents scored significantly higher during and after the campaign

than they did on the pretest. University student scores improved significantly at midtesting and at posttesting. The failure of the rural community residents to gain in nutrition knowledge does not mean that such a group cannot be reached by way of radio. Advertising and education campaigns must develop messages for the intended listeners (Chicci and Guthrie, 1982).

Talk-Back Television

Many factors need to be considered in developing programs to update the knowledge and skills of practitioners in a rapidly changing area. In a continuing education survey, Broski and Upp (1979) found that the two most common factors hindering participation were "too far to travel" and "cost". A five-evening course was presented on talk-back television at six statewide branches at the University of Connecticut.

Presentations in twenty to thirty minute segments were televised for a group of dietitians entitled "Clinical Dietitics Update". A survey questionnaire was developed and mailed to each of the 67 dietitians who participated in talk-back television courses. Approximately 90 percent of the questionnairs were completed and returned. Traveling distance and cost were two major deterrents to attendance at continuing education programs. The talk-back TV method was an acceptable method of continuing education, since 80 percent of respondents rated it as excellent or good, and many positive comments were made. In addition, 83 percent

indicated that they would enroll in another talk-back TV course. Prior to planning for the future courses, it is important to examine whether the advantages of the increased accessibility and lower cost would outweigh the disadvantages (Polk, 1984).

Nutritional Knowledge and Attitude Studies

Elementary Teachers

Dietary practices established during childhood influence lifetime eating habits. Consequently, the elementary classroom teacher can play a significant role in food habit formation. Petersen and Kies, (1972), surveyed early elementary teachers directly involved in teaching of kindergarten through third grade. The testing instrument was composed of four parts: a) general information; b) nutrition knowledge; c) attitudes and techniques relating to teaching principles and methods, and d) attitudes pertaining to school lunch quality.

Survey results indicated that preparation for teaching nutrition, as based on its inclusion in preparatory curriculum, was poor for the Nebraska elementary teachers. Eighty percent of the teachers thought that concentrated sweets were essential for energy needs. In contrast, 97 percent indicated that carbonated beverages were of limited value in the diets of children. Seventeen percent considered vitamin pills as necessary in maintaining good health in young children.

Eighty-three percent reported that they had no preparatory instruction in methods of teaching nutrition. This indicated that teachers not only have a minimal background in nutrition but relatively no preparation for methods of teaching nutrition in the classroom (Petersen and Kies, 1972).

Mothers and Children

The mother's nutrition knowledge, whatever its scope, is not necessarily applied fully in feeding the family. A study was designed by Emmons and Marian (1973) to gain insight into the nutritional knowledge of mothers and their children and the relationship of this knowledge to the appreciation in the diet. Both mothers and their children were asked to provide 24-hour recalls of the child's diet for the same day. Then, in order to determine whether nutrition knowledge and practices were related, the data on the nutrition knowledge of mothers and their children were compared to the diet of the child. Mothers who gave first importance to the food groups in the main course of a meal often reported vegetable, starch and meat as their dinner. After the main course foods, breads and cereals, and dairy foods were listed next on the list. Surprisingly, little importance was given to dairy foods.

In general, children were less able than their mothers to list the foods or food groups that should be included in their diet each day, however, there were two exceptions. Both the meat group and the dairy foods were listed as

important by a larger percentage of children than their mothers. Since the nutrition knowledge of the mother is of little value to a family unless it is put into practice, an attempt was made to see if the mothers practiced what they reported as important in their children's diets. The findings showed that nutrition practices seemed on the whole much better than what their nutrition knowledge might indicate. The data on nutrition knowledge indicated that mothers had little knowledge of nutrition, yet they fed their children adequate diets (Emmons and Marian, 1973).

High School Students

The junior and senior high school years present the only opportunity for what formal nutrition education most Americans are exposed to. A study was planned by Dwyer, Feldman and Mayer (1979), to assess attitudes toward and nutrition knowledge among students in high school.

A five-question, open-ended interest questionnaire was devised. Students were asked whether nutrition was more, equally, or less interesting than other parts of the health education course they took and why. The majority of the students in all schools found nutrition to be equally or less interesting than other parts of the health education course they had taken, and the reason given was that the subject matter was "boring."

Students were also asked to mention topics in nutrition which they would have liked to have discussed. The highest

ranking topic was weight loss and dieting; second was for a detailed coverage of the proper foods for a well-balanced diet; and third was more explanation and discussion of the effects of deficiencies and excess of nutrients on the body.

Wrong answers on nutrition tests are often indicative of misinformation or wrong learning rather than a total lack of knowledge. Neither students nor teachers seemed to regard nutrition as a high priority area in terms of interests or as a community problem area needing greater stress in schools (Dwyer, Feldman and Mayer, 1970).

Registered Nurses

According to Newton (1967) nurses do a significant amount of nutrition education in an unconscious and/or unplanned fashion. Depending on her nutritional knowledge and attitudes, this type of patient education may support, negate, or neutralize the efforts of others. A questionnaire to assess knowledge of normal and therapeutic nutrition and attitudes toward various aspects of nutrition was developed for nurses. The sample was obtained by mailing questionnaires to the members of the Nebraska Nurses Association.

The most common type of nutrition education reported was a combination of lecture, laboratory, and on-the-ward experience. All nurses reported receiving some type of nutrition education. The nurses expressed favorable attitudes to all six attitude parameters measured. The least favorable attitude was expressed toward nutrition education

in nursing school; however, their score still indicated an attitude more positive than negative. Nurses regarded dietitians as important members of the health care team (99 percent); on the other hand, only half of the nurses believed that dietitians are readily available to patients.

The level of nutritional knowledge appeared somewhat low (50 percent accuracy). In normal nutrition, the nurses were better informed about basic nutritional principles than about their application, whereas in therapeutic nutrition the opposite was true. Nutritional knowledge correlated positively with nurses' attitudes toward their role in the nutrition education of the patient and their perception of the team approach to health care (Vickstrom and Fox, 1976).

Physicians

While many groups of professional people influence the nutrition education of the general public, the physician is regarded as a nutrition educator by his associates, patients, and the general public. Many studies have indicated that nutrition receives insufficient attention in the medical school curricula. A study was conducted by Krause and Fox (1977) to examine the nutritional knowledge and attitudes of physicians and the factors influencing them. A mail survey technique was employed as the research tool, and the sample comprised of the physicians on the mailing lists of the Nebraska Medical Association. Knowledge questions were formulated in two major categories of nutrition: normal and therapeutic.

Sixty-two percent of the physicians had received some nutrition education integrated with other courses in medical school. Only nine percent had received their nutrition education in the form of specific nutrition and/or diet therapy course work. Physicians scored slightly higher on knowledge questions related to basic nutrition than on those concerned with therapeutic nutrition. The findings supported the belief that physicians had a favorable attitude toward nutrition. While they had a positive attitude toward the profession of dietetics, they were less favorable toward the concept of allowing the dietitian to assist in prescribing diets. These findings suggest that nutrition education should be considered as an area for post graduate courses for physicians. Also, a need for a greater awareness and utilization by physicians of the dietitian's potential as a nutritional consultant was indicated (Krause and Fox, 1977).

Dental Students

There is much opportunity for nutrition education in the dental office, however, most dental students have little opportunity to pursue adequate nutrition education even on an elective basis. A nutrition course was developed at the Mount Sinai School of Medicine to relate nutrition to areas of immediate interest in the personal lives of students (Garverick, Deluca and Kight, 1978). A 16-week course was developed for dental sophomores. The course outline included topics like nutrition for physical growth, dietary advice for

the pedodontic patient, diet in relation to rampant caries, nutritional aspects of acute and chronic periodontal disease.

After the course had begun, all students were asked to rank order, based upon their perceived importance of each topic to dental practice based on the course outline. The rankings were solicited at the beginning and again at the end of the semester in three successive courses, one each year. In comparing mean pre- and post-course rankings, it was found that the topic with the highest score was diet in relation to rampant caries. Identifying the stability of interests about nutrition among dental sophomores was the most important outcome of this study. Instructional planning that develops sequences based upon established student interest provides for potential learning situations that will be reinforcing and likely will encourage further activity in clinical situations (Garverick, DeLuca and Kight, 1978).

High School Athletic Coaches

Widespread interest in athletic performance leads to the question of what nutrients can best promote maximum physical efficiency. A study was conducted by Hegsted (1976) to assess the concepts of nutrition as related to athletics that high school coaches in Texas accept and are likely to disseminate to athletes. A questionnaire was designed to collect data. Five areas of concern were included in the study: general nutrition information, nutrient supplementation,

special dietary considerations, pre-event meal, fluids and hydration.

Ninety percent of the respondent listed at least one source of nutrition information. Mentioned most frequently by 66 percent of the coaches were professional journals. When questioned about the adequacy of their preparation for advising athletes about nutrition, 73 percent indicated that their preparation was sufficient. Coaches scored highest on the subsections "general nutrition information" and "fluids and hydration." Coaches were knowledgeable about achieving good nutritional status by a balanced diet, however, 50 percent or more of the respondents were uncertain about the percentage of protein, carbohydrate, and fat that should be included for a balanced diet. Respondents scored lowest on the subtopic "nutrient supplementation." Sixty-eight percent of coaches believed that supplementation with salt tablets is necessary to combat excessive sweating.

In the subsection "special dietary consideration", the majority responded appropriately to the statements regarding weight control. The subjects were found to be generally knowledgeable about the timing of the pre-event meal. More than 70 percent of the coaches responded appropriately to the statements about fluids and hydration. Seventy-seven percent, however, did not recognize the fact that thirst is not an adequate indicator of the need for water and that diets excessively high in protein supplements can lead to dehydration. The lack of adequate college training in

nutrition among the high school athletic coaches surveyed, the sources of nutrition information, and the low scores recorded on the nutrition knowledge questionnaire indicated the need for more effective nutrition education programs for coaches (Bedgood and Tuck, 1983).

Health Sciences

Nutrition is of interest to virtually every segment of the population. One group that is viewed by the public as a reliable source of nutritional information is health professionals. The objective of a study conducted by Poplin (1980) was to learn whether health science students can answer correctly questions frequently posed by the public but not covered in their nutritional education. Non-students were then asked the same questions. Perceived knowledge was greater than 88 percent in all groups with the highest level in the student groups that had received nutritional instruction. Actual knowledge was very much lower in the lay and student groups that had not taken nutrition courses. Of the student groups, dental hygiene and registered nursing students did better than all other students and the public.

Studying nutrition without having a foundation in chemistry and physiology does not enable students in the health sciences to discern fact from fallacy. Students with scientific background upon with which to build their knowledge of nutrition did score significantly better than other students and the public. The goal of the health professional

in serving as a credible source of nutrition information must be not only to answer queries from patients but also to explain rationally why such answers are correct, on the basis of scientific principles (Poplin, 1980).

Nutrition Educators

With the current interests in nutrition education programs, many individuals with a variety of backgrounds have undertaken or have been assigned the task of teaching nutrition. An evaluation instrument which measures nutrition knowledge of potential nutrition educators could serve to select qualified nutrition educators, to identify those who need more training in nutrition, and to maintain quality nutrition education programs. The graduates from Pennsylvania State University between 1968 and 1978 served as the population for a study conducted by Bredbenner (1981). This population included nutritionists, home economists, nurses, health and physical educators, and elementary educators.

Nutritionists achieved significantly higher mean scores on the nutrition knowledge tests than all other groups. The professionals with the most nutrition training as undergraduates presented a higher level of mastery. This test may therefore serve as a tool for determining the mastery or understanding of nutrition subject matter of those persons responsible for or expected to teach nutrition (Bredbenner, 1981).

CHAPTER III

METHOD

The Society for Nutrition Education is concerned with maintaining and improving the nutritional well-being of the people through education. Nutrition educators are also concerned about the lack of application of nutrition knowledge gained in the classroom period, hence, this study was conducted to assess the application of the nutrition knowledge gained, after completing the basic human nutrition course (FNIA 1113). This chapter includes sample selection; research design; data collection, which includes instrumentation and procedure; and data analyses.

Sample

The population in this study was comprised of undergraduate students enrolled in FNIA 1113 at Oklahoma State University, Spring 1984. Although the pretest was administered to 261 students and the posttest to 257 students, only 130 of these students took both the pretest and posttest which made up the sample for this study.

Research Design

The research design utilized in this study was the one group pretest-posttest design

$$O_1 \quad x \quad O_2$$

Where x is the experimental variable, and 0 is the observation or test (Campbell and Stanley, 1966). The pretest was administered before the application of the treatment which was the sixteen week course, and the posttest was given at the end of the treatment period.

In addition to the pretest-posttest design, the 24-hour recall method was also used. The 24-hour recall is a data collection technique where an individual completes a questionnaire or is interviewed by a dietitian/nutritionist or nurse experienced in dietary interviewing and is asked to recall every food item that he/she ate within the last 24-hours, or the previous day (Mahan and Krause, 1979).

The types of food and quantities consumed by a random number of 43 students from the sample of 130 were collected during the second week and again during the fourteenth week of the semester. The nutritional adequacy of the meals were determined to assess if the students eating habits had changed (improved) after completing twelve weeks of the course FNIA 1113.

	Pretest		Posttest
I Knowledge	O_1 1st week	x	O_2 17th week
II Application	R* O_3 2nd week		O_4 14th week

* R = Random Sample Selection (43)

Data Collection

Planning and development of this research was accomplished during the Fall 1983 semester. A research instrument was developed to administer during the Spring 1984 semester.

Instrumentation

In order to develop the instrument necessary for the study, conferences were held with the FNIA 1113 course instructors and a statistician. Previous tests and scores from the academic years 1981-1982 and 1982-1983 were examined. A test grid was prepared based on the FNIA 1113 course outline (Appendix A). A test grid is prepared by allotting the appropriate number of test items in accordance to the number of hours spent on each subject matter in class, and also according to the different levels of the cognitive domain (Appendix B). Test items were retained, reworded or eliminated, and new test items developed based on the grid and in consultation with two graduate faculty of FNIA to establish content validity. Test items with a negative discriminatory score in the printout prepared by the Bureau of Tests and Measurements, were eliminated. Only items with a

discriminatory score of over 0.25 were selected as they fit the test grid.

The instrument consisted of two parts: PART I was designed to obtain general background information, and PART II was designed to obtain data on the students' nutritional knowledge. PART II consisted of multiple choice items (Appendix C). The multiple choice test was used as it can more effectively measure many of the simple learning outcomes, and in addition, it can measure a variety of the more complex outcomes in the knowledge, understanding, and application areas (Gronlund, 1976). According to Sax (1974) multiple choice tests have great versatility in measuring objectives, scoring is highly objective, the effects of guessing by students are minimized, and a substantial amount of course material can be tested in a relatively short time.

The multiple choice test used in the pretest consisted of fifty questions based on a test grid. The posttest which was the actual final examination for the class consisted of 100 test items. Due to miscommunication with the faculty in charge of the course, only 36 of the 50 questions in the pretest were included in the posttest, hence, for statistical purposes, only scores in the 36 test items included in both the pretest and posttest were analyzed (Appendix C and D).

Procedure

Permission was requested from the instructors of the Basic Human Nutrition course (FNIA 1113) to administer the

pretest. After permission was obtained, the test was administered to two sections on January 9, 1984, and to one section on January 10, 1984. Oral and written instructions were given by the researcher, and the students returned the survey as they were completed. The posttest was given during the seventeenth week of the semester as part of the course final examination. Each correct response scored one point.

During the second week of the semester, the students also completed a form listing all the foods they consumed the previous day. Approximate quantities of the food were also noted (Appendix D). The procedure was repeated twelve weeks later during the fourteenth week of the semester. A random sample of 43 students were chosen for the nutritional analysis of the 24-hour recall data. Values from the fourteenth week were compared with those obtained from the second week for nutritional adequacy, based on the percentage of the Recommended Dietary Allowance (RDA, 1980) for the random sample.

Data Analyses

Responses were coded and sent to the Bureau of Testing and Measurements where the Opscan scans material and sends it to the computer center for the processing using Statistical Analysis System (SAS) (Helwig and Council, 1979). Then data were coded and key punched onto computer cards. Standard statistical programs were selected to analyze the

data sets created using SAS. Demographic data were summarized and the t-test was used to analyze the data.

CHAPTER IV

RESULTS AND DISCUSSION

The purpose in this study was to determine the gain in nutritional knowledge and the application of this knowledge towards better food selection after completing the course FNIA 1113 (Basic Human Nutrition). This chapter describes the sample, their nutritional knowledge scores, and the results of testing of the hypotheses.

Description of the Sample

Sex, Age and Class Level

The sample in the study (N=130) was predominantly females (N=130, 79.23%). There were only 27 males (20.77%). The age groups of the subjects ranged from 18 to 22 to 45 and above. Approximately 87.69 (N=114) of the students were in the 18 to 22 age group, while the rest (N=16, 12.23%) fell into the other five age groups listed in the instrument (Appendix C). Ninety-two (70.77%) of the 130 students were classified as freshmen and sophomores, while 38 (29.23%) belonged to the other categories of class, namely juniors, seniors, special and graduate students (Table I).

TABLE I

FREQUENCY AND PERCENTAGE DISTRIBUTION OF THE SAMPLE ACCORDING TO SELECTED VARIABLES

Variable	Frequency	Percentage
Sex		
Females	103	79.23
Males	27	20.77
	130	100.00
Age Group		
18-22	114	87.69
23 & above	16	12.31
	130	100.00
Class Level		
Freshman & Sophomores	92	70.77
Juniors, Seniors, Grad. & Sp.	38	29.33
	130	100.00
Major		
Home Economics	73	56.15
Arts & Sci., Bus., Agri., Educ. and Undecided	57	43.85
	130	100.00
Purpose		
Major or related	73	56.15
Pers. interest, gen. studies, and elective	56	43.10
No response	1	0.75
	130	100.00
Course Required		
Yes	89	68.46
No	41	31.54
	130	100.00

Table I (Continued)

Variable	Frequency	Percentage
Past Nutrition Background		
Yes	50	38.46
No	80	61.54
	130	100.00
Past Chemistry Background		
Yes	68	52.31
No	62	47.69
	130	100.00

Major, Purpose, and Course Requirement

Most of the students (N=73) were enrolled in the College of Home Economics, followed by the College of Arts and Sciences. Those enrolled in Colleges other than Home Economics indicated majors in Arts and Science, Agriculture, Business, Education and the undecided which altogether totalled to 57. Seventy-three of the subjects indicated that the purpose of taking the course FNIA was because it was their major area or related to their major, while 56 enrolled in the course due to personal interest, as part of general studies or as an elective. On the question of whether the course was required or not, 68.46 percent (N=89) indicated that it was required, and 31.54 percent (N=41) said that it was not required in their academic programs (Table I).

Past Nutrition and Chemistry Background

Background information concerning nutrition was asked. Fifty of the students indicated that they had studied nutrition in high school or college, while 80 said they had not attended a nutrition class in college or high school. Of these 80, 55 said that they had never studied nutrition in any formal classroom before. Regarding information about their chemistry background, 68 students said they had attended a chemistry course in high school or college and 62 said they did not have any chemistry in college or high school (Table I).

Evaluation of Nutritional Knowledge

The 130 FNIA 1113 students who participated in this study scored from seven to 20 correct responses with a mean score of 13.72 (38%) in the pretest. In the posttest the number of correct responses ranged from five to 35 with a mean score of 25 (70%) indicating an increase of 32 percent. Figures 1 and 2 illustrate the number of correct responses made by the subjects in the pretest and posttest respectively. Note that only three students scored 20 items correctly out of 36 test questions in the pretest. In contrast, 107 students scored 20 or more items correctly in the posttest.

Figure 3 illustrates the number of students that answered each of the 36 multiple choice items correctly, at the pre- and posttests. There was an increase in all the different areas covered (Table II). Figure 3 illustrates the comparison between the correct responses on the pretest and posttest. The test is in Appendix C and D. Significant increases were seen for the topics on vitamins, Basic Four, lipids and minerals (Table II). Although the increase were not very much on the subject of menu-planning, nutrition labelling and nutrition facts, this might be due to the fact that there were only one question for each of these topics, whereas there were more than one for the other topics (Table II). There were no questions on the topics of water and nutrition in heart disease on the posttest so these two subjects had to be eliminated for statistical analyses even though both of those subjects were covered on the pretest.

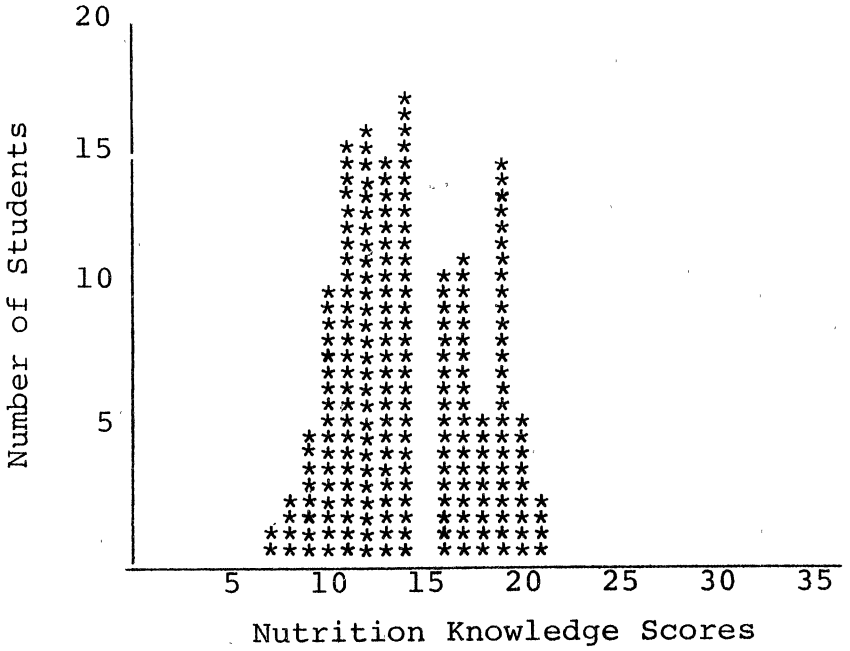

Figure 1. Number of correct responses at pretest

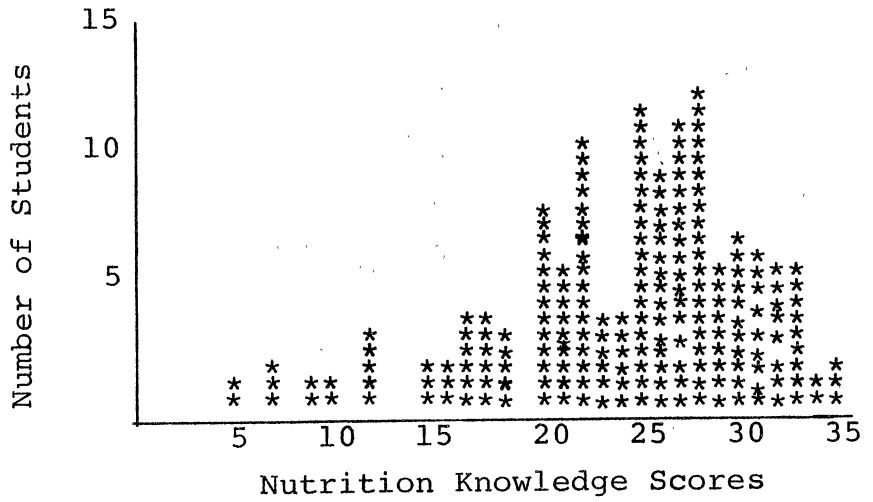

Figure 2. Number of correct responses at posttest

TABLE II

NUMBER OF CORRECT RESPONSES BY NUTRITION TOPICS

Topic	Number of Questions	Correct Responses Made by N=130		Pooled Increase In Scores	Average Increase In Scores
		Pretest	Posttest		
Introduction to Nutrition	3	133*	221*	88	29.3
Weight Control	2	156	190	34	17.0
Basic Four	2	93	220	127	63.5
Energy Needs	1	58	108	50	50.0
Carbohydrates	2	101	147	46	23.0
Lipids	3	143	270	127	42.3
Proteins	2	64	156	92	46.0
Digestion and Absorption	1	41	95	54	54.0
Menu Planning	1	67	86	19	19.0
Vitamins	6	179	498	319	53.1
Minerals	4	238	360	122	30.5
Nutrition Labelling	3	169	192	23	7.6
Nutrition - Life Cycle	5	353	416	63	12.6
Nutrition Facts	1	65	90	25	25.0
	36				

* Pooled scores on three questions

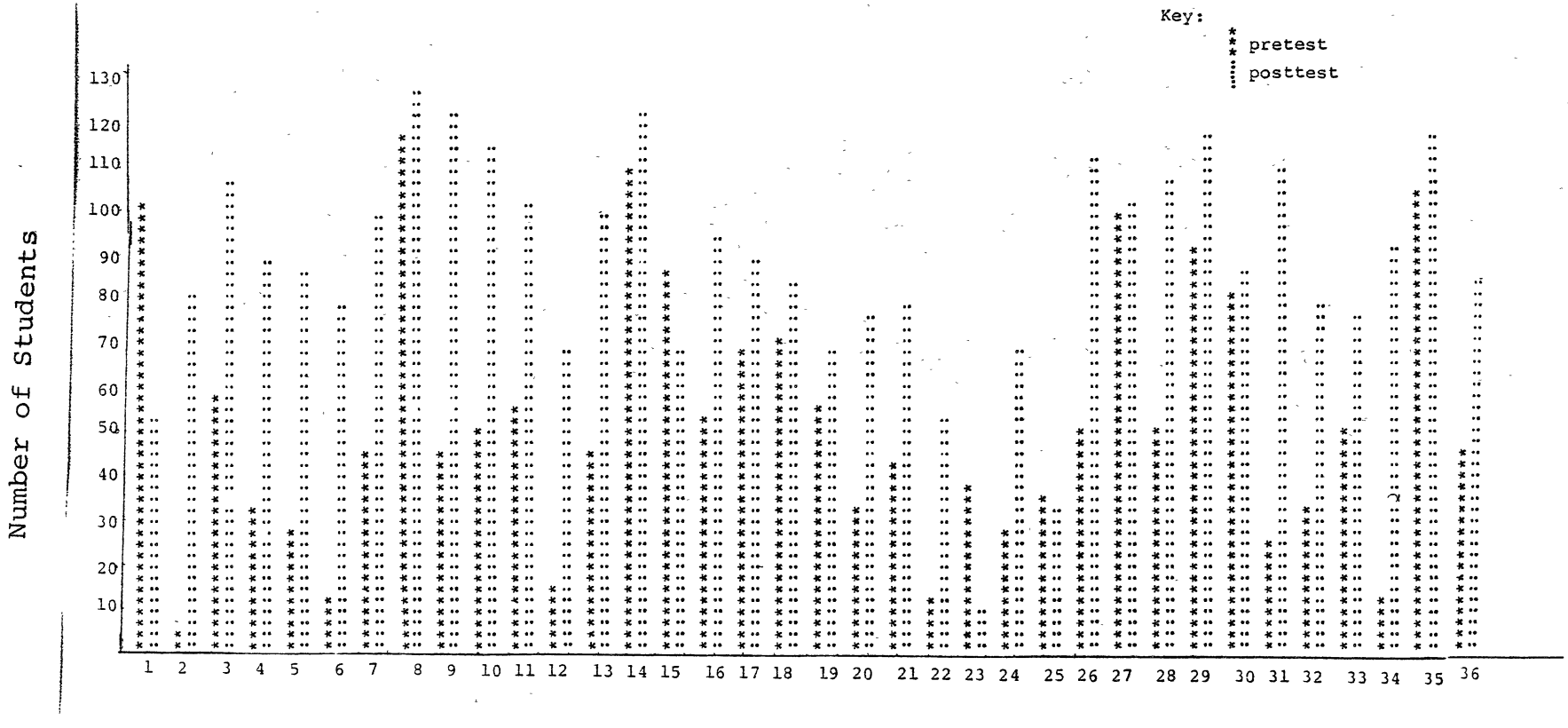

Figure 3. Comparison of correct responses on the pretest and posttest

A comparison of group means in pretest and posttest periods in this study and related research is presented in Table III.

The present study was similar to a study conducted by Carruth, et al (1981), where the students were given a pre-test and then a posttest after instruction. The increase in mean scores is almost identical for both the studies (Table III). The subjects that scored higher on the other studies were dietitians, nutritionists and practicing physicians. This might be due to the fact that they have a good nutrition background or are practicing professionals. The other subjects who might not have had very much nutrition in college scored like the subjects did on their pretest in the present study.

TABLE III

COMPARISON OF GROUP MEANS AT PRE- AND POSTTEST PERIODS OF NUTRITION KNOWLEDGE ASSESSMENT STUDIES

STUDY	SUBJECTS	N	TEST STEMS	MEAN SCORES PRETEST	MEAN SCORES POSTTEST	DIFFERENCE
Reddy, 1984 Present Study	College Students, Predominantly Home Economics Majors	130	36	14 38%	25 70%	11
Carruth, Briley & Roy, 1981	Home Economics Majors	225	--	62.29	72.00	10.00
Dwyer, Stolurow and Orr, 1981	Dietitian & Interns	88	74	63		
	Practicing Physicians	146		53		
	Public Health Graduate Students	41	74	52		
	Medical Students	83		51		
	High School Girls	299		38		
Bredbenner, 1981	Nutrition.	134		44.1		
	Home Economists	93		40.9		
	Nurses	105	50	37.1		
	Health & Phys. Ed.	77		35.7		
	College Graduates	88		35.6		
	Elem. Educators	79		33.0		

Testing of the Hypotheses

The t-test was used to determine if there was a significant difference between posttest mean scores and pretest mean scores of 130 subjects associated with eight selected variables. The significance level accepted was p 0.10.

Hypothesis One

H_1: There will be no significant difference between the posttest mean scores and pretest mean scores of students enrolled in FNIA 1113 during Spring 1984 as associated with selected variables: age, sex, class level, major purpose for taking the course, whether the course was required or not, and previous courses taken in nutrition or chemistry.

Table IV mean scores in the posttest increased as associated with the eight selected variables in the study. The increase in mean scores between females and males; those who are 18 to 22 and 23 and older; lower level class and upper level class was about twelve percent. The increase in mean scores between majors and purposes for taking the class were also similar and were eleven to thirteen percent. None of these differences were significant at the $p \leq 0.10$ level.

TABLE IV

INCREASE IN MEAN SCORES (NUTRITION KNOWLEDGE) AS ASSOCIATED WITH SELECTED VARIABLES

Variable	N	Increase In Mean Scores
Sex		
Females	103	11.88
Males	27	12.33
Age		
18-22	114	12.01
23 and older	16	11.75
Class		
Freshman and Sophomore	92	12.02
Juniors, Seniors, Special and Graduate	38	11.87
Major		
Home Economics	73	11.19
Arts & Science, Education, Business, Agriculture and Undecided	57	13.09
Purpose		
Major or Related	73	11.34
Personal Interest, General Education or Elective	56	12.68
Course Required		
Yes	89	11.02
No	41	14.05
Past Nutrition Background		
Yes	50	11.42
No	80	12.33
Past Chemistry Background		
Yes	68	10.96
No	62	13.09

The major of the student did not seem to make a significant effect on the increase in the mean scores. The Home Economics majors (N=73) increased their posttest score by a mean of 11.11 percent and the others (N=57) increased their mean scores by 13.09 percent. Although there was an increase of 13 percent on the mean score of the other majors, this was attributed mainly by the business and agriculture majors (N=22) whose mean increase were 15 and 14 percent respectively. The mean score of the others (arts and sciences, education, undecided, N=35) ranged from 1.0 to 10 percent and were actually lower than the mean scores of the Home Economic majors. On the average, however, the non-majors had a higher mean score (13%) than the Home Economic majors (11%). It may interest the reader in knowing that majors under Home Economics were not analyzed separately because a majority of the students declare majors in the sophomore year and FNIA 1113 is a freshman level course.

Seventy-three of the respondents listed that they enrolled in FNIA 1113 as it was their major or related to their major area of study. These 73 increased their mean score by 11.34 and the 56 respondents who enrolled in the course due to personal interests, for general studies or as an elective increased their posttest score by a mean of 12.68 percent. Eighty-nine of the students responded that they enrolled in FNIA 1113 because the course was required and 41 enrolled in it even though it was not required for them.

The posttest score for the 89 respondents who indicated that the course was required increased by a mean of 11.05 while the 41 students who took the course although it was not required increased their scores by 14.05. The difference between the posttest and pretest scores of these two groups was significant at the $p \leq 0.10$ level by t-test determination (Table V).

TABLE V

T-TEST PROCEDURE FOR MEAN SCORES AS ASSOCIATED WITH COURSE REQUIREMENT

Course Required	N	Mean	Std. Error	T	P T
Yes	89	11.02	1.14	-1.70	.09
No	41	14.05	1.35		

The mean increase in scores for students who studied nutrition in high school or college (N=50) was 11.42 percent, whereas the increase was 12.33 percent for those students (N=80) who did not study nutrition in high school or college. Sixty-eight of the students responded that they have had some chemistry background at the college or high school level. These 68 respondents increased their score by a mean of 10.96 percent while the remaining 62 who had no chemistry in college or high school increased their score by a mean of

13.09 percent. These differences were not significant at the $p \leq 0.10$ level by t-test determination.

There was no significant difference in the mean nutrition knowledge scores associated with the variables of sex, age group, class level, purpose, major and previous courses taken in chemistry or nutrition; therefore, the researcher failed to reject H_1. There was a significant difference in the mean nutrition knowledge score as associated with the variable of whether the course was required or not, hence, the researcher rejected this part of H_1.

Hypothesis Two

H_2: There will be no significant difference in the application of knowledge of students in food selection between the second week and the fourteenth week of enrollment in FNIA 1113 based on the 24-hour recall method and computer analysis of records of randomly chosen participants.

The t-test was used to determine if there was a difference in the mean intake of nine nutrients between the 24-hour recall data during weeks two and fourteen. The significant level accepted was $p \leq 0.10$.

Data from the 24-hour recalls completed by the random sample of 43 out of the 130 students during the second week and fourteenth week of Spring Semester 1984 were analyzed for nine nutrients: calories, protein, calcium, iron, vitamin A, thiamin, riboflavin, niacin and vitamin C using

computer analysis to determine the nutrition and adequacy of the meals and to assess if the students' eating habits have improved after twelve weeks of the course FNIA 1113.

The 24-hour recalls analyzed at the second week of the semester were an average of a two-day food intake as reported by the students while the fourteenth week 24-hour recall was done only for one day.

Table VI illustrates the recommended dietary allowance (RDA) for females and males of college age and the nutritional intakes of the sample on the second and fourteenth week of Spring Semester as associated with eight selected variables.

TABLE VI

MEAN INTAKE OF NUTRIENTS AS ASSOCIATED WITH THE SELECTED VARIABLES

Variable	N	Time Frame In Weeks	Cal	Pro gm	Ca mg	Fe mg	Vit A I.U.	B_1 mg	B_2 mg	Niacin mg	Vit C mg
Recommended Dietary Allowance (RDA, 1980)											
Female, 19-22 years of age, 55 kg (wt), 163 cm (ht)			2000	44	800	18.00	5000 800 mg R.E.	1.10	1.30	14.00	60
Male, 19-22 years of age, 70 kg (wt), 177 cm (ht)			3000	56	800	10.00	6600 1000 mg R.E.	1.50	1.70	19.00	60
Sex											
Females	35	2	1774	74	821	6.03	4910	0.57	0.88	14.58	91
		14	1772	64	870	6.16	6432	0.58	0.90	12.55	144
Males	8	2	2537	120	4232	16.41	8867	1.43	2.32	25.10	121
		14	2968	164	5120	17.51	4345	2.07	3.25	45.32	177

TABLE VI (Continued)

Variable	N	Time Frame In Weeks	Cal	Pro gm	Ca mg	Fe mg	Vit A I.U.	B_1 mg	B_2 mg	Niacin mg	Vit C mg
Age											
18-22	38	2	1896	83	928	11.40	5067	1.06	1.71	16.57	96
		14	1914	75	1011	11.66	5928	1.19	1.84	17.16	149
23 and older	5	2	1915	69	557	12.50	9257	1.04	1.19	22.31	94
		14	1839	95	595	13.49	9802	1.00	1.52	23.23	155
Class											
Freshmen & Sophomore	26	2	1758	75	774	10.39	4537	0.91	0.76	16.10	67
		14	1933	75	913	11.24	5308	1.07	0.93	18.17	110
Junior, Senior, Grad., and Special	17	2	2114	92	1054	13.28	7111	1.30	1.92	18.98	140
		14	1840	81	1002	12.60	8035	1.29	1.71	17.00	201
Major											
Home Economics	21	2	1821	79	879	11.05	4482	0.95	1.65	16.17	74
		14	1893	76	836	12.04	5557	1.04	1.76	19.37	101
Arts & Science, Agri., Bus., Educ., & undecided	22	2	1966	84	890	11.99	6487	1.15	1.69	18.17	110
		14	1927	81	1094	11.66	7005	1.28	1.88	16.03	192

TABLE VI (Continued)

Variable	N	Time Frame In Weeks	Cal	Pro gm	Ca mg	Fe mg	Vit A I.U.	B_1 mg	B_2 mg	Niacin mg	Vit C mg
Purpose											
Major or related	22	2	1868	79	844	11.29	4982	0.98	1.65	26.54	83
		14	2036	78	894	11.96	6376	1.13	1.88	30.94	136
Gen. Studies, Personal Interest or Elective	21	2	1928	84	939	11.75	5737	1.17	1.52	17.48	108
		14	1774	79	1042	11.73	6909	1.23	1.57	15.74	160
Course Requirement											
Yes	26	2	1823	80	838	11.20	4819	0.97	1.61	16.59	84
		14	1987	79	863	12.27	6140	1.12	1.84	19.89	134
No	17	2	1914	79	949	11.95	6576	1.18	1.76	18.11	113
		14	1685	71	1110	11.09	6511	1.21	1.78	14.26	171
Past Nutrition Background											
Yes	16	2	1706	72	791	11.00	3770	0.99	1.39	14.90	75
		14	1757	73	720	11.62	4938	0.95	1.34	17.97	113
No	27	2	2039	89	936	13.00	6512	1.09	1.80	17.30	109
		14	2019	82	1113	13.17	6902	1.29	2.09	16.19	174

TABLE VI (Continued)

Variable	N	Time Frame In Weeks	Cal	Pro gm	Ca mg	Fe mg	Vit A I.U.	B_1 mg	B_2 mg	Niacin mg	Vit C mg
Past Chemistry Background											
Yes	25	2	2011	91	882	10.90	6291	1.11	2.63	18.90	106
		14	1891	80	910	10.99	6229	1.21	2.64	17.66	130
No	18	2	1730	71	891	10.80	4429	0.97	1.62	12.70	83
		14	1903	76	1051	11.43	6156	1.08	1.96	14.96	168

2nd week - average 2 days 24-hour recall

14th week - 1 day 24-hour recall

Female students (N=35) did not meet their RDA for iron and the B vitamins. Although there is no RDA for calories, the average female 18 to 22 years of age generally needs about 2000 calories per day and the caloric intake of the 35 females in the sample averaged 1774 and 1772 during the second and fourteenth weeks respectively. The vitamin C intake was one and a half to over two times the RDA, while the protein intake was about one and a half times higher. The male subjects (N=8) met the RDA's for all the nine nutrients. In fact, their intake of protein, calcium and vitamin C was much higher than the recommended amounts. There was a significant difference in the intake of protein, vitamins B_1 and B_2 and niacin associated with the variable, sex (Table VI).

The 18 to 22 year old respondents did much better at meeting the RDA's (except iron) than the older respondents. None of the nutrients seem to be consumed in high quantities except for vitamin C (1-1/2 to 2-1/2 times). In contrast, the other group (23 and above) did not meet their requirement for calories, calcium, iron B_1 and B_2. The same could be said of the freshmen and sophomores as they did not meet the requirement for calories, iron, vitamins B_1 and B_2. The juniors, seniors, graduates and special students met their requirements for all the nutrients except for calories on the fourteenth week and iron. Intake of vitamins A and C was almost two to three times the requirement for the older group and also the lower class students.

TABLE VII

RESULTS OF T-TEST SHOWING SIGNIFICANT DIFFERENCES BETWEEN APPLICATION OF NUTRITION KNOWLEDGE AND VARIABLES OF SEX, CLASS LEVEL AND COURSE REQUIREMENT

Variable	N	T-Test	Calories	Protein	B_1	B_2	Niacin	Fe
Sex								
Females	35	$\bar{X}$		-14.41		1.76	-13.95	
		s.e		13.02		11.30	13.05	
		t		-2.30		-1.76	-1.98	
		P		0.03		0.10	0.08	
Males	8	$\bar{X}$		37.21	44.92		80.57	
				17.91	25.78		45.76	
				-1.80	-1.93		-2.70	
				0.07	0.06		0.0009	
Class								
Freshmen and Sophomores	26	$\bar{X}$	10.03					
		s.e	7.54					
		t	2.12					
		P	0.04					
Juniors, Seniors Graduates & Special	17	$\bar{X}$	-13.62					
		s.e	8.21					
		t	2.06					
		P	0.04					
Course Required								
Yes	26	$\bar{X}$	9.56					9.58
		s.e	6.79					6.06
		t	1.89					1.64
		P	0.06					0.10
No	17	$\bar{X}$	-12.90					-7.22
		s.e	9.76					8.22
		t	1.95					1.67
		P	0.05					0.10

The t-test was used to determine the relationship between nutrient intake and the variable of classification in college. Significant differences were found at the $p = 0.04$ level (Table VII) for the intake of calories as associated with class levels.

Twenty-two of the 43 students said they had enrolled in FNIA 1113 as it was their major or related to their major. This group met all their requirements except for iron and calories. Except for protein, they increased the intake of all the other nutrients during the fourteen-week period. Vitamins A and C were the only nutrients which were slightly higher than the average RDA's; the other nutrients were very close to the RDA's. Twenty-one of the students who took the course although they were not majors had a decrease in the intake of all the nutrients except for calcium, vitamin A and C at the posttest period (Table VI). This decrease made them deficient in calories. Again, the intakes of vitamins A and C were about one and a half to almost three times the required amounts.

There was a decrease in the intakes of calories, protein, and iron for the 17 students who said that the course FNIA 1113 was not required in their major. This made them deficient in calories, iron and niacin, whereas the other 26 students increased their intake of all the nutrients at the posttest period (Table VII). Inspite of this increase, the 26 students whose majors required FNIA 1113 were still deficient in their consumption of calories and iron. These

were the two nutrients that were significantly different at the $p \leq 0.10$ level (Table VII) as associated with the variable as to whether the course FNIA 1113 was required or not.

The variable of major did not seem to make a significant difference in the intakes of the different nutrients. Home Economic majors and the other majors were all deficient in their intake of calories, iron, and to some, thiamin and niacin. But, the Home Economics majors increased their intake of all nutrients at the posttest period as opposed to the other majors who decreased their intake of calories, protein, iron and niacin. The other majors also consumed vitamins A and C in larger quantities than required by them.

Past nutrition and/or chemistry backgrounds did not seem to have a significant effect on the intake of the different nutrients. Students who had a previous nutrition class in high school or college were deficient in the intake of calories, iron, vitamin B_1 and for some students also in calcium. The others (N=27), who did not have a nutrition class were deficient only in calories and iron. There was a slight drop in the intake of a few nutrients (Table VI) at the posttest period for both the groups in the variable, past nutrition, but the differences were not significant. Students with a chemistry background (N=25) or without any chemistry background (N=18) were all deficient in their intake, to some extent, of calories, iron and vitamins B_1

(Table VII). Also, the 18 who did not take previous chemistry courses were deficient in their intakes of niacin.

There was a significant difference ($p \leq 0.10$) in the intakes during the second and fourteenth weeks of Spring Semester 1984 of (a) calories, protein, thiamin, riboflavin and niacin as associated with the variable, sex; (b) intake of calories as associated with the variable of class; (c) intake of calories and iron as associated with the variable of course requirement; therefore, the researcher rejects this part of H_2. There was no significant difference in the intake of the various nutrients as associated with the variable of age, major, purpose, past nutrition and/or chemistry, hence, the researcher failed to reject this part of H_2.

CHAPTER V

SUMMARY, RECOMMENDATIONS, AND IMPLICATIONS

Nutrition is a fairly young science. In recent years there seems to be an interest in knowing something about it. Americans are realizing that good habits based partly in nutritional knowledge promote health and the quality of life. Nutrition plays a role in preventive health measures, hence, there seems to be a need for adequate nutrition education regardless of social, cultural, economic patterns, income, location, or educational level (Todhunter, 1969). Many nutrition education programs stress the requisition of nutritional facts as opposed to promoting sound dietary habits which require application of the facts (Petersen and Kies, 1972). Recognition of facts alone does not guarantee improved food habits. Information alone is often not enough to cause or enable a person to improve his/her eating habits and thus his/her nutritional state (Guthrie, 1978).

This study was conducted to determine if the knowledge gain in an introductory course in human nutrition is applied towards better food selection after completing the Basic Human Nutrition course, FNIA 1113. The difference in mean nutrition knowledge scores and application of the knowledge gained associated with the variables of sex, age group,

class, major, purpose, course requirement, past nutrition and/or chemistry background were analyzed.

The review of literature has indicated an urgent need for nutrition education programs aimed at enabling people to select their own food in accordance with their changing conditions. The goal of nutrition education is to develop an informed public and this should be done by using various innovative and interesting approaches for teaching nutrition.

The sample consisted of students enrolled in the Basic Human Nutrition course at Oklahoma State University, Spring 1984. The research instrument which was made up of two parts (background information and 36 multiple choice items) was administered during the first class period and again during the final examination week, Spring 1984. Of the 261 who participated in the pretest and 257 who took the posttest, only 130 were present for both the pre- and posttests, hence, these 130 made up the sample.

The sample of 130 students was comprised of 103 females and 27 males. Approximately 114 of the students were in the 18 to 22 age group and the rest (N=16) were 23 and older. The majority of the sample, 70.77 percent, were classified as freshmen and sophomores. Seventy-three percent of the subjects were enrolled in the college of Home Economics and indicated that they enrolled in FNIA 1113 as it was their major or related to their major area of study. Fifty students indicated that they had a course in nutrition in high school or college but 80 did not. Of the 130 students

in the sample, 52 percent attended a chemistry course in high school or college (Figure 1).

The range for nutrition knowledge scores were 7 to 20 at the pretest period and 5 to 35 at the posttest period. The mean score percentage for the pretest was 38 percent and 70 percent for the posttest, hence, there was an increase in their mean score by 32 percent after the treatment period which was the 16 weeks of instruction.

The differences between nutrition knowledge scores and application of the nutrition knowledge gained and eight variables (sex, age group, class, major, purpose, course requirement, past nutrition background and past chemistry background) were determined using the t-test.

There was a significant difference in the mean nutrition knowledge scores as associated with the variables of whether the course was required or not (Table VII). Also, significant differences existed in the intake of protein, thiamin, riboflavin and niacin as associated with the variable of sex; intake of calories as associated with the variable of class; and intake of calories and iron as associated with the variable of whether the course was required or not at p= or 0.10 level (Table VII). Only these parts of H_1 and H_2 were rejected by the researcher because of these significant differences. The researcher failed to reject the other parts of H_1 and H_2 where no significant differences were determined.

Recommendations

The results of this study indicated several recommendations for future studies:

1. Administer the pretest a week after classes have begun in order to have a larger "permanent" sample as enrollment is very unstable during the first week of classes.
2. Nutrition knowledge scores of undergraduates who have completed a basic human nutrition course could perhaps be compared with nutrition knowledge scores of other students who have not completed a college level basic human nutrition course.
3. A follow-up study using the same sample and survey instrument could be administered one or two semesters later to assess how much of the knowledge gained had been retained.
4. The questions regarding the variables, past nutrition and chemistry backgrounds, need to be expanded to delineate the effects of experiences in high school versus experiences in college level on the knowledge scores.
5. The effects of rural versus urban living, race or ethnic origin and religious beliefs need to be explored relative to the application of nutrition knowledge in food selection.

6. Perhaps other nutrient data bases could be used to assess the intake of other nutrients besides the eight nutrients that were analyzed in this study.
7. The 24-hour recall method could be expanded to at least three days, or even a week, in order to have a more realistic view of the food consumption of university students.
8. To ensure that all subject matter covered in the classroom are included in assessing knowledge gained, test grids need to be used to construct all course examinations.

Implications

Results of this study indicated that nutrition knowledge scores improved with formal classroom instructions in basic nutrition. Knowledge gained in nutrition, however, did not have a substantial impact in changing the adequacy of nutritional intake after fourteen weeks of instruction. Perhaps creative nutrition strategies which includes a laboratory experience, simulation games or other "hands on" activities emphasizing the application of nutrition theory could be implemented to ensure that students practice what they learn and perhaps retain more knowledge when they are more actively involved in the learning process.

New findings in nutrition research are becoming more and more accessible to the public by means of modern information technology. Nutrition knowledge gained and/or retained

could be updated as the need arises. Integration of nutrition education into the curricula not only for the medical and allied medical professions, but perhaps also for all other professions and the public, is imperative for the attainment and maintenance of good health and improved quality of life for all individuals.

BIBLIOGRAPHY

Adamec, C.: Survey of nutrition knowledge as a part of nutrition education. J. Nutr. Educ. Summer: 108, 1972.

Bedgood, B. L. and Tuck, M. B.: Nutrition knowledge of high school athletic coaches in Texas. J. Am. Dietet. A. 83: 672, 1983.

Bentivegna, A., Kelly, E. J. and Kalenak, A.: Diet, fitness and athletic performance. Phys. Sportsmed. 7: 98, 1979.

Betty, R. C., Briley, E. M. and Roy, S. K.: Exemption of students for first courses in food nutrition. J. Nutr. Educ. Winter: 101, 1971.

Bloom, B. S.: Taxonomy of Educational Objectives. 1st ed. New York Longmans, Green, 1956.

Boren, A. R., Dixon, P. N. and Harden, M. L.: Innovations in nutrition education. J. Am. Dietet. A. 80: 148, 1982.

Briggs, G. M.: The need for nutrition education. J. Nutr. Educ. 1(1): 78, 1969.

_____: The need for nutrition education. J. Nutr. Educ. 1: 7, 1969.

Byrd-Bredbenner, C.: A nutrition knowledge test for nutrition educators. J. Nutr. Educ. 13(3): 97, 1981.

Campbell, D. T. and Stanley, J. C.: Experimental and Quasi-Experimental Designs for Research. Chicago, Ill.: Rand McNally College Publishing Co., 1966.

_____, Commentary: What is nutrition education? J. Am. Dietet. A. 64: 17, 1974.

Carruth, B. R. and Foree, S. B.: Cartoon approach to nutrition education. J. Nutr. Educ. Fall: 57, 1971.

Cooper, K. A. and Go, C. E.: Analysis of nutrition curriculum guides at the K-12 level. J. Nutr. Educ. 8(2): 62, 1976.

Cronin, F. J., Pao, E. M. and Hama, M. Y.: Calories decrease - diets improve. Agric. Res. 28: 12, 1980.

deVries, H. A.: Physiology of Exercise. 3rd Ed. Dubuque, Iowa: Wm. C. Brown Co., Publishers, 1980.

Dugdale, A. E., Chandler, D. and Baghurst, K.: Knowledge and belief in nutrition. Am. J. Clin. Nutr. 32: 441, 1979.

Dwyer, J. T., Feldman, J. J. and Mayer, J.: Nutritional literacy of high school students. J. Nutr. Educ. Fall: 59, 1970.

_____, Stolurow, K. A. and Orr, R.: A nutrition knowledge test for high school students. J. Nutr. Educ. 13(3): 93, 1981.

Emmons, L. and Marian: Nutrition knowledge of mothers and children. J. Nutr. Educ. 5(2): 134, 1973.

Eppright, E. S.: Urgent need for nutrition education. J. Nutr. Educ. Winter: 113, 1971.

Food & Nutrition Board: Recommended Dietary Allowances, 8th ed., Washington, D. C.: National Academy of Sciences, 1974.

_____: Recommended Dietary Allowances, 9th ed., Washington, D. C.: National Academy of Sciences, 1980.

Garverick, C. M., DeLuca, C. and Kight, H. R.: Nutrition interests of dental students. J. Nutr. Educ. 10(4): 167, 1978.

Getchell, B.: Physical Fitness A Way of Life. 2nd ed., New York: John Wiley & Sons, Inc., 1979.

Goldsmith, G. A.: Nutrition services for mothers and children. J. Nutr. Educ. Summer: 20, 1969.

Gronlund, N. E.: Measurement and Evaluation in Teaching. 3rd ed., New York: McMillan Publishing Co., Inc., 1976.

Guthrie, H. A.: Is education not enough. J. Nutr. Educ. 10(2): 57, 1978.

Helwig, J. T. and Council, K. A.: SAS User's Guide. Raleigh, North Carolina: SAS Institute, Inc., 1979.

Howat, P. M. and Johnson, F.: "Mini" assessment of nutritional interest, knowledge and food habits. J. Am. Dietet. A. 77: 582, 1980.

Johnson, M. J. and Butler, J. L.: Where is nutrition education in U. S. public schools? J. Nutr. Educ. 7(1): 20, 1975.

Jones, J. L. and Weimer, J.: Health-related food choices. Natl. Food Rev. 12: 16, 1980.

Karvetti, R. L.: Effects of nutrition education. J. Am. Dietet. A. 79: 660, 1981.

Kieks, B. A., Hendricks, D. G. and Wyse, B. W.: Parent involvement in nutrition education for primary grade students. J. Nutr. Educ. 14(4): 137, 1982.

Krause, B. O. and Fox, H. M.: Nutritional knowledge and attitudes of physicians. J. Am. Dietet. A. 70: 607, 1977.

Krause, M. V. and Mahan, L. K.: Food, Nutrition and Diet Therapy. 6th ed., W. B. Saunders Co., Philadelphia, 1979.

Kreutler, P. A.: Nutrition in Perspective. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1980.

Lackay, C. J., Kolasa, K. M., Pennee, K. P., and Mutch, B. L.: Development of the NKT - A general nutrition knowledge test for teachers. J. Nutr. Educ. 13: 100, 1981.

Leverton, R. M.: What is nutrition education? J. Am. Dietet. A. 64: 17, 1974.

_____: Facts and fallacies about nutrition and learning. J. Nutr. Educ. Fall: 7, 1969.

Lovett, R. and Barker, E. and Marcus, B.: The effect of a nutrition education program at the second grade level. J. Nutr. Educ. Fall: 81, 1970.

MacKenzie, L. and Arboe, E.: Cross-age teaching an important concept for nutrition education. J. Nutr. Educ. 11: 138, 1979.

Manoff, R. K.: Potential uses of mass media in nutrition programs. J. Nutr. Educ. 5(2): 125, 1973.

Marston, R. M. and Welsh, S. O.: Nutrient content of the national food supply. Natl. Fd. Rev. 13: 19, 1981.

Marvosh, M.: A "fair" way to teach nutrition. J. Nutr. Educ. Fall: 48, 1970.

Mayer, J. and Fisk, D. C.: Commentary: J. Nutr. Educ. 2(1): 80, 1970.

McKenrick Chilli, A. H. and Guthrie, H. A.: Effectiveness of radio in nutrition education. J. Nutr. Educ. 14(3): 99, 1982.

_____: Nutrition and human performance. Dairy Council Digest. 51: 13, 1980.

O'Farrell, M. J. and Kendrick, J. L.: Educator's attitudes toward nutrition education in Florida. J. Nutr. Educ. Winter: 15, 1972.

Pao, E. M.: Nutrient consumption patterns of individuals, 1977 and 1965. Fam. Econ. Rev. Spring: 16, 1980.

Parker, E.: Big ideas in nutrition education. School Lunch J. April: 34, 1971.

Petersen, M. E. and Kies, C.: Nutrition knowledge and attitudes of early elementary teachers. J. Nutr. Educ. Winter: 11, 1972.

Polk, M. R.: Talk-back television: continuing education for the 1980's. J. Am. Dietet. A. 84: 75, 1984.

Poolton, M. A.: Predicting Application of nutrition education. J. Nutr. Educ. Summer: 110, 1972.

Poplin, L. E.: Practical knowledge of nutrition in the health sciences. J. Am. Dietet. A. 77: 576, 1980.

_____: Position paper on nutrition education for the public. J. Am. Dietet. A. 62: 429, 1973.

Prefontaine, M.: Construction and validation of a nutrition test. J. Nutr. Educ. 7(4): 152, 1975.

Prescott, R.: Per capita food consumption highlights. Natl. Fd. Rev. 13: 7, 1981.

Risek, R. L. and Jackson, E. M.: Current food consumption practices and nutrient sources in the American diet. Consumer Nutrition Center. Human Nutrition. Science and Education Administration, USDA, 1980.

Sadowsky, J. D.: In-service nutrition education for elementary teachers. J. Nutr. Educ. 5(2): 139, 1973.

Sax, G.: Principles of Educational Measurement and Evaluation. Belmont, CA: Wadsworth Publishing Co., Inc., 1974.

Schifferes, J. J. and Peterson, L. J.: Essentials of Healthier Living, 4th ed. New York: John Wiley & Sons, Inc., 1972.

Schubert, E. P.: Nutrition education: How much can or should our schools do? J. Nutr. Educ. Summer: 9, 1970.

Senate Select Committee on Nutrition and Human Needs: Dietary Goals for the United States. 2nd ed. Washington, D. C.: Superintendent of Documents, 1977.

Shannon, B., Graves, K. and Hart, M.: Food behavior of elementary school students after receiving nutrition education. J. Am. Dietet. A. 81: 428, 1982.

Sims, L. S.: Demographic and attitudinal correlates of nutrition knowledge. J. Nutr. Educ. 8(3): 122, 1976.

Smith, H. M. and Justice, C. L.: Effects of nutrition programs on third grade students. J. Nutr. Educ. 11(2): 92, 1979.

Spitze, H. T.: Innovation techniques for teaching nutrition. J. Nutr. Educ. Spring: 156, 1971.

Stansfield, P. and Fox, H.: Grocers - nutrition knowledge and attitudes. J. Nutr. Educ. 9: 69, 1977.

Steel, G. D. and Torree, J. H.: Principles and procedures of Statistics. 2nd ed. New York: McGraw Hill, 1980.

Steinberg: Schools are teaching nutrition - but they're teaching it the wrong way. School Lunch 7(5): 84, 1966.

Todhunter, E. N.: Approaches to nutrition education. J. Nutr. Educ. Summer: 8, 1969.

Tolin, D., Newell, K., Greig, S. and Staab, J.: A comparison of two approaches to nutrition education at the third grade level. School Food Serv. Res. Rev. 3(1): 24, 1979.

Ullrich, H. D.: Towards a national nutrition education policy. J. Nutr. Educ. 11:60, 1979.

U. S. Department of Agriculture - U. S. Department of Health and Human Services: Nutrition and your health: Dietary guidelines for Americans. Washington, D. C.: U. S. Government Printing Office, 1980.

U. S. Department of Health, Education and Welfare: Surgeon General's Report on Health Promotion and Disease Prevention: Healthy People. Publishing No. 79-55071, Washington, D. C., 1979.

_____: Food & nutrient intakes of individuals in one day in the United States, Spring 1977. Nationwide Food Consumption Survey 1977-1978. Preliminary Report No. 2. Washington, D. C.: U. S. Government Printing Office. September, 1980.

Vickstrom, J. A., and Fox, H. M.: Nutritional knowledge and attitudes of registered nurses. J. Am. Dietet. A. 68: 453, 1976.

Wakefield, L. M. and Allene: Nutrition course for elementary teachers by telephone (Telenet). J. Nutr. Educ. 5(3): 190, 1973.

White, P. L.: Why all the fuss over nutrition education? J. Nutr. Educ. 8(2): 54, 1976.

Wilson, E. H., Lawroski, M. A. and Wallace, A. P.: Puppets are effective teachers. J. Nutr. Educ. Winter: 22, 1972.

Young, E. A. and Weser, E.: Integration of nutrition in medical education. J. Nutr. Educ. 7(3): 112, 1975.

APPENDIXES

APPENDIX A

OKLAHOMA STATE UNIVERSITY
College of Home Economics
Department of Food, Nutrition and
Institution Administration

Monday Aug. 22	Wednesday Aug. 24	Friday Aug. 26
Lecture: Introduction to course Read: pp XIII-XVI, 3-13, 15 Do: Packet 2-3 SS 4 SS 9-11	Introduction to Nutrition (Bring text & packet) Due: SS 4	Film "Look Before You Eat" Lecture: Food Records Read: Text 227-287, SS D-1 Do: Begin D3-6 Weight & Measure before class Monday Look: Food Models Display Case - 4th Floor South HEW
Monday Aug. 29	**Wednesday Aug. 31**	**Friday Sept. 2**
Lecture: Over-weight/Under-weight Energy Needs Read: Text 240-246 Do: D 7-10 SS 12-17	Lecture: Energy Needs Weight Control Read: 287-309 SS 18-19	Lecture: Dietary Study Do: Packet D 11-15 (Col. 1-6 only) BE IN CLASS

Appendix A (continued)

Monday Sept. 5	Wednesday Sept. 7	Friday Sept. 9
Labor Day	Lecture: Weight Control Film: "For Tomorrow We Shall Diet" Read: Appendix M p. 100-104 SS 5-6 Packet Appendix A	Lecture: Basic 4 and other Dietary Standards DUE: D 10, 14, 15, Col. 1-6 Complete Read: p. 18-40, 46-55 Do: SS 20-23
Sept. 12	**Sept. 14**	**Sept. 16**
Lecture: Carbohydrates Do: COMPLETE Col. 7-13 p. D 14 & 15	Lecture: Carbohydrates Read: p. 59-80, 82-93 Do: SS 28-30 SS 24-27	Lecture: Lipids
KEYPUNCH DIETARY CARDS THIS WEEK See Appendix B (packet)		
Sept. 19	**Sept. 21**	**Sept. 23**
Lecture: Lipids Read: Chap 3 & 4 for Friday	No Class in lieu of Exam I Sept. 22	Lecture: Protein Do: SS 31-35 DUE: a) D 3-6 b) D 10, 14-15 Col. 1-13 c) KEYPUNCHED CARD

*** Thursday, Sept. 22
EXAM I
6:30 P.M.
Ag. H. 101
Introduction, Chap 1, 2, 8

Appendix A (continued)

Monday Sept. 26	Wednesday Sept. 28	Friday Sept. 30
Lecture: Protein Read: Chp 5 Do: SS 36-42	Lecture: Digestion Film: The Human Body: The Digestive System	Lecture: Digestion & Absorption Read: Chp 6
Oct. 3	**Oct. 5**	**Oct. 7**
Lecture: Absorption & Metabolism	Lecture: Principles of Menu Planning Read: 317-321, Chp 9	Lecture: Characteristics of Vitamins Film: Vitamins in Food Do: SS 43-49
Oct. 10	**Oct. 12**	**Oct. 14**
Lecture: B Vitamins Alcohol Read: Chp 10 Do: Begin D 17-23 New keypunched Cards	Lecture: Vitamin C Read: Chp 11	Lecture: Fat Sol. Vitamins Do: SS 50-54
Oct. 17	**Oct. 19**	**Oct. 21**
Lecture: Fat Soluble Vitamins Read: p. 321-323 Chp 12 Except Highlight *** Thursday, Oct. 20 EXAM II 6:30 P.M. Ag. H. 101 Chp 3-6, 9, 10 Menu Planning	No class in lieu of Exam II October 20	Lecture: Major Minerals Do: SS 55-60

Appendix A (continued)

Monday Oct. 24	Wednesday Oct. 26	Friday Oct. 28
Fall Break	Lecture: Major Minerals Read: Chp 13 Except Highlight	Lecture: Trace Minerals Do: SS 61-67 DUE: a) D 10, 17, 18, 21-23 b) old printout c) new cards
Oct. 31	**Nov. 2**	**Nov. 4**
Lecture: Trace Minerals Read: Chp 14	Lecture: Water Read: Highlight 12 p. 438-447 Do: SS 68-72	Lecture: Nutrition Labeling Read: Highlight 13, p. 479-489 Do: SS 73-75
Nov. 14	**Nov. 16**	**Nov. 18**
No Class in lieu of Exam III *** Tuesday, Nov. 15 EXAM III Chp 11, 12, 13, 14 Highlight 11, 12, 13	Lecture: Lactation & Infant Nutr. Read: 550-574	Lecture: Children
Nov. 21	**Nov. 23**	**Nov. 25**
Lecture: Youth DUE: D 25-27 Weight Chart D-8 Old & New Printouts	Lecture: Older Adult	Thanksgiving
Nov. 28	**Nov. 30**	**Dec. 2**
Lecture: Complete Life Cycle Read: Highlight 6, p. 208-220	Lecture: Nutr. in Heart Disease Do: SS 80-82	Lecture: Nutr. Facts & Fallacies

Appendix A (continued)

Monday Dec. 5	Wednesday Dec. 7	Friday Dec. 9
Complete Coursework	Review Videotape - 003A-HEW - You must attend at least one of the following sessions:	
	Wed Dec. 7	9:30 - 10:30 11:30 - 12:30
	Thurs Dec. 8	12:30 - 1:30 4:00 - 5:00
	Fri Dec. 9	9:20 - 10:20 11:20 - 12:20

FINAL EXAM - TUESDAY DECEMBER 13 - 3:00-4:50

ROOM 101 AG HALL

APPENDIX B

GRID

TOPICS	NUMBER OF LECTURES	NO. OF QUESTIONS PRETEST	POSTTEST
Introduction to Nutrition	2	3	3
Energy Needs	2	1	1
Weight Control	2	2	2
Basic Four	2	2	2
Carbohydrates	2	2	2
Lipids	2	3	3
Proteins	2	2	2
Digestion and Absorption	3	1	1
Menu Planning	1	1	1
Vitamins	3	3	3
Fat Soluble Vitamins	2	3	3
Minerals	2	2	2
Trace Minerals	2	2	2
Nutrition Labelling	1	3	3
Nutrition - Life Cycle	5	5	5
Nutrition in Heart Disease	1	0	0
Nutrition Facts	1	1	1
Water	1	0	0
	36	36	36

Appendix B (continued)

TOPICS	COGNITIVE DOMAIN
Knowledge	12
Comprehension	9
Application	6
Analysis and Synthesis	4
Evaluation	5
	36

APPENDIX C PRETEST

OKLAHOMA STATE UNIVERSITY

DEPT. OF FOOD NTRITION & INSTITUTION ADMINISTRATION
NUTRITION SURVEY
PART I GENERAL INFORMATION

STUDENT I.D. _____

DIRECTION: Please check (✓) the appropriate answers:

1. SEX: Female ___ Male ___

2. AGE:
   18-22 ___ 33-37 ___
   23-27 ___ 38-42 ___
   28-32 ___ 45 & above ___

3. WHAT IS YOUR MAJOR AREA OF STUDY?

   Agriculture ___ Engineering ___
   Arts & Science ___ Home Economics ___
   Business ___ Undecided ___
   Education ___

4. WHAT IS YOUR CURRENT CLASSIFICATION IN COLLEGE?

   Freshmen ___ Senior ___
   Sophomore ___ Graduate ___
   Junior ___ Special ___

5. PURPOSE OF TAKING THIS COURSE:

   Major ___ General Studies ___
   Related to Major ___ Elective ___
   Personal Interest ___

6. IS THE COURSE REQUIRED?

   Yes ___ No ___

Check all that applies

7. WHAT IS YOUR PAST NUTRITION BACKGROUND?	yes	no
Studied nutrition in high school	___	___
Studied nutrition in college	___	___
Never studied nutrition	___	___
Studied chemistry in high school	___	___
Studied chemistry in college	___	___

8. If you have had or are currently enrolled in chemistry course(s), please specify course titles:

PART II

Nutrition Knowledge of Students Enrolled in FNIA 1113

Directions: Please circle the correct answers

1. Recommended dietary modification for Americans include:
   a. decreased use of meat and increased use of fish and poultry.
   b. reduction in calories to achieve and maintain desirable weight.
   c. reduction in fat (with increased use of polyunsaturated oils) to 30-35% of the days calories.
   d. all of the above.

2. One of the medical hazards of obesity is:
   a. increased death rates from heart attacks.
   b. increased risk of developing hypertension.
   c. increased death rate from diabetes.
   d. all of the above.

3. The U. S. RDA is:
   a. the amount of a nutrient required to insure good health.
   b. the same as the RDA.
   c. the value distinctly higher than many people need.
   d. revised annually.

4. Total energy needs are based on:
   a. sleeping metabolism, activity needs and specific dynamic action.
   b. basal metabolism, activity and specific dynamic action.
   c. basal metabolism and activity.
   d. sleeping metabolism and specific dynamic effect.

5. A lacto-ovo-vegetarian:
   a. eats no animal flesh (i.e. beef, pork, poultry, fish).
   b. eats only plant foods.
   c. cannot obtain complete protein from his/her diet.
   d. is usually under weight.

6. Which lists of food contain the largest amount of poly-unsaturated fatty acids?
   a. beef, lamb, pork.
   b. chicken, fish, corn oil.
   c. whole milk, cheddar cheese, butter.
   d. butter, cream, coconut oil.

7. The U. S. dietary goals recommend that consumption of complex carbohydrates
   a. remain the same.
   b. be eliminated.
   c. be increased.
   d. be decreased.

8. Assume that a person consumes 2,400 Kcal. Approximately how many of these calories will be used for the "specific dynamic effect" of food?
   a. 24 Kcal. b. 240 Kcal. c. 100 Kcal. d. 3,500 Kcal.

9. As a "rule of thumb" in menu planning, breakfast should contribute about what fraction of the days total nutrient intake?
   a. 1/8 b. 1/3 c. 1/2 d. 5/8

10. The protein requirement for a 143 lbs. female athlete is about:
    a. 130 gr. b. 114 gr. c. 57 gr. d. 52 gr.

11. Milk is low in which of the following nutrients:
    a. phosphorous & calcium
    b. calcium & iron
    c. iron & ascorbic acid
    d. ascorbic acid & phosphorous

12. Where is alcohol metabolized?
    a. in the liver only.
    b. in the brain & liver.
    c. throughout the body.
    d. in the skeletal muscles.

13. A disease state characterized by extreme weight loss which stems from psychological disturbances is called:
    a. anorexia.
    b. anorexia nervosa.
    c. aplexia.
    d. aplexia nervosa.

14. The minimum daily servings recommended for adults from the fruit and vegetable group are:
    a. 2 b. 3 c. 4 d. 5

15. An example of a toxic metal that pollutes some waters is:
    a. zinc b. calcium c. mercury d. fluoride

16. An enzyme is one of the following:
    a. organic catalyst
    b. protein
    c. made in the body
    d. all of the body

17. The essential fatty acid which is a polyunsaturated fatty acids is:
    a. oleic b. stearic c. linoleic d. arachidonic

18. A polysaccharide that provides roughage or fiber to diet is:
    a. cellulose
    b. sucrose
    c. glycogen
    d. triglycerides

19. Water is a nutrient in that:
    a. it is essential to the body.
    b. it provides energy.
    c. it is organic.
    d. if taken in excess, it is stored in body tissues.

20. The first rich source of iron for most infants will be:
    a. evaporated milk.
    b. orange juice.
    c. human milk.
    d. cereals prepared for babies.

21. The pancrease secretes a juice which digests:
    a. carbohydrates
    b. protein
    c. fat
    d. abc

22. Studies of the incidence of cancer around the world have shown that:
    a. diet has no relationship to cancer.
    b. certain types of diet cause cancer.
    c. some dietary habits are associated with a high incidence of cancer.
    d. race is more important than diet in determining susceptibility to cancer.

23. A major shift in the American diet suggested by the dietary goals is:
    a. to significantly increase protein intake.
    b. to significantly decrease protein intake.
    c. to increase the intake of complex carbohydrates.
    d. to decrease the intake of all types of carbohydrates.

24. Which program is designed to meet part of the nutrient needs of children ages 5-17?
    a. WIC.
    b. school lunch and breakfast.
    c. food stamps.
    d. EFNEP.

25. "Enrichment" of white bread requires the addition of which group of nutrients?
    a. phosphorus, calcium and ascorbic acid.
    b. nutrients to make it equal to whole wheat bread.
    c. calcium and ascorbic acid.
    d. iron and certain B-vitamins.

26. A "rule of thumb" for gauging serving sizes for pre-schoolers is:
    a. 1/4 cup for each year of age.
    b. 1/2 cup for all ages.
    c. 1 tablespoon per year of age.
    d. 1 teaspon per year of age.

27. Diets of teenage athletes compared to diets of sedentary teenages should contain:
    a. more fluids and calories.
    b. more protein.
    c. more vitamins.
    d. the same amounts of nutrients as any teenager of the same size and sex.

28. A bowl of raisin bran contains the following amounts of the carbohydrate:

starch	13 grams
sugar	11 grams
fiber	4 grams
total	28 grams

    How many kilocalories will it provide to your body after digestion?
    a. 112 Kcal. b. 100 Kcal. c. 96 Kcal. d. 11 Kcal.

29. From the following, select the best breakfast:
    a. bacon, eggs, toast, coffee.
    b. oatmeal, milk, orange juice.
    c. 1/2 grapefruit, toast, apple juice.
    d. sweet roll, bacon, koolaid.

30. What happens when an essential amino acid required for formation of a certain protein is missing?
    a. Amino acid chain will be stored until the missing amino acid is supplied in the diet.
    b. synthesis of the protein will stop.
    c. glucose will be substituted.
    d. another amino acid will be substituted in its place.

31. The best source of the precursor for Vitamin A is:
    a. green beans
    b. orange
    c. peas
    d. pumpkin

32. The major minerals found in bone matrix are:
    a. calcium, potassium, fluoride
    b. iron, copper, iodine
    c. phosphorus, calcium, zinc
    d. phosphorus, calcium, magnesium

33. Which of the following foods supply the least cholestrol and saturated fats?
    a. poultry
    b. beef
    c. dairy products
    d. lamb

34. The vitamin that prevents pernicious anemia is:
    a. folacin
    b. bioflavin
    c. cobalamin
    d. biotin

35. A manufacturer does not have to list the ingredients in a food if:
    a. the food is nutritious.
    b. there is a standard of identity for the product.
    c. no special claims are made about the nutrient content of the food.
    d. there is a nutrition label.

36. To lose 2 lbs of body fat per week, a person must reduce the daily caloric intake by:
    a. 1500 b. 1000 c. 500 d. 250

37. A polysaccharide as a reserve form of energy in the body is:
    a. cellulose
    b. sucrose
    c. glycogen
    d. triglycerides

38. The vitamin that aids in the clotting of blood is:
    a. Vitamin B_1
    b. Vitamin K
    c. Vitamin C
    d. Vitamin E

39. Which of the following may occur during the later years that contribute to poor nutritional status:
    a. limited income
    b. reduced absorption
    c. poor teeth
    d. all of the above.

40. Calculate the calorie value of one oatmeal cookie which contains 6 gm carbohydrate, 3 gm fat, 1 gm protein, 3 gm water and 13 mg vitamins and minerals.
    a. 13 b. 55 c. 61 d. 78

41. The vitamin that helps the eyes to adjust to dim light is:
    a. Vitamin A
    b. Thiamin
    c. Vitamin C
    d. Folacin

42. The caloric content of the diet and/or caloric expenditure of the body determines the requirement for which of the following groups of vitamins:
    a. ascorbic acid, cobalamin and thiamin
    b. thiamin, riboflavin and folacin
    c. folacin, niacin and cobalamin
    d. niacin, riboflavin and thiamin

43. Taking diuretics may be harmful because of loss of:
    a. potassium
    b. phosphorus
    c. calcium
    d. zinc

44. Cobalt is needed as part of:
    a. folacin
    b. hormones
    c. vitamin B_{12}
    d. hemoglobin

45. The vitamin especially needed for collagen formation is:
    a. vitamin A
    b. cobalamin
    c. vitamin C
    d. vitamin D

46. Which of the following nutrients supply energy to the body:
    a. carbohydrate, minerals, fat.
    b. fat, protein, vitamins.
    c. protein, fat, water.
    d. carbohydrate, protein, fat.

Answer 47-49 by referring to the menu provided.

MORNING

1/2 grapefruit
scrambled eggs (2)
bacon (2)
enriched white toast (2)
margarine (2 tsp)
milk, whole (8 oz.)

NOON

grilled cheese sandwich
2 ww bread & cheese
soft drink (10 oz.)
banana (1)
potato chips

EVENING

roast beef (4 oz.)
baked potato (1)
sour cream (2 Tbsp)
spinach salad (1 C.)
roll (1)
margarine (1 Tbsp)
milk, whole (8 oz.)

SNACK

apple (1)
cola (1)

47. To lower the total fat content of this menu without changing the nutrient content, one could:
    a. substitute orange juice for the soft drink.
    b. eliminate the bacon.
    c. eliminate the banana.
    d. eliminate the baked potato.

48. The best source of riboflavin in this menu is:
    a. spinach
    b. banana
    c. whole wheat bread
    d. milk

49. In order to reduce sodium intake but not to reduce total nutritive value of the menu, one could:
    a. substitute carrot sticks for potato chips.
    b. substitute milk for soft drink at lunch.
    c. substitute ham for roast beef at dinner.
    d. substitute lettuce for spinach.

50. Which of the following groups is susceptible to developing iron deficiency anemia?
    a. women of child-bearing age
    b. older infants
    c. people with low incomes
    d. all of the above

APPENDIX C POSTTEST

FNIA 1113
FINAL EXAM (Form A & C)

Name _____

Spring 1984

Roll Number _____

INSTRUCTIONS: Mark the letter of the correct response on the line beside the appropriate number on your answer sheet.

1. The "Basic Four" is:
   a. well known and followed by all people.
   b. a simple device for planning a day's meals.
   c. an all-inclusive outline of dietary needs.
   d. a guarantee of obtaining all needed nutrients for each day.

2. From the following, select the best breakfast according to the criteria given in class.
   a. bacon, eggs, toast, coffee.
   b. oatmeal, milk, orange juice.
   c. 1/2 grapefruit, toast, apple juice.
   d. sweet roll, bacon, koolaid.

3. What are the minimum daily servings recommended for adults from the fruit and vegetable group?
   a. 2 b. 3 c. 4 d. 5

4. Diets of teenage athletes compared to sedentary teenagers should contain:
   a. more fluids and calories
   b. more protein
   c. more vitamins
   d. the same amount of nutrients as any teenager of the same size and sex.

5. The U.S. RDA is:
   a. the amount of a nutrient required to insure good health.
   b. the same as the RDA.
   c. revised annually.
   d. a value distinctly higher than many people need.

6. The U.S. Dietary Goals recommend that consumption of complex carbohydrates:
   a. remain the same
   b. be increased
   c. be eliminated
   d. be decreased

7. The dietary guidelines were developed and published by:
   a. a committee of the U.S. Senate.
   b. the U.S. Department of Agriculture.
   c. the National Institutes of Health
   d. Whitney and Hamilton
   e. The Food and Nutrition Board of the National Research Council.

8. Use of diuretics:
   a. may cause loss of potassium.
   b. may cause deficiency of calcium and/or iron.
   c. may cause loss of fat-soluble vitamins.
   d. may cause edema
   e. is not a problem if they are obtained over-the-counter (non-prescription).

9. "Enrichment" means that white bread contains added:
   a. phosphorus, calcium, and ascorbic acid.
   b. iron and certain B-vitamins.
   c. calcium and ascorbic acid.
   d. protein and certain B-vitamins.
   e. nutrients to make it equal to whole wheat bread.

10. One of the three general functions of nutrients is:
   a. absorption through the villi.
   b. elevation of blood pressure.
   c. digestion of carbohydrates.
   d. regulation of metabolic processes.

11. The protein requirement for a 143 pound female athlete is about:
   a. 130 grams
   b. 114 grams
   c. 57 grams
   d. 52 grams

12. Teenagers who starve themselves to become excessively thin may be suffering from:
   a. inborn errors of metabolism.
   b. edema.
   c. anorexia nervosa.
   d. pica.
   e. carcinoma.

13. Which of the following groups is susceptible to iron deficiency anemia:
   a. women of child-bearing age
   b. children
   c. older infants
   d. people with low income
   e. all of the above

14. A "rule of thumb" for gauging serving sizes for preschoolers is:
    a. 1/4 cup for each year of age.
    b. 1/2 cup for all ages.
    c. 1 tablespoon per year of age.
    d. 1 teaspoon per year of age.

15. Most nutritionists recommend that solid foods should be included in the diet of infants. . .
    a. no sooner than nine months.
    b. by the end of the second week.
    c. no later than one month.
    d. 4-6 months.

16. The first rich source of iron for most infants will be:
    a. evaporated milk.
    b. orange juice.
    c. human milk.
    d. cereals prepared for babies.

17. Milk is low in which PAIR of the following nutrients:
    a. phosphorus and calcium
    b. calcium and iron
    c. iron and ascorbic acid
    d. ascorbic acid and phosphorus.

18. A diet which may be associated with Osteoporosis in later life is:
    a. low in fat
    b. low in eggs
    c. low in milk and milk products
    d. high in polyunsaturates

19. To lose two pounds of body fat per week a person must reduce the daily caloric intake or increase exercise output per day by:
    a. 250 kilocalories
    b. 500 kilocalories
    c. 1000 kilocalories
    d. 1500 kilocalories

20. A piece of pecan pie has 20% water, 6 g of protein, 27 g of fat, and 60 g of CHO. Total calories are:
    a. 672 b. 587 c. 507 d. 402

21. If an essential amino acid required for formation of a certain protein is missing:
    a. the amino acid chain will be stored until the missing amino acid is supplied in the diet.
    b. synthesis of the protein will stop.
    c. glucose will be substituted.
    d. another amino acid will be substituted in its place.

22. An incomplete protein is:
    a. lacking or low in one or more essential amino acids.
    b. lacking in vitamins.
    c. low in fiber.
    d. found only in animal products.

23. Amylase is an example of:
    a. a complete protein.
    b. an enzyme.
    c. a fat-soluble vitamin.
    d. a polysaccharide.

24. The essential fatty acid which is a polyunsaturated fatty acid is:
    a. oleic
    b. stearic
    c. linoleic
    d. arachidonic

25. The list of foods containing the largest amount of poly-unsaturated fatty acids is:
    a. beef, lamb, pork
    b. chicken, fish, and corn oil
    c. whole milk, cheddar cheese, butter
    d. butter, cream, coconut oil

26. The best source of the precursor for vitamin A is:
    a. green beans
    b. orange
    c. peas
    d. pumpkin

27. The chemical name for common table sugar is:
    a. dextrose
    b. linulose
    c. maltose
    d. sucrose.

28. Pregnant and lactating women need double the usual amount of folacin. A good source would be:
    a. fresh spinach
    b. enriched bread
    c. apples
    d. pork

29. Weight gain in pregnancy should be:
    a. only in the last trimester.
    b. none for women who are overweight when they become pregnant.
    c. moderate - 24 to 30 pounds.
    d. restricted to 16 pounds or less.

30. The program that is particularly concerned with elderly persons is:
    a. FDA
    b. food stamps
    c. congregate meals
    d. WIC
    e. EFNEP

31. Changes that may occur during the later years and contribute to poor nutritional status include:
    a. limited exercise
    b. limited income
    c. reduced absorption
    d. poor teeth
    e. all of these

32. Recommended dietary modifications for Americans include:
    a. decreased use of meat and increased use of fish and poultry.
    b. reduction in calories to achieve and maintain desirable weight.
    c. reduction in fat (with increased use of polyunsaturated oils) to 30-35% of the day's calories.
    d. All of the above.
    e. "a" and "b" of the above.

33. One change that needs to be made by adults in their dietary habits is a decrease in total energy value of food consumed, in comparison with the teen years. This is necessary because of:
    a. an increase in basal metabolic rate.
    b. a decrease in activity.
    c. a decrease in basal metabolic rate.
    d. "a" and probably also "c"
    e. "b" and probably also "c"

34. Which of the following contains a list of food additives that are believed to be safe?
    a. The Food Additives Amendment of 1958
    b. The Delaney Clause
    c. GRAS
    d. Index of Nutritional Quality
    e. All of these

35. Which of the following substances is a food additive?
    a. an artificial color
    b. a nutrient added to fortify a food
    c. a flavoring agent
    d. all of the above

36. Nutrition information is reliable if:
    a. it is published or "in print".
    b. endorsed by a physician.
    c. has references to scientific studies.
    d. all of the above
    e. none of the above

37. The class of nutrients that regulate the body's water balance through ions is:
    a. vitamins
    b. minerals
    c. water
    d. protein
    e. water

38. The primary nutrient digested in the small intestine is:
    a. carbohydrate
    b. fat
    c. protein
    d. all of the above

39. The vitamin that aids in the clotting of blood is:
    a. Vitamin B_1
    b. Vitamin K
    c. Vitamin C
    d. Vitamin D
    e. Vitamin E

40. The vitamin especially needed for collagen formation:
    a. Vitamin A
    b. Cobalamin
    c. Vitamin C
    d. Vitamin D
    e. Niacin

41. The vitamin that helps the eyes to adjust to dim light:
    a. Vitamin A
    b. Thiamin
    c. Vitamin C
    d. Vitamin D
    e. Folacin

42. The vitamin that prevents pernicious anemia:
    a. Folacin
    b. Bioflavin
    c. Cobalamin
    d. Biotin
    e. Amemioflavin

43. The major minerals found in bone matrix are:
    a. calcium, potassium, fluoride
    b. iron, copper, iodine
    c. phosphorus, calcium, zinc
    d. phosphorus, calcium, magnesium

44. The minerals most frequently low in the American diet are:
    a. iron and copper
    b. copper and phosphorus
    c. iron and calcium
    d. calcium and phosphorus
    e. iron and phosphorus

45. Which of the following is <u>not</u> a vitamin and/or a mineral deficiency disease?
    a. berberi
    b. pellegra
    c. pernicious bulemia
    d. Rickets
    e. scurvy

MATCH the words in column B with column A. Mark the letter of the correct response on the line beside the appropriate number on your answer sheet.

A - Functions	B - Minerals
46. Catalyst in blood clot formation	A. chloride
47. Helps maintain acid pH in stomach	B. iron
48. Part of vitamin B_{12}	c. calcium
49. Transporter for oxygen in the blood	d. zinc
	e. cobalt

GO TO NEXT PAGE

A - Definitions	B - Terms
51. Calories used in the body at rest to maintain vital functions (heartbeat, respiration, temperature, control, etc.)	A. absorption
51. The sum total of all chemical reactions that go on in living cells	B. basal metabolism
52. Passage of digestive products from the small intestine into the blood or lymphatic systems	C. digestion
53. Process by which foods are reduced physically and chemically into their simplest form (basic units)	D. hydrolysis
	E. metabolism

A - Definitions	B - Terms
54. A polysaccharide that provides roughage or fiber to the diet	A. cellulose
55. A polysaccharide used as a reserve form of energy in the body.	B. enzyme
56. Another name for common fats and oils.	C. glycogen
	D. sucrose
	E. triglycerides

A - Definitions	B - Terms
57. Accumulation of fluid in the tissues	A. anemia
58. A disease characterized by thickening of the walls of the arteries.	B. arteriosclerosis
59. A disease involving the red blood cells	C. beriberi
	D. edema
	E. pellegra

A - Definitions	B - Programs
60. Nutrition education program for very low income families sponsored by the Cooperative Extension Service.	A. WIC
61. Program designed to meet part of the nutrient needs of children ages 5-17.	B. School Lunch and Breakfast
62. Supplemental food program for at-risk pregnant women and small children.	C. Food Stamps
63. Program designed to supplement money spent for food by low-income families.	D. PWC
	E. EFNEP

True or False: On your answer sheet mark "T" or "F" as appropriate.

T F 64. Unless a citrus fruit is consumed once a day, it is almost certain an individual will develop scurvy.

T F 65. The body really needs no carbohydrate since it can obtain needed energy from protein and fat.

T F 66. Vitamin C toxicity is likely to result if a person regularly drinks large servings of orange juice.

T F 67. The fat-soluble vitamins are actually essential fatty acids.

T F 68. Nutritional anemias are probably the most frequently occurring deficiency diseases in the U.S.

T F 69. One of the most important factors contributing to problems of malnutrition among some senior citizens is too little money to buy the food needed for a good diet.

T F 70. Formula feeding is nutritionally superior to breast milk.

T F 71. A kilocalorie is a unit in which energy is measured.

T F 72. Grapefruit can assist in burning up body fat stores.

T F 73. Because both margarine and butter are fats, they contain approximately the same number of calories per serving.

T F 74. Teenaged girls usually have the best intake of nutrients of all school age persons since they are concerned with good health.

T F 75. High alcohol consumption often leads to a deficiency of B vitamins.

T F 76. Adults and children need different nutrients.

T F 77. To follow the U.S. Dietary Goals, adults should change from whole milk to skim milk.

T F 78. Supplementation of the diets of athletes with added wheat germ oil and Vitamin E has been shown to improve athletic performance.

T F 79. All vegetable oils are unsaturated.

T F 80. Manufacturers could easily do without food additives if they wanted to.

T F 81. Heavy beer drinkers do not have the nutritional problems associated with high use of other types of alcoholic drinks.

Answer questions 82-93 by referring to the menu below. Mark the letter of the correct response on the line beside the appropriate number on your answer sheet.

MORNING

1/2 Grapefruit
Scrambled eggs (2)
Bacon (2)
Enriched white toast (2)
Margarine (2 tsp)
Milk, whole (8 oz.)

NOON

Grilled Cheese Sandwich
(2 slices WW bread, 1 sl. cheese)
Potato chips
Soft Drink (10 oz.)
Banana (1)

EVENING

Roast Beef (4 oz.)
Baked Potato (1)
Sour Cream (2 Tbs)
Margarine (1 Tbs)
Spinach Salad (1 C.)
Roll (1)
Margarine (1 Tbs)
Milk, whole (8 oz.)

SNACK

Apple (1)
Cola (1)

82. To lower the total fat content of this menu, without changing the nutrient content substantially:
    a. substitute orange juice for the soft drink
    b. eliminate the bacon
    e. eliminate the banana
    d. eliminate the baked potato

83. The best source of iron in this menu is:
    a. grilled cheese sandwich
    b. roast beef
    c. milk
    d. bacon

84. To increase the fiber content for the day, substitute:
    a. white bread for whole wheat bread in sandwhich
    b. whole wheat toast for enriched white toast
    c. orange juice for the banana
    d. tortilla chips for potato chips

85. The best source of riboflavin in this menu is:
    a. spinach
    b. banana
    c. whole wheat bread
    d. milk

86. In order to reduce sodium intake but not to reduce total nutritive value of the menu, one could:
    a. substitute carrot sticks for potato chips
    b. substitute milk for the soft drink at lunch
    c. substitute ham for roast beef at dinner
    d. substitute lettuce for spinach
    e. do all of the above

TRUE or FALSE regarding the menu:

T F 87. The above menu would supply the recommended number of servings from the milk group for a pregnant woman.

T F 88. There is enough protein in this menu to meet the recommended servings from the meat group for a breast-feeding woman.

T F 89. The recommended servings from the fruit and vegetable group for a pregnant woman are supplied by this menu.

T F 90. This menu does not meet the recommended number of servings for the fruit and vegetable group for a 24-year old male.

T F 91. This menu supplies more than enough dairy products to meet the recommended number of servings of the milk group for a 21-year old non-pregnant female.

T F 92. To adjust this menu for a preschool child (3-6 years), one should increase the amount of each serving of milk.

T F 93. There are at least 5 substitutions or eliminations of foods that could be made in this menu to reduce calories without reducing portion size of foods or their vitamin, mineral, and protein content.

GO TO NEXT PAGE FOR QUESTIONS 94-100

NUTRITION INFORMATION
PER SERVING

Serving Size .....1 ounce (1¼ cups)
Servings per Container..... 15

	1 ounce Cheerios	Cheerios plus ½ cup vitamin D milk
Calories	110	190
Protein, grams	4	8
Carbohydrate, grams	20	26
Fat, grams	2	6
PERCENTAGE OF U.S. RECOMMENDED DAILY ALLOWANCES (U.S. RDA)		
Protein	6	15
Vitamin A	25	30
Vitamin C	25	25
Thiamin	25	30
Riboflavin	25	35
Niacin	25	25
Calcium	4	20
Iron	25	25
Vitamin D	10	25
Vitamin B_6	25	30
Vitamin B_{12}	25	35
Phosphorus	15	25
Magnesium	10	15
Zinc	6	8
Copper	8	8

INGREDIENTS: Oat flour, wheat starch, salt, sugar, calcium carbonate, trisodium phosphate, sodium ascorbate (vitamin C), niacin (a B vitamin), artificial color, iron, vitamin A palmitate, pyridoxine hydrochloride (vitamin B_6), riboflavin (vitamin B_2), thiamin mononitrate (vitamin B_1), cyanocobalamin (vitamin B_{12}) and vitamin D_2.

General Mills, Inc.
General Offices
Minneapolis, Minnesota 55440
Made in U.S.A.

CARBOHYDRATE INFORMATION

	Cheerios	
	1 ounce	with ½ cup milk
Starch and related carbohydrates, grams	19	19
Sucrose and other sugars, grams	1	7
Total carbohydrates, grams	20	26

Values by formulation and analysis.

0 21000 60061

Questions 94-100 refer to the label at the left.

Mark the letter of the correct response on the line beside the appropriate number on your answer sheet.

T F 94. The manufacturer was required to use a nutrition label on this product.

T F 95. This product is a good source of copper.

T F 96. This product is high in fat.

T F 97. This product would be suitable for a person attempting to increase his intake of calcium.

T F 98. This product contains no additives.

99. Which of the following was not required on the label?
a. the manufacturer's name
b. the list of ingredients
c. nutrient information of cereal plus vitamin D milk
d. calories provided by the product

100. The stated calories are based on:
a. 15 ounces
b. 1 ounce
c. 1 cup
d. the value for all cereals

APPENDIX D

FOOD RECORD SHEET Name _____

Day _____ Date _____ Day of Week _____

FOOD	AMOUNT	BASIC FOUR FOOD GROUP
Breakfast		
Lunch		
Dinner		
Snacks		

Typical?

VITA

Sandhya E. Reddy

Candidate for the Degree of

Master of Science

Thesis: NUTRITION KNOWLEDGE OF COLLEGE STUDENTS ENROLLED IN A BASIC HUMAN NUTRITION COURSE

Major Field: Foods, Nutrition and Institute Administration

Biographical:

Personal Data: Born in Hyderabad, India, February 20, 1956, daughter of Mr. & Mrs. K. V. N. Reddy. Married to E. P. Reddy on August 19, 1976.

Education: Graduated from Rosary Convent, Hyderabad, in May 1971; received Intermediate Degree from Osmania University in July 1973; received Bachelor of Science Degree in Home Science from Andhra Pradesh Agricultural University in August 1976; completed requirements for the Master of Science degree at Oklahoma State University in December, 1984.

Professional Experience: Clinical Dietitian, St. John's Medical Center, January 1981 to December 1981.

Professional Organizations and Honors: Student member of American Dietetic Association.